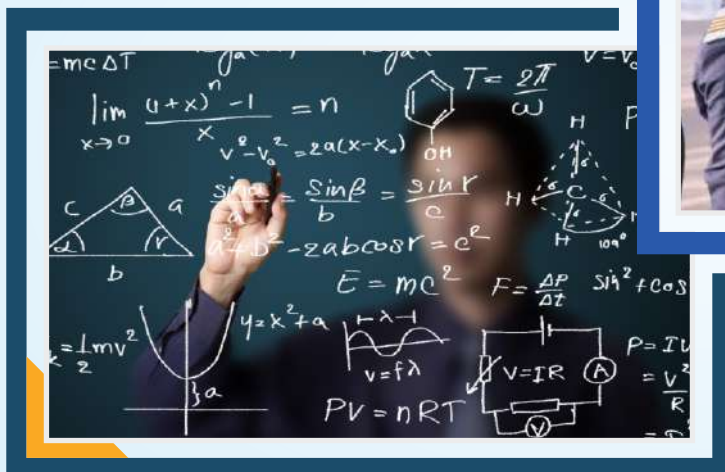




## SAMPLE MODULE NDA ENTRANCE EXAM

### MATHEMATICS



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# NDA ENTRANCE EXAM

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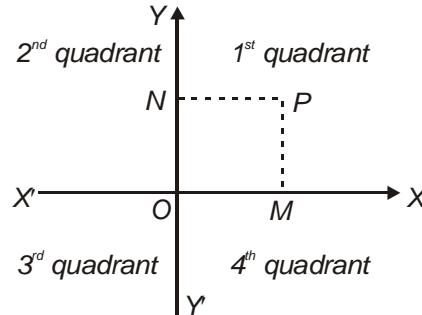
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## 9. STRAIGHT LINE

### 1. CARTESIAN SYSTEM OF RECTANGULAR CO-ORDINATES

To identify a point P in the two dimensional plane, we associate with it, an ordered pair of numbers, in the following way:

Let OX and OY be two fixed perpendicular straight lines in the plane of the paper.



The line OX is called, the axis of x ; the line OY is called, the axis of y ; the two together are called the axes of coordinates. The point O is called the origin (of reference) and OXY is referred to as the Cartesian system. We shall restrict ourselves to rectangular Cartesian system (where OX and OY are perpendicular).

From any point P in the plane, draw lines PM and PN parallel to Y and X axes respectively. The distance OM = x is called as abscissa of P ; the distance ON = y is called as ordinate of P ; the two together, i.e. (x, y), are referred to as the coordinates of P.

Distances measured along OX are positive and those measured opposite to it are negative. Distances measured in the direction of OY are positive and those measured opposite to it are negative.

OXY = 1 <sup>st</sup> quadrant	Abscissa & ordinate both +ve
OX'Y = 2 <sup>nd</sup> quadrant	Abscissa -ve & ordinate +ve
OX'Y' = 3 <sup>rd</sup> quadrant	Abscissa -ve & ordinate -ve
OXY' = 4 <sup>th</sup> quadrant	Abscissa +ve & ordinate -ve

**Illustration 1:** In a triangle ABC, the maximum of the three abscissa is -2 and minimum of three ordinates is +1. In which quadrant the triangle lies?

**Solution :** Since maximum of abscissa is -2, it is clear that  $x_1, x_2, x_3$  all are less than zero i.e. on the left of Y-axis, so either OX'Y or OX'Y' quadrants are possible. Since minimum of ordinates is +1, hence all ordinates are positive i.e. above X-axis, so OX'Y is the required quadrant.

### 2. DISTANCE FORMULA

Distance between points P ( $x_1, y_1$ ) and Q ( $x_2, y_2$ ) i.e. length of line segment PQ is given by

$$PQ = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

Distance of point P( $x_1, y_1$ ) from origin is given by  $OP = \sqrt{x_1^2 + y_1^2}$

**Note :**

To prove that a given four sided figure is :

1. **Square** : Prove that four sides are equal & diagonals are equal
2. **Rhombus** : Four sides equal, diagonals unequal.

**3. Rectangle** : Opposite sides equal & diagonals equal.

**4. Parallelogram** : Opposite sides equal & diagonals unequal.

Diagonals bisect each other in all the above.

**Illustration 2:** Three points A(2, 3), B(2, 6), C(5, 3) form a triangle. The triangle ABC is

**Solution :**  $AB = \sqrt{(2-2)^2 + (6-3)^2} = 3$

$$AC = \sqrt{(2-5)^2 + (3-3)^2} = 3$$

$$BC = \sqrt{(2-5)^2 + (6-3)^2} = 3\sqrt{2}$$

$AB^2 + AC^2 = BC^2$  hence triangle is right angled isosceles.

### 3. AREA OF TRIANGLE

If A ( $x_1, y_1$ ), B ( $x_2, y_2$ ) and C ( $x_3, y_3$ ) form a triangle then area of  $\Delta ABC$  is given by

$$\Delta = \frac{1}{2} \begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} \text{ or } \Delta = \frac{1}{2} \left| \begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \\ x_3 & y_3 \end{vmatrix} \right| = \frac{1}{2} \{x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)\} \text{ 'Stair-method'}$$

Area of  $\Delta OAB$ , where O is origin of co-ordinate system is given by  $\Delta = \frac{1}{2}(x_1y_2 - x_2y_1)$

### 4. CONDITION FOR COLLINEARITY OF 3-POINTS

If A, B & C are collinear, the area of triangle ABC has to be zero i.e.

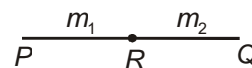
$$\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} = 0 \text{ or } x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2) = 0$$

### 5. SECTION FORMULA

Coordinates of the point R ( $\bar{x}, \bar{y}$ ) which divides the join of the points P( $x_1, y_1$ ) and Q( $x_2, y_2$ )

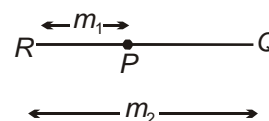
(i) internally, in the ratio  $m_1 : m_2$ , are

$$\bar{x} = \frac{m_1x_2 + m_2x_1}{m_1 + m_2} ; \bar{y} = \frac{m_1y_2 + m_2y_1}{m_1 + m_2}$$



(ii) externally, in the ratio  $m_1 : m_2$ , are

$$\bar{x} = \frac{m_1x_2 - m_2x_1}{m_1 - m_2} ; \bar{y} = \frac{m_1y_2 - m_2y_1}{m_1 - m_2}$$



where  $m_1 \neq m_2$

**Note :**

- (i) Mid point ( $m_1 = m_2$ ) of PQ is  $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$ .
- (ii) For finding the ratio of division, use  $\lambda : 1$ . If  $\lambda$  comes out to be positive, it indicates internal division otherwise external.

**Illustration 3:** Diagonal AC & BD of quadrilateral ABCD are divided in the ratio of  $\lambda : 1$  and  $t : 1$  respectively by their point of intersection, where  $A(0, 2)$ ,  $B(3, 3)$ ,  $C\left(\frac{6}{5}, \frac{46}{5}\right)$  and

$D\left(\frac{1}{2}, \frac{37}{4}\right)$  are the vertices. Then find the value of  $\lambda$  and  $t$ .

**Solution :** Equating the x coordinate of intersection point, we get

$$\frac{\frac{6\lambda}{\lambda+1} + 2}{\lambda+1} = \frac{\frac{t}{t+1} + 3}{t+1} \quad \dots(i)$$

equating y coordinate of intersection point, we get

$$\frac{\frac{46\lambda}{\lambda+1} + 2}{\lambda+1} = \frac{\frac{37t}{t+1} + 3}{t+1} \quad \dots(ii)$$

solving equations (i) & (ii), we get

$$\lambda = 5$$

$$t = 4$$

## 6. CENTROID, INCENTRE & EX-CENTRES OF A TRIANGLE

If vertices of  $\triangle ABC$  have coordinates  $A(x_1, y_1)$ ,  $B(x_2, y_2)$  and  $C(x_3, y_3)$ , then

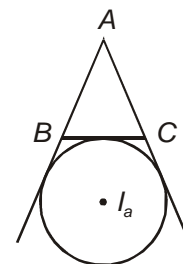
(i) Coordinates of its centroid are  $\left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}\right)$

(ii) Coordinates of its incentre are  $\left(\frac{ax_1 + bx_2 + cx_3}{a + b + c}, \frac{ay_1 + by_2 + cy_3}{a + b + c}\right)$ ,

where  $a = BC$ ,  $b = AC$  and  $c = AB$

(iii) Coordinates of excentre  $I_a$  are

$$\left(\frac{-ax_1 + bx_2 + cx_3}{-a + b + c}, \frac{-ay_1 + by_2 + cy_3}{-a + b + c}\right)$$



**Note :** Incentre is the point of intersection of internal bisectors of angles of triangle. Its distance from all three sides is same and called inradius ( $r$ ) of circle.

## 7. CIRCUMCENTRE

It is the point of intersection of perpendicular bisectors of sides, so its distance from all three vertices is same. If  $O(x, y)$  be circumcentre of  $\triangle ABC$ ,  $[A(x_1, y_1), B(x_2, y_2), \text{ and } C(x_3, y_3)]$  then  $OA^2 = OB^2 = OC^2$

i.e.  $(x-x_1)^2 + (y-y_1)^2 = (x-x_2)^2 + (y-y_2)^2 = (x-x_3)^2 + (y-y_3)^2$  when solved shall give  $(x, y)$ .

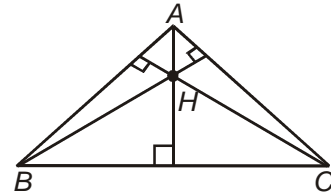
**Note :**

(i) If D, E, F are mid points of BC, AC and AB respectively, then

$$\left. \begin{array}{l} \text{Slope of BC} \times \text{Slope of OD} = -1 \\ \text{Slope of CD} \times \text{Slope of OE} = -1 \\ \text{Slope of AB} \times \text{Slope of OF} = -1 \end{array} \right\} \text{Solving any two, we get } x \text{ \& } y$$

(ii) Circumcentre is also given by

$$\left[ \frac{x_1 \sin 2A + x_2 \sin 2B + x_3 \sin 2C}{\sin 2A + \sin 2B + \sin 2C}, \frac{y_1 \sin 2A + y_2 \sin 2B + y_3 \sin 2C}{\sin 2A + \sin 2B + \sin 2C} \right]$$



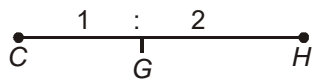
## 8. ORTHOCENTRE

It is the point of intersection of the perpendicular drawn from the vertices of the triangle on the opposite sides. When vertices and the angles of the triangle are given, then orthocentre is given by

$$\left( \frac{x_1 \tan A + x_2 \tan B + x_3 \tan C}{\tan A + \tan B + \tan C}, \frac{y_1 \tan A + y_2 \tan B + y_3 \tan C}{\tan A + \tan B + \tan C} \right)$$

**Note :**

- In case of equilateral triangle, centroid, incentre, circumcentre and orthocentre of the triangle lie at the same point.
- Circumcentre C, centroid G and orthocentre H of a triangle are collinear and centroid divides the line joining circumcentre and orthocentre in the ratio of 1 : 2



**Illustration 4:** Triangle ABC has its vertices as  $(5\sqrt{2}, 5)$ ,  $(3\sqrt{2}, 9)$  and  $(-\sqrt{2}, 2)$  respectively. Find the distance of centroid from origin.

**Solution :** G, Centroid =  $\left( \frac{7\sqrt{2}}{3}, \frac{16}{3} \right)$

$$\begin{aligned} OG &= \sqrt{\left(\frac{7\sqrt{2}}{3}\right)^2 + \left(\frac{16}{3}\right)^2} \\ &= \frac{1}{3} \sqrt{98 + 256} = \frac{\sqrt{354}}{3} = \sqrt{\frac{118}{3}} \end{aligned}$$

## 9. LOCUS AND ITS EQUATION

When a point moves, so as always to satisfy a given condition or conditions, the path it traces out is called as its locus under these conditions.

Equation to the locus (or curve) is the relation between coordinates of an arbitrarily chosen point on the curve and which relation holds for no other points except those lying on the curve.

### Method for writing equation of a locus

1. Assume the point whose locus (path) is to be found is  $(h, k)$ .
2. Make the equation involving  $(h, k)$  as per the conditions given.
3. Simplify this equation.
4. Substitute  $h$  with  $x$  and  $k$  with  $y$  in the simplified form of equation.

**Illustration 5:** Find the equation of the locus of a point so that sum of its distance from two given points  $P(3, 2)$  and  $Q(4, 3)$  is 4.

**Solution :**

1. Let the required variable point be  $R(h, k)$
2.  $PR + QR = 4$ , Hence  $\sqrt{(h-3)^2 + (k-2)^2} + \sqrt{(h-4)^2 + (k-3)^2} = 4$
3.  $h^2 + k^2 + 13 - 6h - 4k = 16 + h^2 + k^2 + 25 - 8h - 6k - 8\sqrt{(h-4)^2 + (k-3)^2}$   
 $\Rightarrow 2h + 2k - 28 = -8\sqrt{(h-4)^2 + (k-3)^2}$   
 $\Rightarrow h + k - 14 = -4\sqrt{(h-4)^2 + (k-3)^2}$   
 $\Rightarrow h^2 + k^2 + 196 - 28h - 28k + 2hk = 16h^2 + 16k^2 + 400 - 32h - 24k$   
 $\Rightarrow 15h^2 + 15k^2 - 2hk - 4h + 4k + 204 = 0$
4. Hence locus is

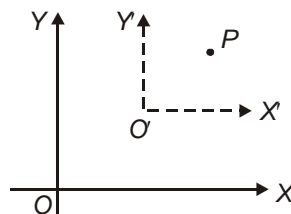
$$15x^2 + 15y^2 - 2xy - 4x + 4y + 204 = 0$$

## 10. SHIFTING OF ORIGIN AND ROTATION OF AXES

### 1. Change of axes, by changing origin, the direction of axes remaining the same

Let  $OXY$  and  $O'X'Y'$  be two rectangular Cartesian system of axes.

Let  $P$  be any point in the plane of the axes and let  $P$  and  $O'$  have coordinates  $(x, y)$  and  $(h, k)$  respectively with respect to  $OXY$  system. Then the coordinates  $(x', y')$  of  $P$  with respect to the system  $O'X'Y'$  are given by  $x = x' + h$  ;  $y = y' + k$

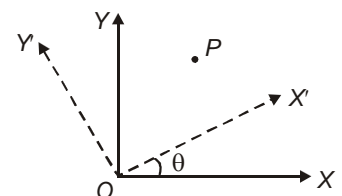


### 2. Change of axes (without changing the origin), by changing the direction of axes, both systems of coordinates being rectangular

If a point  $P$  in the plane of  $OXY$  has coordinates  $(x, y)$  and  $(x', y')$  with respect to the system  $OXY$  and  $O'X'Y'$  respectively, then

$$x = x' \cos \theta - y' \sin \theta$$

$$y = x' \sin \theta + y' \cos \theta$$



## 11. GENERAL EQUATION OF A STRAIGHT LINE

An equation of the form  $ax + by + c = 0$  where  $a$  &  $b$  both are not zero simultaneously, represents a straight line.

Slope of a line is denoted by  $m = \tan\theta$ ; where  $\theta$  is the inclination of line to the positive direction of x-axis. ( $\theta$  measured anticlockwise from +ve x-axis is taken as positive).

Slope of a line joining two points  $(x_1, y_1)$  and  $(x_2, y_2)$  is

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{y_1 - y_2}{x_1 - x_2}$$

Slope of line  $ax + by + c = 0$  is  $m = -a/b$

**Note :**

- (i) Slope of x-axis is zero.
- (ii) Slope of y-axis is infinite (undefined).
- (iii) Slope of line equally inclined with both axes is either 1 or  $-1$  ( $\theta = 45^\circ$  or  $135^\circ$ ).
- (iv) Two lines with slopes  $m_1$  and  $m_2$  are parallel if  $m_1 = m_2$  and perpendicular if  $m_1 m_2 = -1$ .
- (v) Points  $A(x_1, y_1)$ ,  $B(x_2, y_2)$  and  $C(x_3, y_3)$  are collinear (i.e. lie on a straight line) if slope between A and B is equal to slope between B and C.

**Illustration 6:** The three vertices of a triangle are  $A(5, 5)$ ,  $B(7, 3)$ ,  $C(1, 2)$ . Find the slope of median from A.

**Solution :**  $D \equiv \left( \frac{1+7}{2}, \frac{2+3}{2} \right)$

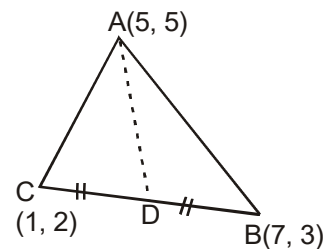
$$\equiv \left( 4, \frac{5}{2} \right)$$

$$A \equiv (5, 5)$$

$$\text{Hence, slope of } AD = \frac{5 - 5/2}{5 - 4}$$

$$= \frac{5/2}{1}$$

$$= 5/2$$



## 12. INTERCEPTS OF A LINE

Let a line  $L \equiv ax + by + c = 0$ , intersects OX - axis at A and OY - axis at B, then OA and OB are called x-intercept and y-intercept of line respectively. For x - intercept, substitute  $y = 0$  in the equation i.e.  $ax + c = 0$

$\therefore x = -c/a$  is the x - intercept.

Similarly, for y - intercept put  $x = 0$

i.e.  $by + c = 0$

$\therefore y = -c/b$  is the y - intercept.

Hence, length of x intercept is  $|-c/a|$  and length of y intercept is  $|-c/b|$ .

### 13. VARIOUS FORMS OF EQUATION OF STRAIGHT LINE

- (i) Line with slope  $m$  and a given point  $(x_1, y_1)$  on it

$$y - y_1 = m(x - x_1) \quad \text{(Slope point form)}$$

- (ii) Line with two given points  $(x_1, y_1)$  and  $(x_2, y_2)$  on it

$$\frac{y - y_1}{y_1 - y_2} = \frac{x - x_1}{x_1 - x_2} \quad \text{(Two point form)}$$

- (iii) Line with given slope  $m$  and intercept  $c$  on  $y$ -axis

$$y = mx + c \quad \text{(Slope intercept form)}$$

- (iv) Line with given intercepts  $a$  and  $b$  on  $x$  and  $y$  axes respectively

$$\frac{x}{a} + \frac{y}{b} = 1 \quad \text{(Double intercept form)}$$

- (v) Line at perpendicular distance  $p$  from the origin where the perpendicular makes angle  $\alpha$  with  $OX$

$$x \cos \alpha + y \sin \alpha = p \quad \text{(Normal or perpendicular form)}$$

- (vi) Line making an angle  $\alpha$  with  $OX$  and passing through  $(x_1, y_1)$  and  $r$  as the directed distance of any point  $P(x, y)$  on the line

$$x = x_1 + r \cos \alpha ; \quad y = y_1 + r \sin \alpha \quad \text{(Symmetric or parametric form)}$$

**Illustration 7:** Find the co-ordinates of two points which are at  $3\sqrt{2}$  distance from the point  $(1, 3)$

and lie on a straight line passing from this point and inclined at  $\frac{2\pi}{3}$  angle to  $x$ -axis.

**Solution :** Clearly symmetric or parametric form shall be most helpful in such questions

$$x = x_1 + r \cos \alpha ; \quad y = y_1 + r \sin \alpha$$

$$\text{Given } \alpha = 2\pi/3, \quad x_1 = 1, \quad y_1 = 3, \quad r = \pm 3\sqrt{2}$$

So, points are

$$x = 1 \pm 3\sqrt{2} \cos 2\pi/3 = 1 \pm 3\sqrt{2} \left(-\frac{1}{2}\right) = 1 \mp \frac{3}{\sqrt{2}}$$

$$y = 3 \pm 3\sqrt{2} \sin 2\pi/3 = 3 \pm 3\sqrt{2} \left(\frac{\sqrt{3}}{2}\right) = 3 \pm \frac{3\sqrt{3}}{\sqrt{2}}$$

$$\left(1 - \frac{3}{\sqrt{2}}, 3 + \frac{3\sqrt{3}}{\sqrt{2}}\right) \text{ and } \left(1 + \frac{3}{\sqrt{2}}, 3 - \frac{3\sqrt{3}}{\sqrt{2}}\right) \text{ are the required points.}$$

### 14. ANGLE BETWEEN TWO LINES

If  $\theta$  be the angle between the lines  $y = m_1x + c_1$  and  $y = m_2x + c_2$  then,

$$\theta = \tan^{-1} \left| \frac{m_1 - m_2}{1 + m_1m_2} \right|.$$

**Note:**

- (i) If  $\theta$  is angle between two lines, then  $\pi - \theta$  is also the angle between them.
- (ii) If both  $m_1$  &  $m_2$  are undefined, then angle between lines is 0.
- (iii) If  $m_1$  is undefined &  $m_2 = \tan\theta$ , then angle between lines is  $\left(\frac{\pi}{2} - \theta\right)$
- (iv) The two lines which make angles  $\phi$  with the given line  $y = mx + c$  and passing through the point  $(x_1, y_1)$  are given by  $y - y_1 = m_1(x - x_1)$  and  $y - y_1 = m_2(x - x_1)$ ,  
where  $m_1 = \frac{m - \tan \phi}{1 + m \tan \phi}$ ;  $m_2 = \frac{m + \tan \phi}{1 - m \tan \phi}$
- (v) The length  $r$  of the line segment drawn through a given point  $(x_1, y_1)$  and making an angle  $\theta$  with x-axis, to meet the line  $ax + by + c = 0$  is given by  $r = -\frac{ax_1 + by_1 + c}{a \cos \theta + b \sin \theta}$

**15. CONDITIONS FOR TWO LINES TO BE INTERSECTING, PARALLEL OR PERPENDICULAR**

Two lines  $a_1x + b_1y + c_1 = 0$  and  $a_2x + b_2y + c_2 = 0$  will be

1. coincident if  $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$
2. parallel if  $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$
3. perpendicular if  $a_1a_2 + b_1b_2 = 0$
4. intersecting if  $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

**Note :**

- (i) Line parallel to  $ax + by + c = 0$  is  $ax + by + k = 0$ , i.e., only constant term has to be changed.
- (ii) Line perpendicular to  $ax + by + c = 0$  is  $bx - ay + \lambda = 0$ , i.e., interchange the coefficients of  $x$  and  $y$  and change the sign of one of them and change the constant term.

**Illustration 8:** Find the equation of lines parallel and perpendicular to the line  $2x + 3y + 5 = 0$ , which pass through origin.

**Solution :** Line parallel to given line is  $2x + 3y + k = 0$ .  
Since, it passes through origin.  
So,  $k = 0$   
Hence,  $2x + 3y = 0$  is the required parallel line.  
Any line perpendicular to  $2x + 3y + 5 = 0$  is  
 $3x - 2y + \lambda = 0$  ( $\lambda = 0$ , since it passes through origin)  
 $\therefore 3x - 2y = 0$  is the required perpendicular line.

**16. DISTANCE BETWEEN TWO PARALLEL LINES**

Let  $ax + by + c_1 = 0$  &  $ax + by + c_2 = 0$  are two parallel lines, then distance between them is given

by  $d = \frac{|c_1 - c_2|}{\sqrt{a^2 + b^2}}$

### 17. PERPENDICULAR DISTANCE OF A LINE FROM A POINT

The length  $p$  of the perpendicular from the point  $(x_1, y_1)$  to the line  $ax + by + c = 0$  is given by

$$p = \frac{|ax_1 + by_1 + c|}{\sqrt{a^2 + b^2}}$$

### 18. POINTS IN RELATION TO A LINE $ax + by + c = 0$

- The points  $P(x_1, y_1)$  and  $Q(x_2, y_2)$  lie on the same side or on the opposite side of the line  $ax + by + c = 0$  according as  $ax_1 + by_1 + c$  and  $ax_2 + by_2 + c$  have same sign or opposite sign.
- The ratio in which the line  $ax + by + c = 0$  divides the line segment joining  $P(x_1, y_1)$  and

$$Q(x_2, y_2) \text{ is } -\frac{ax_1 + by_1 + c}{ax_2 + by_2 + c}$$

- Coordinates of the foot of the perpendicular drawn from  $P(x_1, y_1)$  to the line  $ax + by + c = 0$

$$\text{are given by } \frac{x - x_1}{a} = \frac{y - y_1}{b} = -\frac{ax_1 + by_1 + c}{\sqrt{a^2 + b^2}}$$

- Coordinates of the image of  $P(x_1, y_1)$  in the line  $ax + by + c = 0$  are given by

$$\frac{x - x_1}{a} = \frac{y - y_1}{b} = -\frac{2(ax_1 + by_1 + c)}{\sqrt{a^2 + b^2}}$$

### 19. CONCURRENCY OF LINES

The lines  $a_1x + b_1y + c_1 = 0$  ;  $a_2x + b_2y + c_2 = 0$  and  $a_3x + b_3y + c_3 = 0$  are concurrent if they pass

through the same point ; the condition for concurrency is 
$$\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = 0$$

**Note :** To prove three line to be concurrent show that the point of intersection of any two lines, satisfies the equation of third line.

**Illustration 9:** Show that the line  $3x + 4y - 6 = 0$  does not divide the triangle ABC whose vertices are  $(0,0)$ ,  $(1,-1)$  &  $(-3, 2)$ .

**Solution :**  $3x + 4y - 6 = 0$   
 $x = 0, y = 0 \Rightarrow \text{LHS} = -6$   
 $x = 1, y = -1 \Rightarrow \text{LHS} = -7$   
 $x = -3, y = 2 \Rightarrow \text{LHS} = -7$

Hence all the three vertices fall on the same side of line, hence the line does not divide the triangle.

**Illustration 10:** The three line  $2x + 3y - 5 = 0$ ;  $2x + 4y - 6 = 0$  and  $x + 7y - 8 = 0$  are

**Solution :** 
$$\begin{vmatrix} 2 & 3 & -5 \\ 2 & 4 & -6 \\ 1 & 7 & -8 \end{vmatrix}$$

$$= 2(-32 + 42) - 3(-16 + 6) - 5(14 - 4)$$

$$= 20 + 30 - 50 = 0$$

Hence lines are concurrent

## 20. FAMILY OF LINES

Lines through the point of intersection of two given lines  $a_1x + b_1y + c_1 = 0$  and  $a_2x + b_2y + c_2 = 0$  are given by  $(a_1x + b_1y + c_1) + \lambda(a_2x + b_2y + c_2) = 0$ ; where  $\lambda$  is a parameter.

It represents a family of lines. Any particular line (member of the family) can be found from the additional condition stated about the required line.

## 21. ANGLE BISECTORS BETWEEN TWO LINES

The equations of the bisectors of the angles between two intersecting lines

$a_1x + b_1y + c_1 = 0$  and  $a_2x + b_2y + c_2 = 0$  are given by

$$\frac{a_1x + b_1y + c_1}{\sqrt{a_1^2 + b_1^2}} = \pm \frac{a_2x + b_2y + c_2}{\sqrt{a_2^2 + b_2^2}}$$

### Rule for writing a particular bisector

Write the equations of the lines so that constant terms are positive

If  $a_1a_2 + b_1b_2 > 0$  then  $\frac{a_1x + b_1y + c_1}{\sqrt{a_1^2 + b_1^2}} = \frac{a_2x + b_2y + c_2}{\sqrt{a_2^2 + b_2^2}} \dots(1)$

gives the obtuse angle bisector.

If  $a_1a_2 + b_1b_2 < 0$  then (1) gives the acute angle bisector.

**Note** : If the equations are written so that the constant terms have same sign, then (1) gives bisector of the angle in which the origin lies (and not necessarily the acute angle bisector).

**Illustration 11:** For the straight lines  $4x + 3y - 6 = 0$  and  $5x + 12y + 9 = 0$ , find the equation of the bisector of the angle which contains the origin.

**Solution** : Re-writing the given equations so that constant terms are positive, we have

$$-4x - 3y + 6 = 0 \dots(i)$$

$$\text{and } 5x + 12y + 9 = 0 \dots(ii)$$

$$\begin{aligned} \text{Now } a_1a_2 + b_1b_2 &= (-4)(5) + (-3)(12) \\ &= -20 - 36 = -56 < 0 \end{aligned}$$

So, the origin lies in acute angle.

$\therefore$  The equation of the bisector of the acute angle between the lines (i) and (ii) is

$$\frac{-4x - 3y + 6}{\sqrt{(-4)^2 + (-3)^2}} = + \frac{5x + 12y + 9}{\sqrt{5^2 + (12)^2}}$$

$$\Rightarrow -52x - 39y + 78 = 25x + 60y + 45$$

$$\Rightarrow 7x + 9y - 3 = 0$$

**22. IMPORTANT POINTS**

1. Area of the triangle, whose sides are  $y = m_1x + c_1$ ,  $y = m_2x + c_2$  and  $y = m_3x + c_3$  is given by

$$A = \frac{1}{2} \left| \sum \frac{(c_1 - c_2)^2}{m_1 - m_2} \right|$$

2. Area of the triangle made by the line  $ax + by + c = 0$  with the co-ordinate axes is  $\frac{c^2}{2|ab|}$ .

3. Area of rhombus, formed by  $ax \pm by \pm c = 0$ , is given by,  $A = \left| \frac{2c^2}{ab} \right|$

4. Area of the parallelogram formed by the lines  $a_1x + b_1y + c_1 = 0$ ,  $a_2x + b_2y + c_2 = 0$ ,  $a_1x + b_1y + d_1 = 0$ ,  $a_2x + b_2y + d_2 = 0$  is given by  $A = \left| \frac{(d_1 - c_1)(d_2 - c_2)}{a_1b_2 - a_2b_1} \right|$

5. The equation of a line whose mid-point is  $(x_1, y_1)$  in between the axes is  $\frac{x}{x_1} + \frac{y}{y_1} = 2$ .

6. The equation of a straight line which makes a triangle with the axes whose centroid is  $(x_1, y_1)$  is given by  $\frac{x}{3x_1} + \frac{y}{3y_1} = 1$ .

**SOLVED OBJECTIVE EXAMPLES**

1. Find the point which divide the line joining the points  $(-3, -4)$  and  $(-8, -7)$  externally in the ratio  $7 : 5$ .

(a)  $\left(-\frac{41}{2}, -\frac{29}{2}\right)$       (b)  $\left(-\frac{39}{2}, -\frac{29}{2}\right)$

(c)  $\left(-\frac{41}{2}, -\frac{39}{2}\right)$       (d)  $\left(-\frac{35}{2}, -\frac{29}{2}\right)$

Sol. (a)

Let  $A(-3, -4)$  &  $B(-8, -7)$

Let  $Q(\alpha, \beta)$  divide  $AB$  externally in the ratio of  $7 : 5$ .

$$\alpha = \frac{7 \cdot (-8) - 5 \cdot (-3)}{7 - 5} = -\frac{41}{2}$$

$$\begin{array}{ccc} \overline{\quad\quad\quad} & & \\ A & B & Q \\ (-3, -4) & (-8, -7) & (\alpha, \beta) \end{array}$$

$$\beta = \frac{7 \cdot (-7) - 5 \cdot (-4)}{7 - 5} = -\frac{29}{2}$$

Hence, the required point is  $\left(-\frac{41}{2}, -\frac{29}{2}\right)$ .

2. For what values of  $k$  are the points  $(k, 2 - 2k)$ ,  $(1 - k, 2k)$   $(-4 - k, 6 - 2k)$  collinear ?

(a)  $k = \frac{1}{2}, -0$       (b)  $k = \frac{1}{3}, 1$

(c)  $k = \frac{1}{2}, -1$       (d)  $k = \frac{1}{2}, -2$

Sol. (c)

If points are collinear then

$$\frac{1}{2} \begin{vmatrix} k & 2 - 2k & 1 \\ 1 - k & 2k & 1 \\ -1 - k & 6 - 2k & 1 \end{vmatrix} = 0$$

$$\Rightarrow \begin{vmatrix} k & 2 - 2k & 1 \\ 1 - 2k & 4k - 2 & 0 \\ -4 - 2k & 4 & 0 \end{vmatrix} = 0$$

$$\Rightarrow 4(1 - 2k) - (4k - 2)(-4 - 2k) = 0$$

$$\Rightarrow 4 - 8k + 16k - 8 + 8k^2 - 4k = 0$$

$$\Rightarrow 8k^2 + 4k - 4 = 0 \Rightarrow 2k^2 + k - 1 = 0$$

$$\Rightarrow k = \frac{-1 \pm \sqrt{1 + 8}}{4} = \frac{-1 \pm 3}{4}$$

$$\Rightarrow k = \frac{1}{2}, -1$$

3. The ends of a rod of length  $l$  move on two mutually perpendicular lines. Find the locus of the point on the rod which divides it in the ratio  $1 : 2$ .

(a)  $4y^2 + x^2 = \frac{2l^2}{9}$       (b)  $4y^2 + x^2 = \frac{4l^2}{9}$

(c)  $2y^2 + x^2 = \frac{2l^2}{9}$       (d)  $3y^2 + x^2 = \frac{4l^2}{9}$

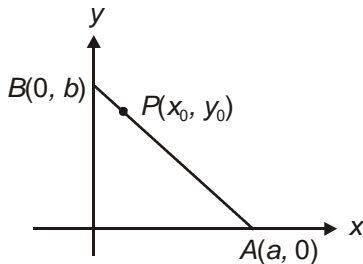
Sol. (b)

Let the two mutually perpendicular lines be the  $x$  and  $y$  axes and let  $P(x_0, y_0)$  be any point on the locus. Let  $AB$  denote the corresponding position of the rod such that

$$\frac{AP}{BP} = 2 \text{ and where } A(a, 0) \text{ and } B(0, b).$$

Then,  $l^2 = AB^2 = a^2 + b^2$

$$y_0 = \frac{2b+0}{3} ; \quad x_0 = \frac{2 \cdot 0 + 1 \cdot a}{3}$$



$$\therefore \left(\frac{3y_0}{2}\right)^2 + (3x_0)^2 = l^2$$

$$y_0^2 + 4x_0^2 = \frac{4l^2}{9}$$

Equation to locus is  $4x^2 + y^2 = \frac{4l^2}{9}$ .

Note : If  $\frac{AP}{BP} = \frac{1}{2}$  then equation to locus

would be  $4y^2 + x^2 = \frac{4l^2}{9}$ .

4. Vertices of a triangle are  $(2 \cos \theta, \sin \theta)$ ,  $(\sin \theta, \cos \theta)$ ,  $(-\cos \theta, -2 \sin \theta)$ . Find the locus of its centroid, as  $\theta$  varies.

(a)  $9(x^2 + y^2) = 2$       (b)  $5(x^2 + y^2) = 2$

(c)  $3(x^2 + y^2) = 2$       (d)  $7(x^2 + y^2) = 2$

Sol. (a)

Let centroid of the  $\Delta$  be  $(h, k)$ , then

$$h = \frac{2 \cos \theta - \cos \theta + \sin \theta}{3}; \quad k = \frac{\sin \theta - 2 \sin \theta + \cos \theta}{3}$$

$$\Rightarrow 3h = \cos \theta + \sin \theta ; \quad 3k = \cos \theta - \sin \theta$$

squaring and adding,

$$\Rightarrow 9h^2 + 9k^2 = 2$$

$\therefore$  Required locus is,  $9(x^2 + y^2) = 2$ .

5. Find the coordinates of the orthocentre of the triangle whose vertices are  $(0, 0)$ ,  $(2, -1)$  and  $(-1, 3)$ .

(a)  $(-2, -4)$

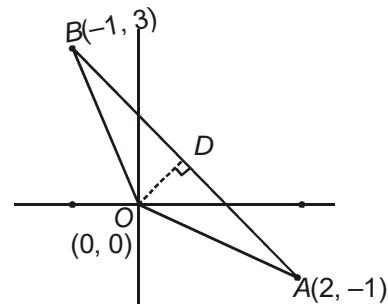
(b)  $(-4, 2)$

(c)  $(-4, -3)$

(d)  $(3, -4)$

Sol. (c)

Let  $OAB$  be the triangle as shown in the figure.



$$\text{Slope } AB = \frac{3 - (-1)}{-1 - 2} = -\frac{4}{3}$$

Slope of altitude  $OD = \frac{3}{4}$  and its equation is

$$y = \frac{3}{4}x \quad \dots(1)$$

Slope  $OB = -3$

$\therefore$  Slope of altitude through  $A = \frac{1}{3}$

Eq. of altitude from  $A$  is  $y + 1 = \frac{1}{3}(x - 2)$

$$3y - x + 5 = 0 \quad \dots(2)$$

Solving (1) and (2), the coordinates of orthocentre are  $x = -4, y = -3$ , i.e.  $(-4, -3)$ .

6. Find the coordinates of those points on the line  $3x + 2y = 5$  which are equidistant from the lines  $4x + 3y = 7$  and  $2y = 5$ .

(a)  $\left(\frac{1}{16}, \frac{77}{32}\right)$  &  $\left(-\frac{1}{14}, \frac{73}{28}\right)$

(b)  $\left(\frac{1}{16}, \frac{75}{32}\right)$  &  $\left(-\frac{3}{14}, \frac{73}{28}\right)$

(c)  $\left(-\frac{1}{16}, \frac{77}{32}\right)$  &  $\left(\frac{1}{14}, \frac{73}{28}\right)$

(d) None of these

Sol. (a)

It is obvious that the desired points lie on  $3x + 2y = 5$  as well as on the bisectors of angles formed by the lines

$4x + 3y = 7$  .....(1)

$2y - 5 = 0$  .....(2)

Equations to the angle bisectors are

$\frac{4x+3y-7}{5} = \pm \frac{2y-5}{2}$

$8x+6y-14 = \pm(10y-25)$

$8x + 16y - 39 = 0$  ;  $8x - 4y + 11 = 0$

Solving  $3x + 2y = 5$  and  $8x + 16y = 39$  we

get  $x = \frac{1}{16}, y = \frac{77}{32}$

Solving  $3x + 2y = 5$  and  $8x - 4y + 11$

$= 0$  we get  $x = -\frac{1}{14}, y = \frac{73}{28}$

7. The line L has intercepts a and b on the coordinate axes. While keeping the origin fixed, if the coordinate axes are rotated through a fixed angle, the same line has intercepts p and q on the rotated axes, then which of the following is true?

