**SOLUTIONS OF PRACTICE PAPER - 1**
**MATHEMATICS - 10**

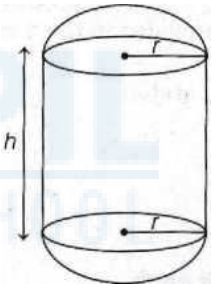
**Sol 1**. (a) The probability of an impossible event is 0.

**Sol 2.** (c) On a die, there are six numbers 1,2,3,4,5 and 6.
∴ Total number of possible outcomes = 6
Number on dice which are greater than 4 = 5, 6
∴ Favourable number of elementary events = 2
∴ Required probability = $\frac{2}{6} = \frac{1}{3}$

**Sol 3.** (b) We have, $\sin^2\theta + \frac{1}{1+\tan^2\theta}$
$= \sin^2\theta + \frac{1}{\sec^2\theta}$ [∵ $\sec^2 A = 1 + \tan^2 A$]
$= \sin^2\theta + \cos^2\theta$ [∵ $\sec A = \frac{1}{\cos A}$]
= 1 [∵ $\sin^2 A + \cos^2 A = 1$]

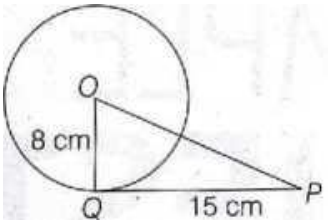
**Sol 4.** (d) We know that area of sector A of radius r and length of arc / is given by
$A = \frac{1}{2}lr$
∴ $A = \frac{1}{2} \times 3.5 \times 5\ 2$
= $8.75 cm^2$

**Sol 5**. (c)




Total curved surface area
= Curved surface area of cylinder
+ 2 × Curved surface area of hemispheres
= 2 πrh + 2 × (2 $\pi r^2$)
= 2 πrh + $4\pi r^2$

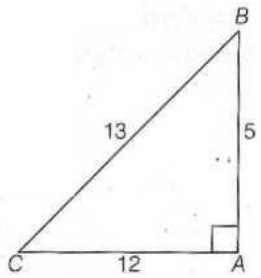
**Sol 6**. (b) Given, OQ = 8 cm and PQ = 15 cm.




In right angled ΔOPQ, using Pythagoras theorem
$OP = \sqrt{OQ^2 + QP^2} = \sqrt{8^2 + 15^2}$
$= \sqrt{64 + 225} = \sqrt{289}$ = 17 cm

**Sol 7.** (b) Let 10 observations be $x_1, x_2, x_3, \ldots, x_{10}$
Given, $\frac{x_1 + x_2 + x_3 + \ldots + x_{10}}{10} = 12.5$ … (i)
Now, if each observation multiplied by 5, then new mean = $\frac{5x_1 + 5x_2 + \ldots + 5x_{10}}{}$
$= \frac{5(x_1 + x_2 + \ldots + x_{10})}{10}$ [using Eq. (i)]
= 5 × 12.5 = 62.5

**Sol 8.** (c) With reference to ∠B, we have Base = AB = 5, perpendicular = AC = 12 and hypotenuse = BC =13




$\therefore \sin B = \frac{AC}{BC} = \frac{12}{13}$
and $\tan B = \frac{AC}{AB} = \frac{12}{5}$

**Sol 9.** (b) $3 \sin 30° - 4\sin^3 60°$
$= 3 \times \frac{1}{2} - 4\left(\frac{\sqrt{3}}{2}\right)^2 = \frac{3}{2} - 4 \times \frac{3\sqrt{3}}{8}$
$= \frac{3}{2} - \frac{3\sqrt{3}}{2} = \frac{3-3\sqrt{3}}{2} = \frac{3(1-\sqrt{3})}{2}$

**Sol 10**. (c) We know that
Mode $= 3$ (Median) –2 (Mean)
$=3(143) - 2(143.06)$
$=429 - 286.12 = 142.88$

**Sol 11.**The given equations can be re-written as
$4x + ky - 1 = 0$ and $6x - 10y - 14 = 0$
On comparing with $a_1x + b_1y + c_1 = 0$ and
$a_2x + b_2y + c_2 = 0$, we get
$a_1 = 4, b_1 = k, c_1 = -1$
and $a_2 = 6, b_2 = -10, c_2 = -14$
For unique solution,
$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$
$\Rightarrow \frac{4}{6} \neq \frac{k}{-10}$
$\Rightarrow k \neq -\frac{20}{3}$
Thus, given lines have a unique solution for all real values of k, except - $\frac{20}{3}$.

