



SCIENCE APTITUDE TEST

CLASS 10

ANSWER KEY WITH SOLUTIONS

DATE : 05.01.25

IIT Ashram
IIT JEE | NEET | GUJCET | FOUNDATION (6 to10)



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PART - I : MENTAL ABILITY

1.

Sol. (d)

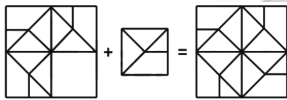
Figure d is odd one as in all other figures dot is at right angle and in figure d at right angle two lines are present.

2.

Sol. (d)

3.

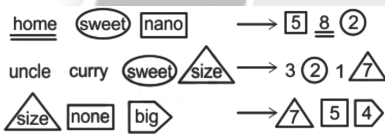
Sol. (d)



Hence, figure given in option 4 will complete the pattern.

4.

Sol. (b)



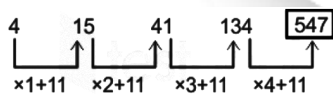
Hence, nano is coded as '5'.

5.

Sol: (d)

The logic followed here is:

Given series is 4, 15, 41, 134, ?



Therefore, '547' is missing the number.

6.

Sol: (a)

The letters can be rearranged as follows,

- a) AAAPPY → PAPAYA
- b) HCNAIPS → SPINACH
- c) GGEATNPL → EGGPLANT
- d) AABBCGE → CABBAGE

All of them are vegetables except PAPAYA.

Thus the odd word is AAAPPY

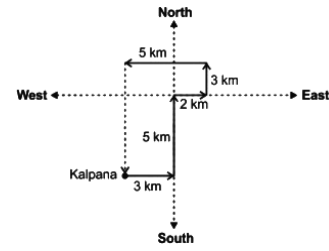
7.

Sol. (a)

The logic followed here is:

Draw a direction diagram as per the given information;

Therefore, Kalpana is North of the starting position.



8.

Sol. (b)

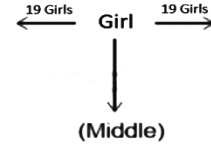
Logic: As per the question. The girl is 20th from both sides.

It means she is in the middle position.

Hence, the total number of students will be

$$19 + 19 + 1 = 39.$$

Therefore, the correct answer is "39".



9.

Sol. (c)

10.

Sol. (c)

From the year 2004 to 2011 there are two leap years i.e. 2004 and 2008. As we are starting from 3rd March 2004, hence we are not considering the one extra day which was in February. Thus, from 3rd March 2004 to 3rd March 2011 there will be only one leap year. Total number of days (3rd March 2004 to 2nd March 2011)

$$= 6 \times 365 + 1 \times 366 = 2190 + 366 = 2556 \text{ days}$$

$$2556 \div 7 = 365 \text{ weeks and } 1 \text{ day}$$

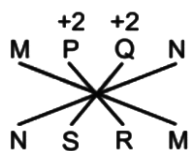
The 365th week will end on Sunday and the next day would be Monday. Thus, the day on 2nd March would be Monday.

Hence, March 3, 2011 would be a Tuesday

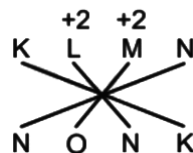
11.

Sol: (b)

The pattern followed here is:



Similarly,



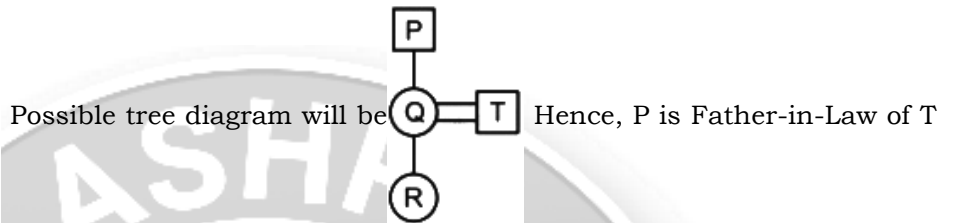
Hence, NONK is the correct answer.

12.

Sol. (d)

symbols:

Symbol in Diagram	Meaning
○	Female
□	Male
==	Married Couple
—	Siblings
	Difference of A Generation

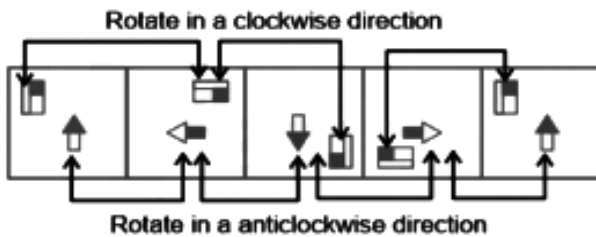


13.

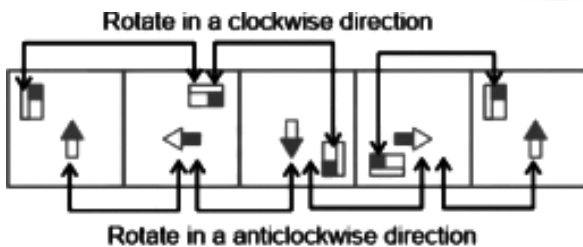
Sol. (c)

The pattern followed here is:

1. The arrow rotates in an anti-clockwise direction in its own position and one by one arrow's front and last position parts become dark.
2. A rectangular rotates in a clockwise direction and also rotates a clockwise direction in a box.