(a)  $\frac{1}{p^2} - \frac{1}{q^2} = \frac{1}{a^2} + \frac{1}{b^2}$

(b)  $\frac{1}{p^2} + \frac{1}{q^2} = \frac{1}{a^2} + \frac{1}{b^2}$

(c)  $\frac{1}{p^2} + \frac{1}{q^2} = \frac{1}{a^2} - \frac{1}{b^2}$

(d)  $\frac{1}{p^2} - \frac{1}{q^2} = \frac{1}{a^2} - \frac{1}{b^2}$

Sol. (b)

Suppose that the axes are rotated in the anticlockwise direction through an angle  $\alpha$ . The equation of the line L with respect to the

old axes is given by  $\frac{x}{a} + \frac{y}{b} = 1$ . To find the

equation of L with respect to the new rotated axes, we replace  $x$  by  $x \cos \alpha - y \sin \alpha$  and  $y$  by  $x \sin \alpha + y \cos \alpha$  so that the equation of L with respect to the new axes is

$\frac{1}{a}(x \cos \alpha - y \sin \alpha) + \frac{1}{b}(x \sin \alpha + y \cos \alpha) = 1$

$\Rightarrow \left(\frac{1}{a} \cos \alpha + \frac{1}{b} \sin \alpha\right)x + \left(\frac{1}{b} \cos \alpha - \frac{1}{a} \sin \alpha\right)y = 1$

.....(1)

Since p and q are the intercepts made by this line on coordinate axes we have

$\frac{1}{p} = \frac{1}{a} \cos \alpha + \frac{1}{b} \sin \alpha$  and  $\frac{1}{q} = \frac{1}{b} \cos \alpha - \frac{1}{a} \sin \alpha$

Squaring and adding we get

$\frac{1}{p^2} + \frac{1}{q^2} = \frac{1}{a^2} + \frac{1}{b^2}$

8. A straight line through the origin 'O' meets the parallel lines  $4x + 2y = 9$  and  $2x + y + 6 = 0$  at the points P and Q respectively. Then find the ratio in which the point 'O' divides the segment PQ.

(a)  $\frac{2}{5}$  (b)  $\frac{3}{4}$

(c)  $\frac{4}{7}$  (d)  $\frac{2}{3}$

Sol. (b)

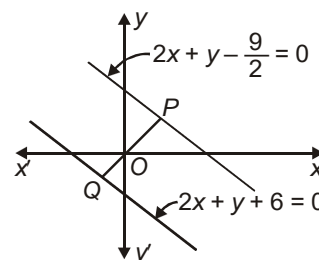
Taking PQ in any direction, ratio of OP and OQ will be same, so taking  $PQ \perp$  to the given parallel lines

$OP = \perp$  from (0, 0) on  $2x + y - \frac{9}{2} = 0$

$= \frac{\left|-\frac{9}{2}\right|}{\sqrt{4+1}} = \frac{9}{2\sqrt{5}}$

$OQ = \perp$  from (0, 0) on  $2x + y + 6 = 0$

$= \frac{6}{\sqrt{4+1}} = \frac{6}{\sqrt{5}}$



$\therefore \frac{OP}{OQ} = \frac{\frac{9}{2}\sqrt{5}}{\frac{6}{\sqrt{5}}} = \frac{9}{12} = \frac{3}{4}$

**PRACTICE EXERCISE**

- The equation of the line whose slope is 3 and which cuts off an intercept 3 from the positive x – axis is  
(a)  $y = 3x - 9$  (b)  $y = 3x + 3$   
(c)  $y = 3x + 9$  (d) None of these
- The equation of the straight line passing through the point (3, 2) and perpendicular to the line  $y = x$  is  
(a)  $x - y = 5$  (b)  $x + y = 5$   
(c)  $x + y = 1$  (d)  $x - y = 1$
- If the coordinates of the vertices of the triangle ABC be (-1, 6), (-3, -9), and (5, -8) respectively, then the equation of the median through C is  
(a)  $13x - 14y - 47 = 0$   
(b)  $13x - 14y + 47 = 0$   
(c)  $13x + 14y + 47 = 0$   
(d)  $13x + 14y - 47 = 0$
- The equation of the lines which passes through the point (3, -2) and are inclined at  $60^\circ$  to the line  $\sqrt{3}x + y = 1$   
(a)  $y + 2 = 0, \sqrt{3}x - y - 2 - 3\sqrt{3} = 0$   
(b)  $x - 2 = 0, \sqrt{3}x - y + 2 + 3\sqrt{3} = 0$   
(c)  $\sqrt{3}x - y - 2 - 3\sqrt{3} = 0$   
(d) None of these
- The equation of a straight line passing through (-3,2) and cutting an intercept equal in magnitude but opposite in sign from the axes is given by  
(a)  $x - y + 5 = 0$  (b)  $x + y - 5 = 0$   
(c)  $x - y - 5 = 0$  (d)  $x + y + 5 = 0$
- A line passes through the point of intersection of  $2x + y = 5$  and  $x + 3y + 8 = 0$  parallel to the line  $3x + 4y = 7$  is  
(a)  $3x + 4y + 3 = 0$  (b)  $3x + 4y = 0$   
(c)  $4x - 3y + 3 = 0$  (d)  $4x - 3y = 3$
- The points A (1, 3) and C (5, 1) are the opposite vertices of rectangle. The equation of line passing through other two vertices and of gradient 2, is  
(a)  $2x + y - 8 = 0$  (b)  $2x - y - 4 = 0$   
(c)  $2x - y + 4 = 0$  (d)  $2x + y + 7 = 0$
- Equation of a straight line on which length of perpendicular from the origin is four units and the line makes an angle of  $120^\circ$  with the x–axis, is  
(a)  $x\sqrt{3} + y + 8 = 0$  (b)  $x\sqrt{3} - y = 8$   
(c)  $x\sqrt{3} - y = 8$  (d)  $x - \sqrt{3}y + 8 = 0$
- Equations of lines which passes through the points of intersection of the lines  $4x - 3y - 1 = 0$  and  $2x - 5y + 3 = 0$  and equally inclined to the axes are  
(a)  $y \pm x = 0$  (b)  $y - 1 = \pm 1(x - 1)$   
(c)  $x - 1 = \pm 2(y - 1)$  (d) None of these
- A line is such that its segment between the straight lines  $5x - y - 4 = 0$  and  $3x + 4y - 4 = 0$  is bisected at the point (1, 5), then its equation is  
(a)  $83x - 35y + 92 = 0$  (b)  $35x - 83y + 92 = 0$   
(c)  $35x + 35y + 92 = 0$  (d) None of these
- Equation of the line which passes through the point (-4,3) and the portion of the line intercepted between the axes is divided internally in the ratio 5 : 3 by this point, is  
(a)  $9x + 20y + 96 = 0$  (b)  $20x + 9y + 96 = 0$   
(c)  $9x - 20y + 96 = 0$  (d) None of these
- If we reduce  $3x + 3y + 7 = 0$  to the form  $x \cos \alpha + y \sin \alpha = p$ , then the value of p is  
(a)  $\frac{7}{2\sqrt{3}}$  (b)  $\frac{7}{3}$   
(c)  $\frac{3\sqrt{7}}{2}$  (d)  $\frac{7}{3\sqrt{2}}$
- If the slope of a line passing through the point A (3, 2) be  $\frac{3}{4}$ , then the points on the line which are 5 units away from A, are  
(a) (5, 5), (-1, -1) (b) (7, 5), (-1, -1)  
(c) (5, 7), (-1, -1) (d) (7, 5), (1, 1)
- The equation of the line which makes right angled triangle with axes whose area is 6 sq. units and whose hypotenuse is of 5 units, is  
(a)  $\frac{x}{4} + \frac{y}{3} = \pm 1$  (b)  $\frac{x}{4} - \frac{y}{3} = \pm 3$   
(c)  $\frac{x}{6} + \frac{y}{1} = \pm 1$  (d)  $\frac{x}{1} - \frac{y}{6} = \pm 1$

15. Equations of diagonals of square formed by lines  $x = 0$ ,  $y = 0$ ,  $x = 1$  and  $y = 1$  are  
 (a)  $y = x, y + x = 1$  (b)  $y = x, x + y = 2$   
 (c)  $2y = x, y + x = \frac{1}{3}$  (d)  $y = 2x, y + 2x = 1$
16. If the lines  $y = 3x + 1$  and  $2y = x + 3$  are equally inclined to the line  $y = mx + 4$  then  $m =$   
 (a)  $\frac{1 + 3\sqrt{2}}{7}$  (b)  $\frac{1 - 3\sqrt{2}}{7}$   
 (c)  $\frac{1 \pm 3\sqrt{2}}{7}$  (d)  $\frac{1 \pm 5\sqrt{2}}{7}$  s
17. The angle between the two lines  $y - 2x = 9$  and  $x + 2y = -7$ , is  
 (a)  $60^\circ$  (b)  $30^\circ$   
 (c)  $90^\circ$  (d)  $45^\circ$
18. The obtuse angle between the lines  $y = -2$  and  $y = x + 2$  is  
 (a)  $120^\circ$  (b)  $135^\circ$   
 (c)  $150^\circ$  (d)  $160^\circ$
19. The inclination of the straight line passing through the point  $(-3, 6)$  and the midpoint of the line joining the point  $(4, -5)$  and  $(-2, 9)$  is  
 (a)  $\pi / 4$  (b)  $\pi / 6$   
 (c)  $\pi / 3$  (d)  $3\pi / 4$
20. The line passing through the points  $(3, -4)$  and  $(-2, 6)$  and a line passing through  $(-3, 6)$  and  $(9, -18)$  are  
 (a) Perpendicular  
 (b) Parallel  
 (c) Makes an angle  $60^\circ$  with each other  
 (d) None of these
21. If the line  $2x + 3ay - 1 = 0$  and  $3x + 4y + 1 = 0$  are mutually perpendicular, then the value of  $a$  will be  
 (a)  $\frac{1}{2}$  (b) 2  
 (c)  $-\frac{1}{2}$  (d) None of these
22. The equation of the bisector of the acute angle between the lines  $3x - 4y + 7 = 0$  and  $12x + 5y - 2 = 0$  is  
 (a)  $21x + 77y - 101 = 0$   
 (b)  $11x - 3y + 9 = 0$   
 (c)  $31x + 77y + 101 = 0$   
 (d)  $11x - 3y - 9 = 0$
23. If vertices of a parallelogram are respectively  $(0, 0)$ ,  $(1, 0)$ ,  $(2, 2)$  and  $(1, 2)$ , then angle between diagonals is  
 (a)  $\pi / 3$  (b)  $\pi / 2$   
 (c)  $3\pi / 2$  (d)  $\pi / 4$
24. If the length of the perpendicular drawn from the origin to the line whose intercepts on the axes are  $a$  and  $b$  be  $p$ , then  
 (a)  $a^2 + b^2 = p^2$  (b)  $a^2 + b^2 = \frac{1}{p^2}$   
 (c)  $\frac{1}{a^2} + \frac{1}{b^2} = \frac{2}{p^2}$  (d)  $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{p^2}$
25. The distance between  $4x + 3y = 11$  and  $8x + 6y = 15$ , is  
 (a)  $\frac{7}{2}$  (b) 4  
 (c)  $\frac{7}{10}$  (d) None of these
26. The vertex of an equilateral triangle is  $(2, -1)$  and the equation of its base is  $x + 2y = 1$ . The length of its sides is  
 (a)  $4 / \sqrt{15}$  (b)  $2 / \sqrt{15}$   
 (c)  $4 / 3\sqrt{3}$  (d)  $1 / \sqrt{5}$
27. The distance of the line  $2x - 3y = 4$  from the point  $(1, 1)$  measured parallel to the line  $x + y = 1$  is  
 (a)  $\sqrt{2}$  (b)  $\frac{5}{\sqrt{2}}$   
 (c)  $\frac{1}{\sqrt{2}}$  (d) 6
28. The position of the point  $(8, -9)$  with respect to the lines  $2x + 3y - 4 = 0$  and  $6x + 9y + 8 = 0$  is  
 (a) Point lies on the same side of the lines  
 (b) Point lies on the different sides of the line  
 (c) Point lies on one of the line  
 (d) None of these
29. The points  $(at_1^2, 2at_1), (at_2^2, 2at_2)$  and  $(a, 0)$  will be collinear, if  
 (a)  $t_1 t_2 = 1$  (b)  $t_1 t_2 = -1$   
 (c)  $t_1 + t_2 = 1$  (d)  $t_1 + t_2 = -1$
30. If the lines  $x + y = 0, y - 2 = 0$  and  $3x + 2y + 5 = 0$  are concurrent, then value of  $q$  will be  
 (a) 1 (b) 2  
 (c) 3 (d) 5

31. The co-ordinates of the foot of perpendicular from the point (2, 3) on the line  $x + y - 11 = 0$  are  
 (a) (-6,5) (b) (5,6)  
 (c) (-5,6) (d) (6,5)
32. If A and B are two points on the line  $3x + 4y + 15 = 0$  such that  $OA = OB = 9$  units, then the area of the triangle OAB is  
 (a) 18 sq. units (b)  $18\sqrt{2}$ sq. units  
 (c)  $18/\sqrt{2}$  sq. units (d) None of these
33. The equation to the sides of a triangle are  $x - 3y = 0$ ,  $4x + 3y = 5$  and  $3x + y = 0$ . The line  $3x - 4y = 0$  passes through  
 (a) The incentre  
 (b) The centroid  
 (c) The circumcentre  
 (d) The orthocentre of the triangle
34. A point moves such that its distance from the point (4,0) is half that of its distance from the line  $x = 16$ . The locus of this point is  
 (a)  $3x^2 + 4y^2 = 192$  (b)  $4x^2 + 3y^2 = 192$   
 (c)  $x^2 + y^2 = 192$  (d) None of the sew
35. If the co-ordinates of the middle point of the portion of a line intercepted between coordinate axes is (3,2), then the equation of the line will be  
 (a)  $2x + 3y = 12$  (b)  $3x + 2y = 12$   
 (c)  $4x - 3y = 6$  (d)  $5x - 2y = 10$
36. The medians AD and BE of a triangle with vertices A (0,b), B (0,0) and C (a,0) are perpendicular to each other, if  
 (a)  $a = \sqrt{2} b$  (b)  $a = -\sqrt{2} b$   
 (c) Both (a) and (b) (d) None of these
37. If the equation of base of an equilateral triangle is  $2x - y = 1$  and the vertex is (-1, 2), then the length of the side of the triangle is  
 (a)  $\sqrt{\frac{20}{3}}$  (b)  $\frac{2}{\sqrt{15}}$   
 (c)  $\sqrt{\frac{8}{15}}$  (d)  $\sqrt{\frac{15}{2}}$
38. The sides AB, BC, CD and DA of a quadrilateral are  $x + 2y = 3$ ,  $x = 1$ ,  $x - 3y = 4$ ,  $5x + y + 12 = 0$  respectively. The angle between diagonals AC and BD is  
 (a)  $45^\circ$  (b)  $60^\circ$   
 (c)  $90^\circ$  (d)  $30^\circ$
39. The diagonals of a parallelogram PQRS are along the lines  $x + 3y = 4$  and  $6x - 2y = 7$ . Then PQRS must be a  
 (a) Rectangle (b) Square  
 (c) Cyclic quadrilateral (d) Rhombus
40. The area enclosed within the curve  $|x| + |y| = 1$  is  
 (a)  $\sqrt{2}$  (b) 1  
 (c)  $\sqrt{3}$  (d) 2
41. The image of the point (4, -3) with respect to the line  $y = x$  is  
 (a) (-4, -3) (b) (3, 4)  
 (c) (-4, 3) (d) (-3, 4)
42. A point equidistant from the points (2, 0) and (0, 2) is  
 (a) (1, 4) (b) (2, 1)  
 (c) (1, 2) (d) (2, 2)
43. If a vertex of an equilateral triangle is on origin and second vertex is (4, 0), then its third vertex is  
 (a)  $(2, \pm\sqrt{3})$  (b)  $(3, \pm\sqrt{2})$   
 (c)  $(2, \pm 2\sqrt{3})$  (d)  $(3, \pm 2\sqrt{2})$
44. If the point dividing internally the line segment joining the points (a, b) and (5, 7) in the ratio 2 : 1 be (4, 6), then  
 (a)  $a = 1, b = 2$  (b)  $a = 2, b = -4$   
 (c)  $a = 2, b = 4$  (d)  $a = -2, b = 4$
45. The ratio in which x-axis divides the join of the points (2, -3) and (5, 6) is  
 (a) 2 : 1 (b) 1 : 2  
 (c) 2 : -1 (d) None of these
46. The points which trisect the line segment joining the points (0, 0) and (9, 12) are  
 (a) (3,4), (6,8) (b) (4,3), (6,8)  
 (c) (4,3), (8,6) (d) (3,4), (8,6)
47. The mid-points of sides of a triangle are (2, 1), (-1, -3) and (4,5). Then the coordinates of its vertices are  
 (a) (7,9), (-3, -7), (1,1) (b) (-3, -7), (1,1), (2,3)  
 (c) (1,1), (2,3), (-5,8) (d) None of these

48. P and Q are points on the line joining A  $(-2, 5)$  and B  $(3, 1)$  such that  $AP = PQ = QB$ . Then the mid-point of PQ is  
 (a)  $\left(\frac{1}{2}, 3\right)$  (b)  $\left(-\frac{1}{2}, 4\right)$   
 (c)  $(2, 3)$  (d)  $(1, 4)$
49. The extremities of a diagonal of a parallelogram are the points  $(3, -4)$  and  $(-6, 5)$ . If third vertex is  $(-2, 1)$ , then fourth vertex is  
 (a)  $(1, 0)$  (b)  $(-1, 0)$   
 (c)  $(1, 1)$  (d) None of these
50. The three points  $(-2, 2)$ ,  $(8, -2)$  and  $(-4, -3)$  are the vertices of  
 (a) An isosceles triangle  
 (b) An equilateral triangle  
 (c) A right angled triangle  
 (d) None of these
51. The points  $(3a, 0)$ ,  $(0, 3b)$  and  $(a, 2b)$  are  
 (a) Vertices of an equilateral triangle  
 (b) Vertices of an isosceles triangle  
 (c) Vertices of a right angled isosceles triangle  
 (d) Collinear
52. The quadrilateral formed by the vertices  $(-1, 1)$ ,  $(0, -3)$ ,  $(5, 2)$  and  $(4, 6)$  will be  
 (a) Square (b) Parallelogram  
 (c) Rectangle (d) Rhombus
53. The points  $(-a, -b)$ ,  $(0, 0)$ ,  $(a, b)$  and  $(a^2, ab)$  are  
 (a) Collinear  
 (b) Vertices of a rectangle  
 (c) Vertices of a parallelogram  
 (d) None of these
54. If vertices of a quadrilateral are A  $(0, 0)$ , B  $(3, 4)$ , C  $(7, 7)$  and D  $(4, 3)$  then quadrilateral ABCD is  
 (a) Parallelogram (b) Rectangle  
 (c) Square (d) Rhombus
55. Two vertices of a triangle are  $(5, 4)$  and  $(-2, 4)$ . If its centroid is  $(5, 6)$  then the third vertex has the coordinates  
 (a)  $(12, 10)$  (b)  $(10, 12)$   
 (c)  $(-10, 12)$  (d)  $(12, -10)$
56. The incentre of the triangle formed by  $(0, 0)$ ,  $(5, 12)$ ,  $(16, 12)$  is  
 (a)  $(7, 9)$  (b)  $(9, 7)$   
 (c)  $(-9, 7)$  (d)  $(-7, 9)$
57. The equations of the sides of a triangle are  $x + y - 5 = 0$ ;  $x - y + 1 = 0$  and  $y - 1 = 0$ , then the coordinates of the circumcentre are  
 (a)  $(2, 1)$  (b)  $(1, 2)$   
 (c)  $(2, -2)$  (d)  $(1, -2)$
58. Ortho centre of the triangle formed by the lines  $x + y = 1$  and  $xy = 0$  is  
 (a)  $(0, 0)$  (b)  $(0, 1)$   
 (c)  $(1, 0)$  (d)  $(-1, 1)$
59. If the coordinates of the points A, B, C, be  $(4, 4)$ ,  $(3, -2)$  and  $(3, -16)$  respectively, then the area of the triangle ABC is  
 (a) 27 (b) 15  
 (c) 18 (d) 7
60. The area of the triangle formed by the lines  $7x - 2y + 10 = 0$ ,  $7x + 2y - 10 = 0$  &  $y + 2 = 0$  is  
 (a) 8 sq. unit (b) 12 sq. unit  
 (c) 14 sq. unit (d) None of these
61. The vertices of the triangle ABC are  $(2, 1)$ ,  $(4, 3)$  and  $(2, 5)$ . D, E, F are the mid-points of the sides. The area of the triangle DEF is  
 (a) 1 (b) 1.5  
 (c) 3 (d) 4
62. If the area of the triangle with vertices  $(x, 0)$ ,  $(1, 1)$  and  $(0, 2)$  is 4 square units then a value of x is  
 (a) -2 (b) -4  
 (c) -6 (d) 8
63. Three points  $(p + 1, 1)$ ,  $(2p + 1, 3)$  and  $(2p + 2, 2p)$  are collinear, if  $p =$   
 (a) -1 (b) 1  
 (c) 2 (d) 0
64. If equation of three sides of a triangle are  $x = 2$ ,  $y + 1 = 0$  and  $x + 2y = 4$  then coordinates of circumcentre of this triangle are  
 (a)  $(4, 0)$  (b)  $(2, -1)$   
 (c)  $(0, 4)$  (d)  $(-1, 2)$
65. The new coordinates of a point  $(4, 5)$ , when the origin is shifted to the point  $(1, -2)$  are  
 (a)  $(5, 3)$  (b)  $(3, 5)$   
 (c)  $(3, 7)$  (d) None of these
66. The equation of the locus of a point whose distance from  $(a, 0)$  is equal to its distance from y-axis, is  
 (a)  $y^2 - 2ax = a^2$  (b)  $y^2 - 2ax + a^2 = 0$   
 (c)  $y^2 + 2ax + a^2 = 0$  (d)  $y^2 + 2ax = a^2$

67. The locus of a point which moves so that its distance from x-axis is double of its distance from y-axis is

- (a)  $x = 2y$                       (b)  $y = 2x$   
(c)  $x = 5y + 1$                 (d)  $y = 2x + 3$

68. The locus of a point which moves so that it is always equidistant from the point A(a, 0) and B(-a, 0) is

- (a) A circle  
(b) Perpendicular bisector of the line segment AB  
(c) A line parallel to x-axis  
(d) None of these

69. The locus of the moving point P, such that  $2PA = 3PB$  where A is (0,0) and B is (4,-3), is

- (a)  $5x^2 - 5y^2 - 72x + 54y + 225 = 0$   
(b)  $5x^2 - 5y^2 + 72x + 54y + 225 = 0$   
(c)  $5x^2 + 5y^2 + 72x + 54y + 225 = 0$   
(d)  $5x^2 + 5y^2 - 72x + 54y + 225 = 0$

70. If A(-a,0) and B(a,0) are two fixed points, then the locus of the point on which the line AB subtends the right angle, is

- (a)  $x^2 + y^2 = 2a^2$             (b)  $x^2 - y^2 = a^2$   
(c)  $x^2 + y^2 + a^2 = 0$         (d)  $x^2 + y^2 = a^2$

71. If sum of distances of a point from the origin and lines  $x = 2$  is 4, then its locus is

- (a)  $x^2 - 12y = 36$             (b)  $y^2 + 12x = 36$   
(c)  $y^2 - 12x = 36$             (d)  $x^2 + 12y = 36$

72. **Assertion (A)** : If  $\theta$  is the obtuse angle between the lines  $8x + y - 4 = 0$  and  $4x + 7y - 4 = 0$ , then  $\tan \theta = \frac{-4}{3}$ .

**Reason (R)** : Angle between the two lines is given by  $\tan \theta = \frac{m_1 - m_2}{1 + m_1 m_2}$

- (a) Both A and R are true and R is the correct explanation of A.  
(b) Both A and R are true but R is not the correct explanation of A.  
(c) A is true but R is false.  
(d) A is false but R is true.

73. **Assertion (A)** : Length of perpendicular from a point to the line  $ax + by + c = 0$  is  $\frac{|ax_1 + by_1 + c|}{\sqrt{a^2 + b^2}}$ .

**Reason (R)** : Distance between the line  $12x - 5y + 9 = 0$  and the point (1, 2) is  $\frac{28}{13}$ .

- (a) Both A and R are true and R is the correct explanation of A.  
(b) Both A and R are true but R is not the correct explanation of A.  
(c) A is true but R is false.  
(d) A is false but R is true.

74. Match the following :

Column I	Column II
(a) The slope of the line passing through the points (3, -2) and (-1, 4) is	(i) $\frac{1}{\sqrt{3}}$
(b) The angle between two lines if the slope of one line is $\frac{1}{2}$ and slope for other line is 3 is	(ii) $\tan^{-1} \frac{1}{3}$
(c) The slope of the line making inclination of $30^\circ$ with the positive direction of the x-axis is	(iii) $\frac{\pi}{4}$
(d) The angle between two lines if the slope of one line is $\frac{1}{2}$ and slope for other line is 1 is	(iv) $\frac{-3}{2}$

- (a) (a) - (iv), (b) - (iii), (c) - (i), (d) - (ii)  
(b) (a) - (i), (b) - (ii), (c) - (iii), (d) - (iv)  
(c) (a) - (iv), (b) - (iii), (c) - (ii), (d) - (i)  
(d) (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)

75. Match the following :

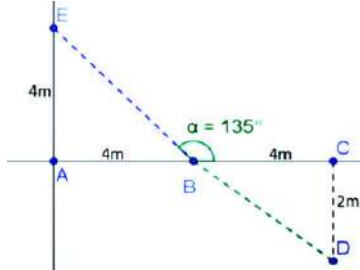
Column I	Column II
(a) Distance between the points (6, -4) and (3, 0) is	(i) $\frac{3}{7}$
(b) The x-coordinate which divides the line segment joining A(1, -3) and B(-3, 9) internally, in the ratio 1: 3 is	(ii) $\sqrt{17}$
(c) Distance between the points (5, 4) and (1, 5) is	(iii) 0
(d) The y-coordinate which divides the line segment joining A(1, -3) and B(-3, 9) internally, in the ratio 2 : 5 is	(iv) 5

- (a) (a) - (iv), (b) - (iii), (c) - (ii), (d) - (i)  
(b) (a) - (i), (b) - (ii), (c) - (iii), (d) - (iv)  
(c) (a) - (iv), (b) - (iii), (c) - (i), (d) - (ii)  
(d) (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)

Question No. 76 to 80 are based on the given text.

Read the text carefully and answer the questions :

Five students Anita, Bob, Chetan, Danish and Ela have their homes respectively situated at points A, B, C, D and E. Assuming A is the origin and B, C are on the X - axis and E is on Y - axis.  $AB = BC = AE = 4\text{m}$  and  $CD = 2\text{m}$ . Answer the following questions.



76. What will be slope of BE?  
 (a) 0 (b) - 1  
 (c) Not defined (d) 1
77. What would be the coordinates of point D?  
 (a) (8, -2) (b) (4, 2)  
 (c) (0, 2) (d) (8, 2)
78. What would be the equation of the line BE?  
 (a)  $x - y = 2$  (b)  $x + y = 2$   
 (c)  $x - y = 4$  (d)  $x + y = 4$
79. What would be the equation of BD?  
 (a)  $2x - y = 4$  (b)  $2x + y = 4$   
 (c)  $x - 2y = 4$  (d)  $x + 2y = 4$
80. What would be the equation of CE?  
 (a)  $x + 2y = 8$  (b)  $2x - y = 8$   
 (c)  $x - 2y = 8$  (d)  $2x + y = 8$

# NDA

NDA ENTRANCE EXAM

SAMPLE

# GENERAL ABILITY TEST



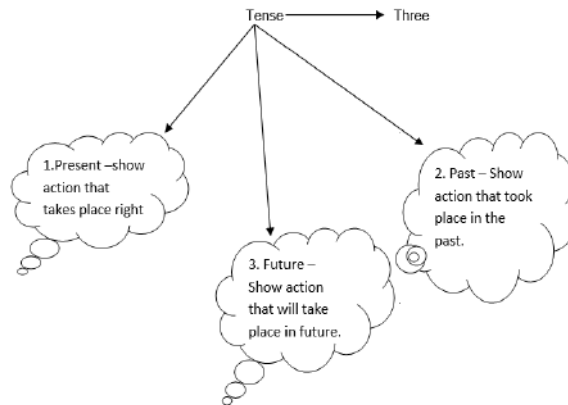
# NDA ENTRANCE EXAM

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## 10. TENSE

**Definition :** Tense is the form taken by a verb to show the time of an action or state.



**Four kinds –**

- Simple or indefinite
- Continuous
- Perfect
- Perfect Continuous

1. **Simple or Indefinite :** It does not say anything about completion of an action. It only states the action or an event.
2. **Progressive or Continuous :** It indicates that the action is incomplete and still in progress or continuity.
3. **Perfect :** It indicates that the action is complete.
4. **Perfect Continuous :** It indicates that the action has been in progress for sometime.

### HELPING VERB TABLE

Tense	Indefinite	Continuous	Perfect	Perfect Continuous
<b>Present</b>	Do / Does	Is / Am / Are	Has / Have	Has been / Have Been
<b>Past</b>	Did	Was / Were	Had	Had been
<b>Future</b>	Will / Shall	Will be / Shall be	Will have / Shall have	Will have been / Shall have been

### MAIN VERB TABLE (EX. : GO)

Tense	Indefinite	Continuous	Perfect	Perfect Continuous
<b>Present</b>	I form (Go)	I form + ing (Going)	III form (Gone)	I form + ing (Going)
<b>Past</b>	II form (Went)	I form + ing (Going)	III form (Gone)	I form + ing (Going)
<b>Future</b>	I form (Go)	I form + ing (Going)	III form (Gone)	I form + ing (Going)

### INDEFINITE TENSE STRUCTURE TABLE

Tense	Present	Past	Future
<b>Affirmative</b>	Subject + MV <sub>1</sub> + s/es + object	Subject + MV <sub>2</sub> + Object	Subject + will/shall + MV <sub>1</sub> + object
<b>Negative</b>	Subject + do/does + MV <sub>1</sub> + object	Subject + did + not + MV <sub>1</sub> + object	Subject + will/shall + not + MV <sub>1</sub> + object
<b>Interrogative</b>	Do/does + Subject + MV <sub>1</sub> + object + ?	Did + Subject + MV <sub>1</sub> + object + ?	Will / shall + Subject + MV <sub>1</sub> + object + ?
<b>Interronegative</b>	Do/does + Subject + not + MV <sub>1</sub> + object + ?	Did + Subject + not + MV <sub>1</sub> + object + ?	Will / shall + Subject + not + MV <sub>1</sub> + object + ?

**INDEFINITE TENSE TRANSLATION TABLE**

Tense	Present	Past	Future
<b>Affirmative</b>	He goes to school.	He went to school.	He will go to school.
<b>Negative</b>	He does not go to school.	He did not go to school.	He will not go to school.
<b>Interrogative</b>	Does he go to school ?	Did he go to school ?	Will he go to school ?
<b>Interronegative</b>	Does he not go to school ?	Did he not go to school ?	Will he not go to school ?

**Present Indefinite**

I / we / You / They / Helping Verb – Do  
He / she / It / Singular / H.V. – Does

**Future Indefinite**

I / We / Helping verb – Shall  
he / She / It / Singular / You / H.V. – Will

**NOTE :** MV<sub>1</sub> is always used with helping verb did.

**CONTINUOUS TENSE STRUCTURE TABLE**

Tense	Present	Past	Future
<b>Affirmative</b>	Subject + is/am/are + MV <sub>1</sub> + ing + object.	Subject + was / were + MV <sub>1</sub> + ing + object.	Subject + will / shall + be + MV <sub>1</sub> + ing + object.
<b>Negative</b>	Subject + is/am/are + not + MV <sub>1</sub> + ing + object.	Subject + was / were + not + MV <sub>1</sub> + ing + object.	Subject + will / shall + not + be + MV <sub>1</sub> + ing + object.
<b>Interrogative</b>	is/am/are + subject + MV <sub>1</sub> + ing + object + ?	Was / Were + subject + MV <sub>1</sub> + ing + object + ?	Will/Shall + subject + be + MV <sub>1</sub> + ing + object + ?
<b>Interronegative</b>	is/am/are + subject + not + MV <sub>1</sub> + ing + object + ?	Was / Were + subject + not + MV <sub>1</sub> + ing + object + ?	Will/Shall + subject + not + be + MV <sub>1</sub> + ing + object + ?

**CONTINUOUS TENSE TRANSLATION TABLE**

Tense	Present	Past	Future
<b>Affirmative</b>	I am writing a letter.	I was writing a letter.	I shall be writing a letter.
<b>Negative</b>	I am not writing a letter.	I was not writing a letter.	I shall not be writing a letter.
<b>Interrogative</b>	Am I writing a letter ?	Was I writing a letter ?	Shall I be writing a letter ?
<b>Interronegative</b>	Am I not writing a letter ?	Was I not writing a letter ?	Shall I not be writing a letter ?

**Present Continuous**

I – am, he/she/it/  
Singular – H.V. – is  
You/We/They/Plural – H.V. –are

**Past Continuous**

I/he/she/it/Singular – H.V. – was  
You/We/They/Plural – H.V.- were

**PERFECT TENSE STRUCTURE TABLE**

Tense	Present	Past	Future
<b>Affirmative</b>	Subject + Has/have + MV <sub>3</sub> + Object.	Subject + had + MV <sub>3</sub> + Object.	Subject + will/shall + MV <sub>3</sub> + Object.
<b>Negative</b>	Subject + Has/have + not + MV <sub>3</sub> + Object.	Subject + had + not + MV <sub>3</sub> + Object.	Subject + will/shall + not + have + MV <sub>3</sub> + Object.
<b>Interrogative</b>	Has/have + subject + MV <sub>3</sub> + Object + ?	Had + subject + MV <sub>3</sub> + Object + ?	Will/shall + subject + have + MV <sub>3</sub> + Object + ?
<b>Interronegative</b>	Has/have + subject + not + MV <sub>3</sub> + Object + ?	Had + subject + not + MV <sub>3</sub> + Object + ?	Will/shall + subject + not + have + MV <sub>3</sub> + Object + ?

**PERFECT TENSE TRANSLATION TABLE**

Tense	Present	Past	Future
<b>Affirmative</b>	My mother has cooked food.	My mother had cooked food.	My mother will have cooked food.
<b>Negative</b>	My mother has not cooked food.	My mother had not cooked food.	My mother will have not cooked food.
<b>Interrogative</b>	Has my mother cooked food ?	Had my mother cooked food ?	Will my mother have cooked food ?
<b>Interronegative</b>	Has my mother not cooked food ?	Had my mother not cooked food ?	Will my mother not have cooked food ?

**Present Perfect**

He/ She /It/ Singular/ H.V. – Has  
I/ We /You/ They/ H.V. – have

**Past Perfect**

With all subjects –  
H.V. – had

**Future Perfect**

I / We /H.V. – Shall have  
He /She /It /Singular /H.V. –Will have

**PERFECT CONTINUOUS TENSE STRUCTURE TABLE**

Tense	Present	Past	Future
<b>Affirmative</b>	Subject + has/have + been + MV <sub>1</sub> + ing + object +since/for + time.	Subject + had + been + MV <sub>1</sub> + ing + object +since/for + time.	Subject + will/shall + have + been + MV <sub>1</sub> + ing + object +since/for + time.
<b>Negative</b>	Subject + has/have + not + been + MV <sub>1</sub> + ing + object +since/for + time.	Subject + had + not + been + MV <sub>1</sub> + ing + object +since/for + time.	Subject + will/shall + not + have + been + MV <sub>1</sub> + ing + object +since/for + time.
<b>Interrogative</b>	has/have + Subject + been + MV <sub>1</sub> + ing + object +since/for + time + ?	had + Subject + been + MV <sub>1</sub> + ing + object +since/for + time + ?	Will/shall + Subject + have + been + MV <sub>1</sub> + ing + object +since/for + time + ?
<b>Interronegative</b>	has/have + Subject +not + been + MV <sub>1</sub> + ing + object +since/for + time + ?	had + Subject +not + been + MV <sub>1</sub> + ing + object +since/for + time + ?	Will/shall + Subject + not + have + been + MV <sub>1</sub> + ing + object +since/for + time + ?

**PERFECT CONTINUOUS TENSE TRANSLATION TABLE**

Tense	Present	Past	Future
<b>Affirmative</b>	It has been raining since morning.	It had been raining since morning.	It will have been raining since morning.
<b>Negative</b>	It has not been raining since morning.	It had not been raining since morning.	It will not have been raining since morning.
<b>Interrogative</b>	Has It been raining since morning ?	Had It been raining since morning ?	Will It have been raining since morning ?
<b>Interronegative</b>	Has It not been raining since morning ?	Had It not been raining since morning ?	Will It not have been raining since morning ?

Since – Point of time

For – Period of time

**PRESENT TENSE**

To show an action for or a state of being of present time.

**1. Simple Present or Present Indefinite Tense :**

**Keywords :** Always, never, regularly, daily, generally, often, seldom, everyday, at times, rarely, once a day, twice a week etc.

Uses —→ To show :

a) A universal truth

Ex.: The earth moves round the sun.

b) A regular or habitual action.

Ex.: I go for a walk every morning.

c) A general truth / a proverb

Ex.: Fortune favours the brave.

d) Characteristics

Ex.: Chameleon changes its colour

e) A future plan action

Ex.: The Rajdhani Express leaves for Bhopal at 6:00a.m.

f) Likes or dislikes

Ex.: She prefers tea to coffee.

g) Surprises and wishes.

Ex.: May you live long !

**2. Present Continuous Tense :**

**Keywords :** At this time, at this moment, now a days, these days, tonight, still, today, at present etc.

Uses —→ To show :

a) An action in progress at the time of speaking.

Ex.: He is reading a book.

b) An action not necessarily taking place at the time of speaking.(temporary action)

Ex.: They are building tall buildings here.

c) A definite plan or action in future .

Ex.: We are going for picnic on Monday.

d) A prediction

Ex.: It is going to be very hot this month.

**Note : verb not used in continuous tense :**

→ Perception : see, hear, smell, notice, recognize

→ Appearing : appear, look, seem

→ Emotion : want, wish, desire, feel, like, love, hate, hope, refuse, prefer

→ Thinking : think, suppose, believe, agree, understand, remember, forget, know

→ Possession : have, own, possess, belong to

**3. Present Perfect Tense :**

**Keywords :** Just, recently, lately, already, ever, so far, yet etc.

Uses —→ To show :

a) An action that has just been completed.

Ex.: He has just finished his work.

b) An action that has started in the past and is still continuing.

Ex.: This house has stood here for hundred years.

c) An action or even in the past whose time is not mentioned.(no specific time in the past)

Ex.: She has given her book to Asha.

d) A past event whose effect still exists.

Ex.: I have taken my lunch and now I am free.