**Sol 12.** (c) Given, AP is 21, 18, 15, ...
Here, a = 21 and d = 18 – 21 = –3
Let n th term of given AP be –81.
Then, $a_n = -81$
$\Rightarrow a + (n-1)d = -81$ [$\because a_n = a + (n-1)d$] …(i)
On putting the values of a and d in Eq. (i), we get
$21 + (n-1) \times (-3) = -81$
$\Rightarrow 21 - 3n + 3 = -81$
$\Rightarrow 24 - 3n = -81$
$\Rightarrow -3n = -81 - 24$
$\therefore n = \frac{-105}{-3} = 35$
Hence, 35th term of given AP is -81.

**Sol 13.** (c) AB = $\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$

**Sol 14.** (b) Given, a = 2, $a_{20} = 62$ and n = 20
Now, sum of first 20 terms

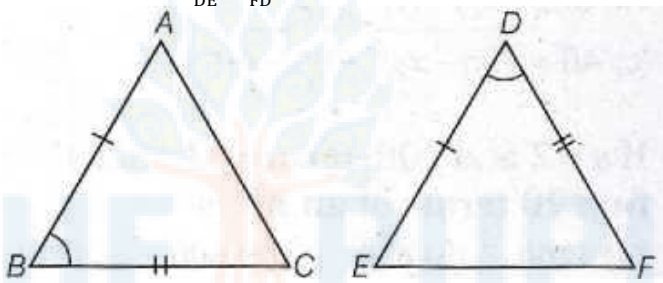
$S_{20} = \frac{20}{2}(2 + 62)$ [$\because S_n = \frac{n}{2}(a + a_n)$]
$= 10 \times 64 = 640$

**Sol 15.** (d) HCF (a, b) = 1
LCM (a, b) = ab
$\therefore$ HCF (a, 6) × LCM (a, b) = 1 × ab = ab

**Sol 16**. (b) Let α and β be the zeroes of ($mx^2 – 6x - 6$).
Here, a = m, b = –6 and c = –6
Given, αβ = – 3
$\therefore \frac{c}{a} = -3 \Rightarrow \frac{-6}{m} = -3 \Rightarrow m = 2$

**Sol 17**. (a) Given, $2x^2 – 5x – 3 = 0$
Splitting the middle term, we get
$2x^2 - 6x + x - 3 = 0$
$\Rightarrow 2x(x – 3) + 1(x – 3) = 0$
$\Rightarrow (x – 3)(2x + 1) = 0$
$\Rightarrow x = -\frac{1}{2}, 3$

**Sol 18**. (c) Given, in ΔABC and ΔDEF, $\frac{AB}{DE} = \frac{BC}{FD}$

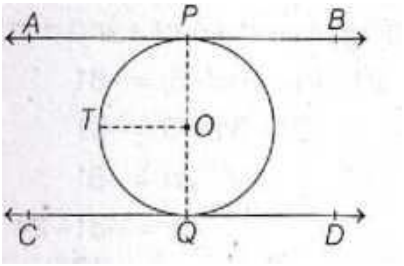



ΔABC and ΔEDF will be similar, if
$\angle B = \angle D$ [by SAS similarity criterion]

**Sol 19**. (b) Assertion $\sin 60°\cos 30^0 + \sin 30°\cos 60°$
$\frac{\sqrt{3}}{2}\left(\frac{\sqrt{3}}{2}\right) + \left(\frac{1}{2}\right)\left(\frac{1}{2}\right) = \frac{3}{4} + \frac{1}{4} = \frac{4}{4} = 1$
So, Assertion is true.
**Reason** We know, sin 90° = 1 and cos 90° = 0
So, Reason is true.
But Reason is not the correct explanation of Assertion.