- Final series is



14.

Sol. (b)

For every mirror image based on a clock,

Given:

The clock shows the time = 1:19

To find :

Time is shown in the mirror image

Concept used:

For mirror image

(11-hours): (60 - minutes)

Solution:

Hours = 1

Minutes = 19

Mirror image = (11-1): (60-19)

⇒ Mirror image = 10:41

15.

Sol: (a)

$$132 + 6 - 9 \times 13 / 31 = ?$$

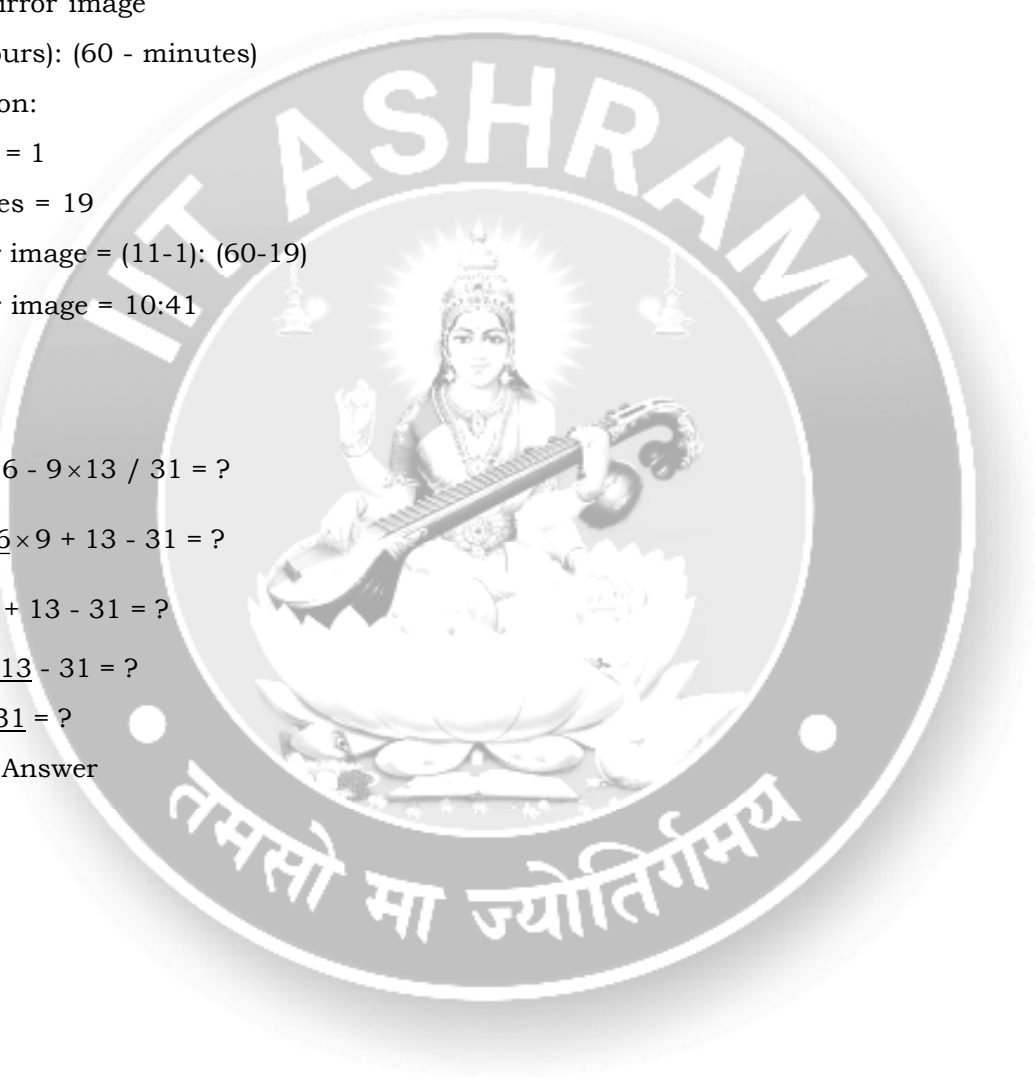
$$\underline{132} \div 6 \times 9 + 13 - 31 = ?$$

$$\underline{22} \times 9 + 13 - 31 = ?$$

$$\underline{198} + 13 - 31 = ?$$

$$\underline{211} - 31 = ?$$

$$180 = \text{Answer}$$



PART - I : MATHEMATICS

1.

Sol: (b)

$$\frac{k+2k+1}{2} = 2k-1 \Rightarrow 3k+1 = 4k-2 \quad \therefore k = 3$$

2.

Sol: (b)

Circumference - Radius = 37 cm

$$\Rightarrow 2\pi r - r = 37 \Rightarrow 2 \times \frac{22}{7} \times r - r = 37 \Rightarrow r = 7 \text{ cm}$$

$$\therefore \text{Circumference} = 2\pi r = 44 \text{ cm}$$

3.