#### 4. Present Perfect Continuous Tense :

Uses : ———>To show :

- a) To show an action, which began in the past and is still going on.  
Ex.: The girl has been crying for an hour.

### PAST TENSE

To show action or event of past time.

#### 1. Past Indefinite / Simple Past Tense

Keywords : Yesterday/ The day before / last night / last week / last month / in + year etc.

Uses : ———>To show :

- a) A habitual or regular action in the past.  
Ex.: I went to the temple daily when I was young.  
b) An action which took place over a period in past and is now over.  
Ex.: She come from Bombay today.  
c) The habitual past can also be expressed by using ' used to ' .  
Ex.: She used to drink tea in the morning.

#### 2. Past Continuous Tense :

Keywords : At that time / at that moment / those days / that day / yesterday etc.

Uses : ———>To show :

- a) An action which has started in the past but had not ended at the time of which we are speaking.  
Ex.: She was crying last night.  
b) Also used for an action that was going on during a given period or at a period of time in the past.  
c) Simple Past + Past Continuous  
Or  
Past Continuous + Simple Past  
In a clause while / when / As are used  
Ex.: As I was crossing the road. I saw an accident.  
He was reading a book when she went in.

#### 3. Past Perfect Tense :

Uses : To show two action

- a) An action completed at some point in the past before another action took place.  
Ex.: The train had started before I reached the station.  
Past Perfect + before + Simple Past  
Simple Past + after + Past Perfect  
b) In conditional sentences  
To show desires in the past that have not been fulfilled / impossible to fulfil.  
Ex.: I wish I had not wasted my time. (not Fulfilled)  
I had taken an appointment, I would have seen the doctor.(impossible to fulfil)

#### 4. Past Perfect Continuous :

Uses : To show

- a) An action which began in the past and continued upto a certain point of time in the past.  
Ex.: She had been making dolls since last years.

### FUTURE TENSE

#### 1. Future Indefinite or Simple Future :

Keywords : Tomorrow / the next day / the days after tomorrow / next week / next month / next year etc.

Uses : To show

a) An action we believe or think will happen in the future.

Ex.: If you go there, you will enjoy a lot.

b) An action that will happen as a habitual action.

Ex.: The children will come back from school.

## 2. Future Continuous Tense :

Keywords : At this time tomorrow / the next day / at this moment tomorrow etc.

Uses : To show

a) An action that take place in the future as a matter of routine or as a planned happening.

Ex.: We shall be leaving for Bombay tomorrow in the morning.

## 3. Future Perfect Tense :

Keywords : By + time / by the end of (time)

Uses : To show

a) An action which will be completed at some point of time in the future.

Ex.: I shall have finished this work by the end of tomorrow.

## 4. Future Perfect Continuous Tense :

Uses : ———>To show

a) An action which will be in progress over a period of time that will end in the future.

Ex.: By next June they will have been living in Germany for five years.

Note : Going to :

We use the going to form to suggest people's intention to do something in the near future.

Ex.: The teacher is going to give us a test today.

We are going to shift to a new house tomorrow.

(We have already decided to do so)

## PRACTICE EXERCISE

1. She worked here since 1990 (a) / now she wants to leave (b) / this place and go to her village (c) / to reside there permanently. (d) / No Error (e)
2. I assure you (a) / that I will accomplish (b) / the given task (c) / before you will come here. (d) / No Error (e)
3. She gets up early (A)/goes to the office at 10am (B)/comes back at 6am(c) / and then prepare food for the family.(D)/No Error (e)
4. He is coming here (a) / every month to observe (b) / the running activities. (c) / No Error (d)
5. He had reached (a) / my home (b) / after I had left. (c) / No Error (d)
6. I understand (a) / the reason why (b) / he didn't tell me (c) / about the matter. (d) / No Error (e)
7. Nobody know (a) / what is going (b) / to happen (c) / in future. (d) / No Error (e)
8. After his sudden death (a) / his younger brother (b) / had come here (c) / two months ago. (d) / No Error (e)
9. I am thinking (a) / that he (b) / understands me (c) / very well. (d) / No Error (e)
10. He is resembling (a) / his mother (b) / but in nature (c) / she is totally different. (d) / No Error (e)
11. Has your mother (a) / ever been (b) / to Mumbai ?. (c) / No Error (d)
12. Vasco-di-Gama (a) / had discovered (b) / India in 1790. (c) / No Error (d)
13. If he had (a) / intimated me (b) / I would come on time. (c) / No Error (d)
14. Radhika will have (a) / completed (b) / the project (c) / by the end of the day. (d) / No Error (e)
15. If he was a bird (a) / he would fly (b) / in the sky. (c) / No Error (d)

16. Suppose he will not (a) / come here (b) / what will you do. (c) / No Error (d)
17. Sahil told (a) / me that (b) / he will pass (c) / the examination. (d) / No Error (e)
18. As they will reach there (a) / I will start (b) / doing it. (c) / No Error (d)
19. Why are (a) / you worried (b) / now, I am considering (c) / the matter. (d) / No Error (e)
20. India had (a) / got freedom on 15th (b) / august 1947. (c) / No Error (d)
21. This is the first time (a) / that I saw I such an eye-catchy picture (b) / in my life. (c) / No Error (d)
22. If he had (a) / reached here (b) / he would have got (c) / it on time. (d) / No Error (e)
23. If I were (a) / a bird (b) / I would fly. (c) / No Error (d)
24. He will (a) / has accomplished (b) / the task by the end of March. (c) / No Error (d)
25. The Sun (a) / rises in the east (b) / and is setting (c) / in the west. (d) / No Error (e)
26. She doesn't attend (a) / the party unless (b) / somebody doesn't (c) / invite me. (d) / No Error (e)
27. If he would have (a) / intimated me (b) / I would have attended (c) / the seminar. (d) / No Error (e)
28. As long as she (a) / will stay here (b) / she will visit (c) / the temple every day. (d) / No Error (e)
29. Rahul had come (a) / here last month (b) / but his brother (c) / will come tomorrow. (d) / No Error (e)
30. Mayank has reached (a) / here (b) / two months ago. (c) / No Error (d)
31. One of my friends (a) / learn computer course (b) / now a days. (c) / No Error (d)
32. I bad reached (a) / the station (b) / after the train (c) / had departed. (d) / No Error (e)
33. He is working (a) / with me (b) / in the office (c) / for a long time. (d) / No Error (e)
34. Most of the relatives (a) / were invited to attend (b) / the birthday party but (c) / some of them didn't reach yet (b) / No Error (e)
35. 1 getup early (a) / at 5 o'clock (b) / but she get up (c) / at 6. (d) / No Error (e)
36. My mother (a) / told me (b) / that learning (c) / never ended. (d) / No Error (e)
37. An Atheist (a) / is a person who (b) / never believe in God. (c) / No Error (d)
38. He has been (a) / to Mumbai (b) / twice but I (c) / hadn't been yet. (d) / No Error (e)
39. If you have any answer to his question(A)/you will have become (B)/the most intelligent student (C)/of the class.(D)/No Error(E)
40. He told me (a) / every day about (b) / in incidents taking places (c) / every now and then. (d) / No Error (e)
41. The Judge tried (a) / to ask him (b) / what had happened (c) / there in his presence. (d) / No Error (e)
42. She has been (a) / doing it (b) / for the last ten years. (c) / No Error (d)
43. Sushma told to me (a) / that she will (b) / go out (c) / in the vacation. (d) / No Error (e)
44. If I was (a) / in abroad (b) / I would enjoy (c) / like anything. (d) / No Error (e)
45. In case it (a) / will rain (b) / what will you do. (c) / No Error (d)
46. He will let me (a) / know as soon as (b) / he will get (c) / any information about it. (d) / No Error (e)
47. Suppose he (a) / came here (b) / what will you do. (c) / No Error (d)
48. It is about time (A)/ he had taken (B)/ his cousin to temple. (C)/ No Error (D)
49. The owner came (A)/ to visit the company (B)/ much later than (C)/ I had expected. (D)/ No Error (E)
50. This is the (A)/ most interesting topic (B)/ that I learnt (C)/ in the school time. (D)/ No Error (E)

# NDA ENTRANCE EXAM

## GEOGRAPHY CONTENTS

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## **Part-I (Physical Geography)**

### **The Universe**

- The study of universe is known as Cosmology.
- All heavenly bodies i.e. Stars, planets, satellites, asteroids, meteors, comet dust are called celestial bodies, which together forms universe.
- Science of studying heavenly bodies is called Astronomy.
- The universe is commonly defined as the totality of everything that exists including all physical matter and energy the Planets, Stars, Galaxies and the contents of intergalactic space.
- The universe comprises of billions of galaxies. The galaxies are made up of millions of Stars held together by the force of gravity and these Stars account for most of the masses of the galaxy Andromeda is our nearest galaxy.
- Galaxy is giant assemblies of Stars, Planets, Gases and dust. These Stars occur in huge bunches or clusters. They are so big that they have sometimes been called *Islands Universe*. Milky way and Andromeda are two examples.
- Our own galaxy is called the Milky Way (or the Akash Ganga) and it contains about 300 billion Stars and one of these is our Sun. Planets and other objects go round the Sun and make up the solar system with the Sun at the centre.
- **Geocentric Theory** In AD 140 Ptolemy propounded the theory that the Earth was the centre of the universe and the Sun and other heavenly bodies revolved around it.
- **Heliocentric Theory** In 1543, Copernicus said that the Sun is the centre of universe and not the Earth.
- Kepler supported Copernicus but said that the Sun is the centre of Solar system and not the universe.
- In 1924, Edwin Hubble first demonstrated existence of galaxies beyond Milky Way.

Structurally, the galaxies are found in 3 forms

- **Spiral** have a central nucleus with great spiral arms. *Milky Way* and *Andromeda* are the examples.
- **Elliptical** without spiral arms.
- **Irregular** with no shape.

### **Evolution of Universe**

*The three main theories put forward to explain the origin and evolution of the universe are*

- Big Bang Theory** (Proposed by Georges Le maitre in 1930) Big Bang was an explosion that occurred 13.8 billion years ago, leading to the formation of galaxies of Stars and other heavenly bodies.
- Steady State Theory**  
Bondi, Gold and Fred Hoyle developed this theory and states that although the universe is expanding, it nevertheless does not change its appearance over time, it has no beginning and no end.
- The Pulsating Theory**  
According to this theory, the universe is supposed to be expanding and contracting alternately *i.e.*, *pulsating*. At present, the universe is expanding.
- Red Shift Theory**  
Light is formed by band of colors called spectrum. Violet has shortest and Red has the longest wavelength. Movement of a star or galaxy affects its light as seen by the observer. When the star is approaching the observer, light shifts to the Violet end of the spectrum and shifts to the red end when star recedes away.

This is known as Dopplers Effect or Doppler Shift. Doppler Shift of the Galaxies show that they are receding and Universe is in a state of rapid expansion. This astronomical observation is known as Red Shift.

### Solar System

- The Solar system comprises of the Sun, 8 planets, their Moons and other non stellar objects, which are believed to have been developed from the condensation of gases and other lesser bodies.
- The Sun is at the centre of the solar system and all the planets revolve around it in elliptical orbit. It is the nearest star to the Earth.
- The size of Solar system has been estimated to at about  $10^5$  AU.

### Distance from Sun of all planets:-

Planet	Distance ( in million kilometers )	Planet	Distance ( in million kilometers )
Mercury	58	Jupiter	778
Venus	160	Saturn	1427
Earth	150	Uranus	2871
Mars	228	Neptune	4497

### Components of the Solar System

Our Solar System consists of

- The Sun, eight planets (excluding Pluto) and their respective satellites.
- Interstellar debris such as asteroids, meteoroids, comets.
- The electrically charged gases called Plasma.
- Interplanetary dust particles.
- The components of Solar system other than planets dwarf planets and satellites are called as Small Solar System Bodies (SSSB).

### Origin of the Solar System

Various theories were given to explain the Origin of the Solar System.

Hypothesis	Propounded by
Gaseous Hypothesis	Kant
Nebular Hypothesis	Laplace
Planetesimal Hypothesis	Chamberline and Moulton
Tidal Hypothesis	Sir James Jeans and Harold Jeffreys
Binary star Hypothesis	HN Russell
Supernova Hypothesis	F Hoyte
Inter – stellar Dust Hypothesis	Otto Schmidt
Electromagnetic Hypothesis	H Alfven
Protoplanet Hypothesis	G Kuiper
Nebular Cloud Hypothesis	Dr Von Weizsacker

### The Sun

- The Sun was born about 5 Bn years ago and accounts for more than 99% of the mass of the Solar system and due to this, the Sun exerts immense gravitational pull to keep the planets rotating around it in definite elliptical orbit.

- The Sun is the major source of energy of the Solar system. The energy is provided by the nuclear fusion reaction that converts hydrogen into helium in the core of the Sun.
- Sun is continuously emitting huge amount of heat and light and expected to glow for next 5 Bn years.
- Superimposed on Sun's white light are hundred of dark lines called **Fraunhofer lines**. Each line indicates some elements present in the Solar System.

### Some of the Concepts Associated with Sun

- **Solar Winds** The Sun is continuously emitting streams of proton in all directions either as spiral stream called Solar Wind or bouts of incandescent material called Solar Flares. Solar flares being hot ionized gases pose danger to satellite communication.
- **Aurora** The constituent particles of the solar wind are trapped by the Earth's magnetic field and enter the Earth's upper atmosphere as Aurora. It is described **Aurora Borealis** in the Northern hemisphere and **Aurora Australis** in Southern hemisphere.
- **Plages and Sunspots** The surface of the Sun continuously changing. Bright spots are called *Plages* and *dark spots* are called *Sunspots*. The Sunspots are cold and dark regions on the Sun's surface with a periodicity of 11 years. These spots greatly influence the global climate.

### Planets

- A planet is a heavenly body that moves in a clear elliptical orbit around a Star, such as the Sun.
- There are 8 planets of the Solar system and all the planets moves around a Sun in the fixed path.

### Mercury

It is the innermost and smallest planet in the solar system.

- Mercury is nearest to the Sun.
- **Rotation Period** 58.65 days.
- **Revolution Period** 88 days (Fastest in Solar System).
- It has no satellite and no atmosphere.
- Surface is rocky and one side does not receive sunlight.
- Has the highest **diurnal range** of temperature.
- Has the shortest year.

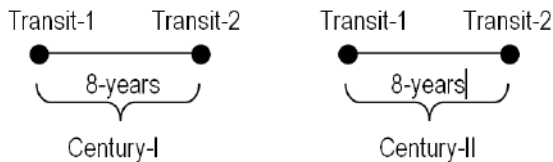
### Venus

- Also known as **Earth's twin, Morning Star, Evening Star**.
- Brightest heavenly body after Sun and Moon because of 70% albedo.
- Venus is Closest Planet to Earth.
- **Hottest Planet** in our Solar system because of 97% CO<sub>2</sub>
- Slightly smaller than Earth. (500 km less in diameter).
- Rotates clockwise (East to west) unlike others.
- Size nearly same as Earth.
- It has no satellite.
- **Slowest rotation** period in our Solar system (257 days)
- Almost equal **rotation** and **revolution** (244.7 days).

### Transit of Venus

A transit of Venus occurs when Venus passes directly between the Sun and Earth.

This **alignment** is rare, coming in pairs that are eight years apart but separated by over a century.



Last thrilling sight was in 2004 and this is 2nd transit which is last of 21st Century. The next transit will be in the year 2117.

One of the most spectacular celestial phenomenon **transit of Venus** is being observed over large stretch of Asia including India, Philippines Australia, North America.

### Mars

- Mars is the *fourth* nearest planet to the Sun.
- Almost half the size of Earth, diameter is slightly more than half but mass is  $1/10^{\text{th}}$  of Earth.
- Mars is called *Red Planet* because it appears as a reddish ball when looked through a telescope.
- **Revolution Period** 687 days.
- **Rotation Period** 24.6 hrs (almost equal to Earth)
- It has two satellites **Phobos** and **Deimos**.
- It has signs of water.
- There is possibility of life.
- Various space missions have been sent e.g. *Vikings, Pathfinder, Mars Odyssey, MoM*.

### Jupiter

- Largest of all planets almost 11 times of Earth.
- Called *Lord of the Heavens*.
- A great *red spot* (a cyclone) is detected on it.
- **Fastest rotation time** in our Solar system (9.8 hrs.)
- **Revolution Period** 11 years 11 months.
- Mass is more than the combined mass of all Planets.
- It has 67 satellites (prominent are *Europa, Ganymede* and *Callisto*).
- *Europa* resembles the living condition like that of Earth.
- *Ganymede* is the largest satellite of our Solar system.

### Saturn

- Second largest planet (in size) after Jupiter.
- Nine times the size of Earth
- **Least density** of all (30 times less dense than Earth).
- **Revolution Period** 29 years and 5 months.
- **Rotation Period** 10.3 hours.
- More than 62 satellites (prominent is titan). It has the Largest number of natural satellites or Moons.
- It has system of ring (3 well defined).

### Uranus

- Identified as a planet in 1781 by William Herschel.
- Rotates from **North to South** as it is inclined at an angle of  $98^\circ$  to its orbit.
- **Revolution Period** 84 years.
- **Rotation Period** 10.8 hours.
- Like Saturn it is also surrounded by a system of 9 faint rings.
- It has 27 satellites (*Miranda, Ariel, Umbrial, etc.*)

## Neptune

- Appears as 'Greenish Star' because of presence of 'Methane'.
- **Revolution Period** 165 years.
- **Rotation Period** 16.1 hours.
- Discovered by **JG Galle** of **Berlin** in 1846.
- Has 14 Satellites.
- Prominent satellite are '*Trion* and *Neroid*'.
- Uranus and Neptune are called *Jovian twins*.

## Pluto

Pluto is no longer considered a planet-in our solar system. Pluto orbits beyond the orbit of Neptune. It is much smaller than any of the official Planets and now classified as a **dwarf planet**. It is the second largest dwarf planet in the solar system. In Roman mythology, Pluto (Greek Hades) is the God of the underworld.

### Some Important Facts

Biggest Planet	-	Jupiter
Smallest Planet	-	Mercury
Biggest Satellite	-	Gannymede
Smallest Satellite	-	Deimos
Blue Planet	-	Earth
Green Planet	-	Uranus
Brightest Planet	-	Venus
Brightest Planet Outside Solar system	-	Sirius (Dogstar)
Closest Star of Solar System	-	Proxima Centauri
Coldest Planet	-	Neptune
Evening Star	-	Venus
Red Planet	-	Mars
Slowest Revolution in Solar System	-	Neptune
Slowest Rotation in Solar System	-	Venus
Earth's Twin	-	Venus

## Comet

- Comet is a member of the Sun's family, part of the Solar system.
- Comet travels on a path or elliptical orbit around the Sun on a regular schedule.
- It has a head and a tail. Its tail originates once it gets closer to the Sun.
- May have originated from a huge cloud the 'oort cloud' that is thought to surround the Solar system.
- The brightest part of the comet is head (coma).
- It is made up of solid matter combined with gases.

## Asteroids

- Asteroids or minor planets circle in a broad belt between the orbits of Mars and Jupiter.
- It is the debris left over from the formation of inner planets. Also called 'Planetoids' or small planets.
- They are **chunks** of rock covered in frozen gases.

## Meteoroids

Meteoroids are small bodies that travel through space. Meteoroids are smaller than Asteroids, most are smaller than the size of a pebble. Meteoroids have many sources. Most meteoroids come from asteroids that are broken apart by impacts with other asteroids. Other meteoroids come from the Moon, from comets and from the planet Mars.

## **Meteors**

A meteor is a meteoroid that has entered the Earth's atmosphere usually making a fiery trail as it falls. It is sometimes called a **shooting Star** or a **falling Star**.

The friction between the fast-moving meteor and the gas in the Earth's atmosphere causes intense heat, the meteor glows with heat and then burns. A meteor shower is a phenomenon in which many meteors fall through the atmosphere in a relatively short time and in approximately parallel trajectories. A very intense meteor shower is called a **Meteor storm**.

## **Meteorites**

A Meteorite is a Meteor that has fallen to Earth. These rare objects have survived a fiery fall through the Earth's atmosphere and have lost a lot of mass during that process. Meteorites are made up of rock and/or metals.

## **Moon**

Only upto 59% of Moon surface is directly visible from Earth. It takes 27 days, 7 hrs, 43 min and 11.47 sec to complete one revolution around the Earth.

- Rotates on its axis in exactly the same time as that in revolution. That's why we see only one side of the Moon.
- Circumference - 11000 km.
- Diameter- 3474 km
- Average Distance from Earth - 384400 km
- Moon light takes 1.3 sec to reach Earth.
- Mt Leibnitz is the highest point on moon's surface.

## **Phases of the Moon**

- Due to its spherical shape, only one-half of the Moon gets illuminated by the Sun.
- Visible surface of Moon is not the same everyday because it revolves round the Earth.
- Visible shape of the Moon are referred to as the phases of the Moon.
  - (i) **New Moon** This is the phase when the Moon is between the Earth and the Sun and consequently the part of the Moon Facing us is in complete darkness. (New Moon = No Moon)
  - (ii) **Full Moon** This occurs on the 14th day after the New Moon. The moon at this time shows its fully lighted surface. (Full Moon = Complete Moon)
- When two full Moons occur in a single month the second full Moon is called a Blue Moon.

## **Stars**

Stars are heavenly bodies emitting light and made up of hot gases like Hydrogen and Helium.

If the Star is bigger than the Sun but not more than twice as big, it will turn into a **Neutron Star** or **Pulsar**. They are formed due to nova or supernova explosion.

A Star's colour indicates the temperature of its surface. Blue color denotes maximum temperature. Then comes yellow. then red. etc.

## **Evolutionary Stages of a Star**

- (i) **Adult Star** It is the stage, where the helium core become increasingly heavy accompanied with expanding outer layers.
- (ii) **Red Giant** This stage results into the swelling and reddening of the outer regions of the Star. Such Stars of gigantic dimension is called Red Star.
- (iii) **White Dwarf** If the mass of the Star is relatively small like that of our Sun, the gases that reach the outer layer are expelled. As these expelled gases cool and contract, the Star becomes a white dwarf.

## The Earth

- Only planet of our Solar system where life exists.
- Also called 'Blue Planet'.
- Mass  $5.97 \times 10^{24}$  kg
- **Polar Circumference** - 40008 km
- **Equatorial circumference** - 40075 km.
- Area Nearly 510 million Sq. kms.
- 5<sup>th</sup> largest planet of our Solar system.
- **Perigee** Nearest position of Earth to Moon (356400 km).
- **Apogee** Farthest position of Earth from Moon (407000 km).
- **Aphelion** Farthest position of Earth from Sun on July 4 about 152 million km.
- **Perihelion** Nearest position of Earth to Sun on Jan. 3, about 147 million km.
- The history of the Earth is studied in terms of geological years, periods and the epochs.

## Shape of the Earth

The Earth is an oblate spheroid, a sphere flattened along the axis from pole to pole such that there is a bulges around the equator. Earth bulges at the equator and is flattened the poles.

The shape of Earth is also called **Geoid**. At equator our weight will be less and when we are at poles our weight will be more. *Geodesy is a branch of science deals with Earth's size and shape.*

## Equinoxes

- These are the days, when days and nights are equal.
- Under this situation, the Sun is vertically overhead at the equator. It happens on two days of the year *i.e.* 21st March and 23rd September.
- 21st March **Vernal Equinox**.
- 23rd September **Autumnal Equinox**.

### Important Facts: Earth

Age of the Earth	4.6 billion years
Earth's circumference at the Equator	24901.55 miles (40075 km)
Earth's circumference between the Poles	24859.82 miles (40008 km)
Earth's diameter ( Equator)	7926.28 miles (12756.1 km)
Lowest elevation on Land	Dead sea 1369 feet below sea level (417.25) m
Deepest point in the Ocean – Mariana Trench	Western Pacific Ocean 35840 trench (1097 m)
Highest temperature Recorded	134 <sup>o</sup> F Death Valley, California, USA July10, 1913
Lowest temperature recorded	-128.5 <sup>o</sup> F Vostok, Antarctica, July, 1983 (-89.2 <sup>o</sup> C)

## Solstice

### Summer Solstice

- After the March equinox, the Sun appears to move Northward and is vertically overhead at the Tropic of Cancer on 21st June. This is known as *Summer Solstice*.
- On 21st June, the Northern hemisphere will have its longest day and shortest night. The Southern hemisphere will have shortest day and longest night.

### Winter Solstice

- On 22<sup>nd</sup> December, the sun is overhead at the tropic of Capricorn.
- This is the winter solstice, when the Southern hemisphere will have its longest day and shortest night.
- A summary of daylight hours in the Northern and Southern hemisphere is as follows.

## The Earth's Movement

The Earth moves in space in two distinct ways *Rotation* and *Revolution*.

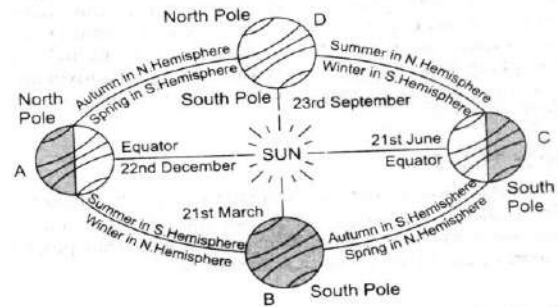
- (i) It rotates on its own axis from West to East once in every 24 hours. It causes day and night.
- (ii) It revolves around the Sun in an orbit once in every  $365\frac{1}{4}$  days. It causes the seasons and the year.

### Rotation of Earth

- Spins on its imaginary axis from West to East in 23 hours, 56 minutes and 4 seconds called Sidereal Day
- The rotational speed at equator is max (1667 km/hr) and then decreases towards the poles, where it is zero.
- The days and the nights are equal at the equator.

The rotation of the Earth causes

- (i) Day and night.
- (ii) Change in the direction of winds and ocean currents in different hemisphere (Coriolis Effect).
- (iii) Rise and fall of **tides** every day.
- (iv) A difference of 1 hour between the two meridians which are  $15^\circ$  apart.



### Revolution of Earth

- It is the Earth's motion in elliptical orbit around the Sun.
- It takes 365 days, 5 hours, 48 minutes and 45.51 seconds. It leads to one extra day in every fourth year.

The revolution of Earth results in

- (i) change of seasons.
- (ii) variation of the length of the days and nights at different times of the year.
- (iii) shifting of the wind belts.

### Seasons

- They are the periods into which the year can be divided as a result of the climatic conditions, mainly due to the changes in duration and intensity of solar radiation.
- There are four seasons.

### Latitude

- Latitude is the angular distance of a point on Earth surface from the centre of Earth, measured in degree. These lines are called parallels of latitude and on the globe they are circles. The circumference of the circles decreases from equator to pole and at the pole it converges to a point.
- The distance between any two parallels of latitude is always equal.  
One degree latitude = Approx 111 km (69 miles)
- The most important lines of latitudes are equator ( $0^\circ$ ), the Tropic of Cancer ( $23\frac{1}{2}^\circ$ N), the Tropic of Capricorn ( $23\frac{1}{2}^\circ$  S), the Arctic Circle ( $66\frac{1}{2}^\circ$  N) and the Antarctic Circle ( $66\frac{1}{2}^\circ$  S).

### Longitude

- Longitude is the angular distance of a point on the Earth surface along the equator, East or West from the **Prime meridian**. On the globe, they form semi circles from pole to pole passing through the equator.

- Prime meridian is the semi circle from pole to pole, from which all the other meridians radiate Eastwards and Westwards up to 180°. In 1884, it has been decided that the zero meridian is one that passes through the Royal Astronomical Observatory at **Greenwich** near **London**. 180° meridian (**International Date Line**) is exactly opposite to the Prime meridian. Such points are called antipodal points.

### Coordinated Universal Time (UTC)

To avoid confusion about having many local times within one country, a particular meridian is chosen for the whole country; whose time is known as **standard time**.

- The Indian Government has accepted the meridian of 82.5° East for standard time, which is 5 hour 30 minutes ahead of the UTC.
- The Earth is divided in 24 longitudinal zones, each being 15° or 1 hour apart in time ( $360^\circ = 24$  hours,  $360/24 = 15^\circ$  in 1 hour) or 1° in 4 minute are called Standard Time Zones.
- Larger countries such as USA, Russia and Canada, which have greater East West stretch have to adopt several time zones for practical purposes.
- Russia has as many as 11 time zones.
- Both USA and Canada have five time zones, viz, the Atlantic, Eastern, Central, Mountain and Pacific time zones.

### International Date Line

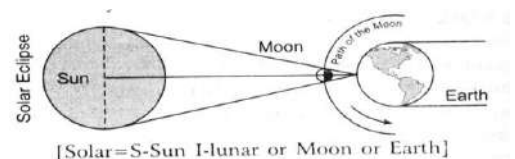
- It is the 180° meridian running over the Pacific Ocean deviating at Fiji, Soama and Gilbert Islands. This meridian is considered to be deviated at the land masses, so that the travelers do not feel inconvenient.
- One who crossing the Date Line from West to East repeat a day and travelers crossing it from East to West lose a day.

### Eclipses

- An eclipse occurs when the Sun, Moon and Earth are in a straight line (Syzygy). There are two types of eclipses - *Solar* and *Lunar eclipse*.
- Generally, a total of seven eclipse including solar and lunar eclipses, take place in a year.

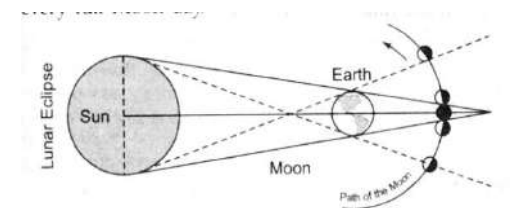
### Solar Eclipse

- When Moon comes between Sun and Earth (Syzygy).
- It is three types Partial, Total and Annular.
- It will happen only on a new Moon day when the Moon is in line with the Sun. A Solar Eclipse doesn't occur on every new Moon day.



### Lunar Eclipse

- When the Earth comes between Sun and Moon.
- Occurs only on a full Moon day but it doesn't occur on every full Moon day because the Moon is not in the same position in relation to that of the Earth, anti the Sun on every full Moon day.



### Structure of Earth's Interior

The interior of Earth is divided into three parts

### The Crust

The crust is the outermost and the thinnest layer of the Earth. This layer has the least density and its thickness varies about 8 to 40 km. **Mohorovic Discontinuity** or Moho, marks the lower limit of the crust and this discontinuity is identified on the basis of rock density.

The rocks forming the crust of the Earth are rich in lighter minerals like silica and aluminum. Hence, this layer is also called as **Sial** (silica and aluminum). The average density of this layer is  $2.7 \text{ gm/cm}^3$ .

### The Mantle

- It is about 2900 km in thickness, composed of minerals in a semi solid state.
- It is divided into further two layer upper mantle and lower mantle. The upper part of the mantle is called the **Asthenosphere**, which is about 250 km thick.
- Due to presence of minerals like silica and magnesium in the rocks forming this layer of the Earth, the mantle layer is also known as **Sima** (silica and magnesium).
- The average density of this layer is about  $5.68 \text{ gm/cm}^3$ .
- The transitional zone separating the mantle from the core is called the **Gutenberg Discontinuity**.

### The Core

- The core is the innermost layer of the Earth and occupies its center. It is about 3500 km in radius.
- This layer is also known as **Nife** (nickel and iron), because this layer contain large concentration of iron and nickel.
- Density of this part of the Earth is  $17.2 \text{ gm/cm}^3$  and is many times greater than the average density of the Earth ( $5.53 \text{ gm/cm}^3$ ).

### Discontinuities

The various layers are separated by discontinuities, which are evident in seismic data.

**Connard** discontinuity lies between upper crust and lower crust.

**Mohorovic** discontinuity between crust and mantle.

**Repetti** discontinuity lies between upper mantle and lower mantle.

**Gutenberg** discontinuity between core and mantle. Here, the Earth's density as well as velocity of P waves increases.

**Lehman** discontinuity divides upper core and lower core.

### Composition of Whole Earth

Elements	Percentage(%)	Elements	Percentage(%)
Iron	35	Magnesium	13
Oxygen	30	Nickel	2.4
Silicon	15	Sulphur	1.9

### Composition of Earth's Crust

Elements	Percentage(%)	Elements	Percentage(%)
Oxygen	46	Magnesium	4
Silicon	28	Calcium	2.4
Alumi-num	8	Potassium	2.3
Iron	6	Sodium	2.1

### Continental Drift Theory

- This theory is given by Alfred Wagener. in 1915, to explain the origin and evolution of the continents and the oceans.
- According to this theory about 250 million years ago, there was only one continent named *Pangea* means. All Earth and it was surrounded by one mass of water body, named **Panthalassa**.

- The present shape of the continents and oceans is due to the breakup of Pangaea.
- This breaking process Started about 200 million years ago.
- The Northern rift cuts Pangaea from East to West creating **Laurasia** in the North and **Gondwanaland** in South. A shallow sea called **Tethys** was situated between the *Laurasia* and the *Gondwanaland*.

### Plate Tectonics

- Plate tectonic is a scientific theory that describes the large-scale motions of Earth's lithosphere.
- The word tectonics comes from the Greek word meaning builder.
- The theory of Plate tectonics states that the lithosphere is divided into several rigid segments, which include both oceanic and continental crusts. These segments are called plates and they are moving on the asthenosphere, which is not a liquid, but a solid which flows under stress.
- About 20 such plates have been identified. There are seven major plates such as Eurasia, Antarctica, North America, South America, Pacific, African and Indian Plate.
- There are various intermediate size plates such as China, Philippine, Arabian, Iran, Nazca, Cocos, Caribbean and Scotia Plates.
- Most of the Earth's seismic activity, volcanism and mountain building occur along with these dynamic boundaries.

Depending upon the type of movement, plate margins are of three types

- Divergent Plate Margin** (Constructive margins)
- Convergent Plate Margin** (Destructive margins)
- Parallel Plates Margin** (Conservative margin or Transform Boundary)

Collision can occur between two oceanic plates, one oceanic and one continental plate or two continental plates.

Divergent Plate Boundary	Convergent Plate Boundary	Transform Fault Boundary
When the plates move apart with the upwelling of material from the mantle, divergent plate boundary results.	A convergent plate boundary is one, where two plates collide, one plate bending downward and subducting below the other.	They are located, where plates slide past one another without the creation or destruction of crust.
Formation of the mid oceanic ridges are the example of divergent plate margin.	Deep oceanic trench is formed adjacent to the zone of subduction. Fold mountains are the result of convergent plate boundary.	San Andreas fault along the West coast of Mexico is a famous transform fault.

### Earthquakes

- It refers to the vibration of the Earth's surface caused by the endogenetic forces of Earth.
- The magnitude or intensity of energy released by an earthquake is measured by the **Richter Scale**, whereas the damage caused is measured by modified **Mercalli Intensity Scale**.
- The place of origin of Earthquake is called **focus**. The place on the ground surface, which is perpendicular to the focus or hypocenter is called **epicenter**.
- Seismology is the special branch of geology that deals with the study of earthquake.
- The waves generated by Earthquake are called seismic waves and are classified into 3 types such as
- **Primary Wave** (P Waves) These are the waves of short wavelength and high frequency. They are longitudinal waves and can travel through solid, liquid and gases.

- **Secondary Wave (S Waves)** these are the waves of short wave length and high frequency They are transverse waves, which travel through all solid particles.
- **Surface Waves or Long Waves (L Waves)** They are the waves of long wavelength, confined to the skin of the Earth's crust. It causes most of the Earthquake's structural damage.
- **The Earthquakes Zones, in India** The Indian plate is moving from South to North at the speed of 5 cm/year and the Eurasian Plate is static on its own position, so there is a collision between Indian Plate and Eurasian Plates. Due to this collision, the Earthquakes occurs in the Himalayan regions of India. The collision also results in the increase of the height of Himalayas at the speed of 1 cm/year.

### Distribution of Earthquakes

*Most of the world Earthquake occur in*

- The zones of young fold mountain.
- The zones of folding and faulting.
- The zone of junction of continental and oceanic margin.
- The zone of active volcanoes.
- Along different plate boundaries.

*The traditional zones of Earthquakes*

- Circum Pacific belt
- Mid Continental belt
- Mid Atlantic belt

### Volcanism

- Volcanism includes all phenomena connected with the movement of heated material from the interior towards the surface of the Earth.
- A volcano is a vent or opening, through which heated materials consisting of gases, water, liquid lava, fragments of rocks are ejected from the highly heated interior to the surface of the Earth.
- Volcanic eruptions are closely associated with several integrated processes such as.
- Gradual increase in temperature with increasing depth, due to the heat generated by degeneration of radioactive elements inside the Earth.
- Origin of magma due to the lowering of the melting point caused by reduction in pressure of overlying rocks due to fractures caused by splitting of plates.

### Classification of Volcanoes

*On the Basis of Mode of Eruption*

Central Eruption or Explosive Type	Fissure Eruption or Quiet Eruption
Here the magma comes with great force through the small vent and spread to a distant position, e.g. Hawaiian type, Strombolian type, Pelean type, Vesuvius type	Large quantities of lava quietly flow up from fissures and spread out over the surrounding areas. Successive flow of lava plateau. E.g., Deccan Plateau.

*On the basis of Periodicity of Eruption*

Active Volcano	Dormant Volcano	Extinct Volcano
Volcano which erupt periodically e.g. Etna, Stromboli, Mayon	Volcano which becomes quiet after their eruption for some time e.g. Fujiyama, Krakatoa, Barren Island	They have no Indication of future eruption

### Various Volcanic Belts

- **Circum-Pacific Belt** (*Fire girdle of the Pacific or the Pacific ring of fire*). It extends across the Kamchatka Peninsula, Kurile Islands, the Islands of Japan, Philippines, New Guinea, New Zealand and Solomon Islands.
- **Highest Volcanic Peaks** Cotopaxi (South America), Fujiyama (Japan), Valley of ten thousand smokes (Alaska).
- **Mid-Continental Belt** (Volcanic zones of convergent continental plate Margins). It includes volcanoes of Alpine mountain chain, the Mediterranean Sea and the fault zone of Eastern Africa of Stromboli, Vesuvius, Etna, Kilimanjaro, etc.
- **Mid-Atlantic Belt** in which the volcanoes are fissure eruption type, e.g., Iceland, Canary Islands, Cape Verde, Azores etc.

### Weathering

It is the process of disintegration or decomposition of rocks in Situ by natural agents. It is a *static process*.