**Sol 20. (a) Assertion (A)**
Here, $a_1 = 2$, $b_1 = 3$, $c_1 = 5$
and $a_2 = 4$, $b_2 = 6$, $c_2 = 7$ [$\because k = 6$]
So, $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ $\left[\because \frac{2}{4} = \frac{3}{6} \neq \frac{5}{7}\right]$
So, the given system of equations has no solution (i.e. inconsistent).
So, the Assertion is true.
**Reason (R)** $a_1x + b_1y + c_1 = 0$
and $a_2x + b_2y + c_2 = 0$
We know, for the system of equations to be inconsistent,
$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$
So, both Assertion and Reason are true and Reason is a correct explanation of Assertion.

**Sol 21.** Given AB and CD are two parallel tangents at the point P and Q of a circle with centre 0.
To prove POQ is a diameter of the circle.




(1)

**Construction** Join OP and OQ and draw OT || AS.
**Proof** ∠APO + ∠TOP = 180° [∵ OT || AB]
⇒ 90° + ∠TOP = 180° [∵ OP 1 AB]
⇒ ∠TOP = 180° - 90° = 90°
Similarly, ∠TOQ = 90°
∴ ∠TOP + ∠TOQ = 90° + 90° = 180°
Since, POQ is a straight line.
Hence, POQ is a diameter of the circle with centre O. **Hence proved.** (1)

**Sol 22.** Out of 25 numbers, 1,2,3,…, 25 one number can be chosen in 25 ways.
∴ Total number of elementary events = 25 (1)
The number selected will be a prime number, if it is chosen from the numbers
2, 3, 5, 7, 11, 13, 17, 19, 23.
∴ Favourable number of elementary events = 9
Hence, required probability = $\frac{9}{25}$ (1)

Or

There are 13 letters in the word 'ASSASSINATION' out of which one letter can be chosen in 13 ways.
∴ Total number of elementary events = 13
(i) There are 6 vowels in the word 'ASSASSINATION'. So, there are 6 ways of selecting a vowel.
Probability of selecting a vowel = $\frac{6}{13}$ (1)
(ii) We have, probability of selecting a consonant
= 1 – Probability of selecting a vowel
= $1 - \frac{6}{13} = \frac{7}{13}$ (1)

**Sol 23**. The sequence goes like this
2, 4, 6, 8, ...
Here, 4 – 2 = 6 – 4 = 8 – 6 = 2
So, it is an AP with first term, a = 2,
common difference, d = 4 – 2 = 2
and total number of terms, n = 15 (1)
∴ Sum of first 15 even natural numbers
$S_{15} = \frac{n}{2}[2a + (n-1)d] = \frac{15}{2}[2 \times 2 + (15-1)2]$
[∵ $S_n = \frac{n}{2}\{2a + (n-1)d\}$]
$= \frac{15}{2}[4+28] = \frac{15}{2} \times 32 = 240$ (1)

**Sol 24**. Since, x = 2 is a root of the equation
$2x^2 + kx - 6 = 0$
∴ $2 \times 2^2 + 2k - 6 = 0$
⇒ $8 + 2k - 6 = 0$
⇒ $2k + 2 = 0 \Rightarrow k = -1$ (1)
On putting k = –1 in the equation $2x^2 + kx - 6 = 0$, we get
$2x^2 - x - 6 = 0 \Rightarrow 2x^2 - 4x + 3x - 6 = 0$
⇒ $2x(x - 2) + 3(x - 2) = 0 \Rightarrow (x - 2)(2x + 3) = 0$
⇒ x - 2 = 0 or 2x + 3 = 0
⇒ $x = 2$ or $-\frac{3}{2}$
Hence, the other root is $-\frac{3}{2}$. (1)

**Sol 25**. LHS = cot A + tan A = $\frac{\cos A}{\sin A} + \frac{\sin A}{\cos A}$

$\left[\because \cot\theta = \frac{\cos\theta}{\sin\theta}, \tan\theta = \frac{\sin\theta}{\cos\theta}\right]$

$$= \frac{\cos^2 A + \sin^2 A}{\sin A \cdot \cos A} = \frac{1}{\cos A \cdot \sin A}$$

$[\because \sin^2\theta + \cos^2\theta = 1]$ (1)