Sol: (c)

$$V_1 = \pi r_1^2 h \Rightarrow V_2 = \pi r_2^2 h = \pi \left(\frac{r_1}{2}\right)^2 h = \frac{\pi r_1^2 h}{4} = \frac{V_1}{4} \Rightarrow \frac{V_2}{V_1} = \frac{\frac{V_1}{4}}{V_1} = \frac{1}{4} = 1:4$$

4.

Sol: (b)

Circumference of Base = Width of paper

$$2\pi r = 22 \text{ cm} \Rightarrow 2 \times \frac{22}{7} \times r = 22 \Rightarrow \therefore r = \frac{7}{2}$$

5.

Sol: (b)

Perimeter of circle = perimeter of square

$$2\pi r = 4a \Rightarrow r = \frac{4a}{2\pi} = \frac{2a}{\pi}$$

$$\text{Required ratio} \frac{\pi r^2}{a^2} = \frac{\pi \left(\frac{2a}{\pi}\right)^2}{a^2} = \frac{4}{\pi} = \frac{14}{11} = 14:11$$

6.

Sol: (d)

$$n(C) = 1$$

$$n(S) = 7$$

$$\therefore P(E) = \frac{1}{7}$$

7.

Sol: (c)

$$n(E) = 10$$

$$n(S) = 30$$

$$\therefore P(E) = \frac{10}{30} = \frac{1}{3}$$

8.

Sol: (b)

$$a_n = 2n + 1$$

$$a = a_1 = 2 \times 1 + 1 = 3$$

$$S_n = \frac{n}{2}[a + a_n] = \frac{n}{2}(3 + 2n + 1) = \frac{n}{2}[2n + 4] = n(n + 2)$$

9.

Sol: (c)

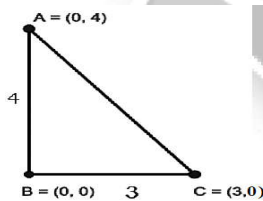
$$3y + 5 = \frac{3y - 1 + 5y + 1}{2}$$

$$6y + 10 = 8y$$

$$\therefore y = 5$$

10.

Sol: (d)



$$AC = \sqrt{AB^2 + BC^2} = \sqrt{4^2 + 3^2} = 5$$

$$\therefore \text{Perimeter} = 4 + 3 + 5 = 12$$

11.

Sol: (c)

$$\tan 3x = \sin 45^\circ \cos 45^\circ + \sin 30^\circ$$

$$\tan 3x = \frac{1}{\sqrt{2}} \times \frac{1}{\sqrt{2}} + \frac{1}{2}$$

$$\tan 3x = \frac{1}{2} + \frac{1}{2} = 1 = \tan 45^\circ$$

$$3x = 45^\circ \therefore x = 15^\circ$$

12.

Sol: (a)

$$P(x) = x^2 - 5x + 4$$

$$P(3) = (3)^2 - 5(3) + 4 = 9 - 15 + 4 = -2$$

$$\therefore \text{Required no} = 2$$

13

Sol: (c)

$$12 = 2^2 \times 3 \quad \Rightarrow \quad 15 = 3 \times 5 \quad \Rightarrow \quad 21 = 3 \times 7$$

$$\text{LCM} = 2^2 \times 3 \times 5 \times 7 = 420$$

14.

Sol: (a)

$$kx - y = 1.5$$

$$6x - 2y = 3$$

Equation has infinitely many solutions.

$$\Rightarrow \frac{k}{6} = \frac{-1}{-2} \therefore k = 3$$

15.

Sol: (b)

$$D = b^2 - 4ac = (8)^2 - 4(4\sqrt{2})(2\sqrt{2}) = 64 - 64 = 0$$

16.

Sol: (b)

A.P. 9, 17, 25,

$$a = 9, d = 17 - 9 = 8$$

$$S_n = 636$$

$$\frac{n}{2}[2a + (n-1)d] = 636 \Rightarrow \frac{n}{2}[2 \times 9 + (n-1)8] = 636 \Rightarrow \frac{n}{2} \times 2[9 + (n-1)4] = 636$$

$$n(4n + 5) = 636$$

$$4n^2 + 5n - 636 = 0$$

$$4n^2 - 48n + 53n - 636 = 0$$

$$(n-12)(4n + 53) = 0$$

$$n = 12$$

17.

Sol: (c)

$$\pi r^2 = \pi r_1^2 + \pi r_2^2$$

$$\Rightarrow r^2 = r_1^2 + r_2^2$$

$$= 64 + 36 = 100$$

$$\therefore R = 10 \text{ cm}$$

18.

Sol: (b)

$$P(E) = \frac{n(E)}{n(S)} \Rightarrow 0.18 = \frac{n(E)}{900}$$

$$\therefore n(E) = 0.18 \times 900 = 162$$

19.

Sol: (d)

side of box a = diameter of ball

$$a = 2r \Rightarrow r = \frac{a}{2}$$

$$\therefore \text{Volume of ball} = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi \left(\frac{a}{2}\right)^3 = \frac{\pi}{6}a^3$$

20.