*There are three types of weathering*

- **Physical Weathering** (or mechanical weathering)
  - (i) It involves rock disintegration without any change in the chemical constituents of the rocks.
  - (ii) The factors responsible for physical weathering are temperature change, crystallisation of water into ice, the pressure release mechanism.
- **Chemical Weathering** It involves the decomposition due to chemical changes. There are various chemical processes, which cause chemical weathering such as Solution, Oxidation, Carbonation, Hydration, Hydrolysis and Chelation.
- **Biological Weathering** Plants and animals including man largely control it.  
*It is divided into three types such as*
  - (i) Faunal weathering
  - (ii) Floral weathering
  - (iii) Anthropogenic weathering

### Erosion

It involves removal of rock material and then transportation of it. Therefore, erosion is performed by mobile agents such as streams, winds, waves and underground water.

### Rocks

- The solid part of the Earth's crust are called rocks.
- The rocks are made up of two or more minerals.
- Minerals are obtained from rocks.
- A rock can be defined as an aggregate of minerals.

*Rocks are classified in three main types depending on the process of their formation*

- Igneous
- Sedimentary
- Metamorphic

### Igneous Rocks

- Formed due to the cooling, solidification and crystallisation of hot and molten magma.
- They are called as the **primary rocks** as all the other rocks are formed directly or indirectly from the **igneous rocks**.
- It is believed that the igneous rocks are formed during each period of geological history of Earth.

- They are hard, granular and crystalline rocks, less affected by chemical weathering.
- Moreover, it does not have any fossil or does not form any strata or layers of lava.

### Classification of Igneous Rocks

*On the basis of Mode of Occurrence*

- **Intrusive Rocks** They are formed due to the solidification of rising magma below the surface of the Earth, e.g., Granite, Lapolith, Batholiths, Sills etc.
- **Extrusive Rocks** They are formed due to cooling and solidification of hot and molten magma at the Earth surface, e.g., Basalt, Gabbro etc.

*On the basis of Silica Content*

- **Acidic** It has more silica content e.g., **Granite**.
- **Basic** It has less amount of silica content e.g., **Gabbro**.

### Sedimentary Rocks

- It is formed due to the aggregation and compaction of sediments derived from the older rocks, plants, animals and contains fossils of plants.
- The sedimentary rocks can be classified on the basis of the nature of sediments Mechanically, Chemically and Organically formed rocks.

### Metamorphic Rocks

- These are the changed form of igneous and sedimentary rocks.
- These are the rocks, which change either in form or composition without disintegration.
- Already formed metamorphic rocks are metamorphosed and this process is called **Metamorphosis**.
- The agents of metamorphism are Heat, Compression and Solution.

Sedimentary Rocks	Metamorphic Rocks
Limestone	Marble
Sandstone	Quartzite
Shale/clay	Slate, Phyllite, Schist
Coal	Diamond

Original Rocks	Metamorphic Rocks
Sandstone	Quartzite
Limestone	Marbal
Shale and mudstone	Slate
Granite	Gneisse
Coal	Graphite Coal
Clay	Slate

### Landforms

#### Types of Mountains

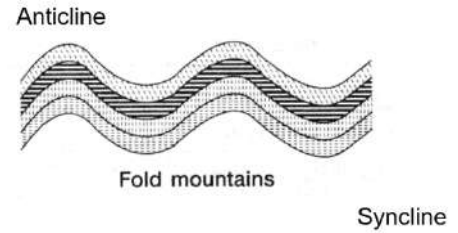
Based on their mode of formation four main types of mountain can be distinguished.

#### Fold Mountains

- It is formed due to the compressive forces generated by endogenetic forces, earthquake, landslide.
- Example of Fold moutain Himalayas, Alps, Andes, Rockies, Atlas etc.

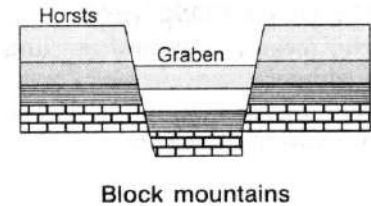
On the basis of age, fold mountains are grouped into

- (a) **Young/New Fold Mountains** It came into existence after the continental drift. e.g., Himalayas, Andes, Rockies, Alps. Himalayas are regarded as the youngest mountains in the world.
- (b) **Old Mountains** They belong to pre-drift era, then subject to denudation and uplift. eg., Pennines (Europe), Appalachians (US), Aravallis (India) etc.



### Block Mountains

- (i) It is formed when great block of Earth's crust may be raised or lowered due to tectonic activities.
- (ii) The land between the two parallel faults either rises forming Block mountains or Horsts or Subsides into a depression termed as Rift valley or Graben.
- (iii) Example of Block mountain Narmada, Tapi and Damodar valley in India, the Vosges in France and Block forest in Germany through which Rhine river flows



### Volcanic Mountains

- (i) They are formed due to the accumulation of volcanic material. It is also called as mountains Accumulation.
- (ii) Examples Mt Fuji (Japan), Cotopaxi in Andes. Vesuvius and Etna in Italy, Mt Mayon (Philippines etc).

### Residual or Dissected Mountain

- (i) They are formed as a result of erosion of plateaus and high planes by various agents of erosion.
- (ii) Examples Catskill mountains of New York, Sierras of Spain, Girnar and Rajmahal of India.

### Plateaus

Tabular upland having relief of more than 500 feet may be defined as plateau. Tibetan plateau (5000 m) is the highest plateau in the world.

*According to their mode of formation and their physical appearance. plateau may be grouped into the following types*

- **Tectonic Plateau** These are formed by Earth movements. which cause uplift and are normally of a considerable size and fairly uniform altitude.
  - (i) When plateau are enclosed by Fold mountains, they are known as **Intermont Plateau**.
  - (ii) Examples of Tectonic Plateau are Tibetan Plateau between the Himalayas and the Kunlun and the Bolivian Plateau between two ranges of the world.
- **Volcanic Plateau** These are formed by accumulation of lava. e.g., Deccan Plateau (India).
- **Dissected Plateau** Through the continual process of weathering and erosion by running water, ice and winds high extensive plateau are gradually worn down, and their surface made irregular as example is the Scottish Highlands.

### Plains

A relatively low-lying and flat land surface with least difference between its highest and lowest points is called a Plain. The plains are divided into structural, erosional and depositional plains.

**Forms of Plain**

<b>Structural Plain</b>	<b>Erosional Plain</b>	<b>Depositional Plain</b>
Formed due to the uplift of a part of the sea floor e.g. the great plain of U.S.A.	Formed when the elevated tract of land is worn down to a plain by the process of erosion. e.g., Plains of North Canada.	Formed by filling up of sediments into depressions along the foothills, lakes and seas e.g., Indo-Gangetic Plains

**Islands**

An island is any piece of land that is surrounded by water. A grouping of geographically or geologically related Islands is called an *archipelago*. The various types of Islands are named according to the way they were formed.

*They are*

- **A Continental Island** is simply an island that rests on the continental shelf. Because of this, these islands are always quite close to a given continent. Also, the water level around a continental island is very shallow, typically less than 600 feet. Canadian island of Newfoundland is a continental island, as is Greenland. Great Britain is the largest continental island in Europe.
- **Volcanic Islands** are formed when volcanoes deep in the ocean rise above the water's surface.
- **A Coral Island** is an island that forms a ring and partially or totally encloses a shallow body of water or lagoon. Coral islands, which are large collections of coral a top rock (usually volcanic) in the ocean. Lakshadweep island in Indian Ocean is best example of coral Islands.
- **Alluvial Islands** are formed by the outward flow of water depositing silt and gravel at the mouth of a river. New Moore island at the mouth of Ganga river in West Bengal is an alluvial Island.
- **Barrier Islands** are formed by waves depositing sand on the shallow ocean bottom as they crash on the shoreline.
- **Tectonic Island** are formed by the result of tectonic activity. By the tectonic movement long island arcs (archipelagoes) are formed. Indonesia, Philippines, Japan groups of island are best example of it.

**Lakes**

A lake is a body of water surrounded by land from all the sides. A lake can be fed and drained by rivers and streams.

**Types of Lakes**

*Lakes can be classified as*

**Tarn**

Tarn lakes (also often classified as Alpine lakes) are usually associated with glacial regions areas that have been glaciated in the past. These follows form as the ice scours out the side of a hill, creating what is called a cirque. Tarn lakes from the last ice ages are evident along some slopes of the Adirondack Mountains and from more recent glaciations in the European Alps.

**Rift Valley Lake**

Rift valley lakes occur in areas where rock is pulling apart. As a narrow wedge of land drops from the movement, a long, narrow lake often forms. The Rift valley, which cuts through Africa and Asia, contains the largest group of such lakes, including lake Nyasa.

**Crater Lake**

Crater lakes form at a volcanic peak. When an extinct volcano collapses, it often leaves a somewhat circular depression; water from rain and runoff eventually fills the lake. Crater lake in Oregon is a good example of such a lake.

### Deflation Lake

Deflation lakes usually occur in deserts as the wind blows out depressions in the sand. If the hole reaches the local groundwater table, it can create an oasis. Such features dot the Sahara desert in Africa which are locally called Oasis.

**Oxbow Lake** Oxbow lakes are created by a curved river meander that was cut off by sediment or other means, creating a bowed shaped lake. The Mississippi River shows evidence of past Oxbow lakes.

**Artificial Lake** Artificial lakes are those usually formed by the damming of a river. These lakes are usually created to regulate the flow of a seasonal flooding river and many times offer a constant supply of potable (drinkable) water or generated electricity.

### Important Lakes and their countries

Lakes	Countries	Area (km <sup>2</sup> )
Caspian Sea	Kazakhstan, Turkmenistan, Iran, Azerbaijan, Russia	371000
Superior	Canada, United States	82414
Victoria	Uganda, Kenya, Tanzania	69485
Michigan	United States	58000
Tanganyila	Burundi, Tanzania, Zambia	32893
Baikal	Russia	31500
Great Bear Lake	Canada	31080
Malanei Malawi	Tanzania, Malawi, Mozam, bique	30044
Great Slave Lake	Canada	28930
Balkhash	Kazakhstan	18428
Ladoga	Russia	18130
Nicaragua	Nicaragua	8001
Great Salt Lake	United States	

### Atmosphere

Atmosphere is a thick gaseous envelope surrounding the Earth from all sides and attached to Earth through the force of gravitation.

### Significance of Atmosphere

- Acts as a filter because it absorbs the various unwanted radiation.
- Source to various gases.
- Supports life forms in biosphere.
- Extent of Atmosphere Almost 97% of effective atmosphere confines within the height 29 km of the Earth's surface. So, the vertical distribution of the atmosphere is not uniform and even not homogeneous. It extends between 16-29000 km from the sea level.

### Composition

The atmosphere is composed of gases, vapours and particulates.

- Gases such as Helium, Ozone and Hydrogen etc are present in traces.
- Ozone gas absorbs the ultraviolet radiations and save the biosphere from its adverse impact.

## Layers of Atmosphere

### Troposphere

- It extends up to 16 km from the Earth's surface. Thickness varies from 8 km at poles to 16km at equator.
- At every 165 m, there is a drop of 1°C (or 6.4°C per km). This is called **Normal Lapse Rate of Temperature**.
- **Tropopause** separates troposphere from stratosphere.
- This, layer accounts for practically the entire water vapour, all dust particles and most of the Carbon dioxide contained in the atmosphere. Due to this all weather phenomena such as condensation, precipitation and storms, etc occur in the troposphere only.

### Stratosphere

- The stratosphere extends up to about 50 km, where **stratopause** separates it from the mesosphere.
- In this layer, the temperature increases with increase in height. This phenomenon is known as temperature inversion.
- The temperature rises in this layer from about—60°C at the tropopause to 0°C at stratopause.
- The part of the stratosphere, in which there is a concentration of ozone is often called ozonosphere. It absorbs ultraviolet radiation, which is harmful for us.
- Stratosphere is free from dust particles and also from atmospheric turbulences. Hence, this layer is considered ideal for flying of jet aircrafts.

### Mesosphere

- Mesosphere extends above the stratopause up to a height of about 80 km.
- In this layer, the temperature decreases with height like in the troposphere and it falls from about 0°C at its base to about - 100°C at 80 km height.
- It is considered the coldest layer of the atmosphere.
- The upper limit of the mesosphere is marked by the Mesopause, a transitional layer separating it from the ionosphere.

### Ionosphere

- Ionosphere is located above the mesosphere and extends up to about 600 km.
- This layer is also called as ionosphere because it contains electrically charged ions that reflect the radio waves back to the Earth thus making radio communication possible
- Absorption of solar radiation by ionised particles cause increase in temperature with increasing height in ionosphere.
- Due to large concentration of ionised particles in this layer the ionosphere acts as a protective layer against meteorites, that are burnt in this layer.

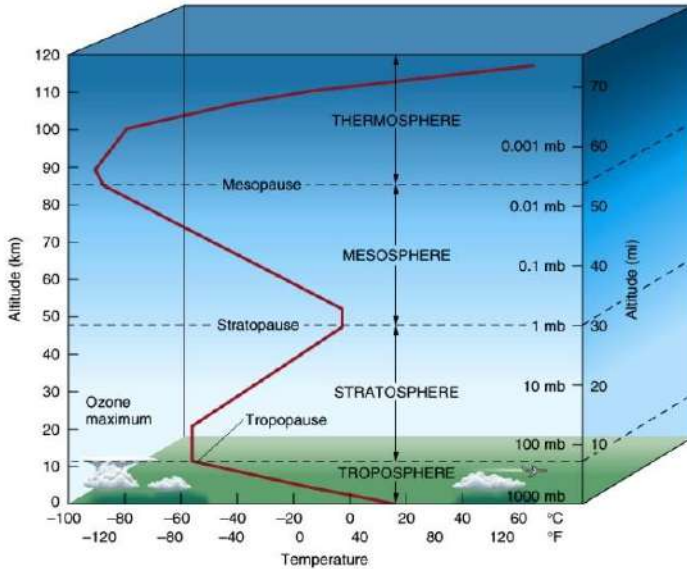
### Thermosphere

- The zone between the 85 km and 400 km above surface is often called *thermosphere*. In this layer, temperature increases with increasing altitude. The upper limit of the thermosphere, the **thermopause** is generally taken at an altitude of about 600 km.
- The day temperature at 600 km altitude exceed 14000 while night temperature remain about 225°C
- The upper part of the thermosphere contains only the lighter gases like helium and hydrogen.

### Exosphere and Magnetosphere

- The outermost part of the atmosphere of the Earth is called Exosphere.
- This zone of the atmosphere extends up to a height about 900 km.

- The upper limit of the exosphere is uncertain as this layer acts as a transitional layer between the Earth atmosphere and the space. The outer part of the exosphere is called Magnetosphere.



### Atmospheric Pressure

- Air is an extremely compressible gas having its own weight. The pressure exerted by air due to its weight called atmospheric pressure on the Earth's surface.
- Atmospheric pressure is neither the same for all regions nor same for one region all the time.
- Atmospheric pressure is affected by various factors such as altitude, temperature and Earth's rotation.

### Influence on the Atmospheric Pressure

**Altitude** Air pressure increases, when air descends due to the decrease in volume. When air rises its volume increases and the outward pressure of its molecules is spread over a larger area and its pressure decreases.

**Temperature** The pressure of air rises, when its temperature falls. Low temperatures at the poles cause the air to contract—high pressure develops; whereas the high temperature along the equator causes the air to expand—low pressure develops.

### Equatorial Low Pressure Belt

- It is located on either side of the geographical equator in a zone extending between 5°N and 5°S. Its location is not stationary and there is a seasonal drift of this belt with the northward (summer solstice) and southward (winter solstice) migration of the Sun.
- It is thermally induced because of the intense heating of the ground surface by the almost vertical Sun rays.
- It represents the zone of convergence of North East and South East trade winds. This convergence zone is characterized by light and feeble trade winds. And because of the frequent calm conditions this belt is called as a belt of calm or doldrums.

### Greenhouse Effect and Global warming

**A Greenhouse Gas** (sometimes abbreviated GHG) is a gas in the atmosphere that absorbs & emits radiation within the thermal infrared range. The process is the fundamental cause of the greenhouse effect.

The primary greenhouse gases in the Earth's atmosphere are water vapour, carbon dioxide, methane, nitrous oxide and ozone.

**Global Warming** is the increase of Earth's average surface temperature due to effect of green house gases such as carbon dioxide emissions from burning fossil fuels or from deforestation. This is a type of greenhouse effect.

### **Ozone Layer Depletion**

The ozone layer is located within the Stratosphere, about 24 km above the Earth's surface. The layer consist of ozone gas molecules that are formed as the sunlight reacts with oxygen.

### **Kyoto Protocol**

- The Kyoto Protocol is a protocol to the United Nations Framework Convention on Climate Change (UNFCCC), aimed at fighting global warming.
- The UNFCCC is an international environmental treaty with the goal of achieving the 'stabilisation' of green house gas concentration in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system".
- The protocol was initially adopted on December 11, 1997 in Kyoto. Japan and enforce on Feb 16, 2005.
- The Intergovernmental Panel on Climate Change (IPCC) has predicted an average global rise in temperature of 1.4° C to 5.8° C between 1990 and 2100. If successfully and completely implemented the Kyoto Protocol will reduce that increase by somewhere between 0.02° C and 0.28° C by the year 2050.

### **Subtropical High Pressure Bel**

- It extends between 30° to 35° in both the hemispheres.
- It is not thermally induced, but dynamically induced as it owes its origin to the rotation of the Earth and sinking and settling down of winds.
- Here the convergence of winds at higher altitude above this zone results in the subsidence of air from higher altitudes. Thus, decent of wind results in concentration of their volume and ultimately causes high pressure.
- This zone of high pressure is also called as Horse Latitude.

### **Sub Polar Low Pressure Belt**

- It extends between 60° to 65° in both the hemisphere.
- The low pressure belt does not appear to be thermally induced because there is low temperature throughout the year and as such there should have been high pressure belt instead of low pressure belt. Thus, it is dynamically induced.
- It is more developed and regular in Southern hemisphere than in Northern hemisphere because of the over dominance of water (ocean) in the Southern hemisphere.

### **Polar High Pressure Belt**

High pressure persists at the poles throughout the year because of the prevalence of very low temperature all the year round.

### **Shifting of Wind Belts**

- The entire system of pressure and wind belts follows the movement of midday Sun. In June, when overhead Sun is over the Tropic of Cancer, all the belts move about 5°-10° North of their average position.
- In the same manner, when the Sun is overhead at the Tropic of Capricorn in December, all the belts swings 5°-10° South of their average position.

## Wind System

The pressure difference is the major cause of the genesis of the wind system. The air moves from high pressure to low pressure.

- The slope of pressure from high to low is called as **pressure gradient**, which is also called as barometric slope.
- The imaginary line joining the points having same pressure is called isobars. The direction of air movement should be perpendicular to the isobars because the direction of pressure gradient is perpendicular to the isobars but the direction is deviated from the expected one due to **Coriolis force** caused by the rotation of Earth.

## Wind Direction and Related Laws

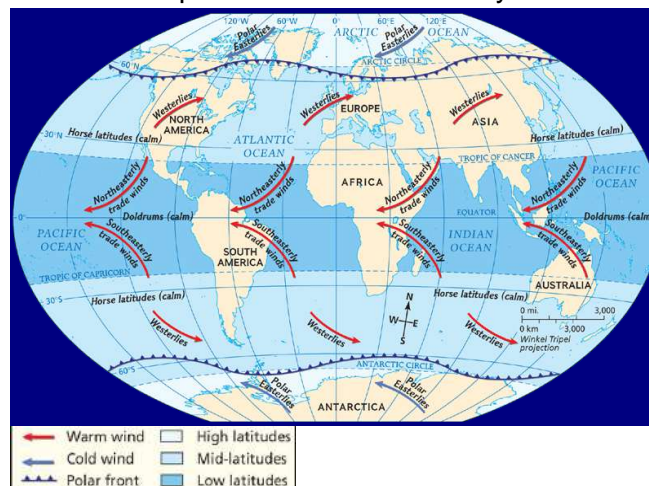
- The Coriolis force generated due to the rotation of Earth acts as a deflective force to the wind direction.
- Because of the Coriolis force, all the winds are deflected to the right in the Northern hemisphere while they are deflected to the left in the Southern hemisphere with respect to the rotating Earth. This is referred to as **Farrel's Law**.
- The Coriolis force is absent along the equator, hut increases progressively towards the poles.

## Types of Winds

### Permanent Winds

These winds include trade wind, westerlies and polar winds.

- **Trade Wind** These are steady currents of air blowing from the sub tropical high pressure belt towards the equatorial low pressure belt. Under the influence of the Coriolis forces they flow from the North-East in the Northern hemisphere and from South-East in the Southern hemisphere.
- **Westerlies** The permanent winds blowing from the subtropical high pressure belt to the sub polar low pressure belt in both the hemisphere is called Westerlies. The general direction of the westerlies is South West to North West in the Northern hemisphere and North West to South East in the Southern hemisphere.  
Because of the dominance of the land masses in the Northern hemisphere the Westerlies become more complex and complicated and become less effective during summer seasons and more vigorous during winter seasons.
- **Polar Winds** Polar winds blows from polar high pressure belt to sub polar low pressure belt. They are North Easterly in Northern hemisphere and South Easterly in the Southern hemisphere.



## Secondary Wind Movements

Seasonal Winds The winds, which reverse its direction completely every 6 months is called Seasonal winds. The best example is Monsoon winds.

## Cyclones and Anticyclones

### Cyclones

Cyclones are the centers of low pressure surrounded by closed isobars having increasing pressure outward and closed air circulation from outside towards the central low pressure in such a way that

- Air blows inward in **anticlockwise** direction in the Northern hemisphere.
- Air blows inward in **clockwise** direction in the Southern hemisphere.

Cyclone	Region
Typhoons	China Sea
Tropical Cyclones	Indian Ocean
Hurricanes	Caribbean Sea
Tornadoes	USA
Willy Willies	Northern Australia

### Anticyclone

- They are the wind system, which has the highest pressure at the centre and lowest at the outer margins surrounded by circular isobars where wind blows.
  - from centre to outward in clockwise direction in Northern hemisphere.
  - from centre to outward in anticlockwise direction in Southern hemisphere.
- They are high pressure system and common in subtropical belts and practically absent in the equator region.
- They are generally associated with rainless fair weather and that's why they are called as *weatherless phenomena*

### Thunderstorms

- Thunderstorms are local storms characterised by swift upward movement of air and heavy rainfall with cloud thunder and lighting.

### Tornado

- Tornadoes are very strong tropical cyclones of smaller size In the Mississippi valley (US), they are called Twisters.
- They are more destructive than cyclones as the speed of winds is very high, exceeding 320 km/hour.

### Jet Stream

- The strong and rapidly moving circumpolar Westerly air circulation in a narrow belt of a few 100 km width the upper limit of troposphere is called Jet Stream.
- Their circulation path is wavy and meandering.
- The extent of the Jet Streams narrows down during the summers because of their Northwards shifting while these extend up to 20°N latitude during winter season.

**Local Winds**

<b>Winds</b>	<b>Nature</b>	<b>Region</b>
Land Breeze	Warm	Experienced along coastal areas. Land breeze blows from land to sea.
Sea Breeze	Cold	Experienced along coastal areas. Sea breeze blows from sea to land.
Chinook (snow eater)	Warm	Rockies (USA and Canada)
Sirocco	Hot	North Africa
Fohn	Warm	Alps/Europe
Khamsin	Hot	Egypt
Blizzard	Cold	Siberian, Canada, USA
Bora	Cold	Yugoslavia
Southerly Burster	Cold	Australia
Purga	Cold	Russian, Tundra
Bire	Cold	France
Cape Doctor	Cold	South Africans's coast
Harmattan (The doctor)	Hot	Sahara to Guinea Coast (Ghana, Nigeria)
Zonda	Warm	Argentina, Chile/Andes
Brick Fielder	Hot	Australia
Samun	Hot	Iran
Levanter	Cold Wind	Spain
Norwester	Hot Wind	New Zealand
Leveche	Hot	Algeria, Morocco
Santa Ana	Warm	USA (California)
Berg	Warm	South Africa
Yoma	Warm	Japan
Karaburan	Hot	Tarim Basin
Black Roller	Hot/Dusty	North America
Kalbaisakhi	Hot	North India
Mistral	Cold	France to Mediterranean (Rhine valley)

**Humidity and Related**

**Aspects**

- Humidity of air refers to the content of the water vapour present in the air at a particular time and place.
- Humidity is measured by an instrument called hygrometer. Another instrument used for the same purpose is sling psychrometer

The atmospheric humidity is expressed in a number of ways such as

<b>Measurement of Humidity</b>	<b>Definition</b>
Humidity Capacity	The capacity of air of certain volume at certain temperature to retain maximum amount of moisture content
Absolute Humidity	The total weight of moisture content per volume of air at definite temperature is called absolute humidity.
Specific Humidity	The mass of the water vapour in grams contained in a kilogram of air and it represents the actual quantity of moisture present in a definite air.
Relative Humidity	It is the ratio of the amount of water vapour actually present in the air having definite volume and temperature (i.e., absolute humidity) to the maximum amount the air can hold (i.e., humidity capacity)

$$\text{Relative Humidity} = \frac{\text{Absolute humidity}}{\text{Humidity capacity}} \times 100$$

- Condensation is the change of physical state of matter from gaseous phase into liquid phase and is the reverse of vaporization.
- When the relative humidity reaches 100%, the air is completely saturated. The air temperature is said to be as dew point.
- Smog (Smoke + Fog) is a form of fog that occurs in areas, where the air contains a large amount of smoke.
- Fog is made from the droplets of water suspended in the lower layer of the atmosphere. Fog is not considered as a form of precipitation. Visibility of less than 1 km is the internationally recognised definition of fog.
- Haze is formed by water particles that have condensed in the atmosphere and visibility lie between 1 to 2 km.
- Frost is the moisture on the ground surface that condenses directly into ice, *i.e.*, when condensation occurs below freezing point.

### Clouds

- Clouds are a mass of small water droplets or tiny ice crystals.
- Clouds are classified according to their appearance, form and height.
- *There are four groups*
  - (i) High Clouds 6000 metre to 12000 metre
  - (ii) Middle Clouds 2100 metre to 6000 metre
  - (iii) Low Clouds below 2100 metre
  - (iv) Clouds of great vertical extent 1500 to 9000 metre
- The different types of clouds are given Latin names, which are the combination of the following words
- Cirrus means looking like a feather and used to describe the very high clouds.
- Cumulus means looking like a hipe. It is used to describe the clouds having flat bases and rounded tops.
- Stratus means lying in level sheets. It is used for layer type of clouds.
- Alto means high.
- Nimbus means rain cloud.

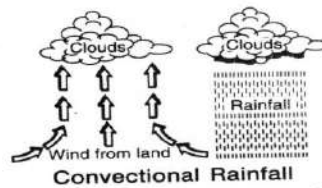
### Types of Clouds

High Clouds	Middle Clouds	Low clouds	Clouds with Great Vertical Extent
Cirrus Composed of small ice crystal, white, wispy and fibrous in appearance.	Alto cumulus Composed of water droplets in layers and patches	Strato cumulus Large globular masses, bumpy looking, soft and grey in appearance forming a pronounced regular and sometimes wavy pattern.	Cumulus Round topped and flat based forming a whitish grey globular mass, consist of individual cloud units.
Cirro stratus looks like a thin white almost transparent sheet, which causes the Sun and Moon to have halos.		Stratus These are low, grey and layered, almost fog like in appearance, bringing dull weather and often accompanied by drizzle.	

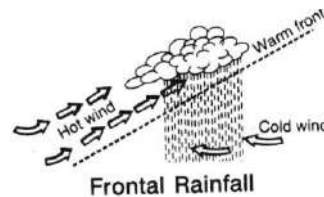
## Precipitation

On the basis of its origin, precipitation may be classified into three main types

- **Convective Rainfall** It occurs due to thermal convection currents caused due to insolation heating of ground surface.



- **Orographic Rainfall** occurs due to ascent of air forced by mountain barrier.
- **Frontal Rainfall** It occurs due to upwards moment of air caused by convergence of cold air masses against warm air masses.



- **Cyclonic Rainfall** When the air is caused to rise upward due to cyclonic circulation, the resulting precipitation is called cyclonic rainfall.
- The average weather conditions over a large area are called the climate of a place.
- The factors, which control the weather and the climatic conditions are latitude, altitude, unequal distribution of land and water, ocean current, air pressure and wind, mountain barrier, nature of ground surface, different types of atmospheric storms etc.

### Precipitation in different Forms

Convective Precipitation	Orographic Precipitation	Cyclonic Precipitation
It occurs daily in the afternoon in the equatorial regions. It is of very short duration but occurs in the form of heavy rainfall. It occurs through thick, dark and extensive cumulo – nimbus clouds. It is accompanied by cloud, thunder and lightning.	The windward slope receives the maximum amount of rainfall, whereas the leeward side receives less rainfall. The windward slopes of the mountains at the time of rainfall are characterized by cumulus clouds while leeward slope has stratus clouds. It can occur in any season.	Rainfall associated with the temperate cyclone occurs, when two extensive air masses of different physical properties converge. In tropical region two extensive air masses of similar physical properties converge to form tropical cyclones, wherein lifting of air is almost vertical and very often associated with convection.

## Climate

Weather refers to the sum total of the atmospheric condition in term of temperature, pressure, wind, moisture, cloudiness, precipitation and visibility of a particular place at any given time.

### World Climatic Types

Climatic Zone	Climatic Types	Rainfall	Natural Vegetation
Equatorial Zone(10°N-10°S)	Hot, wet equatorial	Rainfall all the year	Equatorial rain forest
Hot Zone	(a)Tropical Monsoon (b)Tropical Marine	Heavy summer rain Rain mainly in summer	Monsoonal forest Savana (Tropical)

	Sudan Type Desert Type (a) Saharan type (b) Mid Latitude type	Little rain	grassland) Desert vegetation and scrub
Warm Temperate Zone (30°N-45°S)	Western margin (Mediterranean type) Central Continental type (Steppe type) Eastern type (a) China type (b) Gulf type (c) Natal type	Winter Rain Light summer Heavier summer	Mediterranean forest Steppe, temperate grass Warm, wet forests
Cool temperate Zones (45°N-65°S)	Western Margin (British type) Central Continental (Siberian type)	Rain in autumn and winter Light summer rain	Deciduous forest Coniferous forest
Cold Zone (65°N-90°S)	Eastern Margin (Lauritian Type) Arctic or Polar Mountain Climate	Moderate summer rain Very light summer rain Heavy rainfall	Mixed Forest Tundra, Mosses, lichens Alpine, fern, conifers

### Koeppen Classification Of Climate

**Table 12.2 : Climatic Types According to Koeppen**

Group	Type	Letter Code	Characteristics
A-Tropical Humid Climate	Tropical wet Tropical monsoon Tropical wet and dry	Af Am Aw	No dry season Monsoonal, short dry deason
B-Dry Climate	Subtropical steppe Subtropical desert Mid-latitude steppe Mid-latitude desert	BSh BWh BSk BWk	Low-latitude semi aride or dry Low-latitude arid or dry Mid-latitude semi arid or dry Mid-latitude arid or dry
C-Warm temperate (Mid-latitude) Climates	Humid subtropical Mediterranean Marine west coast	Cfa Cs Cfb	No dry season, warm summer Dry hot summer No dry season, warm and cool summer
D-Cold Snow-forest Climates	Humid continental Subarctic	Df Dw	No dry season, severe winter Winter dry and very severe
E-Cold Climates	Tundra Polar ice cap	ET EF	No true summer Perennial ice
H-Highland	Highland	H	Highland with snow cover

### Great Desert

Name	Country/Region
Sahara(Libyan, Nubian)	North Africa
Australian (Gibson, Simpson, Victorian Great Sandy)	Australia
Arabian (Rub al khali, An- Nafud)	Arabia
Dast-e-Lut (Barren Desert)	Iran
Dast-e-kavir(Salt-e-Kavir) (Salt Desert)	Iran
Desierto de Sechura	Peru

Atacama	North Chile
Patagonia	Argentina
Kalahari	Botswana
Namib	Namibia

**Some Important Isopleth**

Isopleth	Reaction	Isopleth	Reaction
Isohels	Sunshine	Isobath	Equal depth in sea
Isohyets	Rainfall	Isohaline	Salinity
Isonif	Snow	Isohypse (or contour lines)	Elevation above sea-level
Isocline	Slope	Isodapane	Equal transportation cost
Isotherm	Temperature	Isobronts	Thunder Storm at the same time
Isobars	Equal Pressure		

**Famous Grasslands of the World**

Grass lands	Countries	Grass lands	Countries
Steppe	Eurasia	Veld	South Africa
Pustaz	Hungary	Downs	Australia
Prairies	N. America	Cantebury	New Zealand
Pampas	Argentina		

**Hydrosphere**

The water component of the earth is called hydrosphere. It includes the oceans, seas, lakes, ponds, rivers and streams. The hydrosphere covers about 70% of the surface of earth.

**Composition of Hydrosphere**

Storage Component	Total Percentage of water
Oceans	97.6
Saline lakes and inland seas	0.008
Ice capes and glaciers	1.9
Ground Water	0.5
Soil moisture	0.01
Lakes	0.009
Freshwater rivers	0.0001
Atmosphere	0.0009

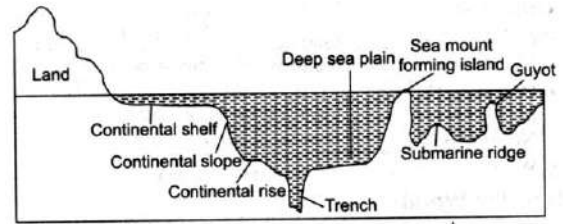
**Relief Features of the Oceans**

**Continental Shelf**

- The shallow submerged extension of the continent is called the continental shelf.
- Extends to a depth of 100 fathoms (1 fathoms 1.8 m).
- Average width 70 km; average slope 17 feet/mile or about 1°.
- Continental shelf covers 7.5% area of the oceans. It extends over 13.3% of the Atlantic ocean 5.7% of Pacific ocean and 4.2% of Indian ocean.
- If mountains extend along the coast, the shelf will be narrower.
- About 20% petrol and gas are found here. They also provide the richest fishing ground in the world.

### Continental Slope

- Extends seawards from the continental shelf.
- Depth 200-2000 fathoms (3660 m).
- Average slope 20 to 50 degrees
- The boundary between shelf and slope is known as Andesite Line, names, after the Andesite Rock.
- They cover about 8.5% of the total ocean area.



### Continental Rise

- Continental rise is an area at the foot of the slope slightly rising due to the accumulation of debris transported over the slope.
- Average slope - 0.5° to 1°.
- Oil deposits occur here.

### Abyssal or the Deep Sea Plains

- It is the deepest and most extensive part of the oceanic floor.
- Average depth 3000 m to 6000 m.
- It covers about 75.9% of total oceanic area.
- Parts of the Abyssal plains are occupied by raised ridges submarine mountains and by very deep trenches canyons.

### Deeps/Trenches

- Trenches are narrow and steep sides depressions.
- Trenches are formed, when two plates of the Earth's crust are moving together and one is being pushed down below the other.
- Marina trench (challenger deep) is the deepest trench in the world situated in the NW Pacific oceans, near philippines. It is more than 11 km deep.

### Oceanic Ridges

- Oceanic Ridges are formed by the volcanic activity the spreading boundary of plates. It is thousands of km long and hundreds of km wide mountain range on the oceanic floor.
- Their summits may rise above the sea level in the form Islands *i.e.*, Iceland, Azores Island.

### Coral Reefs

- Coral reefs are formed due to accumulation and compaction of skeletons of lime secreting organisms known as Coral Polyps.
  - Corals are found mainly in the tropical oceans and sea because they require high mean annual temperature ranging between 20°C to 25°C.
  - Corals do not live in deeper waters due to lack sufficient sunlight and oxygen.
- On the basis of nature, shape and mode of occurrence, the reefs is classified into three types

- (i) Fringing Reefs It develop along the continental margins or along the islands.
  - The seaward slope is steep and vertical while the landward slope is gentle.
  - They are usually attached to the coastal land, but occasionally they are separated from the shore by a shallow and narrow lagoon called 'Boat Channel'
  - This type of reefs are found near Rameshwaram in the Gulf of Mannar.

- (ii) **Barrier Reefs** Largest coral reefs off the coastal platform, but parallel to them.
- The reef lies at a distance away from the coast. Hence a broad lagoon develops between the reef and the shore.
  - The Great Barnes Reef of Australia is the largest barrier reef in the world.
- (iii) **Atoll** A reef of narrow growing corals of horse shoe shape and crowned with plam trees is called an atoll.
- It is formed around an islands or in an elliptical form on a submarine platform.
  - Funafuti atoll of Ellice Islands is a famous atoll.

### **Coral Bleaching**

When corals are stressed by changes in conditions such as temperature, light or nutrients, they expel the symbiotic algae living in their tissues, causing them to turn completely white, this phenomenon is known as **coral bleaching**.

### **Salinity**

Salinity is defined as the total amount of solid material in grams contained in 1 kg of sea water and is expressed as part per thousand. The oceanic salinity not only affects the marine organism and plant community, but also affects the physical properties of the ocean such as temperature, pressure, density, waves and currents.

- Average salinity in Southern hemisphere is more than that of Northern hemisphere.
- **Iso-halines** represent the salinity distribution in the surface of the sea. These are the lines joining places having an equal degree of salinity.
- The main source of salinity is dissolution of the rocks of oceanic crust, which contains salts.
- Poles have minimum salinity because of addition of fish water in the form of icebergs and excessive snowfall.
- Variation in salinity causes vertical circulation of water.
- More saline water freezes slowly while the boiling point of saline water is higher than the fresh water.
- Salinity also increases the density of water.

### **Salinity : Controlling Factor**

Controlling Factor	Relation with Salinity
Evaporation	Greater the evaporation, higher the salinity
Percipitation	Higher the precipitation, lower the salinity
Influx of river water	Big voluminous rivers pour down immense volume of fresh water into the oceans and salinity is reduced at the mouth.
Atmospheric Pressure	Anticyclonic condition with stable air and high temperature increases the salinity of the surface water of the ocean.
Circulation of ocean water	Ocean currents affects the spatial distribution of salinity by mixing sea waters.

Salinity on an average decreases from equator to poles. The highest salinity is recorded near the tropics rather than the equator because of the heavy precipitation in the equatorial region.

### **Waves**

Waves are the oscillatory movements in water mainly produced by winds, manifested by an alternate rise and fall of the sea surface.

The waves are the important agents of erosion in the coastal regions, where they carve out various landforms like caves, bays, gulfs, capes and cliffs.

- Seismic waves or Tsunamis are the waves caused by earthquakes in volcanic eruptions in the sea bottom.
- The Tsunamis, which hit the coast in South East Asia on 26th December, 2004, caused havoc in that region.

## **Ocean Currents**

- An ocean current is a continuous, directed movement of ocean water generated by the forces acting upon it, such as breaking waves, wind, coriolis effect, temperature and salinity differences and tides caused by the gravitation pull of the Moon and the Sun.
- Ocean currents circulate in clockwise direction in Northern hemisphere and in anti-clockwise direction in Southern hemisphere.