$= \frac{1}{\sin A} \cdot \frac{1}{\cos A}$ = cosec A sec A

$\left[\because \operatorname{cosec}\theta = \frac{1}{\sin\theta} \text{ and } \sec\theta = \frac{1}{\cos\theta}\right]$

RHS Hence proved. (1)

Or

We have, $\cos^2 30° + \sin^2 45° - \frac{1}{3}\tan^2 60°$

$= \left(\frac{\sqrt{3}}{2}\right)^2 + \left(\frac{1}{\sqrt{2}}\right)^2 - \frac{1}{3}\left(\sqrt{3}\right)^2$ (1)

$$\left[\because \cos 30° = \frac{\sqrt{3}}{2} \sin 45° = \frac{1}{\sqrt{2}} \text{ and } \tan 60° = \sqrt{3}\right]$$

$= \frac{3}{4} + \frac{1}{2} - \frac{3}{3} = \frac{3+2}{4} - 1 = \frac{5}{4} - 1 = \frac{5-4}{4} \equiv \frac{1}{4}$ (1)

**Sol 26**. **Given** in figure, two chords AS and CD intersect each other at point P.

To prove (i) $\Delta APC \sim \Delta DPB$

(ii) $AP \cdot PB = CP \cdot DP$

**Proof**

(i) In $\Delta APC$ and $\Delta DPB$,

$\angle APC = \angle DPB$ [vertically opposite angles]

and $\angle CAP = \angle BDP$

[angles in the same segment]

$\therefore \Delta APC \sim \Delta DPB$ [by AA similarity criterion] (1)

(ii) We have, $\Delta APC \sim \Delta DPB$ [proved in part (i)]

$\therefore \frac{AP}{DP} = \frac{CP}{BP}$ (1)

[$\because$ if two triangles are similar, then the ratio of their corresponding sides is equal]

$\therefore AP \cdot BP = CP \cdot DP$

or AP-PB = CP-DP Hence proved. (1)

**Sol 27**. Given, a circle is inscribed in the triangle, whose sides are BC = 8cm, AC = 10 cm and AS = 12 cm.

Let AD = AF = x, BD = BE = y

and CE = CF = z

[$\because$ the length of two tangents drawn from an external point to a circle are equal]

We have, AB = 12

$\Rightarrow$ AD + DB = 12

$\Rightarrow$ x + y = 12 ...(i)

AC = 10

$\Rightarrow$ AF + FC = 10

$\Rightarrow$ x + z – 10 ...(ii)

and BC = 8

$\Rightarrow$ CE + EB = 8

$\Rightarrow$ z + y = 8 ..(iii)(1)

On adding Eqs. (i), (ii) and (iii), we get

2(x + y + z) = 12 + 10 + 8

$\Rightarrow$ x + y + z = $\frac{30}{2}$ = 15 ...(iv)

On putting x + y = 12 from Eq. (i) in Eq. (iv), we get

12 + z = 15

$\Rightarrow$ z = 3

On putting z + y = 8 from Eq. (iii) in Eq, (iv), we get
x + 8 = 15
$\Rightarrow$ x = 7 (1)
On putting x + z = 10 from Eq, (ii) in Eq. (iv), we get
10 + y = 15
$\Rightarrow$ y = 5
Hence, AD = 7 cm, BE = 5 cm and CF = 3cm (1)

**Sol 28.** LHS = $\frac{\sin A+\cos A}{\sin A-\cos A}+\frac{\sin A-\cos A}{\sin A+\cos A}$

$=\frac{(\sin A+\cos A)^2+(\sin A-\cos A)^2}{(\sin A-\cos A)(\sin A+\cos A)}$ (1)

$$=\frac{[\sin^2 A+2\sin A\cos A+\cos^2 A+\sin^2 A-2\sin A\cos A+\cos^2 A}{\sin^2 A-\cos^2 A}$$

$[\because (a\pm b)^2=a^2+b^2\pm 2ab]$ (1)

$$=\frac{2\sin^2 A+2\cos^2 A}{\sin^2 A-\cos^2 A}=\frac{2(\sin^2 A+\cos^2 A)}{\sin^2 A-\cos^2 A}$$

$=\frac{2}{\sin^2 A-\cos^2 A}$ [$\because \sin^2\theta + \cos^2\theta = 1$]
= RHS Hence proved. (1)