Sol. (d)

$$OP = 20 \text{ cm}$$

$$T_0 = r = 12 \text{ m}$$

$$PT^2 + TO^2 = PO^2$$

$$PT^2 + 12^2 = 20^2$$

$$PT^2 = 256$$

$$\therefore PT = 16 \text{ cm}$$

21.

Sol. (b)

$$3x + 4y = 12 \Rightarrow 3x + 4 \times 41 = 12 \Rightarrow x = \frac{-152}{3}$$

$$\therefore \text{one solution } (x, y) = \left(\frac{-152}{3}, 41 \right)$$

22.

Sol. (d)

$$a_n = 4$$

$$a + (n - 1)d = 4 \Rightarrow a + (7 - 1)(-4) = 4 \Rightarrow a + (-24) = 4 \Rightarrow a = 28$$

23.

Sol: (a)

$$a_{18} - a_{14} = 32 \Rightarrow a + 17d - (a + 13d) = 32 \Rightarrow 4d = 32 \Rightarrow d = \frac{32}{4} = 8$$

24.

Sol. (c)

$$\text{Required ratio} = \frac{a}{\frac{\sqrt{3}}{2} \times a} = \frac{2}{\sqrt{3}} = 2 : \sqrt{3}$$

25.

Sol. (d)

$$9^2 \neq 5^2 + 7^2$$

26.

Sol. (b)

$$C_1 = 2\pi r_1 \Rightarrow C_2 = 2\pi r_2 = 2\pi(3r_1) = 6\pi r_1 \therefore C_2 = 3C_1$$

27.

Sol. (a)

Side of Square = a

$$\text{Radius of incircle} = r_1 = \frac{a}{2}$$

$$\text{Radius of circumcircle} = r_2 = \frac{\sqrt{2}a}{2} = \frac{a}{\sqrt{2}}$$

$$\text{Required ratio} = \frac{\pi r_1^2}{\pi r_2^2} = \frac{1}{2} = 1 : 2$$

28.

Sol. (a)

$$E = \{(2, 6)(6, 2)(3, 5)(5, 3)(4, 4)\}$$

$$n(E) = 5$$

$$n(s) = 36$$

$$\therefore P(E) = 5/36$$

29.

Sol. (a)

$$3x^2 - 2x - 5 = 0$$

$$3x^2 + 3x - 5x - 5 = 0$$

$$3x(x + 1) - 5(x + 1) = 0$$

$$(x + 1)(3x - 5) = 0$$

$$x = -1, \frac{5}{3}$$

30.

Sol. (d)

$$x^2 + 5x + a = 0$$

$$\alpha + \beta = \frac{-5}{1}$$

$$\alpha + \beta = -5 \dots \dots \dots (i)$$

$$2\alpha + 5\beta = -1 \dots \dots \dots (ii)$$

from equation (i) & (ii),

$$\alpha = -8, \beta = 3$$

$$\alpha\beta = a = -8 \times 3 = -24$$

31.

Sol. (b)

$$\frac{r_1}{r_2} = \frac{3}{4} \Rightarrow \frac{h_1}{h_2} = \frac{2}{3} \Rightarrow \frac{V_1}{V_2} = \frac{\pi r_1^2 h_1}{\frac{1}{3} \pi r_2^2 h_2} = 3 \left(\frac{r_1}{r_2} \right)^2 \left(\frac{h_1}{h_2} \right)$$

$$= \frac{9}{8} = 9:8$$

32.

Sol. (a)

According to question,

$$\alpha = -2, \beta = -3$$

$$f(x) = x^2 - (\alpha + \beta)x + \alpha\beta$$

$$= x^2 + 5x + 6$$

33.

Sol. (b)

34.

Sol. (b)

$$2x^2 - 5x + 4 = 0 \Rightarrow \alpha + \beta = \frac{-b}{a} = \frac{5}{2} \Rightarrow \alpha\beta = \frac{c}{a} = \frac{4}{2} = 2$$

$$\therefore \text{Required ratio} = \frac{5/2}{2} = \frac{5}{4} = 5:4$$

35.

Sol. (d)

$$11a_{11} = 7a_7$$

$$11(a + 10d) = 7(a + 6d)$$

$$11a + 110d = 7a + 42d$$

$$4a = -68d$$

$$a = \frac{-68d}{4} = -17d$$

$$\therefore a_{18} = a + 17d = -17d + 17d = 0$$

36.

Sol. (c)

Since points A, O, C are collinear,
they will lie on the same line,

i.e. they will not form triangle

Therefore,

$$\text{Area of } \triangle AOC = 0$$

$$\frac{1}{2} [x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)] = 0$$

Here

$$x_1 = 1, y_1 = 2$$

$$x_2 = 0, y_2 = 0$$

$$x_3 = a, y_3 = b$$

Putting values

$$\frac{1}{2} [1(0 - b) + 0(b - 2) + a(2 + 0)] = 0$$

$$1(-b) + 0 + 2a = 0 \times 2$$

$$-b + 2a = 0$$

$$2a = b$$

37.

Sol. (c)

$$\sin\theta + \sin^2\theta = 1$$

$$\sin\theta = 1 - \sin^2\theta$$

$$\sin\theta = \cos^2\theta$$

$$\cos^2\theta + \cos^4\theta = \cos^2\theta + (\cos^2\theta)^2$$

$$\sin^2\theta + \sin^2\theta = 1$$

38.