Ocean currents are of two types

- (i) **Warm Currents:** The ocean currents flowing from lower latitude to higher latitude are called as warm currents.
- (ii) **Cold Currents:** The ocean currents flowing from higher to lower latitude are called as cold currents.

## **Currents of North Pacific Ocean**

### **Warm Currents**

- North Equatorial Current flows Westwards from the Western coast of Mexico to the Philippines.
- Kuroshio Current is an extension of North Equatorial Current near Japan Coast.
- Alaska Current It flows along the coast of British Columbia and the Alaska Peninsula.

### **Cold Currents**

- Oyashio Current flows down from Bering Sea towards Japan from North pole and joins Kuroshio currents.
- Okhotsk Current and Kuril Current flow down from sea of Okhotsk and joins Kuroshio current to the North of Japan.
- West Wind Drift flows towards Alaska.
- Californian Current is an extension of Alaskan currents. It joins finally North Equatorial current and completes clockwise circulation of water.

## **Currents of South Pacific Ocean**

### **Warm Currents**

- **East Australian Current or Great Barrier Current** flows towards East coast of Australia from equator towards Pole.
- South Equatorial Current originates due to South East trade winds and flows Westwards and bifurcates near New Guinea.
- Counter Equatorial Current extends upto Panama Bay. It flows exactly on equator from West to East.

### **Cold Currents**

- Peruvian Current (Humboldt current) flows from South towards equator on the coast of Chile and Peru.
- West Wind Drift flows from *Tasmania* to *Chile* coast of South America.

## **Currents of North Atlantic Ocean**

### **Warm Currents**

- North Equatorial Current is present between Equator and 10°N.
- Cayenne Current flows adjacent to French Guinea and enters into *Carribbean Sea* and *Gulf of Mexico*.
- Florida Current Cayenne current near Florida (US Coast) is called Florida current.
- Antilles Current flows to the East of West Indies and other islands.

- Gulf Stream flows from US coast towards North West Europe under the influence of Westerly winds.
- North Atlantic Drift *Gulf Stream bifurcates into*
  - (i) North Atlantic Drift (warm).
  - (ii) West Wind Drift (cold) and Canaries current (cold).

### **Cold Currents**

- Labrador Current originates in *Baffin bay* and *Davis Strait* and merges with *Gulf Stream* near *Newfoundland*.  
Newfoundland is a famous zone of fishing, commonly known as Grand Bank.
- Irminger Current or Greenland Current flows between Greenland and Iceland and merges with North Atlantic drift.
- Canaries Current flows along the Western coast of North Africa between Madeira Cape Verde and it joins North equatorial current.
- West Wind Drift It flows towards UK.

### **Currents of South Atlantic Ocean**

#### **Warm Currents**

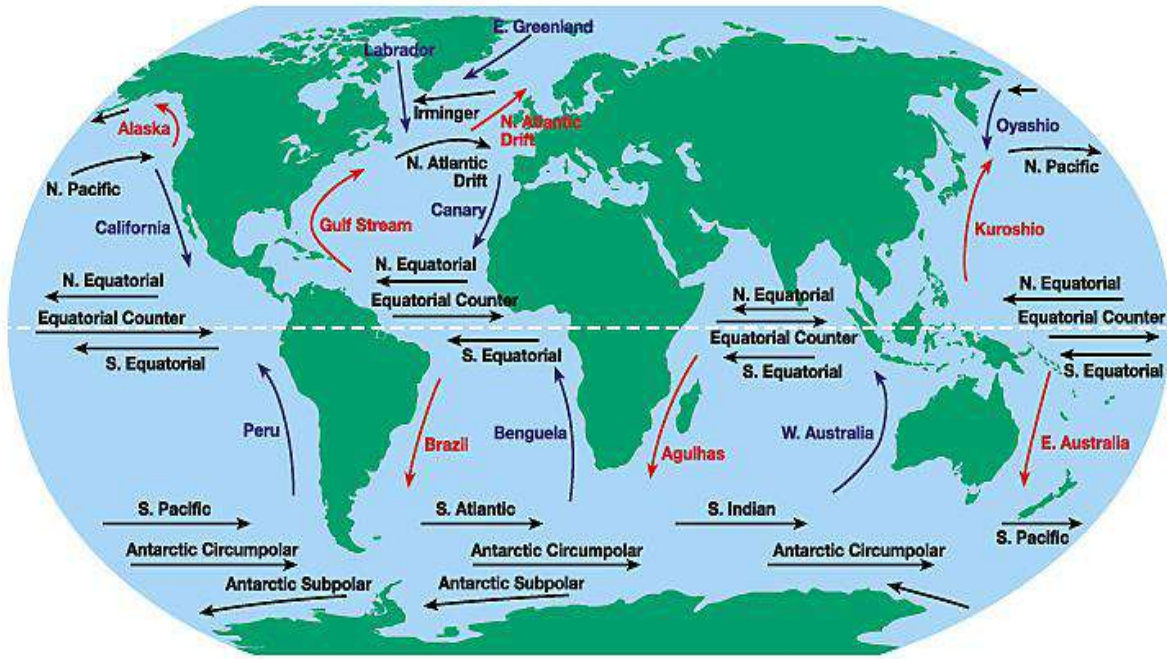
- South Equatorial Current flows between equator and 10°.
- Brazilian Current flows to the East coast of Brazil from equator towards pole.

#### **Cold Currents**

- Falkland Current flows along the South-East coast of South America from South to North.
- Benguela Current flows from South to North near the 'Cape of Good Hope'.
- West Wind Drift is continuence of Brazilian and Falkland current.
- Guinea Current flows near Coast of Guinea (Africa)

### **Current of the Indian Ocean**

- The Asiatic Monsoon influences the currents of the North Indian Ocean, while the currents of South Indian ocean are influenced by the atmosphere's anticyclonic circulation.
- North Equatorial Current flows from East to West and upon reaching the East coast & Africa, a good portion turns Southward, crosses the equator, and becomes the Mozambique current.
- Mozambique Current flows South along the East coast of Africa from the vicinity of the equator to about 35°, where it becomes known as Agulhas Stream.
- Agulhas Stream flows Westward along the Southern West of Madagascar and joins the Mozambique current along the East African coast.
- West Wind Drift Current flows across the Indian ocean to the waters South-West of Australia.
- North-East Monsoon Drift flows along the coast & India during winter.
- South-West Monsoon Drift flows along the coast of India during Summers.
- South Equatorial Current is a significant Pacific. Atlantic and Indian ocean current that flows East-West between the equator and about 20 degrees South.
- Somalia Current is an ocean boundary current that runs along the coast of Somalia and Aman in the Western Indian ocean and is analogous to the Gulf Stream in the Atlantic Ocean.



**PRACTICE EXERCISE-1**

- Twelve constellations referred to as zodiac, are
  - Signs of Roman gods
  - Imaginary region that encompass the path of the planets
  - A group of stars
  - None of these
- Which of the following planets is known as 'Morning Star'?
  - Mercury
  - Venus
  - Mars
  - Jupiter
  - Saturn
- How many years does Pluto take in revolving round the Sun?
  - 110 years
  - 246 years
  - 248 years
  - 250 years
- Comets are celestial bodies moving about the solar system in
  - Elliptical or hyperbolic orbits, usually accompanied by a shining tail
  - Elliptical orbits usually accompanied by a long shining tail
  - Hyperbolic orbit always accompanied by a shining head
  - Hyperbolic orbit without projecting any tail or head
- The temperature of the Sun's outer surface is
  - 60,00,000° C
  - 6,000° C
  - 60° C
  - 0o C
- Which planet of the solar system spins on its axis at the fastest rate?
  - Mercury
  - Earth
  - Jupiter
  - Saturn
- Which among the following four planets is the biggest in size?
  - Venus
  - Mercury
  - Earth
  - Mars
- The term 'meteor' is applied to an interplanetary body
  - After it enters the atmosphere of the earth
  - After it enters the earth's atmosphere and explodes in mid air as a ball of fire
  - After it enters the earth's atmosphere and lands on the surface of the earth without exploding in mid-air
  - Before it enters the earth's atmosphere
- Among the planets of the solar system, the one which has the longest period of rotation is
  - Venus
  - Mars
  - Saturn
  - Pluto
- Which one of the following statements regarding Shooting Stars is incorrect?
  - They are meteors
  - They are the debris which got separated from a comet
  - They emit light due to extremely high temperature caused by friction while they are passing through earth's atmosphere
  - They are a kind of a star
- Which planet is known as the 'Watery Planet'?
  - Mercury
  - Earth
  - Mars
  - Jupiter
- Solar system was discovered by
  - Kepler
  - Galileo
  - Copernicus
  - Eratosthenes
- Huge congregations of stars that are held together by the force of gravity are known as
  - Constellations
  - Solar systems
  - Galaxies
  - Comets
- The unit of measuring distances between the stars is known as
  - Galactic unit
  - Cosmic kilometer
  - Stellar mile
  - Light year
- Even though Pluto is usually the farthest planet, its path is highly elliptical, crossing inside the path of some other planets. As a result, for a period of twenty years from 1979 the farthest planet is not Pluto but
  - Uranus
  - Saturn
  - Neptune
  - Jupiter
- Which planet looks reddish in the night sky?
  - Mercury
  - Mars
  - Jupiter
  - Saturn
- The planets are kept in motion in their respective orbits by
  - Their great size and spherical shape
  - The rotation and density
  - Gravitation and centrifugal force
  - Rotation of the sun on its axis
- The study of heavenly bodies is known as
  - Astrology
  - Astronautics
  - Astronomy
  - Astrophysics

19. Super Nova is  
(a) An asteroid (b) A black hole  
(c) A comet (d) A dying star
20. The altitudes of heavenly bodies appear to be greater than they actually are. This is due to  
(a) Vertical motion of these heavenly bodies  
(b) Motions of the earth  
(c) Atmospheric refraction  
(d) These are visible because of light of the sun reflected from their surface
21. The Milky Way extends through a distance of  
(a) 1 light year (b) 8 light years  
(c) 10 light years (d) 1010 light years
22. The period of one revolution of sun around the centre of galaxy is called  
(a) Parsec (b) Astronomical year  
(c) Cosmic year (d) Light year
23. Which of the following is concerned with the description and mapping of the main features of the Universe?  
(a) Cosmology (b) Astronomy  
(c) Cosmography (d) Geomorphology
24. The same side of the moon always faces the Earth because  
(a) Moon and the Earth have gravitational force  
(b) Moon cannot change its position  
(c) The period of rotation of the Moon on its axis and period of revolution around the Earth is almost the same  
(d) The period of rotation of the Moon is not equal to the period of rotation of the Earth  
(e) None of these
25. Match the following:
- | List 1                                                                      | List 2                                              |
|-----------------------------------------------------------------------------|-----------------------------------------------------|
| A. Waxing and waning of moon                                                | 1. Umbra                                            |
| B. The coning dark shadow                                                   | 2. Penumbra Zone totally deprived of the sun's rays |
| C. The zone of faint shadow                                                 | 3. Celestial sphere                                 |
| D. A hollow sphere of infinite radius at the centre of which our earth lies | 4. Phases of the moon                               |
- (a) 4 1 3 2  
(b) 4 1 2 3  
(c) 3 1 4 2  
(d) 3 2 4 1
26. The light coming from stars gives the idea of their –  
(a) size (b) rotational speed  
(c) mass (d) density
27. The constellations of stars appear at different positions in the sky at different times during night mainly  
(a) because earth rotates about its axis  
(b) because Earth revolves round the sun  
(c) because of optical illusion  
(d) because celestial bodies are changing their positions all the time
28. The sunspots cause  
(a) aurora borealis and aurora Australia  
(b) magnetic storms on the surface of the sun  
(c) polar auroras  
(d) all of these
29. 'Parsec' is the unit of measurement of  
(a) density of stars  
(b) astronomical distance  
(c) brightness of heavenly bodies  
(d) orbital velocity of giant stars
30. The strongest evidence that comets are members of our solar system comes from  
(a) their composition  
(b) their effect on the lives of man  
(c) the shape of their orbits  
(d) the shape and length of their tails
31. Planetesimal hypothesis is concerned with  
(a) Distribution of planets in the Solar System on the basis of their sizes  
(b) Number of satellites belonging to different planets  
(c) The direction of revolution of planets  
(d) The period of rotation of different planets
32. The distance of the nearest star besides the sun from the earth is  
(a)  $4.9 \times 10^{11}m$  (b)  $9.5 \times 10^{15}m$   
(c) 2 light years (d) 4 light years
33. Lunar eclipse does not occur every month because  
(a) The sun's orbit is not always in the same plane as the moon  
(b) the moon revolves at a slower speed than the earth  
(c) the moon's orbit is not all the time in the same plane as the earth  
(d) None of these

34. Which of the following celestial bodies bear the name 'The Sea of Tranquility' and 'The Ocean of Storms'?
- (a) Mars (b) Venus  
(c) Moon (d) Sun
35. The time required by moonlight to reach the earth is
- (a) 1 sec. (b) 1.3 sec.  
(c) 2 sec. (d) 2.3sec
36. The brightest star in the sky is
- (a) Hyades (b) Praesepe  
(c) Sirius (d) Sun
37. Lunar Sea refers to
- (a) A small sea on the moon  
(b) A sea on earth which experiences high tides due to gravitational attraction of the moon  
(c) A dark plain on the moon  
(d) A large water body illuminated by the moonlight
38. The correct sequence of planets in the descending order of their equatorial diameter is
- (a) Mars, Pluto, Uranus, Earth  
(b) Earth, Mars, Pluto, Uranus  
(c) Pluto, Uranus, Mars, Earth  
(d) Uranus, Earth, Mars, Pluto
39. Lunar eclipse is caused when the
- (a) moon comes between the sun and the earth  
(b) earth comes between the sun and the moon  
(c) sun comes between the earth and the moon  
(d) None of these
40. What are Sun spots?
- (a) Regions on earth without winter climate  
(b) Desert areas on the Sun  
(c) Dark patches on the surface of the Sun which are cooler areas  
(d) Dark patches on the surface of the Sun resulting from a localised fall in the temperature to about 4000oK
41. Stars which appear single to the naked eye but are double stars when observed by a telescope, are known as
- (a) Cosmic stars  
(b) Quasars  
(c) Binaries  
(d) Novae and supernovae
42. The 'Solar Corona' mainly consists of
- (a) cosmic rays (b) molten lava  
(c) gases (d) ice
43. Which two planets of the solar system have no satellites?
- (a) Mercury and Venus  
(b) Venus and Mars  
(c) Mercury and Pluto  
(d) Venus and Neptune
44. Which of the following gases is most predominant in the Sun?
- (a) Helium (b) Hydrogen  
(c) Nitrogen (d) Ozone
45. The smallest planet is
- (a) Venus (b) Mercury  
(c) Pluto (d) Uranus  
(e) Neptune
46. If there is no Sun, the colour of the sky would be
- (a) Orange (b) Blue  
(c) Yellow (d) None
47. Match the following:
- |               |                  |
|---------------|------------------|
| A. Ursa Major | 1. Star          |
| B. Sirius     | 2. Constellation |
| C. Milky Way  | 3. Satellite     |
| D. Titan      | 4. Galaxy        |
|               | 5. Planet        |
- |     |   |   |   |   |
|-----|---|---|---|---|
|     | A | B | C | D |
| (a) | 1 | 2 | 3 | 4 |
| (c) | 1 | 2 | 4 | 3 |
| (c) | 2 | 1 | 4 | 3 |
| (d) | 2 | 4 | 1 | 3 |
48. Which one of the following planets is at the farthest distance from the earth?
- (a) Mars (b) Jupiter  
(c) Saturn (d) Neptune
49. The solar wind is composed of
- (a) outward stream of protons on the sun surface  
(b) ionized gas  
(c) plasma  
(d) all of these
50. The densest planet of the solar system is
- (a) Earth (b) Jupiter  
(c) Mercury (d) Uranus

**PRACTICE EXERCISE-2**

1. Solar eclipse occurs when
  - (a) Earth comes between sun and moon
  - (b) Moon is at right angle to the earth
  - (c) Moon comes between sun and earth
  - (d) Sun comes between moon and earth
2. Tides are caused by the gravitational pull of the
  - (a) Earth on the Moon
  - (b) Earth on the Sun
  - (c) Sun and the Moon on the Earth
  - (d) Moon on the Earth
  - (e) None of these
3. The largest planet of the solar system is
  - (a) Earth
  - (b) Mars
  - (c) Jupiter
  - (d) Saturn
4. Which one of the Following is not a satellite of Jupiter?
  - (a) Io
  - (b) Callisto
  - (c) Europa
  - (d) Titan
5. Moon is called a satellite of the earth because
  - (a) It is much smaller than the earth
  - (b) It has no light of its own
  - (c) It revolves round the earth
  - (d) It produces tides on the earth
6. Comets revolve around
  - (a) Sun
  - (b) Earth
  - (c) Venus
  - (d) No single heavenly body
7. The position of a planet when it is nearest to the Sun, is called
  - (a) Perihelion
  - (b) Aphelion
  - (c) Apogee
  - (d) Perigee
8. Which of the following is known as the 'Red Planet'?
  - (a) Mars
  - (b) Mercury
  - (c) Saturn
  - (d) Venus
9. Which of the planets is nearest to the earth?
  - (a) Jupiter
  - (b) Venus
  - (c) Mercury
  - (d) Mars
10. Which planet is known as the Earth's Twin?
  - (a) Venus
  - (b) Mars
  - (c) Uranus
  - (d) Neptune
11. The Saturn rings were discovered by
  - (a) Copernicus
  - (b) Newton
  - (c) Galileo
  - (d) None of these
12. Halley's comet appears once in a period of
  - (a) 24 years
  - (b) 32 years
  - (c) 76 years
  - (d) 84 years
13. Jupiter is larger than the earth by about
  - (a) 5 times
  - (b) 10 times
  - (c) 20 times
  - (d) 50 times
14. Lunar eclipse occurs on
  - (a) New moon
  - (b) Full moon
  - (c) Half moon
  - (d) Quarter moon
15. Which one of the following planets takes the same number of days for rotation and revolution?
  - (a) Mars
  - (b) Venus
  - (c) Mercury
  - (d) Jupiter
16. 'The length of its day and the tilt of its axis are almost identical to those of the earth' This is true of
  - (a) Uranus
  - (b) Neptune
  - (c) Saturn
  - (d) Mars
17. The hottest planet is
  - (a) Mercury
  - (b) Venus
  - (c) Jupiter
  - (d) Saturn
18. The distance between the Earth and the Sun (in million kms.) is
  - (a) 111
  - (b) 149
  - (c) 168
  - (d) 193
19. A terrestrial planet is a planet of
  - (a) A dense, rocky body
  - (b) low density balls of gas
  - (c) low density balls of gas, though they may have rocky core
  - (d) None of these
20. The planet having five moons is
  - (a) Venus
  - (b) Mars
  - (c) Uranus
  - (d) Neptune
21. Planets nearest to the Sun are
  - (a) Mercury and Mars
  - (b) Earth and Mercury
  - (c) Mercury and Venus
  - (d) Mercury and Uranus
22. The tail of the Comet is much larger than its head.  
The length of the tail is approximately
  - (a) 200 - 300 km
  - (b) 20,000- 30,000 km
  - (c) 2,00,00,000 - 3,00,00,000 km
  - (d) 2,00,000 - 3,00,000 km
23. Which of the following is the brightest planet?
  - (a) Mercury
  - (b) Venus
  - (c) Mars
  - (d) Jupiter
  - (e) Saturn

24. The orbits of planets around the Sun, or of satellites around the Earth can be  
(a) circular and elliptic  
(b) circular and hyperbolic  
(c) elliptic and parabolic  
(d) parabolic and hyperbolic
25. The fastest planet is  
(a) Saturn (b) Jupiter  
(c) Pluto (d) Mercury
26. The planet having no moon is  
(a) Mercury (b) Pluto  
(c) Venus (d) Neptune
27. Which of the following sequences of planets is in the ascending order of their distances from the Sun?  
(a) Mercury, Venus, Earth, Mars  
(b) Earth, Mercury, Jupiter, Pluto  
(c) Venus, Earth, Mars, Mercury  
(d) Mars, Venus, Earth, Mercury
28. The planet that has no satellite is  
(a) Mars (b) Uranus  
(c) Neptune (d) Pluto
29. The change in colour of stars arises due to  
(a) variation in their distance from the earth  
(b) variation in their surface temperature  
(c) fluctuations in their composition and size  
(d) irregular absorption or scattering in earth's atmosphere
30. The North Star is a part of the constellation  
(a) Orion (b) Big dipper  
(c) Cassiopeia (d) Little dipper
31. To a space traveller on moon, the lunar sky during day time appears  
(a) white (b) blue  
(c) black (d) red
32. The outermost layer of Sun is called  
(a) Lithosphere (b) Photosphere  
(c) Chromosphere (d) Corona
33. Pole Star is always seen at one point in the sky whereas other stars are not; this is because  
(a) Pole Star rotates with the same period as the earth  
(b) Pole Star is a star of our own galaxy  
(c) Sun and Pole Star are in two opposite directions relative to earth  
(d) Pole Star lies in the axis of spin of the earth
34. The planet having the largest number of satellites in the solar system is  
(a) Mars (b) Jupiter  
(c) Saturn (d) Uranus
35. The 'Sea of Tranquility' is on  
(a) Jupiter (b) Uranus  
(c) Earth (d) Moon
36. Which constellations appear to pass through the zodiac?  
(a) Leo and Orion  
(b) Scorpio and Cancer  
(c) Orion and Scorpio  
(d) Cancer and Great bear
37. An observer at a point on the earth where only the penumbra region of moon's shadow will move past, will observe a  
(a) Total solar eclipse  
(b) Partial solar eclipse  
(c) Total lunar eclipse  
(d) Partial lunar eclipse
38. The radiant energy of the sun is transmitted in the form of  
(a) Short waves (b) Long waves  
(c) Particles (d) None of these
39. The planet that lies at the outermost orbit of the Solar system is  
(a) Saturn (b) Pluto  
(c) Mercury (d) Neptune
40. Which of the following is the largest of the inner planets?  
(a) Venus (b) Mercury  
(c) Mars (d) Earth
41. Match the following:
- | Planet     | Gases in atmosphere                   |
|------------|---------------------------------------|
| A. Venus   | 1. Methane & ammonia                  |
| B. Mars    | 2. Hydrogen, helium, ammonia, methane |
| C. Saturn  | 3. Nitrogen, oxygen                   |
| D. Jupiter | 4. Carbon dioxide                     |
- (a) 4 3 1 2  
(b) 2 3 4 1  
(c) 4 2 3 1  
(d) 2 1 4 3
42. Tides are the highest  
(a) when the earth is nearest to the sun  
(b) when the earth is nearest to the moon  
(c) in the spring  
(d) when the Sun, Moon and Earth are in line
43. Which one among the following four planets is the biggest in size ?  
(a) Mercury (b) Venus  
(c) Earth (d) Mars
44. Asteroids have their orbits between the planets  
(a) Mercury & Venus (b) Earth & Mars  
(c) Mars & Jupiter (d) Jupiter & Saturn

45. Year is longest on  
(a) Mercury (b) Earth  
(c) Jupiter (d) Pluto
46. Ursa Minor is  
(a) The name of an island  
(b) A group of stars that form the Little Dipper in the most northern constellation  
(c) The name of a satellite  
(d) The name of disease in U.S.A.
47. The bright heavenly body with a long luminous tail, is called  
(a) a planet (b) a constellation  
(c) a comet (d) a satellite
48. The four largest planets of the solar system in the descending order are  
(a) Saturn, Jupiter, Uranus, Neptune  
(b) Jupiter, Saturn, Uranus, Neptune  
(c) Uranus, Neptune, Saturn, Jupiter  
(d) Jupiter, Uranus, Saturn, Neptune
49. The Solar eclipse achieves totality only in limited geographical regions because  
(a) the trajectories of the Earth around the Sun and the Moon around the Earth are not perfect circles  
(b) the size of the shadow of the Moon on the Earth is small compared to the cross-section of the Earth  
(c) sun rays can reach most of the peripheral regions of the shadow of the moon due to atmospheric refraction  
(d) the Earth is not a smooth flat surface, but has elevations and depressions
50. On which of the following planets of the solar system does the sun rise in the west and set in the east  
(a) Venus (b) Mars  
(c) Jupiter (d) Saturn

### PRACTICE EXERCISE-3

1. The seasonal contrasts are maximum in  
(a) Low latitudes (b) Mid latitudes  
(c) Sub tropics (d) High latitudes
2. What percentage of insolation is received by the earth's surface?  
(a) 47% (b) 51%  
(c) 66% (d) 87%
3. What is the maximum length of a day on the poles?  
(a) 12 hours (b) 24 hours  
(c) 3 months (d) 6 months
4. Which of the following are true regarding equinoxes?  
(i) They occur on March 21st and Sept 23rd  
(ii) They depict equal days and equal nights on March 21st and Sept 23rd on all places of the, earth.  
(iii) All places on the earth have equal temperature during equinoxes  
(a) (i) and (iii) only (b) (ii) and (iii) only  
(c) (i) and (ii) only (d) (i),(ii) and (iii)
5. Seasons on earth are caused by  
(a) Rotation on earth around its own axis  
(b) Revolution of earth round the Sun and its axis tilted  
(c) Shape of the earth  
(d) None of these
6. The earth rotates around its axis from  
(a) north to south (b) east to west  
(c) south to north (d) west to east
7. The inclination of the earth's axis to the orbital plane is  
(a)  $21\frac{1}{2}^{\circ}$  (b)  $23\frac{1}{2}^{\circ}$   
(c)  $66\frac{1}{2}^{\circ}$  (d)  $90^{\circ}$
8. The mean radius of the earth is approximately  
(a) 3200 Km (b) 6400Km  
(c) 9600Km (d) 12800Km
9. Vernal equinox falls on  
(a) 21st March (b) 21st June  
(c) 23rd September (d) 22nd December
10. The fixed path along which the earth revolves round the sun is called  
(a) the celestial sphere (b) the elliptic path  
(c) the ecliptic plane (d) the earth's orbit
11. The word used to describe the shape of earth is  
(a) Flat (b) Circle  
(c) Sphere (d) Oblate Spheroid
12. Which of the following is the cause for the earth's seasons?  
(a) Variation in the amount of energy given off by the sun  
(b) Its elliptical orbit and varying speed of rotation  
(c) Inclination of its axis of rotation to the plane of orbit  
(d) Its greater distance from the sun during winter than during Summer
13. Equinox occurs when the Sun is vertically above  
(a) Tropic of Capricorn (b) Tropic of Cancer  
(c) Poles (d) Equator

14. What is the correct sequence of the following layers of the Earth as one moves from the surface to the interior  
1. Mantle 2. Crust 3. Core  
Select the correct answer by using the codes given below:  
(a) 1,2,3 (b) 1,3,2  
(c) 2,1 3 (d) 3, 1,2
15. Summer Solstice in the Southern Hemisphere occurs on  
(a) December 22 (b) September 23  
(c) June 21 (d) March 21
16. Consider a specific point on the surface of the earth (say, Delhi). The temperature at a given time of day (say, 12.00 Noon) will in general be higher in summer than in winter. This is because  
(a) the evaporation of water from atmosphere results in precipitation occurring in winter alone  
(b) Sun -rays falling on the earth are inclined more towards the sun in winter  
(c) the earth is closer to the sun in summer than in winter  
(d) the axis of the earth is inclined more towards the sun in winter
17. One degree of the circumference of the earth measures (approx.)  
(a) 100Km (b) 111Km  
(c) 151Km (d) 175Km
18. Heat received by earth from the Sun is known as  
(a) Insolation (b) Solar heat  
(c) Solar radiation (d) Thermal radiation
19. At the core of the earth, the temperature is estimated to be around  
(a) 1000°C (b) 1200°C  
(c) 2000°C (d) 2600°C
20. Match the following:
- | Date              | Conditions in Northern Hemisphere |
|-------------------|-----------------------------------|
| A. March 21st     | 1. Winter Solstice                |
| B. June 21st      | 2. Autumnal Equinox               |
| C. September 21st | 3. Summer Equinox                 |
| D. December 22nd  | 4. Vernal Equinox                 |
- A B C D  
(a) 1 2 3 4  
(b) 1 3 4 2  
(c) 2 3 1 4  
(d) 4 3 2 1
21. The position of the earth in its orbit, when it is at its greatest distance from the Sun causing summer in the Northern Hemisphere is:  
(a) Perihelion (b) Aphelion  
(c) Perigee (d) Apogee
22. The time required for moonlight to reach earth  
(a) 3.6 secs. (b) 2 secs.  
(c) 1.3 secs (d) 1 sec.
23. Which of the following is the best definition of 'Tides'?  
(a) A powerful movement of the ocean which proceed constantly in a definite direction  
(b) A great circulatory movement of sea water caused by difference in density of sea water.  
(c) A periodic rise and fall of sea water caused by the gravitational force of moon and sun on earth.  
(d) A wind and pressure system having a low pressure in centre and circular wind motion  
(e) None of these.
24. Days and nights are equal throughout the globe when Sun is above  
(a) Poles (b) Tropic of Cancer  
(c) Equator (d) Tropic of Capricorn
25. The mean distance between the distances on perihelion and aphelion (in million km.) is  
(a) 111km (b) 149.5km  
(c) 159 km (d) 168.5km
26. The earth rotates on its axis and the exact time needed for one complete rotation is  
(a) 23 hours, 56 minutes, 4.09 seconds  
(b) 23 hours, 58 minutes, 29.5 seconds  
(c) 23 hours, 59 minutes, 7.5 seconds  
(d) 23 hours, 59 minutes, 18 seconds
27. The term that best describes the shape of the earth is  
(a) Ellipse (b) Geoid  
(c) Globe (d) Sphere
28. The speed of rotation of the earth is the highest  
(a) Along the Equator  
(b) At the North Pole  
(c) Along the Tropic of Cancer  
(d) Along the Arctic Circle
29. The exact time taken by the earth for single rotation on its own axis is  
(a) 24 hrs  
(b) 24 hrs 35 secs.  
(c) 23 hrs 50 minutes 7.2 sees  
(d) 23 hrs 56 minutes 4.09 secs

30. The size of the earth was first measured by  
(a) Isaac Newton (b) Galileo  
(c) Copernicus (d) Eratosthenes
31. Only one side of the moon is ever seen from the earth because  
(a) the moon is at pefigee  
(b) the moon does not rotate  
(c) only one side reflects light  
(d) the periods of rotation and revolution of the moon are equal
32. Days and nights are caused by  
1. rotation of the earth on its axis  
2. revolution of the earth around the sun  
3. inclination of the earth's axis  
(a) Only 1 is correct  
(b) 1 and 2 are correct  
(c) 2 and 3 are correct  
(d) All are correct
33. Variation in duration of day and night is due to  
1. rotation of earth on its axis  
2. revolution of earth round the sun  
3. inclination of earth at an angle of  $66 \frac{1}{2}^\circ$   
(a) 1 and 2 (b) 2 and 3  
(c) 1 and 3 (d) 1, 2 and 3  
(e) 1 only
34. The moon is called a satellite of the earth because  
(a) it is much smaller than the earth  
(b) it revolves round the earth  
(c) it draws light from the sun via the earth  
(d) it remains in position due to the gravitational pull of the earth.
35. The crust forms what percentage of the volume of the earth?  
(a) 0.5% (b) 2.5%  
(c) 7.5% (d) 12.5%
36. At a latitude of  $45^\circ$ , the earth spins on its axis at the rate of  
(a) 420 km/hr. (b) 745 km/hr.  
(c) 1120 km/hr. (d) 1542 km/hr.
37. Spring tides occur when  
(a) the moon is nearest to the earth  
(b) the moon is farthest from the earth  
(c) the moon, the sun and the earth are at right angles with the earth at the apex  
(d) the moon, the sun and the earth are in the same line.
38. It is six months long day in the northern polar region and six months long night in the southern polar region because  
(a) earth is revolving around the sun  
(b) earth is inclined towards its orbital plane  
(c) earth is rotating  
(d) None of these
39. 'Green House Effect' means  
(a) pollution in houses in tropical regions  
(b) trapping of solar energy due to atmospheric oxygen  
(c) trapping of solar energy due to atmospheric carbon dioxide  
(d) Cultivation in green houses so as to check pollution.
40. The earth's annual circuit round the sun covers a distance of  
(a) 1.096 million Km (b) 1,036 million Km  
(c) 966 million Km (d) 896 million Km
41. The earth travels around the sun in an oval path and one complete revolution needs  
(a) 365 days, 23 hours, 59 minutes, 58.97 secs.  
(b) 365 days, 17 hours, 8 minutes, 9.54 secs.  
(c) 365 days. 8 hours. 6 minutes, 7.54 secs.  
(d) 365 days, 5 hours, 48 minutes, 45.51 secs.
42. Insolation heats up the land masses more quickly than the water bodies because  
(a) Water is liquid  
(b) Landmasses are solid  
(c) Water needs more energy to warm  
(d) Rocks are bad conductors of heat
43. The heavier silicates named 'Sima' or silica + magnesium are most abundant in the  
(a) Crust (b) Core  
(c) Mantle (d) Ocean floors
44. Which of the following statements regarding the earth's axis are true?  
1. It makes an angle of  $66 \frac{1}{2}^\circ$  with the plane of ecliptic  
2. It maintains a flexible orientation with respect to the stars  
3. It is the most important fact connected with Earth — Sun relationship  
(a) 1 and 2 (b) 2 and 3  
(c) 1 and 3 (d) 1, 2 and 3
45. Which of the following are true regarding equinoxes?  
1. They occur on March 21st and September 23rd.  
2. They depict equal days and equals nights on March 21st and September 23rd on all places of the earth.

3. All places on the earth have equal temperature during equinoxes.  
(a) 1 and 2 only      (b) 2 and 3 only  
(c) 1 and 3 only      (d) 1, 2 and 3
46. The position of the sun is annually twice overhead at Singapore because of the  
(a) rotation of the earth  
(b) revolution of the earth  
(c) elliptical path of the earth's orbit  
(d) parallelism of inclined axis of the earth
47. What is the approximate equatorial circumference of the earth?  
(a) 30,000 Km      (b) 35,000 Km  
(c) 40,000 Km      (d) 45,000 Km
48. Spring tides occur on new moon and full moon days because on these days  
(a) Sun, moon and earth are in the straight line  
(b) Sun and earth are at right angles  
(c) Sun and Moon are at right angles  
(d) Earth and Moon are at right angles
49. The earth revolves around the sun at the speed (per minute) of  
(a) 1000Km      (b) 1200 Km  
(c) 1400 Km      (d) more than 1600 Km
50. Seasonal variation is the least  
(a) In the Arctic circle  
(b) At 45° N latitude  
(c) In the Tropic of cancer  
(d) At the Equator

### PRACTICE EXERCISE-4

1. The surface of Earth that lies between the Tropic of Cancer and the Tropic of Capricorn is called  
(a) North Temperate Zone  
(b) Frigid Zone  
(c) South Temperate Zone  
(d) Torrid Zone
2. The approximate diameter of the earth is  
(a) 4,200 Km      (b) 6,400 Km  
(c) 12,800 Km      (d) 15,600 Km
3. The place which has the longest day and the shortest night on 22nd December, is  
(a) Madras      (b) Madrid  
(c) Melbourne      (d) Moscow
4. The circumference of the earth was first calculated by  
(a) Galileo      (b) Aryabhata  
(c) Eratosthenes      (d) Wegener
5. The Polar diameter of the earth is shorter than equatorial diameter by about:  
(a) 43 km      (b) 60km  
(c) 72 km      (d) 104 km
6. Which of the following pairs of metals are supposed to constitute the internal core of the earth?  
(a) Chromium & Iron      (b) Magnesium & Lead  
(c) Iron & Copper      (d) Nickel & Iron
7. The Earth's annual circuit round the sun covers a distance of  
(a) 1098 million Km      (b) 1038 million Km  
(c) 966 million Km      (d) 896 million Km
8. Spherical shape of the earth was suggested by  
1. Pythagoras  
2. Copernicus  
3. Aristotle  
4. Aryabhata in the chronological order:  
(a) 2,3,4,1      (b) 1,3,4,2  
(c) 4,3,1,2      (d) 3,1,4,2
9. The specific gravity of the earth as a whole is  
(a) 4.50      (b) 4.65  
(c) 5.52      (d) 6.67
10. There is a continual daylight or summer in the Arctic regions from  
(a) 21st December to 21st March  
(b) 21st March to 21st June  
(c) 21st March to 21st September  
(d) 21st June to 21st December

11. Vernal Equinox occurs on  
(a) December 21      (b) September 23  
(c) June 21          (d) March 21
12. The earth revolves round the sun in its orbit by approximately  
(a) 1o per day          (b) 2o per day  
(c) 3o per day          (d) 5o per day
13. The study of time in relation to the earth's history is called  
(a) Palaeontology      (b) Geochronology  
(c) Geohistology      (d) Geography
14. Which is the main proof for curvature of earth?  
(a) Disappearance of a ship slowly from the bottom to top and its appearance from top to bottom when it goes away from and comes to an observer.  
(b) Evidences of circum -navigation of earth  
(c) Evidences of day and night  
(d) Transcontinental air flights
15. The distance between the earth and the sun is smallest in the month of  
(a) January              (b) March  
(c) June                  (d) September
16. What is Sidereal Day?  
(a) The day on which the duration of sunshine is the maximum  
(b) The day on which the duration of sunshine and darkness are equal.  
(c) The time during which the earth makes a complete revolution on its axis in respect of the fixed stars.  
(d) The day on which the sun reaches its maximum distance from the equator.
17. Which of the following is related to the origin of the earth?  
(a) Thermal -convection Hypothesis  
(b) Tetrahedral Hypothesis  
(c) Planetesimal Hypothesis  
(d) Drift Hypothesis
18. Geostationary orbit is at a height of:  
(a) 6 Km                  (b) 1000 Km  
(c) 3600 Km              (d) 36000 Km
19. Owing to the equatorial bulge and the polar flattening, the polar radius of the earth falls short of the equatorial radius by about  
(a) 22Km                  (b) 36Km  
(c) 41Km                  (d) 53 Km
20. Antipodes are  
(a) Lines joining places having a time difference of 12 hours  
(b) Places diametrically opposite on earth's surface  
(c) Places located at a point where degree of latitude is equal to degree of longitude  
(d) Lines joining places having the same depths.
21. The largest amount of reflection of the solar radiant energy which is reflected back into space before reaching the earth's surface is due to  
(a) Clouds  
(b) Water -bodies  
(c) Snow and ice covered areas of the earth  
(d) At the above reflect nearly the same amount
22. What percentage of insolation is received by the earth's surface?  
(a) 43%                      (b) 47%  
(c) 51%                      (d) 90%  
(e) 100%
23. The revelations of a satellite photograph of the earth are as follows:  
1. The Southern hemisphere bulges slightly more than the Northern hemisphere.  
2. It is slightly pear shaped ellipsoid of rotation.  
3. The polar axis of the earth is slightly shorter than the equatorial axis.  
4. The equatorial circumference is about 40,000 Km.  
Which of the above statements are correct?  
(a) 1, 2 and 3              (b) 1, 2, 3 and 4  
(c) 1, 2 and 4              (d) 2, 3 and 4
24. Which of the following is correct?  
(a) At summer solstice the sun shines vertically over the Tropic of Capricorn.  
(b) The sun shines vertically over the Equator once in a year.  
(c) At the North Pole there is darkness for half the year  
(d) None of these
25. The Earth rotates around an axis pointing towards  
(a) the moon                      (b) the pole star  
(c) the sun                          (d) Venus

26. Which of the following statements are true regarding the Earth?
1. It is a Satellite of the Sun.
  2. Its motion around the Sun is called rotation.
  3. Gravitational force of Sun and Earth is responsible for keeping it in orbit.
  4. It receives light from the Sun.
- (a) 1 and 2 only      (b) 1, 2 and 3 only  
(c) 2 and 4 only      (d) 3 and 4 only
27. Maximum altitude of pole star at a place 28°N and 78°E is
- (a) 28°      (b) 62°  
(c) 12°      (d) 78°
28. The earth is at the least distance from the sun (Perihelion) on
- (a) December 22nd      (b) January 3rd  
(c) February 28th      (d) June 21st
29. The earth is at the largest distance from the sun (Aphelion) on
- (a) June 21st      (b) March 21st  
(c) July 4th      (d) September 23rd
30. The incoming short -wave solar radiation is balanced by an equal amount of long -wave radiation from Earth going back to space . This is known as
- (a) Earth radiation  
(b) Wave balance of Earth  
(c) Heat balance of Earth  
(d) Radiation exchange
31. The approximate surface temperature on the sunlight side of the earth is
- (a) 31°C      (b) 23°C  
(c) 17°C      (d) 0°C
32. Which part of the earth's surface receives the highest amount of insolation?
- (a) Tropical deserts      (b) Equatorial region  
(c) Land masses      (d) Water bodies
33. The Sun shines vertically on the Equator
- (a) Throughout the year  
(b) For six months  
(c) Twice a year  
(d) Once a year
34. Choose the incorrect statement;
- (a) All meridians are of the same length  
(b) The axis of the earth is inclined at an angle of 66 1/2° to the horizontal  
(c) The Sun's rays are vertical at all places on the days of the equinoxes  
(d) The summer solstice for the Southern Hemisphere is in December

35. Match the following:

A. March 21st	1. Winter Solstice
B. June 21st	2. Autumnal Equinox
C. September 23 <sup>rd</sup>	3. Summer Equinox
D. December 22 <sup>nd</sup>	4. Vernal Equinox

- |     | A | B | C | D |
|-----|---|---|---|---|
| (a) | 4 | 3 | 2 | 1 |
| (b) | 2 | 3 | 4 | 1 |
| (c) | 1 | 3 | 2 | 4 |
| (d) | 4 | 1 | 2 | 3 |
36. Albedo is defined as
- (a) UV radiations sent out by the Sun  
(b) a substance contained in the upper atmospheric layers of the earth, which is responsible for the reflection of a part of solar radiations  
(c) celestial bodies in earth's atmosphere which add to the green house effect.  
(d) the amount of insolation reflected back W the space by the top of atmosphere, by clouds and ice -covered areas of the Earth's surface
37. The amount of insolation received at a place on the surface of the earth depends on
- (a) its climate      (b) its latitude  
(c) its longitude      (d) its meridian
38. Which one of the following aptly describes the generalised shape of the continents?
- (a) Circular      (b) Hexagonal  
(c) Rectangular      (d) Triangular
39. On the 21st June, the day light is seen at the North Pole for
- (a) Zero hrs.      (b) 12 hrs.  
(c) 18 hrs.      (d) 24 hrs.
40. The equatorial circumference is greater than the polar circumference by approximately
- (a) 22 Km      (b) 75 Km  
(c) 125 Km      (d) 625 Km
41. Of the total volume of the earth, which layer forms the major part?
- (a) Sial      (b) Sima  
(c) Mantle      (d) Core
42. The distance of the equator from either of the poles is
- (a) 500 Km      (b) 5001 Km  
(c) 10,002 Km      (d) 36,005 Km

43. The point in the orbit of a moon that is farthest from the Earth and at which the moon's velocity is at a minimum, is known as  
(a) Aphelion (b) Apogee  
(c) Umbra (d) Perihelion
44. The speed of rotation of the earth is  
(a) 25km/sec. (b) 31km/sec.  
(c) 39.5km/sec. (d) 9.72km/sec.
45. Which of the following phenomenon gives an evidence for the spherical shape of the earth?  
(a) Solar eclipse (b) Lunar eclipse  
(c) Revolution (d) Rotation of Earth
46. The orbit along which the earth revolves is  
(a) Circular (b) Elliptical  
(c) Irregular (d) Shape is unknown
47. The equatorial diameter of the earth is approximately  
(a) 6,357 km (b) 12,756 km  
(c) 18,546 km (d) 12,713km
48. Japan is called 'land of the rising sun' because  
(a) Sun rises there as soon as it sets  
(b) Sun always remains in the eastern part of the sky throughout the day in Japan  
(c) Japan being the Eastern most country in the World, it has the earliest sunrise  
(d) The rays of the sun get reflected from the waters of the sea and make the sunrise beautiful in Japan.
49. Which of the following is not an effect produced by rotation of earth?  
(a) It causes days and nights.  
(b) All heavenly bodies like sun, moon, planets appear to move from East to West.  
(c) Winds change their directions  
(d) Poles have days and nights of 6 months duration.
50. A semifluid shell which includes both the crust and the uppermost part of the mantle is known as  
(a) Lithosphere (b) Mesosphere  
(c) Asthenosphere (d) Semisphere

### PRACTICE EXERCISE-5

1. Which of the following statements is correct?  
(i) All meridians of longitude are of the same length  
(ii) All parallels of latitude are of the same length  
(iii) The Prime Meridian is the longest meridian  
(iv) The Equator is the longest parallel of latitude  
(a) (i) and (ii) (b) (ii) and (iii)  
(c) (iii) and (iv) (d) (i) and (iv)
2. If a place is located at 20°N, 80°E, in which of the following continents does it lie?  
(a) Africa (b) Asia  
(c) Europe (d) North America
3. Days and nights are equal throughout the globe when Sun is above  
(a) Poles (b) Tropic of Cancer  
(c) Equator (d) Tropic of Capricorn
4. Latitude of South Pole is  
(a) 0° (b) 45°  
(c) 90° (d) 180°
5. Which one of the following latitudes forms a great Circle?  
(a) 0° (b) 23 1/2°  
(c) 66 1/2° (d) 90°
6. The latitude of a place expresses its angular position relative to the plane of  
(a) Axis of the Earth (b) Equator  
(c) North Pole (d) South Pole
7. On globe, the latitudes and longitudes intersect each other at  
(a) 30° (b) 45°  
(c) 60° (d) 90°
8. The longest circle which can be drawn on the earth's surface passes through  
(a) Equator (b) Tropic of Cancer  
(c) Arctic Circle (d) Tropic of Capricorn

9. Which of the following is the farthest from the centre of the earth?  
(a) South Pole  
(b) Antarctic Circle  
(c) Tropic of Capricorn  
(d) Equator
10. When it is noon along  $82^{\circ} 30'$  E longitude, along what degree of longitude it will be 6.30 a.m.?  
(a) Along  $165^{\circ}$ E  
(b) Along  $67^{\circ} 30'$  W  
(c)  $0^{\circ}$ E or W  
(d) Along  $82^{\circ} 30'$  W
11. If the difference in time between two places were 2 hours and 20 minutes, then the difference in their longitudes would be  
(a)  $30^{\circ}$  (b)  $35^{\circ}$   
(c)  $40^{\circ}$  (d)  $45^{\circ}$
12. When a ship crosses Date line from west to east  
(a) It loses one day (b) It gains one day  
(c) It loses half a day (d) It gains half a day
13. The International Date Line passes through  
(a) Bering Strait (b) Gibraltar Strait  
(c) Florida Strait (d) Malacca Strait
14. Sense of time is due to  
(a) rotation of the earth  
(b) revolution of the earth  
(c) rotation of moon  
(d) Both (a) & (b) above
15. Which of the following is a Great Circle?  
(a) The Tropic of Cancer  
(b) The Equator  
(c) The Tropic of Capricorn  
(d) The Arctic Circle
16. Which of the following countries are located on the Greenwich Meridian?  
1. Algeria 2. Germany  
3. Guinea 4. Iceland  
(a) 1 and 2 (b) 2 and 3  
(c) 1, 2 and 3 (d) 1, 3 and 4
17. Greenwich Mean Time (GMT) is the standard time of which of the following countries?  
(a) India (b) Japan  
(c) U.K. (d) France
18. At which particular place on earth are days and nights of equal length always?  
(a) Prime meridian (b) Poles  
(c) Equator (d) No where
19. The International Date Line makes slight deviation from  $180^{\circ}$  meridian so that it  
(a) divides the land masses under the same administration  
(b) does not divide the Bering strait  
(c) does not divide a group of islands under the same administration  
(d) divides the Pacific Ocean into two equal halves
20. Which of the following would be the longitudinal distance when there is a difference of one hour in standard time of two places?  
(a) 60 (b) 30  
(c) 15 (d) 90
21. A radio broadcast from Delhi on Monday at 7.30 p.m. is heard at New York on  
(a) Tuesday at 8.35 p.m.  
(b) the same day at 7.30 p.m.  
(c) the same day at 7.30 a.m.  
(d) Sunday at 8.35 p.m.
22. The Earth turns through  $360^{\circ}$  in 24 hours. Each  $15^{\circ}$  longitude represents  
(a) Half an hour  
(b) Forty five minutes  
(c) One hour  
(d) One hour fifteen minutes
23. Which of the following statements regarding the International Date line are correct?  
(1) It is a longitude of  $180^{\circ}$   
(2) It is determined by  $180^{\circ}$  longitude but is not a straight line  
(3) It is a Greenwich meridian helping in fixing time and date  
(4) It solves the problem of time and date among the World's nations  
(a) 1 and 4 (b) 3 and 4  
(c) 2 and 3 (d) 2 and 4
24. Which of the following pairs is not correctly matched?  
(a)  $66^{\circ}30'$  S latitude - Arctic Circle  
(b)  $180^{\circ}$  E or  $180^{\circ}$  W longitude - International Date line  
(c)  $23^{\circ} 30'$  N latitude - Tropic of Cancer  
(d)  $0^{\circ}$  E or  $0^{\circ}$  W longitude - Equator
25. One degree of longitude on the equator is equal to a distance of  
(a) 34.5 miles (b) 50 miles  
(c) 60 miles (d) 69 miles

26. On Monday the 14th June a man crosses the International Date Line at 5 p.m. from the Asian side to the American side. Which of the following will he now assume to be the correct date and time?  
(a) 5 a.m. of Tuesday, the 15th June  
(b) 5 p.m. of Tuesday, the 15th June  
(c) 5 a.m. of Monday, the 14th June  
(d) 5 p.m. of Sunday, the 13th June
27. Which of the following statements is correct?  
(a) All longitudes and latitudes are great circles.  
(b) All longitudes are not great circles.  
(c) All longitudes and equator are great circle.  
(d) All latitudes and Greenwich meridian are great circles.
28. The International Date Line is located in the  
(a) Pacific Ocean (b) Atlantic Ocean  
(c) Indian Ocean (d) Arctic Ocean
29. The latitude of a place is the same as the  
(a) maximum altitude attained by the Sun a noon  
(b) altitude of the celestial pole  
(c) angle between the horizon and the equator  
(d) zenith distance of the full moon when on the meridian
30. U.S.A. is divided into time zones  
(a) 1 (b) 5  
(c) 7 (d) 11
31. Latitude and Longitude both  
(a) pass through poles  
(b) run parallel to the equator  
(c) run parallel to each other  
(d) run perpendicular to each other
32. If a traveller going from Vancouver to Tokyo crosses the International Date Line on Saturday, what will be the day for him at Tokyo?  
(a) Friday (b) Saturday  
(c) Sunday (d) Monday
33. Latitude of a point on the earth is measured by the distance in  
(a) kilo metres from the Poles  
(b) kilo metres from the Equator  
(c) Angles from the Poles  
(d) Angles from the Equator
34. A one-day Cricket match between India and England starts at 10.00 A.M. in London. The direct telecast of the match will begin in India at  
(a) 3.30 A.M. (b) 8.30 A.M.  
(c) 3:30 P.M. (d) 8.30P.M.
35. Which of the following places have their standard times same as GMT?  
1. Madrid 2. Lisbon  
3. Dublin 4. Accra  
(a) 1, 2 and 3 (b) 1,2 and 4  
(c) 1, 3 and 4 (d) 2, 3 and 4
36. What is the difference in time between two places 1o longitude apart?  
(a) 4 minutes (b) 8 minutes  
(c) 10minutes (d) 15minutes
37. The International Date Line passes through the  
(a) Bass strait (b) Bering strait  
(c) Cook strait (d) Horn strait
38. An aeroplane takes off from 30oN latitude, 50oE longitude and lands at the opposite end of the earth. Where does it land?  
(a) 30oN Lat., 50oW Long.  
(b) 30oS Lat., 50oW Long.  
(c) 50oN Lat., 30oW Long.  
(d) 30oS Lat, 130oW Long.
39. A cricket match is being telecasted live from Delhi. If the match commences at 10a.m., at what time would viewers in London have to tune in their sets ?  
(a) 10a.m. (b)4.30a.m.  
(c) 3.30p.m. (d) 10p.m.
40. When it is 12 noon at Greenwich, what is the time at New York (74oW)?  
(a) 4.56 P.M. (b) 4.56 AM.  
(c) 7.04 P.M. (d) 7.04 A.M.
- Hint:** 1° longitude (4 min). 74° longitude will have a difference of 4h 56min. Since New York is to the west of Greenwich, subtract 4 hrs 56 minutes from 12 hrs.
41. What is the longitude of a town if its local time is 6 P.M when Greenwich time is 4 P.M.?  
(a) 20°E (b) 30°E  
(c) 20°W (d) 30°W
- Hint:** A difference of 4 minutes is given by 1o longitude.  
So, a difference of 2 hours (120 minutes) is given by 30° longitude Since the time of the town is ahead of GMT. so it lies to the east of Greenwich.

42. A navigation officer on a ship observes that GMT is 16.20 hrs, when the local time is 12 noon. The longitude of the position of the ship is  
 (a) 65°E (b) 75°E  
 (c) 65°W (d) 75°W
43. Latitudes include 180 lines while longitudes are 360 lines because  
 (a) Longitude is divided from prime meridian while latitude is from equator  
 (b) Longitude is divided from equator while latitude is from prime meridian  
 (c) Longitude is a line that connects North Pole to South Pole and latitude is divided from east to west  
 (d) None of these
44. The International Date Line is an imaginary line extending from pole to pole along the places on the Earth's surface and lies along the  
 (a) 0o meridian (b) 45o meridian  
 (c) 90o meridian (d) 180o meridian
45. The equator is  
 (a) 90o latitude (b) 0o longitude  
 (c) 180o longitude (d) 0o latitude
46. At which of the following places watches will show 5.30 A.M. when it is 12.00 midnight G.M.T.?  
 (a) Canberra (b) New Delhi  
 (c) New York (d) Singapore

47. Match the following:

Countries	World time (hours fast (+) or slow (-) on GMT)
A. Afghanistan	1. - 5
B. Bangladesh	2. + 5 1/2
C. Bhutan	3. + 6
D. Columbia	4. + 4 1/2

- |     | A | B | C | D |
|-----|---|---|---|---|
| (a) | 1 | 3 | 2 | 4 |
| (b) | 3 | 2 | 4 | 1 |
| (c) | 4 | 2 | 1 | 3 |
| (d) | 4 | 3 | 2 | 1 |
48. What is the longitude of a town if its local time is 6 P.M. when Greenwich time is 4 P.M.  
 (a) 20°E (b) 30°E  
 (c) 20°W (d) 30°W
49. Mercator projection refers to  
 (a) Equatorial Belt  
 (b) High altitude contours  
 (c) Lines of longitude and latitude drawn in curved lines  
 (d) Lines of longitude and latitude drawn in straight lines
50. The time of Cairo is 2 hours ahead of Greenwich time. Cairo is situated at  
 (a) 27° East (b) 28° West  
 (c) 30° East (d) 30° West

# NDA ENTRANCE EXAM

## BIOLOGY

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### **3. CONSTITUENTS OF FOOD**

#### **Food**

Food is the material which is required by all living organisms for the production of energy, growth, repairing of tissues and regulation of other life processes.

#### **Balanced Diet**

- Diet that contains all the components in the optimum proportions and quantity required for maintaining the body in perfect state of health, activity and development.
- Various substances of balanced diet are carbohydrates (60%), fats (25%), proteins (15%), vitamins, mineral, roughage and water.
- The amount of each substance required, depends on age, sex occupation of the individuals and on the climatic conditions of the place where one lives.
- Balanced diet should have carbohydrate, proteins, and fats in the ratio of 3/5 : 1/5 : 1/5 respectively.

#### **Carbohydrates**

- They are the main energy producers or fuel substances in our body.
- They are stored in plants and animals in the form of starch and glucose respectively.
- Main constituents of carbohydrates are C, H and O.
- They can be monosaccharides (e.g., glucose, fructose), disaccharides (e.g., Sucrose, lactose, maltose), oligosaccharides and polysaccharides (e.g., glycogen, starch, cellulose).
- Cotton and paper are pure cellulose.
- Cellulose is a polymer of glucose.
- Animals like cow, buffalo, goat can digest cellulose, but human is devoid of it.
- Starch is converted into maltose in saliva of human beings by an enzyme ptyalin or salivary amylase. The disaccharide units bound together by a covalent bond like
  - (i) Maltose (malt sugar) = Glucose + Glucose
  - (ii) Lactose (milk sugar) = Glucose + Galactose
  - (iii) Sucrose (cane sugar) = Glucose + Fructose
- Its 1.0 g gives 4 kcal energy
- Living cells receive carbohydrate from blood mostly as glucose.
- Excess of glucose is stored in liver and muscles as glycogen. i.e., By glycogenesis.
- When level of blood glucose falls, glycogen of liver is hydrolysed to produce it, i.e., Glycogenolysis takes place.
- Excess carbohydrate of food is changed into fat through the process of lipogenesis.
- Cereals (wheat, rice and maize), sugarcane, milk (lactose sugar), fruits, honey, beet, etc., are the source of carbohydrates.

#### **Functions of Carbohydrates**

- To supply energy to the body by the oxidation process.
- To construct the external skeletons of the animals.
- To form nucleic acids and work as raw materials for the production of another substances.

#### **Lipids**

- Lipids are of two types; simple, e.g., Fat and oil and compound, e.g., lecithin and glycolipid.
- They provide two times more energy (9 kcal/g) than carbohydrates.
- Fat is the major stored food kept in adipose tissue.
- Oxidation of 1g fat yields 9.3 kcal energy
- Fat, at 20°C, it is called lipid.
- Stored food is used as fuel when glucose is not available.

- Lipase enzyme digests fat and break it into fattyacids and glycerol.  
There are two types of fatty acids  
Saturated (solid at room temperature) and unsaturated (liquid at room temperature).
- Our diet should contain less saturated fats (butter, ghee, hydrogenated vegetable oils, etc.) in comparison to unsaturated fats (simple vegetable oil).
- Excess of saturated fats in diet may lead to heart attack as they increase blood cholesterol and the disease known as hypercholestroemia
- Human diet should have more unsaturated fatty acids as they can not synthesised in the body itself. Such fatty acids are called essential fatty acids (e.g., Linoleic acid, linolenic acid, etc).

### Functions of Lipids

- Stored source of energy
- To provide the resistive larger in the human bodies, fats are stored behind the skin.
- Fat functions as a cushion and shock absorber foreye balls, gonads kidney, etc.

### Proteins

- The term 'protein' was coined by Mulder in 1838.
- They are made up of carbon, hydrogen oxygen, nitrogen and sulphur.
- They play a vital role in growth, development and repair of the body.
- They are digested in stomach of alimentary canal.
- They are the building block substances.
- Proteins are polymers of amino acids.

### Amino acids are of two types

- (i) Essential can not synthesised in the body and must be taken in diet, e.g., lysine, methionine, valine, tryptophan, phenylalanine etc.
- (ii) Non-essential synthesised in the body and do not need to be taken from out side, e.g., alanine, arginine, aspartic acid, glutamin, cysteine, proline, serine, hystidine, tyrosine.
  - Proteins first breaks down in amino acids then digest. Hence, amino acids are the substances which are never excreted out through urine under normal circumstances in any healthy individual.
  - 1.0 g of protein may **yield** 5.65 kcal energy
  - Daily requirement of protein is 70-i (X) g.
  - Excessive thing of hair in man are due to tow protein content.
  - They build up various protoplasmic structures including cell membrane.
  - All enzymes are proteins.
  - Haemoglobin visual pigments and cytochromes all are proteins.
  - Blood contains proteins for different functioning including blood clotting and antibodies, e.g., Gamma globulins.
  - Main sources are groundnuts soyabean, meat, pulses, fish, eggs milk, etc.

### Functions of Proteins

- Essential for growth and repair of body.
- Act as enzymes or chemical catalyst in metabolic reactions.
- Antibodies are proteins<sup>1</sup> which work for the defence of body.
- Collagen protein is present in bone, tendons, cartilage and transports fatty acids and lipids in blood.
- Insulin protein help to regulate glucose metabolism.
- Keratin is present skin, nails, hair, horns, etc., and acts as an antibodies.

### **Nutritional Deficiencies and imbalances**

- ◆ Protein Energy Malnutrition (PEM) it causes two types of diseases-kwashiorkor and marasmus.
  - (i) Kwashiorkor commonly affects children. Its symptoms are retarded growth, oedema, slender legs and bulging eyes.
  - (ii) Marasmus commonly affects infants under one year of age. Its symptoms are mental retardation, thin and weak body, wrinkled skin, thin limbs, loss of weight.
- ◆ Obesity caused due to excessive intake of food calories. Its symptoms are fat accumulate in tissues, high blood pressure, cardiac disorder and proneness to diabetes.

### **Minerals**

- Metals and non-metals and their salts are called minerals.
- These are inorganic component of our food, which controls our metabolic activities.
- These are raw material for tissue formation and essential parts of enzyme and vitamins.

### **Sodium (Na) and Potassium (K)**

- These are main cation of extra cellular and intracellular fluids.
- Sodium helps in absorption of glucose and electro chemical impulse conduction in nerves and muscles.
- Potassium takes part in muscles and nerves activity and glycogen and protein synthesis.
- Deficiency of sodium and potassium causes cramps and convulsions respectively.
- Its sources are salt (namak), milk, vegetables, etc.

### **Chlorine (Cl)**

- Main anion of extracellular fluid.
- It helps in synthesis of HCl and acid base balance.
- Deficiency of chlorine causes loss of appetite and muscle cramps.
- Its sources are salted food and sea food.

### **Magnesium (Mg)**

- It is enzyme activator.
- It is component of bones and teeth.
- Its deficiency produces convulsion and irregularity of metabolism.
- Its sources are meat and green vegetables.

### **Sulphur (S)**

- It is main constituent of many proteins, enzymes and CO-enzymes.
- Its deficiency disturbs protein metabolism.
- Its sources are dairy products, meat, eggs and broccoli.

### **Cobalt (Co)**

- It is a component of vitamin-B12.
- Its deficiency causes pernicious anaemia.
- It is needed for the formation of RBCs.
- Its sources are meat and yeast.

### Fluorine (F)

- It maintains enamel and checks dental decay or caries.
- In excess, harmful to teeth and bones i.e. caused fluorosis.
- It present in milk and drinking water.
- Its sources are water supplies, tea, seafood, meat-liver and beans.

### Calcium (Ca)

- It major component of bones and teeth.
- It's required for blood Clotting and muscles contraction and heart functioning.
- It's required more in children and pregnant ladies.
- It present in milk, green vegetables, gram, fish, etc.
- It's deficiency causes rickets, muscles spasms and tetany.

### Iodine (I)

- It's essential for production of thyroxine hormone from thyroid gland.
- It's deficiency causes goitre.
- It's sources are iodised salt, fish and seafood.

### Phosphorus (P)

- Along with calcium, it occurs in bones and teeth.
- Component of nucleic acids, phospholipids and ATP
- It's deficiency reduces growth, metabolism and causes rickets in children.
- It's sources are milk, cheese, eggs, peanuts and most foods.

### Iron (Fe)

- It is component of haemoglobin.
- These needed more in girls as compare to boys (25 mg) as girls lose (35 mg) more blood during menstrual cycle.
- It's deficiency leads to anaemia in girls.
- It's sources are green leafy vegetables like spinach, Chenopodium, methi, etc.

### Vitamins

These are accessory food factors, required in small quantity for controlling metabolism and body functioning. They do not provide energy

It discovered by Funk in 1912.

These are of two types; Fat soluble (A, D, E and K) and Water soluble (B-complex and C-complex).

#### Vitamins, Their Sources and Functions

Vitamin's	Common Sources	Functions	Deficiency Symptoms
Vitamin-A (Retinol or Antixerophthalmic vitamin)	Milk, butter, eggs, fish oil, vegetables (carrot), fruits (papaya), liver, etc.	Forms retinal pigments (rhodopsin of rod cells) and iodopsin of cone cells of eye.	Night blindness (no vision in dim light). Xerophthalmia is caused
Vitamin-B1 (Thiamine)	Yeast, wheat bread, peanuts, beans, pulses, etc.	Essential for normal carbohydrate metabolism and functioning of nervous system.	Beri-beri (weakness of limb muscles)



## Check Yourself

- The mode of obtaining food for growth, energy, repair, and maintenance is called  
(a) Carbohydrate (b) Nutrition  
(c) Calorie (d) Fatty acid
- All of the following are the components of food except \_\_\_\_\_.  
(a) Carbohydrates (b) Proteins  
(c) Vitamins (d) Fiber
- Which of the following are called macronutrients?  
(a) Carbohydrates, Proteins, and Vitamins  
(b) Minerals, Proteins, and Vitamins  
(c) Carbohydrates, Proteins, and Fats  
(d) Proteins, Fats, and Minerals.
- Which of the following are the micronutrients?  
(a) Vitamins and Minerals  
(b) Proteins and Vitamins  
(c) Carbohydrates and Fats  
(d) Proteins and Minerals
- Which components of food are called body builder?  
(a) Carbohydrates (b) Proteins  
(c) Vitamins (d) Minerals
- Which of the following nutrients is the energy producer?  
(a) Carbohydrates and Proteins  
(b) Proteins and Fats  
(c) Carbohydrates and Fats  
(d) Proteins and Vitamins
- Which of the following is called Metabolic regulators?  
(a) Vitamins and Minerals  
(b) Vitamins and Water  
(c) Minerals and Roughage  
(d) Carbohydrates and Vitamins
- Which of the following are the primary products of photosynthesis?  
(a) Proteins (b) Carbohydrates  
(c) Minerals (d) Water
- The elements present in the carbohydrates are  
(a) Carbon, Hydrogen, and Oxygen  
(b) Carbon, Hydrogen, and Nitrogen  
(c) Hydrogen, Oxygen, and Sulphur  
(d) Carbon, Oxygen, and Nitrogen
- How much energy will you get from one gram of glucose?  
(a) 3.8 kilocalories (b) 4.2 kilocalories  
(c) 4.8 kilocalories (d) 5.2 kilocalories
- How much percentage of calories are contributed by carbohydrates in the most of our diets?  
(a) 45 (b) 48  
(c) 50 (d) 40
- What is the formula for glucose?  
(a)  $C_6H_{12}O_6$  (b)  $C_6H_6O_{12}$   
(c)  $C_6H_6O_6$  (d)  $C_{12}H_6O_{11}$
- Which of the following is the sweetest among naturally occurring sugar?  
(a) Glucose (b) Lactose  
(c) Starch (d) Fructose
- Which of the following carbohydrates give the instant source of energy?  
(a) Glucose (b) Fructose  
(c) Cellulose (d) Starch
- Which of the following is found more in the human milk in comparison to milk of cow, buffalo, and goat?  
(a) Lactose (b) Fructose  
(c) Starch (d) Cellulose
- Which of the following are the examples of Monosaccharides?  
(a) Glucose, galactose, and fructose  
(b) Galactose, maltose  
(c) Cellulose, starch, and glycogen  
(d) Glucose and cellulose
- Monosaccharides are formed by how many sugar molecules?  
(a) Two sugar molecules  
(b) One sugar molecule  
(c) Three sugar molecules  
(d) Five sugar molecules
- Oligosaccharides are formed by how many sugar molecules?  
(a) 2 to 5 monosugars  
(b) 3 to 6 monosugars  
(c) 2 to 10 monosugars  
(d) 5 to 10 monosugars
- Which of the following are the examples of Oligosaccharides/Disaccharides?  
(a) Maltose, sucrose, lactose  
(b) Lactose, sucrose  
(c) Maltose, sucrose, cellulose  
(d) None

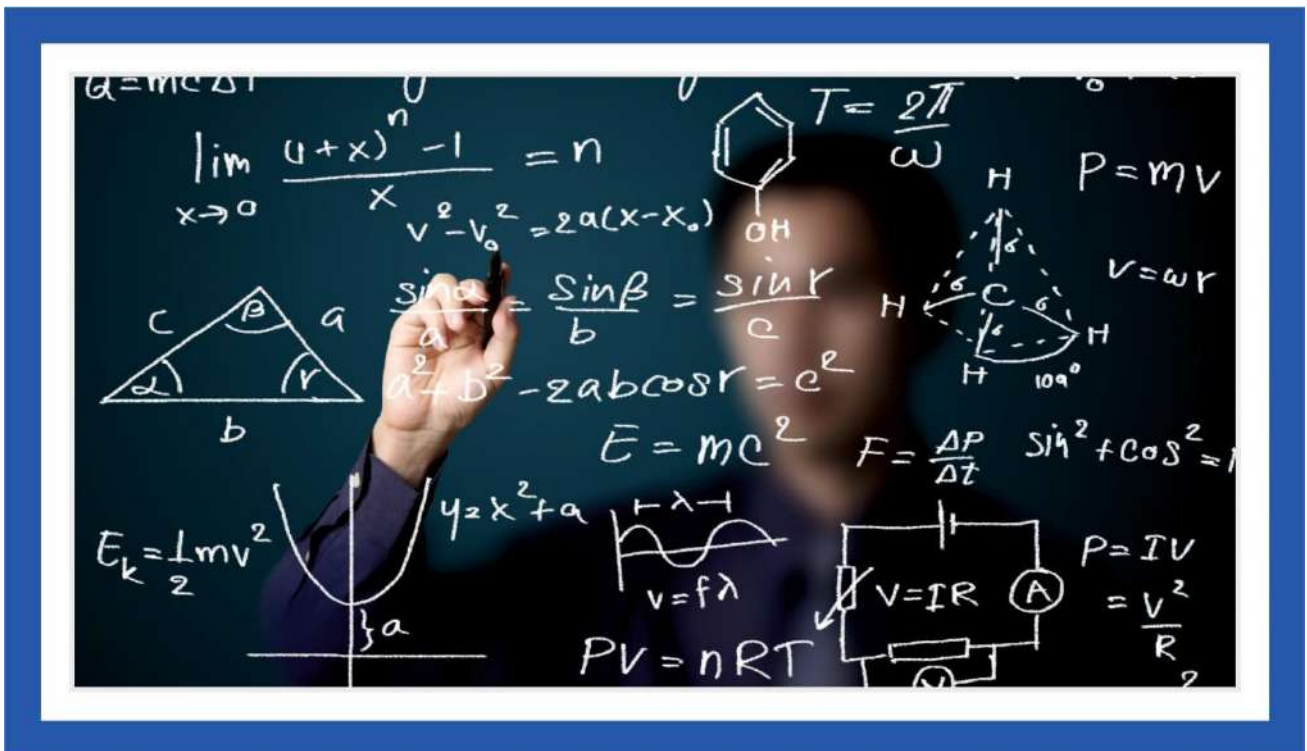
20. Which of the following are the examples of Polysaccharides?  
(a) Cellulose, glucose, sucrose  
(b) Cellulose, starch, glycogen  
(c) Glycogen, starch  
(d) Cellulose, starch, glycogen, heprin
21. Which of the following are structural polysaccharides?  
(a) Cellulose and chitin  
(b) Cellulose and strach  
(c) Heprin and starch  
(d) None
22. The human body uses carbohydrates in the form of \_\_\_\_\_.  
(a) Glucose (b) Glycogen  
(c) Starch (d) enzymes
23. In which form body stores glucose?  
(a) Cellulose  
(b) Starch  
(c) Glycogen and cellulose  
(d) Glycogen
24. Which organ of human body stores glucose in the form of glycogen?  
(a) Lungs  
(b) Liver and muscles  
(c) Stomach and muscles  
(d) Small intestine
25. The brain and RBC needs energy source in the form of  
(a) Proteins (b) Glucose  
(c) Fats (d) Enzymes
26. If a person has not consumed food for a period of time then blood glucose levels start to get low then which organ of body release glucose into the bloodstream to maintain healthy levels?  
(a) Liver (b) Heart  
(c) Heart and Liver (d) Muscles
27. Condensation of glucose molecules ( $C_6H_{12}O_6$ ) results in  
(a) starch (b) cellulose  
(c) glycogen (d) glucagon
28. Starch( $C_6H_{10}O_5$ )<sub>n</sub> is broken down to form glucose( $C_6H_{12}O_6$ ) units when hydrolysed by  
(a) alkaline base (b) acidic base  
(c) neutral base (d) salty base
29. Lactose( $C_{12}H_{22}O_{11}$ ) can be hydrolyzed in glucose( $C_6H_{12}O_6$ ) and galactose( $C_6H_{12}O_6$ ) in the presence of the enzyme  
(a) lactase (b) maltase  
(c) sucrose (d) lipases

# NDA

NDA ENTRANCE EXAM

SAMPLE

# MOCK TEST MATHEMATICS



Time Allowed : 2.30 Hrs.

Maximum Marks : 300

Student's Roll Number : \_\_\_\_\_ Name : \_\_\_\_\_

**General Instructions :**

1. This Test Booklet contains **120 questions** in total.
2. There are **four alternative answers** to every question.
3. **All** questions carry equal marks.
4. You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best.
5. In any case, choose **only one** response for each question.
6. There will be **penalty for wrong answers** marked by the candidate.
7. For each question for which a wrong answer has been given by the candidate, **one-third** of the marks assigned to that question will be deducted as penalty.
8. If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.
9. If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

1. Which one of the following is correct?  
The function  $f(x) = \tan x - x$   
(a) always decreases  
(b) always increases  
(c) never decreases  
(d) sometimes increases or sometimes decreases
2. Which one of the following is correct?  
If **a** and **b** are unit vectors, then  
(a) It is not possible that both **a + b** and **a - b** are unit vectors  
(b) Both **a + b** and **a - b** are unit vectors  
(c) **a + b** is a unit vector but **a - b** is a zero vector if **a** and **b** are parallel  
(d) Both **a + b** and **a - b** are unit vectors only if **a** and **b** are perpendicular to each other
3. What is the value of  $\tan 10^\circ - \tan 7^\circ - \tan 3^\circ$ ?  
(a) 0  
(b)  $\cot 20^\circ$   
(c)  $\cot 80^\circ \cot 83^\circ \cot 87^\circ$   
(d)  $-\tan 10^\circ \tan 7^\circ \tan 3^\circ$
4. What is the value of  $(1111)_2 + (1001)_2 - (1010)_2$ ?  
(a)  $(111)_2$                       (b)  $(1100)_2$   
(c)  $(1110)_2$                       (d)  $(1010)_2$
5. What is the binary number equivalent of the decimal number 32.25?  
(a)  $(100010.10)_2$               (b)  $(1000000.10)_2$   
(c)  $(100000.0)_2$                 (d) None of these
6. What is the value of  $(-1 + i\sqrt{3})^{48}$ ?  
(a) 1                                      (b) 2  
(c)  $2^{24}$                                 (d)  $2^{48}$
7. If the cardinality of set A is 4 and that of a set B is 3, then what is the cardinality of the set  $A \Delta B$ ?  
(a) 1  
(b) 5  
(c) 7  
(d) Cannot be determined
8. The number 0.0011 in binary system represents  
(a) rational number  $3/8$  in decimal system  
(b) rational number  $1/8$  in decimal system  
(c) rational number  $3/16$  in decimal system  
(d) None of the above
9. Which term of the sequence  $20, 19\frac{1}{4}, 18\frac{1}{2}, 17\frac{3}{4}$  is the first negative term?  
(a) 27<sup>th</sup>                                      (b) 28<sup>th</sup>  
(c) 29<sup>th</sup>                                      (d) No term exist
10. The equation  $x - 2(x - 1)^{-1} = 1 - 2(x - 1)^{-1}$  has  
(a) no root                                      (b) one root  
(c) two equal roots                      (d) infinite root
11. If  $a = \frac{\pi}{8}$ , then the value of  $\cos \alpha \cdot \cos 2\alpha \cdot \cos 4\alpha$  is  
(a) 0                                              (b)  $1/4$   
(c) 8                                              (d) 4

12. If  $A, B$  and  $C$  are three sets and  $U$  is the universal set such that  $n(U) = 700, n(A) = 200, n(B) = 300$  and  $n(A \cap B) = 100$ , then what is the value of  $n(A' \cap B')$ ?
- (a) 100 (b) 200  
(c) 300 (d) 400
13. If  $a^2 + b^2 + c^2 = 0$ , then what is value of  $\frac{(a^4 - b^4)^3 + (b^4 - c^4)^3 + (c^4 - a^4)^3}{(a^2 - b^2)^3 + (b^2 - c^2)^3 + (c^2 - a^2)^3}$ ?
- (a)  $a^2 b^2 c^2$  (b)  $-a^2 b^2 c^2$   
(c)  $abc$  (d)  $a^2 b^2 c^2$
14. Let  $z = i^3(i + 1)$  be a complex number. What is its argument?
- (a)  $\pi$  (b)  $\frac{\pi}{4}$   
(c)  $-\frac{\pi}{4}$  (d) None of these
15. Consider the following system of inequalities  $5x + 3y \geq 0$  and  $y - 2x < 2$ . The solution of the above inequalities does not contain any part of the
- (a) Ist quadrant (b) IInd quadrant  
(c) IIIrd quadrant (d) IVth quadrant
16. The group of tall boys is
- (a) a null set (b) a finite set  
(c) a singleton set (d) not a set
17. If  $E$  is the universal set and  $A = (B \cup C)$ , then the set  $E - (E - (E - (E - (E - A))))$  is the same as the set
- (a)  $B' \cup C'$  (b)  $B \cup C$   
(c)  $B' \cap C'$  (d)  $B \cap C$
18. Least value of  $2 \log_{10} x - \log_x (0.01)$  for  $x > 1$  is
- (a) 1 (b) 2  
(c) 3 (d) 4
19. In a class of 35 students, 17 have taken Mathematics, 10 have taken Mathematics but not Economics. Find the number of students who have taken both Mathematics and Economics and the number of students who have taken Economics but not Mathematics if it is given that each student has taken either Mathematics or Economics or both.
- (a) 7, 18 (b) 18, 7  
(c) 10, 18 (d) None of these
20. A college awarded 38 medals in football, 15 in basketball and 20 in cricket, If these medals went to a total of 58 men and only three men got medals in all the three sports, how many received medals in exactly two of the three sports?
- (a) 8 (b) 9  
(c) 18 (d) 11

**Directions (Q. Nos. 21-25)** The next (5) items consist of two statements, one labelled as Assertion (A) and the other as Reason (R). You are to examine these two statements carefully and select the answer to two statements carefully and select the answer to these items using the codes given below

- (a) Both A and R are individually true but R is the correct explanation of A.  
(b) Both A and R are individually true but R is not the correct explanation of A.  
(c) A is true but R is false.  
(d) A is false but R is true.