Sol. (d)

$$\sec A + \tan x = x \dots\dots\dots (i)$$

$$\sec^2 A - \tan^2 A = 1$$

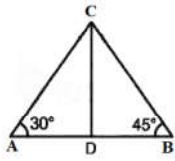
$$(\sec A + \tan A)(\sec A - \tan A) = 1$$

$$\sec A - \tan A = \frac{1}{x} \dots\dots\dots (ii)$$

$$\text{from equation (i) \& (ii), } \sec A = \frac{x^2 + 1}{2x}$$

39.

Sol. (a)



Let CD be the pole and A and B be positions of two persons

⇒ Then CD = 100cm and angle $\angle DAC = 30^\circ$ and angle $\angle DBC = 45^\circ$

$$\Rightarrow \tan 30^\circ = \frac{CD}{AD} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow AD = 100 \times \sqrt{3} \text{ cm}$$

$$\Rightarrow \tan 45^\circ = \frac{CD}{DB} = 1$$

$$\Rightarrow DB = CD = 100 \text{ cm}$$

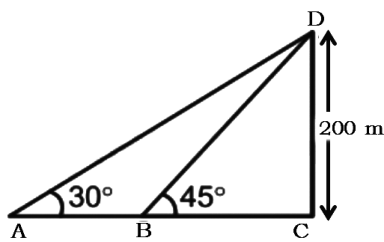
$$\Rightarrow AB = 100\sqrt{3} + 100$$

$$\Rightarrow AB = 273 \text{ cm}$$

The distance between two persons = 273 cm

40.

Sol: (c)



$$\tan 45^\circ = DC / BC = 200 / BC$$

$$\Rightarrow 1 = 200 / BC$$

$$\Rightarrow BC = 200 \text{ m}$$

Distance travelled by the boat = AB

$$\tan 30^\circ = DC / AC = DC / (AB + BC)$$

$$\Rightarrow 1/\sqrt{3} = 200 / (AB + 200)$$

$$\Rightarrow AB + 200 = 200\sqrt{3}$$

$$\Rightarrow AB = 346.41 - 200 = 146.41 \text{ m}$$

$$\text{Speed of the boat} = AB / 100 = 146.41/100$$

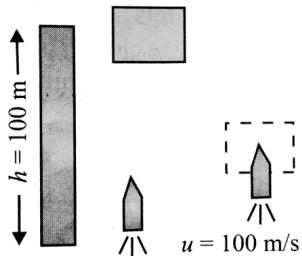
$$\Rightarrow \text{Speed} = 1.464 \text{ m/s} \approx 1.5 \text{ m/s}$$

The correct answer is 1.5 m/s

PART - III : PHYSICS & CHEMISTRY

1.

Sol: (d) 1s



Height of the tower = $s_1 + s_2 = 100\text{m}$.

Where s_1 and s_2 are the displacements covered by wooden block and bullet respectively before the collision.

$$\text{For the block: } s_1 = \frac{1}{2}gt^2 = \frac{1}{2} \times 9.8 \times t^2 = 4.9t^2 \quad \dots\dots (i)$$

$$\text{For the bullet } s_2 = ut - \frac{1}{2}gt^2 = 100t - \frac{1}{2} \times 9.8 \times t^2$$

$$s_2 = 100t - 4.9t^2 \quad \dots\dots(ii)$$

Since, $s_1 + s_2 = 100\text{ m}$

adding (i) and (ii) We get,

$$4.9t^2 + 100t - 4.9t^2 = 100$$

$$\Rightarrow 100t = 100 \quad \Rightarrow \quad t = 1\text{s.}$$

2.

Sol. (b)

$$g = \frac{GM}{R^2} \text{ (g for Earth), and g for planet } \Rightarrow g_p = \frac{GM_p}{R_p^2},$$

$$M_p = 2M, R_p = 2R$$

$$g_p = \frac{G \cdot 2M}{(2R)^2} = \frac{g}{2} = \frac{9.8}{2}, g_p = 4.9 \text{ m/s}^2$$

3.

Sol: (c)

The equation relating momentum P to kinetic energy k is given by

$$k = \frac{P^2}{2m} \quad \text{Or} \quad P^2 = 2mK, P = \sqrt{2mK}$$

$$P \propto \sqrt{E}$$

Here, the kinetic energy of a particle is doubled($2K$),

New momentum P' is given as

$$P' \propto \sqrt{2K} \Rightarrow P' \propto \sqrt{2} P$$

Therefore, momentum becomes $\sqrt{2}$ times.

4.

Sol: (a)

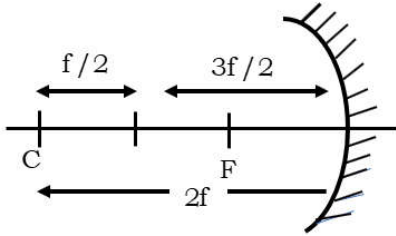
There are 10 wavelengths from 5th crest to 15th crest.

Total distance of 10 wavelengths = 20 cm.

1 wavelength = $20/10 = 2$ cm

5.