21. **Assertion (A)** If  $A$  and  $B$  are two independent events, then  $P(A \cup B) = P(A) + P(B) - P(A)P(B)$ .

**Reason (R)** If  $A$  and  $B$  are two independent events, then  $P(A \cap B) = P(A) \times P(B)$

22. **Assertion (A)** If  $a, b$  and  $c$  are in AP, then  $\cot\left(\frac{A}{2}\right), \cot\left(\frac{B}{2}\right)$  and  $\cot\left(\frac{C}{2}\right)$  are also in AP.

**Reason(R)**  $\cot\left(\frac{A}{2}\right) = \sqrt{\frac{s(s-a)}{(s-b)(s-c)}}$

23. **Assertion (A)** If  $\tan \theta + \tan 2\theta + \tan \theta \cdot \tan 2\theta = 1$  then,  $\theta = \frac{n\pi}{3} + \frac{\pi}{12}$

**Reason (R)** Since,  $\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$  and if  $\tan \theta = \tan \alpha$ , then  $\theta = n\pi + \alpha$

24. **Assertion (A)** If  $A = \begin{bmatrix} \cos \alpha & \sin \alpha \\ \cos \alpha & \sin \alpha \end{bmatrix}$  and

$$B = \begin{bmatrix} \cos \alpha & \cos \alpha \\ \sin \alpha & \sin \alpha \end{bmatrix}$$

then  $AB \neq I$

**Reason (R)** The product of two matrices can never be equal to an identity matrix.

25. **Assertion (A)**  $\lim_{x \rightarrow 0} \frac{\tan x}{x} = 1$

**Reason (R)** If  $\lim_{x \rightarrow 0} f(x) = 1, \lim_{x \rightarrow 0} g(x) = m$ , then  $\lim_{x \rightarrow 0} [f(x) \cdot g(x)] = lm$

26. What is the sum of  $\sqrt{3} + \frac{1}{\sqrt{3}} + \frac{1}{3\sqrt{3}} + \dots$ ?

- (a)  $\frac{\sqrt{3}}{2}$  (b)  $\frac{3\sqrt{3}}{2}$   
(c)  $\frac{2\sqrt{3}}{3}$  (d)  $\sqrt{3}$

27. What is the value of  $n$ , if

$$P(15, n - 1) : P(16, n - 2) = 3 : 4?$$

- (a) 10 (b) 12  
(c) 14 (d) 15

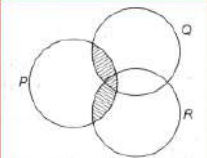
28. The value of  $(\cos \pi + i \sin \pi)^{-1}$  is

- (a) 1 (b)  $-1$   
(c)  $i$  (d)  $-i$

29. If  $\omega$  is the cube root of unity, then the value of  $(1 - \omega + \omega^2)(1 + \omega - \omega^2)$  is  
 (a) 3 (b) 4  
 (c) 5 (d) 6
30. If  $\frac{2+3i}{1+i} = A + iB$ , then the value of  $A$  and  $B$  are  
 (a)  $\frac{5}{2}, \frac{-1}{2}$  (b)  $\frac{5}{2}, \frac{1}{2}$   
 (c)  $-\frac{5}{2}, \frac{-1}{2}$  (d) None of these
31. Pie diagram used to represent statistical data are  
 (a) one dimensional (b) two dimensional  
 (c) three dimensional (d) None of these
32. The mean deviation of the data 3, 5, 6, 7, 8, 10, 11, 14 is  
 (a) 4 (b) 3.25  
 (c) 2.75 (d) 2.4
33. If the geometric mean of three observations 40, 50 and  $x$  is 10, then the value of  $x$  is  
 (a) 4 (b) 2  
 (c) 6 (d) 1/2
34. Two vertices of a  $\Delta ABC$  are  $A(2, -4, 3)$  and  $B(3, -1, -2)$  and its centroid is  $G(1, 0, 3)$ . The third vertex  $C$  is  
 (a)  $(-3, 5, 7)$  (b)  $(-2, 5, 8)$   
 (c)  $(2, -4, 6)$  (d) None of these
35. The value of  $k$  for which the points  $A(6, 9), B(0, 1)$  and  $C(-6, k)$  are collinear is  
 (a) 7 (b) -7  
 (c) -3 (d) 3
36. The distance between the lines  $3x - 4y + 5 = 0$  and  $6x - 8y + 5 = 0$  is  
 (a) 2 (b) 1/2  
 (c) 1 (d) 0
37. If  $\log_{10} 2 = 0.3010$ , then the value of  $\log_{10} 5$  is  
 (a) 0.3241 (b) 0.6911  
 (c) 0.6990 (d) 0.7525
38. The roots of  $x^2 + 9 = 0$ , are  
 (a)  $\pm 3$  (b)  $\pm 3i$   
 (c)  $\pm \frac{1}{3}$  (d) None of these
39. Argument of  $i \frac{1-i\sqrt{3}}{1+i\sqrt{3}}$  is  
 (a)  $60^\circ$  (b)  $120^\circ$   
 (c)  $210^\circ$  (d)  $240^\circ$
40. If  $A \subset B$ , then  $A' \cap B'$  is equal to  
 (a)  $A'$  (b)  $B'$   
 (c)  $B$  (d) None of these
41. If  $a + b + c = 0$ , then a root of the equation  

$$\begin{vmatrix} a-x & c & b \\ c & b-x & a \\ b & a & c-x \end{vmatrix} = 0$$
 is  
 (a)  $(a)^{-1} + (b)^{-1} + (c)^{-1}$  (b)  $a^2 + b^2 + c^2$   
 (c) 1 (d) 0
42. The polynomial  $x^{101} - 1$  is divided by  $(x - 1)$  and then evaluated at  $a + x = 1$ . The value is obtained is  
 (a) 0 (b) 1  
 (c) 100 (d) 101
43. If the equations  $x^2 + bx + c = 0$  and  $x^2 + cx + b = 0$  have a common root, then  
 (a)  $b + c = 0$  (b)  $b + c = 1$   
 (c)  $b + c + 1 = 0$  (d) None of these
44. The relation  $R$  is defined on the set  $A = \{1, 2, 3, 4, 5\}$  by  $R = \{(x, y) : x^2 + y^2 < 16\}$ , then the universal relation is  
 (a)  $\{(1, 1) (2, 1) (3, 1) (4, 1) (2, 3)\}$   
 (b)  $\{(2, 2) (3, 2) (4, 2) (2, 4)\}$   
 (c)  $\{(3, 3) (4, 3) (5, 4) (3, 4)\}$   
 (d) None of these
45. If one root of the equation  
 $3x^4 - 1x^3 + 4x^2 - x - 6 = 0$  is  $\frac{1+i\sqrt{3}}{2}$   
 then the other roots are  
 (a)  $\frac{1+i\sqrt{3}}{2}, \frac{-2}{3}, -3$  (b)  $\frac{1-i\sqrt{3}}{2}, \frac{2}{3}, 3$   
 (c)  $\frac{-1+i\sqrt{3}}{2}, \frac{-2}{3}, 3$  (d)  $\frac{1-i\sqrt{3}}{2}, \frac{-2}{3}, 3$
46. If the row vectors of a square matrix  $A$  are linearly dependent, then  
 (a)  $|A| = 1$  (b)  $|A| = \infty$   
 (c)  $|A| = 0$  (d) None of these
47. The order and degree of the differential equation  
 $\frac{d^4y}{dx^4} = y + \left(\frac{dy}{dx}\right)^4 + \left(\frac{d^2y}{dx^2}\right)^2$  are, respectively  
 (a) 2, 4 (b) 2, 2  
 (c) 4, 2 (d) 4, 1
48. If  $\alpha$  and  $\beta$  are real, then  $\left|\frac{\alpha+i\beta}{\beta+i\alpha}\right|$  is equal to  
 (a) 0 (b) 1/2  
 (c) 1 (d) 2
49. What is the slope of the normal at the point  $(at^2, 2at)$  of the parabola  $y^2 = 4ax$ ?  
 (a)  $\frac{1}{t}$  (b)  $t$   
 (c)  $-t$  (d)  $-1/t$
50. Consider a matrix  $M = \begin{vmatrix} 3 & 4 & 0 \\ 2 & 1 & 0 \\ 3 & 1 & k \end{vmatrix}$  and the following  
 Statement (A) Inverse of  $M$  exists.  
 Statement (B)  $k \neq 0$   
 Which one of the following in respect of the following matrix is correct?  
 (a) A implies B but B does not imply A  
 (b) B implies A but A does not imply B  
 (c) A implies B as well as B implies A  
 (d) None of the above

51. Which one of the following is correct?  
The power set of the null set is  
(a) null set  
(b) a singleton set  
(c) a finite set with two or more elements  
(d) None of the above
52. If  $\theta$  be the angle between the vectors  $2\mathbf{i} + \mathbf{j} + 7\mathbf{k}$  and  $\mathbf{i} + 5\mathbf{j} + \mathbf{k}$ , then  $\cos \theta$  is equal to  
(a)  $\frac{14}{\sqrt{27}}$   
(b)  $\frac{7\sqrt{2}}{27}$   
(c)  $\frac{7}{(27)^2}$   
(d)  $\frac{14}{\sqrt{54}}$
53. The value of  $\lim_{n \rightarrow \infty} \left[ \frac{1}{na} + \frac{1}{na+1} + \frac{1}{na+2} + \dots + \frac{1}{nb} \right]$  is  
(a)  $\log(ab)$   
(b)  $\log(a/b)$   
(c)  $\log(b/a)$   
(d)  $-\log(ab)$
54. The value of  $\lim_{x \rightarrow a} \frac{\log(x-a)}{\log(e^x - e^a)}$  is  
(a) 1  
(b)  $e^a$   
(c)  $e^{-a}$   
(d) -1
55. If the  $j$ th term and  $k$ th term of an AP and  $k$  and  $j$  respectively, then the  $(k + j)$ th term is  
(a) 0  
(b) 1  
(c)  $\mathbf{k + j + 1}$   
(d)  $\mathbf{k + j - 1}$
56. If  $f(x) = (x + 1)^{\cot x}$  is continuous at  $x = 0$ , then what is the value of  $f(0)$ ?  
(a) 1  
(b)  $e$   
(c)  $\frac{1}{e}$   
(d)  $e^2$
57. The lower 24 m portion of a 50 m tall tower is painted green and the remaining portion red. What is the distance of a point on the ground from the base of the tower, where the two different points of the tower subtends equal angles.  
(a) 60 m  
(b) 72 m  
(c) 90 m  
(d) 120 m
58. If  $\frac{x-a}{b+c} + \frac{x-b}{c+a} + \frac{x-c}{a+b} = 3$  then the value of  $x$  is  
(a) 0  
(b) 1  
(c)  $a + b + c$   
(d)  $abc$
59. Which one of the following is correct?  
If  $4 < x^2 < 9$ , then  
(a)  $2 < x < 3$  only  
(b)  $-3 < x < 2$  only  
(c)  $2 < x < 3$  and  $-3 < x < -2$   
(d) None of these
60. The equation of sphere is  $x^2 + y^2 + z^2 - 10z = 0$ . If one end point of a diameter of the sphere is  $(-3, -4, +5)$ , then what is the other point?  
(a)  $(-3, -4, -5)$   
(b)  $(-1, 7, 5)$   
(c)  $(3, 4, -5)$   
(d)  $(3, 4, 5)$
61. If  $\log 2 = 0.3010$  and  $\log 3 = 0.4771$ , then the value of  $\log 48$  is  
(a) 1.6731  
(b) 1.6811  
(c) 1.6911  
(d) 1.8611
62. If  $x > 0$  and  $xy = 1$ , then the minimum value of  $x + y$  is  
(a) -2  
(b) 1  
(c) 2  
(d) None of these
63.  $f(x) = (x + 2)e^{-x}$  is  
(a) decreasing for all  $x \in R$   
(b) decreasing in  $]-\infty, -1[$  and increasing in  $]-1, \infty[$   
(c) increasing for all  $x \in R$   
(d) decreasing in  $]-1, \infty[$  and increasing in  $]-\infty, -1[$
64. The value of the integral  $\int_0^2 |x^2 - x| dx$   
(a) -3/4  
(b) 2/3  
(c)  $\log_e e$   
(d) None of these
65. The slope of a curve  $y = f(x)$  is  $\sin^2 x$ . If the curve passes through the origin, its equation is  
(a)  $y = x + \sin x \cos x$   
(b)  $2y = x - \sin x \cos x$   
(c)  $y = x - \sin x \cos x$   
(d)  $2y = x + \sin x \cos x$
66. A student appears for test I, II and III. The student is successful if he passes either in test I and II or test I and III or I, II and III. The probabilities of the student passing in test I, II, III are  $p, q$  and  $\frac{1}{2}$  respectively. If the probability that the student is successful is  $\frac{1}{2}$ , then  
(a)  $p = 1, q = 0$   
(b)  $p = 2/3, q = 1/2$   
(c)  $p = \frac{3}{5}, q = \frac{2}{3}$   
(d) All are true
67.  $Y = \frac{2 \sin \alpha}{1 + \cos \alpha + \sin \alpha}$  then the value of  $\frac{1 - \cos \alpha + \sin \alpha}{1 + \sin \alpha}$  is  
(a)  $\frac{1}{y}$   
(b)  $\frac{y^2}{y}$   
(c)  $\frac{1-y}{y}$   
(d) None of these
68. If  $A$  lies in the II<sup>nd</sup> quadrant and  $3 \tan A + 4 = 0$ , then the value of  $2 \cot A - 5 \cos A + \sin A$  is equal to  
(a) -53/10  
(b) 23/10  
(c) 37/10  
(d) 1/10
69. The value of the integral  $\int \frac{\sin x dx}{\sin x - \cos x}$  is  
(a)  $\frac{1}{2}x + \frac{1}{2} \log(\sin x - \cos x) + C$   
(b)  $\frac{1}{2}x - \frac{1}{2} \log(\sin x - \cos x) + C$   
(c)  $\frac{1}{2}x + \frac{1}{2} - \log(\sin x - \cos x) + C$   
(d) None of the above
70. The value of the integral  $\int e^{x \log_e a} e^x dx$  is  
(a)  $(ae)^x + C$   
(b)  $(ae)^x \log_{ae} e$   
(c)  $\frac{e^x}{1 + \log_e a} + C$   
(d) None of these

71. When the tangent line on any curve is perpendicular to x-axis, then  
 (a)  $\frac{dy}{dx} = 0$  (b)  $\frac{dy}{dx} = 1$   
 (c)  $\frac{dx}{dy} = 0$  (d)  $\frac{dx}{dy} = 1$
72. The value of middle term in the expansion of  $(3x - \frac{1}{2x})^{16}$   
 (a)  $\frac{12870}{2^8} \times 3^8$  (b)  $\frac{12800}{2^3} \times 3^8$   
 (c)  $12780 \times 3^8$  (d) None of these
73. Under what condition does the equation  $x^2 + y^2 + z^2 + 2ux + 2vy + 2wz + d = 0$  represents a real sphere?  
 (a)  $u^2 + v^2 + w^2 = d^2$  (b)  $u^2 + v^2 > d - w^2$   
 (c)  $u^2 + v^2 + w^2 < d$  (d)  $u^2 + v^2 + w^2 < d^2$
74. If  $A = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$  and  $B = \begin{bmatrix} 1 & x \\ 0 & 1 \end{bmatrix}$  If  $AB = BA$ , then what is the value of x?  
 (a) -1 (b) 0  
 (c) 1 (d) Any real number
75. Let A and B be two invertible square matrices each of order 'n'. what is equal to adj (AB)?  
 (a) (adj A)(adj B) (b) (adj A) + (adj B)  
 (c) (adj A) - (adj B) (d) (adj B)(adj A)
76. If  $x + 1, 4x + 1$  and  $8x + 1$  are in GP, then what is the non-trivial value of x?  
 (a) -1 (b) 1  
 (c)  $\frac{1}{8}$  (d)  $\frac{1}{4}$
77. For an AP with first term u and common difference v, the pth term is 15uv more than the qth term. Which one of the following is correct?  
 (a)  $p = q + 15v$  (b)  $p = q + 15u$   
 (c)  $p = q + 14v$  (d)  $p = q + 14u$
78. What is the value of  $\tan(\tan^{-1}x + \tan^{-1}y + \tan^{-1}z) - \cot(\cot^{-1}x + \cot^{-1}y + \cot^{-1}z)$ ?  
 (a)  $\frac{3\pi}{2}$  (b)  $2(x + y + z)$   
 (c)  $2 - 3 + 1$  (d)  $\frac{3\pi}{2} + x + y + z$
79. What does the shaded region represents in the given below?  
  
 (i)  $(P \cup Q) - (P \cap Q)$  (ii)  $P \cap (Q \cup R)$   
 (iii)  $(P \cap Q) \cap (P \cap R)$  (iv)  $(P \cap Q) \cup (P \cap R)$   
 (a) i and ii (b) ii and iv  
 (c) iii and ii (d) None of these
80. For what values of 'a' does the equation  $\cos 2x + a \sin x = 2a - 7$  posses a real solution?  
 (a)  $a < 2$  (b)  $a \geq 8$   
 (c)  $a > 8$  (d)  $a < -2$
81. If A and B are two non-empty set containing m and n elements respectively, then number of one-one function from A to B when  $(n < m)$  is  
 (a) m! (b) n!  
 (c) 0 (d) None of these
82. The value of the expression  $\tan^{-1} \left\{ \frac{\sqrt{1+x} - \sqrt{1-x}}{\sqrt{1+x} + \sqrt{1-x}} \right\}$  is  
 (a)  $\frac{\pi}{4}$  (b)  $\frac{\pi}{4} - \frac{1}{2} \cos^{-1} x$   
 (c)  $\frac{1}{2} \cos^{-1} x$  (d) None of these
83. Find the values of x such that  $[1 \times 1] \begin{bmatrix} 1 & 3 & 2 \\ 2 & 5 & 1 \\ 15 & 3 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ 2 \\ x \end{bmatrix} = 0$   
 (a) 2 or -14 (b) -2 or -14  
 (c) 2 or 14 (d) None of these
84. Which of the following is correct?  
 (i)  $|A| = |A^T|$ , where  $A = [a_{ij}]_{3 \times 3}$   
 (ii)  $|kA| = k^3|A|$ , where  $A = [a_{ij}]_{3 \times 3}$   
 (iii) If A is a skew-symmetric matrix of odd order, then  $|A| = 0$   
 (iv)  $\begin{vmatrix} a+b & c+d \\ e+f & g+h \end{vmatrix} = \begin{vmatrix} a & c \\ e & g \end{vmatrix} + \begin{vmatrix} b & d \\ f & h \end{vmatrix}$   
 (a) i and ii (b) ii and iii  
 (c) I, ii and iv (d) i, ii and iii
85. Find the value of the constant  $\lambda$ , so that the function given below is continuous at  $x = -1$ .  

$$f(x) = \begin{cases} \frac{x^2 - 2x - 3}{x+1}, & x \neq -1 \\ \lambda, & x = -1 \end{cases}$$
  
 (a)  $\lambda = 4$  (b)  $\lambda = \frac{1}{4}$   
 (c)  $\lambda = -4$  (d) None of these
86. If the number  $\frac{z-1}{z+1}$  is purely imaginary, then  
 (a)  $|z| = 1$  (b)  $|z| > 1$   
 (c)  $|z| < 1$  (d)  $|z| > 2$
87. If  $z = x + iy$  and  $(z)^{1/3} = a - ib$ , then  $\frac{x}{a} = \frac{y}{b} = k(a^2 - b^2)$ , so the value of k is  
 (a)  $k = -4$  (b)  $k = 4$   
 (c)  $k = \frac{1}{4}$  (d) None of these
88. If  $\log_x a, (a)^{x/2}, \log_b x$  are in GP, then x is equal to  
 (a)  $\log_a(\log_b a)$   
 (b)  $\log_a(\log_e a)$   
 (c)  $\log_a(\log_e b) - \log_a(\log_e a)$   
 (d) None of these

89. The order and degree of the differential equation  $\frac{d^2y}{dx^2} = \left(1 + \left(\frac{dy}{dx}\right)^2\right)^{3/2}$  are, respectively  
 (a) 2, 1 (b) 1, 6  
 (c) 1, 3 (d) 2, 2
90. The order of a differential equation whose solution contains two independent arbitrary constant is  
 (a) 2 (b) 1  
 (c) 3 (d) None of these
91. Which one of the following statement is correct?  
 (i)  $\sin^2 30^\circ, \sin^2 45^\circ, \sin^2 60^\circ$  are in GP  
 (ii)  $\cos^2 30^\circ, \cos^2 45^\circ, \cos^2 60^\circ$  are in GP  
 (iii)  $\cot^2 30^\circ, \cot^2 45^\circ, \cot^2 60^\circ$  are in GP  
 (iv)  $\tan^2 30^\circ, \tan^2 45^\circ, \tan^2 60^\circ$  are in GP  
 (a) i and ii (b) iii and iv  
 (c) i, ii and iii (d) None of these
92. If the sum of squares of the roots of the equation  $x^2 + kx - b = 0$  is  $4b$ . What is the value of  $k$ ?  
 (a) 1 (b)  $\sqrt{2b}$   
 (c)  $-b$  (d) 0
93. If one root of the equation  $ax^2 + bx + c = 0$  ( $a \neq 0$ ) is reciprocal of the other root, then which one of the following is correct?  
 (a)  $a = c$  (b)  $b = c$   
 (c)  $a = -c$  (d)  $b = 0$
94. If  $\omega$  is the cube root of unity, then what is the value of  $(2 - \omega + 2\omega^2)^{27}$ ?  
 (a)  $3^{27}\omega$  (b)  $-3^{27}\omega^2$   
 (c)  $3^{27}$  (d)  $-3^{27}$
95. What is the modulus of  $\frac{1}{1+3i} - \frac{1}{1-3i}$ ?  
 (a)  $\frac{3}{5}$  (b)  $\frac{9}{25}$   
 (c)  $\frac{3}{25}$  (d)  $\frac{5}{3}$
96. The number 10101111 in binary system is represented in decimal system by which one of the following number?  
 (a) 157 (b) 175  
 (c) 571 (d) 751
97. If  $A = \{4n + 2 : n \text{ is a natural number}\}$  and  $B = \{3n : n \text{ is a natural number}\}$ , then what is the value of  $A \cap B$ ?  
 (a)  $\{12n^2 + 6n : n \text{ is a natural number}\}$   
 (b)  $\{24n - 12 : n \text{ is a natural number}\}$   
 (c)  $\{60n + 30 : n \text{ is a natural number}\}$   
 (d)  $\{12n - 6 : n \text{ is a natural number}\}$
98. The average daily income of workers of a factory including that of the owner is Rs 110. However if the income of the owner is excluded the average daily income of the remaining 9 workers is Rs 76. What is the daily income of the owner?

- (a) Rs 300 (b) Rs 316  
 (c) Rs 322 (d) Rs 416
99. If  $A = \begin{bmatrix} a & 0 \\ 1 & 1 \end{bmatrix}$  and  $B = \begin{bmatrix} 1 & 0 \\ b & 1 \end{bmatrix}$  such that  $A^2 = B$ , then what is the value of  $a + b$ ?  
 (a) -1 (b) 3  
 (c) 2 (d) None of these
100. The value of the following determinant is  

$$\begin{vmatrix} a+2b & a+4b & a+6b \\ a+3b & a+5b & a+7b \\ a+4b & a+6b & a+8b \end{vmatrix}$$
  
 (a)  $2ab$  (b)  $-2ab$   
 (c) 0 (d) None of these
101. The ratio of the number of boys to the number of girls in a class is 1 : 2. It is known that the probability of a girl and boy getting a 1st division are 0.25 and 0.28 respectively. Find the probability that a student chosen at random will get first division.  
 (a) 0.25 (b) 0.26  
 (c) 0.27 (d) 0.28
102. The value of the integral  $\int \frac{1}{\sqrt{4x-3x^2+5}} dx$  is  
 (a)  $\frac{1}{\sqrt{3}} \sin^{-1} \left(\frac{3x-2}{\sqrt{19}}\right) + C$  (b)  $\sin^{-1} \left(\frac{3x-2}{\sqrt{19}}\right) + C$   
 (c)  $\frac{1}{\sqrt{3}} \cos^{-1} \left(\frac{3x-2}{\sqrt{19}}\right) + C$  (d) None of these
103. Evaluate the limit  $\lim_{x \rightarrow 0} \frac{\log(a+x) - \log(a-x)}{x}$ ,  $a > 0$  is  
 (a)  $a/2$  (b)  $-a/2$   
 (c)  $2/a$  (d)  $-2/a$
104. If the tangent to the curve  $y = x^3 + ax + b$  at (1, 3) is parallel to the line  $x - y + 5 = 0$ , find the value of  $a$  and  $b$ .  
 (a)  $a = -2, b = -5$  (b)  $a = 2, b = 5$   
 (c)  $a = -2, b = 5$  (d) None of these
105. The value of the integral  $\int_0^{\pi/2} \frac{1}{1+\sqrt{\cot x}} dx$  is  
 (a)  $\sin^{-1}(1)$  (b)  $\tan^{-1}(1)$   
 (c)  $\cos^{-1}(-1)$  (d) None of these
106. If  $y = \cos^{-1}(2x) + 2 \cos^{-1} \sqrt{1-4x^2}$ , then the value of  $\frac{dy}{dx}$  is  
 (a)  $\frac{2}{\sqrt{1-4x^2}}$  (b)  $\frac{-2}{\sqrt{1-4x^2}}$   
 (c)  $\frac{1}{\sqrt{1-4x^2}}$  (d) None of these
107. Differential equation of family of all circles having centre on x-axis and radius 2 units is given by  
 (a)  $Y^2 \left[1 + \left(\frac{dy}{dx}\right)^2\right] = 4$  (b)  $y \left[1 + \left(\frac{dy}{dx}\right)^2\right] = 4$   
 (c)  $\left[1 + \left(\frac{dy}{dx}\right)^2\right] = 4y^2$  (d) None of these

108. A rectangle is inscribed in a semicircle of radius 'a' with one of its sides on a diameter of semicircle. Find the dimension of the rectangle, so that its area is maximum.  
 (a)  $I = \sqrt{2}a, b = \frac{a}{\sqrt{2}}$  (b)  $I = 2a, b = \frac{a}{2}$   
 (c)  $I = \sqrt{3}a, b = \frac{a}{\sqrt{3}}$  (d) None of these
109. The differential equation of the family of circle  $x^2 + y^2 - ax - b = 0$ , is  
 (a)  $yy'' + y' + 1 = 0$  (b)  $yy'' + y'^2 + 1 = 0$   
 (c)  $2yy' + 5y' = 0$  (d) None of these
110. If A and B are square matrices of order 2 such that  $\det A = -1$  and  $\det B = -3$ , then  $\det(6AB)$  is equal to  
 (a) 36 (b) 108  
 (c) -108 (d) 81
111. If  $\alpha, \beta$  are real numbers and  $\beta \neq 0$  and  $\alpha + i\beta$  is a root of the equation  $x^3 + qx^2 + r = 0$ , then one of its roots is  
 (a)  $-\alpha + i\beta$  (b)  $2\alpha - q$   
 (c)  $-2\alpha - q$  (d) None of these
112. If  $A = \{x : x^2 + 6x - 7 = 0 : x \in R\}$  and  $B = \{x : x^2 + 9x + 14 = 0 : x \in R\}$ , then the number of elements in the intersection set of A and power set of B is  
 (a) 2 (b) 1  
 (c) 0 (d) None of these
113. What is the vector whose magnitude is 3 and is perpendicular to  $\mathbf{i} + \mathbf{j}$  and  $\mathbf{j} + \mathbf{k}$ ?  
 (a)  $3(\mathbf{i} + \mathbf{j} - \mathbf{k})$  (b)  $\sqrt{3}(\mathbf{i} - \mathbf{j} + \mathbf{k})$   
 (c)  $\pm\sqrt{3}(\mathbf{i} + \mathbf{j} + \mathbf{k})$  (d) None of these
114. In a  $\Delta ABC$ , If  $\cos A = \cos B \cdot \cos C$ , then what is the value of  $\tan A - \tan B - \tan C$ ?  
 (a)  $\tan \pi$   
 (b)  $-1$   
 (c)  $1 + \tan A + \tan B \cdot \tan C$   
 (d) None of these
115. If  $\alpha$  and  $\beta$  are the roots of the equation  $x^2 - 3x + 2 = 0$ , then  $(\alpha + 1)$  and  $(\beta + 1)$  are the roots of following equation  
 (a)  $x^2 + 5x - 6 = 0$  (b)  $x^2 - 5x - 6 = 0$   
 (c)  $x^2 - 5x - 6 = 0$  (d)  $x^2 - 5x + 6 = 0$
116. What is the area of rectangle of which  $r = ai + bj$  is a semi-diagonal?  
 (a)  $a^2 + b^2$  (b)  $2(a^2 + b^2)$   
 (c)  $4(a^2 + b^2)$  (d)  $4ab$   
 (e) None of these
117. If  $f(x) = x$  and  $g(x) = |x|$ , then what is the value of  $(f + g)(x)$ ?  
 (a) 0, for all  $x \in R$  (b)  $2x$  for all  $x \in R$   
 (c)  $\begin{cases} 2x, & \text{for all } x \geq 0 \\ 0, & \text{for all } x < 0 \end{cases}$  (d)  $\begin{cases} 0, & \text{for all } x \geq 0 \\ 2x, & \text{for all } x < 0 \end{cases}$
118. If  $\vec{a} = \mathbf{i} + 2\mathbf{j} + 5\mathbf{k}$ ,  $\vec{b} = 2\mathbf{i} + \mathbf{j} - 3\mathbf{k}$ , then the value of  $(\vec{b} - \vec{a}) \cdot (3\vec{a} + \vec{b})$  equals to  
 (a) -106 (b) -98  
 (c) 53 (d) -53
119. By Baye's theorem, which one of the following probabilities is calculated?  
 (a) Prior probability  
 (b) Likelihood probability  
 (c) Posterior probability  
 (d) Conditional probability
120. The value of  $\sin 1^\circ$ , where  $1^\circ$  represents 1 radian is  
 (a) less than 1 (b) greater than 1  
 (c) equal to 1 (d) None of these

\*\*\*\*\*

**Answer Key**

- |          |          |          |          |          |          |          |          |
|----------|----------|----------|----------|----------|----------|----------|----------|
| 1. (b)   | 2. (a)   | 3. (c)   | 4. (c)   | 5. (c)   | 6. (d)   | 7. (d)   | 8. (c)   |
| 9. (b)   | 10. (a)  | 11. (a)  | 12. (c)  | 13. (b)  | 14. (c)  | 15. (d)  | 16. (d)  |
| 17. (c)  | 18. (d)  | 19. (a)  | 20. (c)  | 21. (a)  | 22. (a)  | 23. (a)  | 24. (c)  |
| 25. (b)  | 26. (b)  | 27. (c)  | 28. (b)  | 29. (b)  | 30. (b)  | 31. (a)  | 32. (c)  |
| 33. (d)  | 34. (b)  | 35. (b)  | 36. (b)  | 37. (c)  | 38. (b)  | 39. (d)  | 40. (b)  |
| 41. (d)  | 42. (d)  | 43. (c)  | 44. (d)  | 45. (d)  | 46. (c)  | 47. (d)  | 48. (c)  |
| 49. (c)  | 50. (c)  | 51. (b)  | 52. (b)  | 53. (c)  | 54. (a)  | 55. (a)  | 56. (b)  |
| 57. (d)  | 58. (c)  | 59. (c)  | 60. (d)  | 61. (b)  | 62. (c)  | 63. (d)  | 64. (c)  |
| 65. (b)  | 66. (d)  | 67. (b)  | 68. (b)  | 69. (a)  | 70. (b)  | 71. (c)  | 72. (a)  |
| 73. (b)  | 74. (b)  | 75. (d)  | 76. (c)  | 77. (b)  | 78. (a)  | 79. (b)  | 80. (b)  |
| 81. (b)  | 82. (b)  | 83. (b)  | 84. (d)  | 85. (c)  | 86. (a)  | 87. (b)  | 88. (a)  |
| 89. (d)  | 90. (a)  | 91. (b)  | 92. (b)  | 93. (a)  | 94. (d)  | 95. (a)  | 96. (b)  |
| 97. (d)  | 98. (d)  | 99. (b)  | 100. (c) | 101. (c) | 102. (a) | 103. (c) | 104. (d) |
| 105. (b) | 106. (a) | 107. (a) | 108. (a) | 109. (b) | 110. (b) | 111. (c) | 112. (c) |
| 113. (b) | 114. (a) | 115. (d) | 116. (d) | 117. (c) | 118. (b) | 119. (d) | 120. (a) |

# NDA

NDA ENTRANCE EXAM

SAMPLE

# MOCK TEST GAT



Time Allowed : 2.30 Hrs.

Maximum Marks : 600

Student's Roll Number : \_\_\_\_\_ Name : \_\_\_\_\_

**General Instructions :**

1. This Test Booklet contains **150 questions** in two parts : **Part - A** and **Part - B**.
2. There are **four alternative answers** to every question.
3. **All** questions carry equal marks.
4. You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best.
5. In any case, choose **only one** response for each question.
6. There will be **penalty for wrong answers** marked by the candidate.
7. For each question for which a wrong answer has been given by the candidate, **one-third** of the marks assigned to that question will be deducted as penalty.
8. If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.
9. If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

**PART -A**

**Selecting Words**

**Directions :** In the following passage at certain points you are given a choice of three words marked (a), (b) and (c), one of which fits the meaning of the passage. Choose the best word out of the three. Mark the letter, viz., (a), (b) or (c), relating to this word on your Answer Sheet. Examples K and L have been solved for you.

The ...K... was in the school in Simla. ...L...She was home sick.

- K. (a) boy (b) horse (c) dog  
L. (a) She (b) It (c) He

**Explanation :** Out of the list given in item K, Only 'boy' is the correct answer because usually, a boy, and not a horse or a dog, attends school. So '(a)' is to be marked on the Answer Sheet for Item K. A boy is usually referred to as 'he' so for item L, '(c)' is the correct answer. Notice that to solve the first K you have to read rest of the sentence and the see what fits best.

**Passage**

After having slept for an hour, Bond decided to go out into the city and try to find his contact. After changing his suit, he carefully locked his room and stepped out of the hotel. No one was around. But he had walked only for a few minutes when it suddenly ...37... to him

that he was being...38...by someone. There was really no ...39... for it except a very slight ...40... of footsteps. He was now walking ...41... the main street, which was crowded ...42... people, He became extremely aware of the danger of people threatening him.

- |                 |              |              |
|-----------------|--------------|--------------|
| 1. (a) felt     | (b) occurred | (c) happened |
| 2. (a) followed | (b) shot     | (c) looked   |
| 3. (a) reason   | (b) cause    | (c) evidence |
| 4. (a) weight   | (b) sound    | (c) hurting  |
| 5. (a) from     | (b) down     | (c) over     |
| 6. (a) with     | (b) by       | (c) in       |

**Synonyms**

**Directions :** Each item in this section consists of a sentence with an underlined word followed by four words or group of words. Select the word or group of words that is most **Similar** in meaning to the underlined word.

7. Leaders' **insatiable** drive for power has weakened the government.  
(a) cunning (b) inexperience  
(c) forceful (d) impossible to satisfy
8. His professional qualification was of **paramount** value.  
(a) advantageous (b) foremost  
(c) equal (d) little

9. Her career is **a paradigm** of political opportunism.  
 (a) result (b) signal  
 (c) model (d) cause
10. Every engineer appreciates **a proficient** electrician.  
 (a) experienced (b) mature  
 (c) honest (d) skilled

### Antonyms

**Directions :** Each item in this section consists of a sentence with an underlined word, followed by four words. Select the word that is most nearly **opposite** in meaning to the underlined word.

11. ENERVATE  
 (a) debilitate (b) fortify  
 (c) introduce (d) conclude
12. DISCRETE  
 (a) loud (b) combined  
 (c) loose (d) circle
13. PRIMITIVE  
 (a) polite (b) naive  
 (c) weak (d) sophisticated
14. PARTITION  
 (a) solidify (b) unify  
 (c) parse (d) enjoin

### Ordering of Sentences

**Directions:** In items in this section, each passage consists of six sentences. The first and the sixth sentences are given in the beginning as S1 and S6. The middle four sentences in each have been removed and jumbled up. These are labeled P, Q, R and S. You are required to find out the proper order for the four sentences and mark accordingly on the Answer Sheet.