Sol: (a)



$$u = -\frac{3f}{2}$$

using mirror formula

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v} \quad \text{OR} \quad \frac{1}{f} - \frac{1}{u} = \frac{1}{v} \Rightarrow -\frac{1}{f} + \frac{2}{3f} = \frac{1}{v} \quad (\text{Substituting for } u)$$

$$-\frac{1}{3f} = \frac{1}{v} \Rightarrow v = -3f$$

6.

Sol: (a)

The diametrically opposite points divide the resistance into half of the total resistance.

($\because R \propto \ell$ and length becomes half)

$$\text{Resistance of each semi circle} \quad R_1 = R_2 = \frac{5}{2} = 2.5\Omega$$

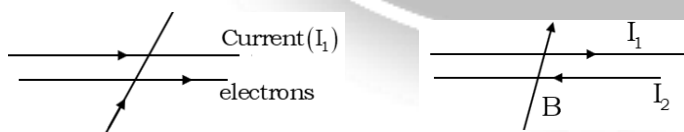
Since, these resistance are connected in parallel

So, equivalent resistance

$$R_{eq} = \frac{R_1 R_2}{R_1 + R_2} = \frac{2.5 \times 2.5}{2.5 + 2.5} = 1.25\Omega$$

7.

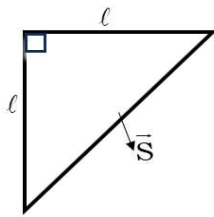
Sol: (b)



Magnetic field due to current through a linear conductor from the left to right at a point below the conductor is acting horizontally into the paper. The electron beam moving from left to right will cause the current right to left. The force on the electrons will be vertically downwards according to Fleming's hand rule.

8.

Sol: (a)



$$\vec{S} = \sqrt{l^2 + l^2} = \sqrt{2l^2} = l\sqrt{2} = 4\sqrt{2} \text{ cm}$$

$$\text{Average velocity} = \frac{\vec{S}}{t} = \frac{4\sqrt{2}}{15 \times 60\text{s}} = \frac{\sqrt{2}}{225} \text{ cm s}^{-1}$$

9.

Sol. (b)

Given: Angle of prism, $A = 60^\circ$, Angle of incidence, $i = 40^\circ$, Angle of emergence $e = 40^\circ$

We know for a prism

$$A + D = i + e$$

$$\text{So, } D = i + e - A$$

$$D = 40^\circ + 40^\circ - 60^\circ$$

$$\text{Hence } D = 20^\circ$$

10.

Sol. (a)

Here, $m = 3$,

$$v - u = 40 \text{ cm.} \dots\dots(1)$$

$$\text{So, } m = \frac{-v}{u} \Rightarrow 3 = \frac{-v}{u}$$

$$\Rightarrow v = -3u \dots\dots(2)$$

From (1) and (2) We get

$$-3u - u = 40$$

$$\Rightarrow u = -10 \text{ cm}$$

$$\text{Now, } v = -3u \Rightarrow v = +30 \text{ cm}$$

$$\text{We know, } \frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

$$\text{So } f = \frac{uv}{u+v} \text{ or } f = \frac{-300}{20} = -15 \text{ cm}$$

11.

Sol: (d)

Given $v = -50 \text{ cm}$ and $u = -25 \text{ cm}$

using lens formula

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}, \quad \frac{1}{-50} - \frac{1}{-25} = \frac{1}{f}$$

$$\frac{1}{f} = \frac{-1+2}{50}$$

$$\therefore f = 50 \text{ cm}$$

12.

Sol. (b)

As we know that if the current flowing through the resistor is I then power is given by $P = I^2R$

$$\therefore P_1 = I^2R$$

If the current flowing through the resistor is increased by 100%

$$\text{Then current becomes} = I + (I \times 100 / 100)\% = 2I$$

Now power

$$P_2 = (2I)^2R = 4I^2R$$

Change in percentage of power is

$$(P_2 - P_1) / (P_1) \times 100\% =$$

$$(4I^2R - I^2R) / (I^2R) \times 100\% = 300\%$$

13.

Sol. (c)

If the key in the arrangement is taken out (the circuit is made open) then there will be no current in the circuit that implies no magnetic field due to the circuit. So only the earth's magnetic field will be present in that region and the field due to it will be straight lines parallel to each other over the horizontal plane ABCD.

14.

Sol. (c)

For. Bulb B1: $P = 100W$

$$V = 250V$$

$$\text{Resistance } R_1 = V^2 / P = (250 \times 250) / 100 = 625\Omega$$

Bulb B2: $P = 100W$

$$V = 200V$$

$$\text{Resistance } R_2 = V^2 / P = (200 \times 200) / 100 = 400\Omega$$

as both are in series, combined resistance R is

$$R = 425 + 600 = 1025\Omega$$

Total current $I = \text{total Voltage} / \text{Total Resistance}$

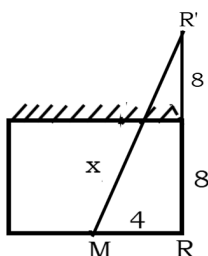
$$= 250 / 1025 = 10 / 41A$$

potential difference Across B2

$$R \times I = 400 \times 10 / 41 = 4000 / 41V \approx 98V$$

15.

Sol: (d)



Perpendicularly the image of R is 8 m behind the mirror (say R'). However, with respect to camera at M , it is the diagonal distance (MR'), which is more than 16 m.

16.

Sol. (a)

Lime juice is acidic in nature and rest all are basic in nature.

17.

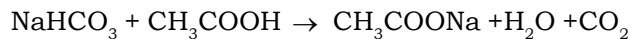
Sol. (b)

All metal oxides react with O_2 gives metal hydroxide. $M + H_2O \rightarrow$ metal hydroxides + H_2 .

18.

Sol. (b)

I, II, and III



→ In this reaction CO_2 gas is evolved, it is colourless and odourless gas and turns lime water milky and also extinguishes burning splinter.

19.

Sol. (c)

Vanilla essence is used as an acid base indicator by a visually impaired student.

20.

Sol. (d)

CO_2 and SO_2 gases turns lime water milky.

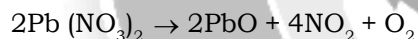
21.

Sol. (d)

Cu metal does not react with dilute acid to produce H_2 gas it is very less reactive metal and placed in the below of Hydrogen in reactivity series.

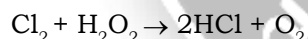
22.

Sol. (d)



23.

Sol. (b)



In this reaction peroxide change to oxygen. So, this behave as a reducing agent.

24.

Sol. (b)

Chemical formula of chili salt peter is $NaNO_3$.

25.

Sol. (b)

II, III, IV, Non metal combine together they form covalent compound.

26.

Sol. (c)

On the basis of reactivity series.

27.

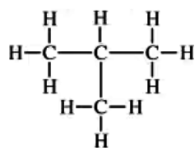
Sol. (d)

Al_2O_3 is amphoteric oxide it react with both acid and base.

28.

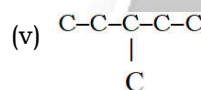
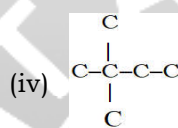
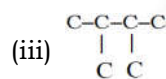
Sol. (d)

Total covalent bond in Iso-butane is 13



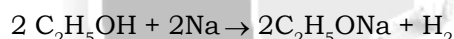
29.

Sol. (c)

Total isomers of hexane (C₆H₁₄) is 5(i) C-C-C-C-C-C (ii) $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ | \\ \text{C} \end{array}$ 

30.

Sol: (b)



PART - IV : BIOLOGY

1.

Sol. (c) hydrolysis of water

In photosynthesis, oxygen is released during the light-dependent reactions. This occurs when water molecules are split (a process known as photolysis) to provide electrons, protons, and oxygen. The oxygen produced comes from the hydrolysis (splitting) of water molecules.

2.

Sol. (d) All of these

Photosynthesis is essential for the survival of all living organisms, directly or indirectly. Plants produce oxygen and organic compounds like glucose through photosynthesis, which are crucial for the survival of animals and other organisms. Animals rely on plants for food (directly or indirectly) and for oxygen, making photosynthesis fundamental for the entire ecosystem.

3.

Sol. (c) Is equal for all living cells

Respiration in plants occurs continuously, both during the day and night, to produce energy for growth, development, and various metabolic processes. It involves the breakdown of glucose to release energy in the form of ATP, which is essential for the plant's survival and growth.

4.

Sol. (a) Partial oxidation of food

Aerobic respiration produces more usable chemical energy than fermentation because fermentation involves the partial oxidation of food (glucose), while aerobic respiration involves the complete oxidation of glucose. In fermentation, the energy yield is much lower, and it produces byproducts like lactic acid or alcohol, whereas aerobic respiration fully breaks down glucose into carbon dioxide and water, releasing much more energy.

5.

Sol: (b) Adrenal

The life-saving hormone, *adrenaline* (also called epinephrine), is secreted by the adrenal glands. This hormone plays a critical role in the body's "fight or flight" response by increasing heart rate, dilating air passages, and increasing blood flow to muscles, helping the body respond to stress or danger.

6.

Sol: (b)

In Mendel's pea plant experiments, he studied two traits independently: seed shape (round vs. wrinkled) and seed color (yellow vs. green). These traits follow independent inheritance as per Mendel's law of independent assortment.

When Mendel crossed a plant with the genotype *RrYy* (heterozygous for both traits) with another *RrYy* plant, the resulting offspring exhibited a phenotypic ratio of 9:3:3:1:

- *9*: Round, Yellow (both dominant traits)
- *3*: Round, Green (dominant shape, recessive color)
- *3*: Wrinkled, Yellow (recessive shape, dominant color)
- *1*: Wrinkled, Green (both recessive traits)

Thus, the expected ratio of offspring when two traits are independently inherited is *9 : 3 : 3 : 1*.

7.

Sol: (b) The concentration of water molecules in surrounding medium is higher than water molecules concentration in the cell

A cell will swell up when it is placed in a hypotonic solution, which means the concentration of water molecules outside the cell is higher than inside. As a result, water moves into the cell by osmosis, causing the cell to take in water and swell.

8.