15. S<sub>1</sub> : At the roadside the driver will be asked to blow through a small glass tube into a plastic bag.  
 S<sub>6</sub>: The driver will be asked to go to the police station.  
 P : And if the colour change does not reach the line the driver cannot be punished under the new law.  
 Q : Inside the tube are chemically treated crystals which change colour if the driver has alcohol on his breath.  
 R : But if the colour change does reach the line then the test has proved positive.  
 S : If the colour change goes beyond a certain line marked on the tube this indicates that the driver is probably over the specified limit.  
 The proper sequence should be  
 (a) PSQR (b) SQRP  
 (c) RPSQ (d) QSPR

16. S<sub>1</sub> : Hope springs eternally in the heart of man.  
 S<sub>6</sub> : This is the central idea of the poem.  
 P : But hope is everlasting  
 Q : Love, friendship and youth perish  
 R : It is nursed by the glorious elements of nature.  
 S : Man derives hope from nature in his gallant struggle after some noble ideal.  
 The proper sequence should be  
 (a) QPRS (b) SRQP  
 (c) RSQP (d) QPSR
17. S<sub>1</sub> : Mr Sherlock Holmes and Doctor Watson were spending a weekend in a University town.  
 S<sub>6</sub> : It was clear that something very unusual happened.  
 P : One evening they evening they received a visit from an acquaintance, Mr Hilton Soames.  
 Q : On that occasion he was in a state of great agitation.  
 R : They were staying in furnished rooms, close to the library.  
 S : Mr Soames was a tall, thin man of a nervous and excitable nature.  
 The proper sequence should be  
 (a) PRSQ (b) RPSQ  
 (c) PQRS (d) RPQS
18. S<sub>1</sub> : The machines that drive modern civilization derive their power from coal and oil .  
 S<sub>6</sub> : Nuclear energy may also be effectively used in this respect.  
 P : But they are not inexhaustible.  
 Q : These sources may not be exhausted very soon.  
 R : A time may come when some other sources have to be tapped and utilised.  
 S : Power may, of course, be obtained in future from forests, water, wind and withered vegetables.  
 The proper sequence should be  
 (a) PQRS (b) QPRS  
 (c) SRQP (d) SPQR
19. S<sub>1</sub> : The body can never stop.  
 S<sub>6</sub> : It comes from food.  
 P : To support this endless activity, the body needs all the fuel for action.  
 Q : Sometimes it is more active than at other times, but it is always moving.  
 R : Even in the deepest sleep we must breathe.  
 S : The fuel must come from some-where.  
 The proper sequence should be  
 (a) PQRS (b) PRQS  
 (c) QRPS (d) SRQP

20. S<sub>1</sub> : American idealism is essentially a belief in the idea of progress.  
 S<sub>6</sub> : This sense they have inherited from the English.  
 P : Therefore, he believes that, because of human effort, the future will be better than the past.  
 Q : But if Americans are usually optimistic, they are not wholly unrealistic.  
 R : The American tends to view history as a record of human achievement.  
 S : They have some common sense practicality.  
 The Proper sequence should be  
 (a) PQRS (b) PQSR  
 (c) RPQS (d) PRQS

### Sentence Improvement

**Directions** : Look at the underlined part of each sentence. Below each sentence are given three possible Substitutions for the underlined part. If one of them, (a), (b) and (c), is better than the underlined part, indicate your response on the Answer Sheet against the corresponding letter (a), (b) or (c). If none of the substitutions improve the sentence, indicate (d) as your response on the Answer sheet. Thus a 'No improvement' response will be signified by the letter (d).

21. The local authorities **were never bothering to** enquire about the unfortunate happenings.  
 (a) were never bothered to  
 (b) never bothered to  
 (c) never were bothering to  
 (d) were never bothering
22. India's outlook on the word **is composing of** these various elements.  
 (a) is composed of (b) is composed by  
 (c) is composed with (d) has been composing
23. How religious intolerance can blight social peace and harmony can be gauged from events **take place around** the globe.  
 (a) taken place over (b) taking place around  
 (c) took place around (d) taken place in
24. The fact-finding team **which had been at** the area found villagers giving information to the police.  
 (a) which had been for (b) that led to  
 (c) which led to (d) that had been to
25. The new facts he has discovered **could not change** my opinion.  
 (a) has not changed  
 (b) could not be changed  
 (c) cannot be changed  
 (d) No correction requires
26. On firm ground the tent **had held** in place by pegs driven into the ground.  
 (a) has been held at (b) was held in  
 (c) was being held with (d) should be held at
27. In the midst of his laborious work, **came a stroke of** good fortune.  
 (a) comes a strike of (b) came stroke of  
 (c) a strike comes of (d) came a stroke for
28. Tourists **have still come** to Egypt and are probably still inscribing their names on the old stones.  
 (a) are still corning (b) have come still  
 (c) still have come (d) will have still come
29. There was a pause when we had finished and then a **strangely subdued** voice broke the silence.  
 (a) the strange subduing  
 (b) a strange subduing  
 (c) the strange subdued  
 (d) No correction required
30. I overheard him saying something to me when I **was quit**.  
 (a) was almost quit (b) was about to quit  
 (c) had about to quit (d) had been quitting
31. We had **not only helped them with** money but also with new machinery and raw material.  
 (a) not only helped them by  
 (b) helped them not only with  
 (c) helped not only to them with  
 (d) not only been helped them by
32. I was shocked to learn that no one **was knowing** where the files were kept.  
 (a) was known (b) knew  
 (c) had been known (d) had been knowing
33. All **you really need is** a mask, a tube, flippers and a spear gun.  
 (a) you really need are  
 (b) your real need are  
 (c) you real need is  
 (d) No correction required
34. Contrast, the construction of great temples, which **had seemingly have presented** great engineering difficulties, was relatively easy.  
 (a) had seemingly presented  
 (b) had been seemed present  
 (c) was seemingly presented  
 (d) would seemingly have presented
35. **Finishing his breakfast**, he started working on the long pending problem.  
 (a) His breakfast finished  
 (b) His breakfast having finished  
 (c) Having finished his breakfast  
 (d) Finished his breakfast

### Spotting Errors

**Directions :** In this Section, a number of sentences are given. The sentences are underlined in three separate parts and each one is labelled (a), (b), (c). Read each sentence to find out whether there is an error in any underlined part. No sentence has more than one error. When you find an error in any one of the underlined parts (a), (b) or (c), indicate your response on the Answer Sheet at the appropriate space. You may feel that there is no error in a sentence. In that case letter '(d)' will signify a 'No error' response.

36. The two friends walked (A)/ besides each other(B)/ in silence.(C)/ No error(D)/
37. It was so lovely weather (A)/ that we spent(B)/ the whole day in the garden.(C)/ No error(D)/
38. He suggested us (A)/ that we should try to improve our condition (B)/ by beginning to work hard.(C)/No error(D)/
39. A man jumped (A)/ in the river(B)/ in a state of depression.(C)/No error(D)/
40. He said he was an employee (A)/ of the gas company (B)/and has come to inspect the gas connect-ion.(C)/ No error(D)/
41. Over three hundred farmers(A)/ marched through the capital(B)/to protest against the new tax.(C)/No error(D)/
42. The teacher(A)/kept encouraging us(B)/to work harder.(C)/No error(D)/
43. He goes(A)/to college(B)/by foot everyday.(C)/No error(D)/
44. Vipis is a big(A)/industrious town with(B)/a number of factories.(C)/No error(D)/
45. The average age(A)/at which people begin to need eye-glasses( B)/vary considerably.(C)/No error(D)/
46. The public(A)/are deadly against(B)/the imposition of any punitive tax.(C)/No error(D)/
47. He always acts the martyr(A)/when he has to do(B)/some domestic chores.(C)/No error(D)/
48. Being the best football player(A)/he was invited(B)/by the local sports club(C)/to play a friendly match on Sunday. (D)/No error(E)/
49. No boy(A)/in his son's class(B)/is as bright(C)/as his son.(D)/No error(E)/
50. Contrary to earlier reports(A)/I found him(B)/brighter than(C)/during the encounter.(D)/No error(E)/

### PART -B

51. Who won the Man Booker International Prize 2018?  
(a) David Grossman  
(b) Olga Tokarczuk  
(c) Philip Roth  
(d) Hankang
52. The 2-day BRICS Summit 2018 was held at which place?  
(a) Johannesburg (South Africa)  
(b) Xiamen (China)  
(c) Goa (India)  
(d) Ufa (Russia)
53. Who has won Wimbledon 2018 Men's singles tournament?  
(a) Novak Djokovic  
(b) Roger Federer  
(c) Rafael Nadal  
(d) Andy murray
54. When is the World Population Day (WPD) celebrated?  
(a) 7 January  
(b) 11 July  
(c) 23 August  
(d) 6 June
55. The first phase of Indo-French joint naval exercise 'Varuna 2018' was conducted in which state?  
(a) Kerala  
(b) Himachal Pradesh  
(c) Maharashtra  
(d) Goa
56. The Second Five Year Plan that called for the establishment of Socialist pattern of society was commonly referred to as the  
(a) Harrod-Domar Plan  
(b) Mahalanobis plan  
(c) Nehru Plan  
(d) Peoples Plan
57. Harappan Crafts display an amazing degree of standardization. According to Kenoyer, what was the possible reason for such an achievement?  
(a) Availability of raw materials at local level  
(b) Centralized markets for crafts  
(c) Specialized training centres for craftsmen  
(d) State control

58. Consider the following statements about Ashokan rock edicts :
1. Major Rock Edict XIII records Ashoka's remorse at the sufferings caused by his Kalinga campaign.
  2. Major Rock Edict X records Ashoka's visit to Lumbini.
  3. Major Rock Edict XII refers to *Dhamma Mahamattas* as a new category of officers instituted by Ashoka.
  4. Major Rock Edict XII speaks about showing tolerance towards all sects.
- Which of the statements given above are correct?
- (a) 1 and 4 only                      (b) 2 and 3  
(c) 3 and 4 only                      (d) 1, 3 and 4
59. Which one of the following is the common element among Rajagriha, Vaishali and Pataliputra?
- (a) Pali canon of the *Sthaviravadins* was compiled there  
(b) Ashokan Major Rock Edicts were Found there  
(c) Places where Buddhist Councils were held  
(d) Places associated with the compilation of Buddhist canons of the Mahasanghikas
60. Which one among the following sects was associated with Gosala Maskariputra?
- (a) Vajrayana                      (b) Ajivikas  
(c) Sthaviravadins                      (d) Mahasanghikas
61. Consider the following statements about the early modern technology in India :
1. The Portuguese brought European movable metal types to Goa in 1550.
  2. The First Indian script of which types were prepared was Tamil.
  3. The English Company's first experiment with printing press was at Calcutta.
  4. The English Company imported Printing press to India In 1674-75 at the request of Bhimji Parak.
- Which of the statements given above are correct?
- (a) 1 and 2 only                      (b) 2 and 3  
(c) 3 and 4                      (d) 1, 2 and 4
62. Which of the following statement (s) is/are true for Olympe de Gouges?
1. She was one of the most important politically active woman in revolutionary France.
  2. She was one of the members of the Committee that drafted the declaration of Rights of the Man and Citizen.
  3. She wrote the Declaration of the Rights of Woman and Citizen

- Select the correct answer using the code given below :
- (a) 1 only                      (b) 3 only  
(c) 1 and 2                      (d) 1 and 3
63. Arrange the following inventions in the field of cotton industry in chronological order (starting with the earliest):
1. James Hargreaves's Spinning Jenny
  2. John Kay's Flying Shuttle
  3. Samuel Crompton's Mule
  4. Richard Arkwright's Water Frame
- Select the correct answer using the code given below :
- (a) 1, 3, 4, 2                      (b) 2, 1, 4, 3  
(c) 4, 1, 3, 2                      (d) 2, 4, 1, 3
64. While opposing the Public Safety Bill, 1928 who among the following said that it was 'a direct attack on Indian nationalism, on the Indian National Congress' and as 'the Slavery of India, Bill No. 1'?
- (a) Motilal Nehru                      (b) Lala Lajpat Rai  
(c) T Prakasam                      (d) Diwan Charnan Lal
65. Soon after the formation of Indian National Congress, the British became suspicious of nationalists. Who among the following called Congress representing only the elite - 'a microscopic minority'?
- (a) Lord Napier                      (b) Lord Dufferin  
(c) Lord Ripon                      (d) Lord Lytton
66. What is the common element among Ram Prasad Bismil, Roshan Singh and Rajendra Lahiri?
- (a) They threw a bomb in the Central Legislative Assembly on 8 April, 1929  
(b) They were the founder members of Swaraj Party  
(c) They were the founders of Hindustan Republican Association  
(d) They were associated with Kakori Conspiracy Case
67. Which of the following is/are **not** Fundamental right(s) under the Constitution of India?
1. Right to education
  2. Right to work.
  3. Right to form associations.
  4. Right to practise any profession
- Select the correct answer using the code given below :
- (a) 1 and 2                      (b) 2 and 4  
(c) 2 only                      (d) 1 and 3

68. Mahatma Gandhi's *Hind Swaraj* is essentially  
 (a) a critique of Western modernity  
 (b) an outline of his philosophy of Satyagraha  
 (c) an invocation to Indians to free themselves from the British  
 (d) a blueprint of Gram Swaraj
69. The Seventh Schedule of the Constitution of India Contains  
 (a) Provisions regarding the administration of tribal areas  
 (b) the Union List, the State List and the Concurrent List  
 (c) a list of recognized languages  
 (d) provisions about the disqualification of Members of Legislatures on grounds of defection
70. Pochampally in Nalgonda district of Telengana became famous in April, 1951 because  
 (a) the Bhoodan movement was launched there by Vinoba Bhave  
 (b) the landless peasants rose up in arms against the landlords  
 (c) it witnessed violent anti-Hindi agitation  
 (d) Silk weavers' cooperative was formed for the first time in India
71. Who among the following was **not** associated with the Sarvodaya movement?  
 (a) Jaya Prakash Narayan  
 (b) Acharya Vinoba Bhave  
 (c) Dhirendra Mazumdar  
 (d) G V Apparao
72. Article 368 of the Constitution of India deals with  
 (a) The powers of the Parliament of India to amend the Constitution  
 (b) Financial emergency  
 (c) Reservation of seats for Scheduled Castes and Scheduled Tribes in the Lok Sabha  
 (d) Official Language of the Union of India
73. Which among the following is **not** a basic feature of the Constitution of India?  
 (a) Fundamental rights  
 (b) Independence of judiciary  
 (c) federalism  
 (d) The unquestioned right of the parliament to amend any part of the Constitution
74. Which one among the following is **not** a fundamental duty?  
 (a) To abide by the Constitution of India and respect the national flag and national anthem  
 (b) To safeguard public property  
 (c) To protect the Sovereignty, Unity and Integrity of India  
 (d) To render compulsory military service
75. Which of the following are the basic features of the Constitution (73rd Amendment) Act?  
 1. Provides for a three-tier structure of panchayats in the village, intermediary and district levels.  
 2. Reservation of seats for Scheduled Castes and Scheduled Tribes and Scheduled Tribes and women in all the tiers of panchayats.  
 3. Election to panchayats under the supervision of the State Election Commissions.  
 4. Introduction of the 11th schedule to the Constitution.  
 Select the correct answer using the code given below  
 (a) 1, 2 and 3 only (b) 3 and 4 only  
 (c) 1, 2, 3 and 4 (d) 2 and 4 only
76. Which endocrine gland requires iodine to synthesize a particular hormone whose deficiency may cause goitre disease?  
 (a) Hypothalamus (b) Pancreas  
 (c) Thymus (d) Thyroid gland
77. Which one of the following is **not** a part of nerves?  
 (a) Axons (b) Connective tissues  
 (c) Schwann cells (d) Smooth muscles
78. The product of conductivity and resistivity of a conductor  
 (a) depends on pressure applied  
 (b) depends on current flowing through conductor  
 (c) is the same for all conductors  
 (d) varies from conductor to conductor
79. Select the correct statements.  
 (I) Soaps are sodium or potassium salts of higher fatty acids.  
 (II) Sodium lauryl sulphate is a cationic detergent.  
 (III) Soaps cannot be used in hard water.  
 (IV) Soaps can be used in acidic solutions.  
 Which of the statements given about is/are correct?  
 (a) I, II and III (b) I and III  
 (c) I, III and IV (d) I, II and IV
80. When the sun is  $30^\circ$  above the horizon shadow of one tree is 17.3 m long. What is the height of this tree?  
 (a) 20 m (b) 17.30 m  
 (c) 10 m (d) 1.73
81. Consider the following statements.  
 I. In an ecosystem, the energy flow is  
 II. The energy movement is from higher to lower trophic level.  
 III. The energy pyramid is upright.  
 Which of the statements, about energy flow, given above are correct?  
 (a) I and II (b) II and III  
 (c) I and III (d) All of these

- 82.** Consider the following statements  
 I. Biofertilizers supply direct nutrients to the crops.  
 II. Biofertilizers are able to take care of N<sub>2</sub>, K and P to the plants.  
 III. Blue-green algae are used as biofertilizers.  
 Which of the statements given above are correct?  
 (a) I and II (b) II and III  
 (c) I and III (d) I, II and III

- 83.** Which of the following pairs is/are correctly matched?

1.	Taifu	Japan
2.	Bagulo	Philippine Island
3.	Hurricanes	N America and Caribbean
4.	Willy-willy	Italy

Select the correct answer using the codes given below

- (a) 1, 2 and 3 (b) 2, 3 and 4  
 (c) 1, 3 and 4 (d) All of these
- 84.** Which of the following statements with regard to the western coastal plain of India are correct?

- It is a narrow belt.
- It is an example of submerged coastal plain.
- It provides natural conditions for development of ports.
- It has well developed deltas.

Select the correct answer using the code given below :

- (a) 1, 2 and 3 only (b) 1 and 2 only  
 (c) 1, 2, 3 and 4 (d) 3 and 4 only
- 85.** Consider the following statements regarding Diastrophic forces

- The epeirogenetic movements are caused due to endogenetic forces working in horizontal movements.
- The orogenetic movements are vertical movements.

Which of the statements given above is/are correct?

- (a) Only 1 (b) Only 2  
 (c) Both 1 and 2 (d) Neither 1 nor 2
- 86.** Consider the following statement regarding crustal bending.

- When horizontal forces work face to face, the crustal rocks are bent due to resistance, compressional and tangential forces.
- Folds are wave like bends, formed due to tensional forces.

Which of the statements given above is/are correct?

- (a) Only 1 (b) Only 2  
 (c) Both 1 and 2 (d) Neither 1 and 2

- 87.** Consider the following statements regarding the Black Soil

- The soil is clayey and fine textured with dark colour
- These are rich in organic matter.
- Black soils are ideal for dry farming due to their moisture retentive quality.

(iv) It becomes sticky due to high percentage of clay and so it is difficult to plough.

Which of the statements given above is/are correct?

- (a) All of these (b) (i), (ii), and (iii)  
 (c) (i), (iii) and (iv) (d) (ii), (iii) and (iv)

- 88.** Match List I with List II and select the correct answer using the code given below the Lists :

List I (Cloud)	List II (Characteristic)
A. Cirrus	1. Rain giving
B. Stratus	2. Feathery appearance
C. Nimbus	3. Vertically growing
D. Cumulus	4. Horizontally spreading

- |     | A | B | C | D |
|-----|---|---|---|---|
| (a) | 3 | 1 | 4 | 2 |
| (b) | 3 | 4 | 1 | 2 |
| (c) | 2 | 4 | 1 | 3 |
| (d) | 2 | 1 | 4 | 3 |

- 89.** The concept of demographic transition provides a model for

- analyzing government responses to changing pattern of population growth
- Explaining major patterns of global population movement throughout the history
- analyzing spatial variations in the distribution, growth and movement of population over time
- Examining the relationship between economic development and natural population change

- 90.** Precursor of which one of the following vitamins comes from  $\beta$ -carotene?

- (a) Vitamin A (b) Vitamin C  
 (c) Vitamin D (d) Vitamin K

- 91.** With reference to the evolution of living organism. Which one of the following sequence is correct?

- Salamander  $\rightarrow$  Python  $\rightarrow$  Kangaroo
- Frog  $\rightarrow$  Crab  $\rightarrow$  Prawn
- Octopus  $\rightarrow$  Dolphin  $\rightarrow$  Shark
- Pangolin  $\rightarrow$  Tortoise  $\rightarrow$  Hawk

- 92.** The Sun is observed to be reddish when it is near the horizon, i.e., in the morning and the evening. This is because

- red light is least scattered by atmosphere
- red light is most scattered by atmosphere
- it is the colour of the Sun in the morning and evening
- Earth's atmosphere emits red light

- 93.** Thermal conductivity of aluminum, copper and stainless steel increases in the order  
 (a) Copper < Aluminum < Stainless Steel  
 (b) Stainless Steel < Aluminum < Copper  
 (c) Aluminum < Copper < Stainless Steel  
 (d) Copper < Stainless Steel < Aluminum
- 94.** Perspiration cools the body because  
 (a) presence of water on the skin is cooling.  
 (b) evaporation requires latent heat  
 (c) water has a high specific heat  
 (d) water is poor conductor of heat
- 95.** The radius of the Moon is about one-fourth that of the Earth and acceleration due to gravity on the Moon is about one-sixth that on the Earth. From this, we can conclude that the ratio of the mass of Earth to the mass of the Moon is about  
 (a) 10 (b) 100  
 (c) 1,000 (d) 10,000
- 96.** In which state, the world's largest solar park 'Shakti Sthala' was inaugurated?  
 (a) Kerala (b) Rajasthan  
 (c) Karnataka (d) Madhya Pradesh
- 97.** The European Space Agency (ESA) successfully landed a spacecraft on a speeding comet that lies 310 million miles away from Earth. As a result, the scientists may find out  
 (a) the age of the Sun  
 (b) the age of the Universe  
 (c) new fundamental atomic particles  
 (d) the role of the comets in bringing organic matter and water to Earth
- 98.** Who is the best actor in 90th Academy Awards (Oscars 2018)?  
 (a) Sam Rockwell (b) Ashraf Ghani  
 (c) Anderson (d) Gary Oldman
- 99.** Thomas Bach is the current President of  
 (a) United Nations  
 (b) World Health Organization  
 (c) International Olympic Committee  
 (d) Food and Agriculture Organization
- 100.** What is the name of the specialised anti-Naxal combat force for the state of Chhattisgarh that was announced by Union Home Minister Rajnath Singh on 21 May 2018? –  
 (a) "Black Panther" (b) "Black Leopard"  
 (c) "Black Cat" (d) "Cobra"
- 101.** Which of the following is the cold current in the Indian Ocean?  
 (a) Somali current (b) Mozambique current  
 (c) Aguihas current (d) SW monsoon current
- 102.** Consider the following statements  
 (i) The Chambal and Betwa are the sub-tributaries of the Ganga.  
 (ii) The Brakar River the head stream of the Meghna, rises of the hills of Nagaland.  
 (iii) The Godavan in the Southern peninsula has the second largest river basin, covering 10 per cent of the area of India.  
 (iv) The basin of the Narmada, in the uplands of the Deccan, flowing to the Arabian Sea, and of the Cauveri in the South, falling into the Bay of Bengal are about the same size.  
 Which of the statements given above is/are correct?  
 (a) All of these (b) (ii), and (iii)  
 (c) (i), (ii), and (iv) (d) (i) (iii), and (iv)
- 103.** Which one of the following is the smallest unit showing the properties of life such as capacity for metabolism, response to the environment, growth and reproduction?  
 (a) Gene (b) Chromosome  
 (c) Nucleus (d) Cell
- 104.** Identify the pair whose dimensions are equal  
 (a) force and work (b) force and stress  
 (c) stress and energy (d) torque and work
- 105.** A ship of mass  $3 \times 10^7$  kg initially at rest is pulled by a force of 5 x N through a distance of 3 m. Assuming that the resistance due to water is negligible, the speed of the ship is  
 (a) 0.1 m/s (b) 1.5 m/s  
 (c) 5 m/s (d) 6 cm/s
- 106.** Which one among the following happens when a swing rises to a certain height from its rest Position?  
 (a) Its potential energy decreases while kinetic energy increases  
 (b) Its kinetic energy decreases while potential energy increases  
 (c) Both potential and kinetic energy decrease  
 (d) Both potential and kinetic energy increase
- 107.** Match the entries given in List I with the entries in List II and select the correct answer using the codes given below the lists.
- | List I                           | List II                   |
|----------------------------------|---------------------------|
| A. Moment of inertia             | 1. $[ML^3T^{-1}]$         |
| B. Torque                        | 2. $mr^2$                 |
| C. Angular momentum              | 3. $\frac{1}{2}/\omega^2$ |
| D. Rotational KE of solid sphere | 4. $r \times F$           |
- |     | A | B | C | D |
|-----|---|---|---|---|
| (a) | 4 | 1 | 3 | 2 |
| (b) | 2 | 4 | 1 | 3 |
| (c) | 3 | 1 | 4 | 2 |
| (d) | 1 | 2 | 3 | 4 |

- 108.** Why is Graphite used in electrolytic cells ?  
 (a) Graphite is soft and can be easily moulded into electrodes  
 (b) Graphite is made of layers of carbon atoms which can slide  
 (c) Graphite is inert to most of the chemicals and remains intact in electrolytic cells  
 (d) Graphite is a good conductor of electricity
- 109.** Washing soda is the common name for  
 (a) Calcium Carbonate  
 (b) Magnesium Carbonate  
 (c) Sodium Carbonate  
 (d) Potassium Carbonate
- 110.** Which one of the following Indian states has the highest proportion of area under forest cover?  
 (a) Madhya Pradesh (b) Sikkim  
 (c) Meghalaya (d) Mizoram
- 111.** Consider the following statements  
 (i) Bharata Natyam though it derives its roots from Andhra Pradesh, has developed into an all India form.  
 (ii) Kathakali is a dance from Kerala.  
 (iii) Kathak is a classical dance form revitalized as a result of the Mughal influence on the Indian culture.  
 (iv) Kuchipudi is a dance form owing its origin to Tamil Nadu.  
 Which of the statements given above is/are not correct?  
 (a) All of these (b) i and iii  
 (c) i and iv (d) Only iii
- 112.** Consider the following statements about salinity  
 (1) The average salinity in oceans and sea is 35 per cent.  
 (2) On an average, salinity decreases from equator towards the pole.  
 (3) The highest salinity is observed between 20°-40° N.  
 (4) The zone between 40°-60° latitude in both the hemispheres records the lowest salinity.  
 Which of the statements given above is/are correct?  
 (a) 1, 2, 3 (b) 2, 3, 4  
 (c) 1, 2, 4 (d) All of these
- 113.** Consider the following  
 (1) Himalayas come in existence by the collision of Indian plate with Eurasian Plate.  
 (2) The height of Himalaya is increasing continuously.  
 (3) Himalayas are divided into Himadri, Middle/Lower Himalaya and Shiwalik.  
 (4) The slope of Himalaya towards China is fast but toward India it is silent.
- Which of the statements given above is/are correct?  
 (a) All of these (b) 2, 3 and 4  
 (c) 3 and 4 (d) 1,2 and 3
- 114.** The seeds of flowering plants are made up of  
 (a) Ovary and ovary wall  
 (b) Embryo, food reserves and coat  
 (c) Cotyledons  
 (d) Zygotes
- 115.** Which property of wood charcoal is useful in making gas masks?  
 (a) Black colour (b) Porous  
 (c) Heavier than water (c) Good adsorbent
- 116.** Dry ice is  
 (a) solid ice without water  
 (b) solid carbon dioxide  
 (c) solid sulphur dioxide  
 (d) solid benzene
- 117.** A deep sea diver may hurt his ear drum during diving because of  
 (a) lack of oxygen  
 (b) high atmospheric pressure  
 (c) high water pressure  
 (d) All of the above
- 118.** When you walk on a woolen carpet and bring your finger near the metallic handle of a door an electric shock is produced. This is because  
 (a) charge is transferred from your body to the handle  
 (b) a chemical reaction occurs when you touch the handle  
 (c) the temperature of the human body is higher than that of the handle  
 (d) the human body and the handle arrive at thermal equilibrium by the process
- 119.** Which one among the following does not wet the walls of the glass vessel in which it is kept?  
 (a) Water (b) Alcohol  
 (c) Mercury (d) Phenol
- 120.** Permanent hardness of water is due to the presence of  
 (a) sulphates of sodium and potassium  
 (b) sulphates of magnesium and calcium  
 (c) carbonates of sodium and magnesium  
 (d) bicarbonates of magnesium and calcium
- 121.** In the reaction  $ZnO + C \rightarrow Zn + Co$ , 'C' acts as  
 (a) an acid (b) a base  
 (c) an oxidising agent (d) a reducing agent

- 122.** Which of the following are the characteristics of organic farming?
1. Use of chemical fertilizers to improve soil fertility.
  2. Frequent decomposing and Fallowing.
  3. Use of herbs to control pests.
  4. Higher productivity per hectare.
- Select the correct answer using the code given below :
- (a) 1 and 4 only                      (b) 1, 3 and 4  
(c) 2 and 3 only                      (d) 2, 3 and 4
- 123.** 'Yakuts' are the nomadic herders of
- (a) Gobi                                      (b) Sahara  
(c) Tundra                                  (d) Kalahari
- 124.** A farmer in a semi-arid area claims that his farming practice is very environment friendly. Which of the following practices on his farm can justify his claim?
1. Planting a tree belt.
  2. Practising crop rotation.
  3. Carrying out a large scale irrigation system.
  4. Using organic fertilizers.
- Select the correct answer using the code given below :
- (a) 3 and 4 only                      (b) 1, 2 and 4  
(c) 1, 3 and 4                        (d) 1 and 2 only
- 125.** The luxuriant growth of natural vegetation in tropical rainforest is due to
1. Fertile soil.
  2. hot and wet climate throughout the year.
  3. intense sunlight for photosynthesis.
  4. seasonal change to facilitate nutrient absorption.
- Select the correct answer using the code given below :
- (a) 1 and 4 only                      (b) 2 and 3 only  
(c) 1, 2 and 3 only                      (d) 1, 2, 3 and 4

**Directions:** The following **8 (Eight)** items consist of two statements, Statement I and Statement II. You are to examine these two statements carefully and select the answers to these items using the code given below:

**Code :**

- (a) Both the statements are individually true and Statement II is the correct explanation of Statement I
- (b) Both the statements are individually true but Statement II is **not** the correct explanation of Statement I
- (c) Statement I is true but Statement II is false
- (d) Statement I is false but Statement II is true

- 126.** Statement I : Growth of plants is smooth with a complete fertilizer.  
Statement II : A complete fertilizer always contains N, P, K.
- 127.** Statement I : The granules of modern gunpowder (also called black powder) are typically coated with Graphite.  
Statement II : Graphite prevents the build-up of electrostatic charge.
- 128.** Statement I : Colour of nitrogen dioxide changes to colourless at low temperature.  
Statement II : At low temperature Nitrogen tetroxide ( $N_2O_4$ ) is formed which is colourless.
- 129.** Statement I : Diamond is very bright.  
Statement II : Diamond has very low refractive index.
- 130.** Statement I : Oxygen gas is easily produced at a faster rate by heating a mixture of potassium chlorate and manganese dioxide than heating potassium chlorate alone.  
Statement II : Manganese dioxide acts as a negative catalyst.
- 131.** Statement I : A body weighs less on a hill top than on earth's surface even though its mass remains unchanged.  
Statement II : The acceleration due to gravity of the earth decreases with height,
- 132.** Statement I : While putting clothes for drying up, we spread them out.  
Statement II : The rate of evaporation increases with an increase in surface area.
- 133.** Statement I : Due to diffused or irregular reflection of light, a closed room gets light even if no direct sunlight falls inside the room.  
Statement II : Irregular reflection, where the reflected rays are not parallel, does not follow the laws of reflection.
- 134.** In a flame which part is called the black zone?  
(a) Outer zone                              (b) Inner zone  
(c) Middle zone                              (d) Top of the flame
- 135.** Which of the following has the maximum mass?  
(a) 0.1 g atom of carbon  
(b) 0.1 mole of ammonia  
(c)  $6.02 \times 10^{22}$  molecules of hydrogen gas  
(d) 1120 cc of carbon dioxide
- 136.** The best conductor of electricity is a 1 M solution of  
(a) boric acid                              (b) acetic acid  
(c) sulphuric acid                              (d) phosphoric acid

137. Which of the following units represents the largest amount of energy?  
 (a) Calorie (b) Joule  
 (c) Erg (d) Electron volt

138. Match List I with II and select the correct answer using the code given below the Lists :

List I (Compound)	List II (Nature)
A. Sodium hydroxide	1. Strong acid
B. Calcium oxide	2. Alkali
C. Acetic acid	3. Weak acid
D. Hydrochloric acid	4. Base

- A B C D  
 (a) 2 3 4 1  
 (b) 2 4 3 1  
 (c) 1 4 3 2  
 (d) 1 3 4 2
139. Which one of the following statements is *not* correct ?  
 (a) Kerala is the largest producer of natural rubber in India  
 (b) Neyveli is an important thermal power generating area of Tamil Nadu  
 (c) Ratnagiri Bauxite mining area is located in Karnataka  
 (d) Assam is the largest tea producing state in India
140. Match List I with List II and select the correct answer using the code given below the Lists :

List I (Paper industry Centre)	List II (State)
A. Kamptee	1. Karnataka
B. Rajahmundry	2. Maharashtra
C. Shahdol	3. Andhra Pradesh
D. Belagola	4. Madhya Pradesh

- A B C D  
 (a) 1 4 3 2  
 (b) 2 3 4 1  
 (c) 1 3 4 2  
 (d) 2 4 3 1
141. The newly formed state of Telengana is surrounded by  
 (a) 5 States (b) 4 States  
 (c) 6 States (d) 3 States
142. Energy is required for maintenance of life. It is obtained by a process called.  
 (a) Metabolism (b) Phagocytosis  
 (c) Photorespiration (d) Decomposition

143. Which of the following is not a bacteriostatic antibiotic?  
 (a) Erythromycin (b) Tetracycline  
 (c) Chioramphenicol (d) Penicillin

**Directions (Q. Nos. 144-146)** In the next three questions given below are two statements labelled as Assertion (A) and Reason (R). In the content of the two statements, find ent the correct answer, using codes given below

- (a) If both Assertion and Reason are correct and Reason is the correct explanation of the Assertion.  
 (b) If both Assertion and Reason are correct but Reason is not the correct explanation of the assertion.  
 (c) If Assertion is correct but Reason is incorrect.  
 (d) If Assertion is incorrect but Reason is correct.

144. Assertion CO and NO both combine with haemoglobin.  
 Reason Both have equal affinity for haemoglobin.

145. Assertion Tungsten has a very high melting point. Reason Tungsten is a covalent compound.

146. Assertion Pyrex glass contains B and Al along with Na as the metal ions.  
 Reason Pyrex glass is a mixture of sodium boro silicates and aluminium borosilicates.

147. Which one among the following is used in making gunpowder?

- (a) Magnesium sulphate  
 (b) Potassium nitrate  
 (c) Sodium stearate  
 (d) Calcium sulphate

148. The cleaning action of soap and detergent in water is due to the formation of

- (a) Micelle (b) Salt  
 (c) Base (d) Acid

149. The chemical used as a fixer/developer in photography is

- (a) Sodium sulphate  
 (b) Sodium sulphide  
 (c) Sodium thiosulphate  
 (d) Sodium sulphite

150. Rain shadow effect is associated with

- (a) Cyclonic rainfall  
 (b) Orographic rainfall  
 (c) Convectonal rainfall  
 (d) Frontal rainfall

\*\*\*\*\*

**NDA Mock Test - 5**  
**General Ability Test**

**Answer Key**

- |          |          |          |          |          |          |          |          |
|----------|----------|----------|----------|----------|----------|----------|----------|
| 1. (b)   | 2. (a)   | 3. (c)   | 4. (b)   | 5. (b)   | 6. (a)   | 7. (d)   | 8. (b)   |
| 9. (c)   | 10. (d)  | 11. (b)  | 12. (b)  | 13. (d)  | 14. (b)  | 15. (d)  | 16. (a)  |
| 17. (b)  | 18. (b)  | 19. (c)  | 20. (c)  | 21. (b)  | 22. (a)  | 23. (b)  | 24. (d)  |
| 25. (d)  | 26. (b)  | 27. (b)  | 28. (a)  | 29. (d)  | 30. (b)  | 31. (b)  | 32. (b)  |
| 33. (d)  | 34. (a)  | 35. (c)  | 36. (b)  | 37. (a)  | 38. (a)  | 39. (b)  | 40. (a)  |
| 41. (c)  | 42. (c)  | 43. (c)  | 44. (b)  | 45. (c)  | 46. (b)  | 47. (d)  | 48. (a)  |
| 49. (e)  | 50. (c)  | 51. (b)  | 52. (a)  | 53. (a)  | 54. (b)  | 55. (d)  | 56. (b)  |
| 57. (d)  | 58. (d)  | 59. (c)  | 60. (b)  | 61. (d)  | 62. (d)  | 63. (b)  | 64. (a)  |
| 65. (b)  | 66. (d)  | 67. (c)  | 68. (a)  | 69. (b)  | 70. (a)  | 71. (d)  | 72. (a)  |
| 73. (d)  | 74. (d)  | 75. (c)  | 76. (d)  | 77. (d)  | 78. (c)  | 79. (b)  | 80. (c)  |
| 81. (c)  | 82. (d)  | 83. (a)  | 84. (a)  | 85. (d)  | 86. (a)  | 87. (c)  | 88. (c)  |
| 89. (d)  | 90. (a)  | 91. (b)  | 92. (a)  | 93. (b)  | 94. (b)  | 95. (b)  | 96. (c)  |
| 97. (d)  | 98. (d)  | 99. (c)  | 100. (a) | 101. (a) | 102. (d) | 103. (d) | 104. (d) |
| 105. (a) | 106. (b) | 107. (c) | 108. (d) | 109. (c) | 110. (d) | 111. (c) | 112. (d) |
| 113. (d) | 114. (b) | 115. (c) | 116. (b) | 117. (c) | 118. (a) | 119. (c) | 120. (b) |
| 121. (d) | 122. (c) | 123. (c) | 124. (b) | 125. (b) | 126. (a) | 127. (a) | 128. (a) |
| 129. (c) | 130. (c) | 131. (a) | 132. (a) | 133. (c) | 134. (b) | 135. (d) | 136. (c) |
| 137. (a) | 138. (b) | 139. (c) | 140. (b) | 141. (a) | 142. (a) | 143. (d) | 144. (c) |
| 145. (c) | 146. (a) | 147. (b) | 148. (a) | 149. (c) | 150. (b) |          |          |

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Class	Subjects	No of Booklets
6th	Physics / Chemistry / Biology / Mathematics	5
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	History / Geography / Civics	1
	Mental Ability	1
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	English Grammar	1
	History / Geography / Civics	3
	Mental Ability	1
8th	Physics / Chemistry / Biology / Mathematics	5
	English Grammar	1
	History / Geography / Civics	3
	Mental Ability	1
9th	Physics / Chemistry / Biology / Mathematics	5
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	Mental Ability	1
10th	Physics / Chemistry / Biology / Mathematics	5
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	History / Geography / Political Science / Economics	4
	Mental Ability	1

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12th NEET	Physics / Chemistry / Biology	13

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	Chemistry	1
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	General Test	2
	Accountancy	1
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	English	1
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