Sol: (c) DNA and protein

Chromosomes are composed of both *DNA* (deoxyribonucleic acid) and *protein*. The DNA carries genetic information, while proteins, such as histones, help package and organize the DNA into a compact structure within the chromosome.

9.

Sol: (c) (iii) and (iv)

Ribosomes are primarily responsible for the synthesis of proteins (which includes enzymes), but they do not play a role in the manufacture of starch molecules and hormones. Starch is a carbohydrate, and its synthesis is carried out by enzymes in the cytoplasm and chloroplasts, not ribosomes.

(i) : Ribosomes do help in the manufacture of protein molecules, so this statement is true.

(ii): Ribosomes help in the manufacture of enzymes, as enzymes are proteins.

(iii): Ribosomes do not help in the manufacture of some hormones.

(iv): Ribosomes do not help in the manufacture of starch molecules, as starch is not a protein.

10.

Sol. (a) **Tracheids**

Tracheids are elongated, hollow cells that transport water between cells without the need for pores. The cell walls of tracheids have pits, but these are not pores, and are instead thinned-out cell walls. “Companion cells and sieve tubes are part of phloem tissue and have perforated cell walls. Vessels are part of xylem and also have perforated cell walls.

11.

Sol. (b) Columnar epithelium.

Here's the explanation:

- (a) **Stratified squamous epithelium:** This type of epithelium is found in areas that undergo abrasion, such as the skin, mouth, and esophagus. It is not responsible for the absorption of digested food in the intestine.
- (b) **Columnar epithelium:** The epithelial cells lining the inner surface of the intestine are primarily columnar cells. These cells have microvilli on their surface, which increase the surface area for absorption. They are specialized for the absorption of nutrients from the digested food.
- (c) **Spindle fibres:** Spindle fibers are involved in cell division, not in absorption, so they are not relevant here.
- (d) **Cuboidal epithelium:** Cuboidal epithelium is found in areas like the kidneys and glands, where secretion and absorption occur, but it is not the main type of epithelium responsible for absorption in the intestine.

12.

Sol: (c) localised and dividing cells

Here's the explanation:

- (a) **Localised and permanent:** Meristematic tissues are localized in certain regions of the plant but are not permanent. They are actively dividing tissues that give rise to new cells, unlike permanent tissues, which do not divide.
- (b) **Not limited to certain regions:** Meristematic tissues are actually localized to specific regions, such as the tips of roots and shoots (apical meristems), and in the cambium (lateral meristem), so this option is incorrect.
- (c) **Localised and dividing cells:** Meristematic tissues are found in specific regions and are characterized by the presence of actively dividing cells. These tissues are responsible for the growth of plants.
- (d) **Growing in volume:** While meristematic tissues contribute to the growth of the plant, they do so through cell division, not by merely growing in volume. The cells divide and differentiate into various types of cells.

13.

Sol: (c) Insulin and glucagon will decrease

Here's the explanation:

The pancreas plays a crucial role in regulating blood sugar levels by secreting two important hormones:

Insulin: This hormone helps lower blood sugar levels by promoting the uptake of glucose into cells.

Glucagon: This hormone helps raise blood sugar levels by promoting the release of glucose from the liver into

If the pancreas stops functioning, it will be unable to secrete insulin and glucagon. As a result:

The *insulin levels* will decrease, leading to higher blood sugar levels because glucose is not being taken up by cells efficiently.

The *glucagon levels* will also decrease, impairing the body's ability to release stored glucose from the liver when blood sugar levels drop.

Thus, the correct answer is *(c) Insulin and glucagon will decrease* because both hormones are secreted by the pancreas, and without its function, their levels would fall.

14.

Sol: (a) Estrogen*.

Here's the explanation:

- (a) **Estrogen***: Estrogen is the primary hormone responsible for the development of secondary sexual characteristics in females, such as the growth of breasts, widening of the hips, and the regulation of the menstrual cycle.
- (b) **Progesterone***: Progesterone plays a key role in the menstrual cycle and pregnancy, but it is not directly responsible for the development of secondary sexual characteristics in females.
- (c) **Testosterone***: Testosterone is the primary male sex hormone. Although females also produce small amounts of testosterone, it is not responsible for secondary sexual characteristics in females.
- (d) **Prolactin***: Prolactin is involved in milk production after childbirth but does not contribute to the development of secondary sexual characteristics.

Thus, the correct answer is *(a) Estrogen*, as it is the hormone responsible for the development of secondary sexual characteristics in females.

15.

Sol: (d) no enzymes

Here's the explanation:

- (a) **Heparin***: Heparin is an anticoagulant, and it is produced by the liver, but it is not a component of bile. Bile does not contain heparin.
- (b) **Amylase***: Amylase is an enzyme that breaks down starch into sugars. It is produced by the pancreas and saliva, not the liver. Bile does not contain amylase.
- (c) **Lipase***: Lipase is an enzyme that breaks down fats. While lipase is important for fat digestion, it is secreted by the pancreas, not the liver. Bile does not contain lipase.
- (d) **No enzymes**: Bile, which is produced by the liver and stored in the gallbladder, contains bile salts, bilirubin, and cholesterol, but it does **not** contain enzymes. Bile aids in the digestion and absorption of fats by emulsifying them, but it does not have digestive enzymes.