Or

LHS = $\frac{\sin\theta-\cos\theta+1}{\sin\theta+\cos\theta-1}=\frac{\tan\theta-1+\sec\theta}{\tan\theta+1-\sec\theta}$
[dividing numerator and denominator by cos θ]

$$=\frac{(\tan\theta+\sec\theta)-1}{(\tan\theta-\sec\theta)+1}$$

$$=\frac{[(\tan\theta+\sec\theta)-1][\tan\theta-\sec\theta]}{[(\tan\theta-\sec\theta)+1][\tan\theta-\sec\theta]}$$

[multiplying and dividing by (tan θ - sec θ)] (1)

$=\frac{(\tan^2\theta-\sec^2\theta)-(\tan\theta-\sec\theta)}{(\tan\theta-\sec\theta+1)(\tan\theta-\sec\theta)}$

[$\because$ (a - b) (a + b) = $a^2 - b^2$]

$=\frac{-1-\tan\theta+\sec\theta}{(\tan\theta-\sec\theta+1)(\tan\theta-\sec\theta)}$

[$\because \tan^2 A - \sec^2 A = -1$] (1)

$=\frac{-(\tan\theta-\sec\theta+1)}{(\tan\theta-\sec\theta+1)(\tan\theta-\sec\theta)}$

$=\frac{-1}{\tan\theta-\sec\theta}$

$=\frac{1}{\sec\theta-\tan\theta}$ = RHS Hence proved. (1)

**Sol 29**. Yes, radius of the park, i.e, inner radius of the park r =1500 m
Width of the footpath around the park = 2 m
Let R be the outer radius of the park including the footpath.
Then, R = 1500 + 2 = 1502 m (1)
Now, area of footpath= $\pi R^2 - \pi r^2$
= $\pi(R^2 - r^2) = 3.14[(1502)^2 - (1500)^2]$ (1)
= 3.14[(1502 + 1500) (1502 – 1500)]
= 314 × 6004 = 18852.56$m^2$
Total cost of construction of the footpath at the rate of Rs. 20 per $m^2$ = 20. × 18852.56
= Rs. 377051.2 (1)

**Sol 30**. Given equation is $\frac{1}{x+4}-\frac{1}{x-7}=\frac{11}{30}, x\neq -4,7$

$\Rightarrow \frac{(x-7)-(x+4)}{(x+4)(x-7)}=\frac{11}{30}$

$\Rightarrow \frac{x-7-x-4}{x^2-7x+4x-28}=\frac{11}{30}$

$\Rightarrow \frac{-11}{x^2-3x-28}=\frac{11}{30}$

$\Rightarrow \frac{-1}{x^2-3x-28} = \frac{1}{30}$
$\Rightarrow -30 = x^2 - 3x - 28$
$\Rightarrow x^2 - 3x + 2 = 0$ (1)
On comparing with the standard quadratic equation $ax^2 + bx + c = 0$, we get
$a = 1, b = -3$ and $c = 2$
By using quadratic formula, we get
$x = \frac{-b \pm \sqrt{2^2-4ac}}{2a}$
$= \frac{-(-3) \pm \sqrt{(3)^2-4(1)(2)}}{2\times 1}$ (1)
$= \frac{3 \pm \sqrt{9-8}}{2} = \frac{3 \pm \sqrt{1}}{2} = \frac{3 \pm 1}{2}$
$\Rightarrow x = \frac{3+1}{2}$ or $x = \frac{3-1}{2} x = \frac{4}{2}$ or $x = \frac{2}{2}$
$\therefore x = 2$ or $x = 1$
Hence the roots of the given equation are 2 and 1. (1)

Or

Let $\frac{2x+3}{x-3} = y$ …(i)
Then, $\frac{x-3}{2x+3} = \frac{1}{y}$ (1/2)
Therefore, the given equation reduces to
$2y - 25\frac{1}{y} = 5$
$\Rightarrow 2y^2 - 25 = 5y$
$\Rightarrow 2y^2 - 5y - 25 = 0$
$\Rightarrow 2y^2 – 10y + 5y – 25 = 0$ [by factorisation method]
$\Rightarrow 2y(y–5) + 5 (y – 5) = 0$
$\Rightarrow (y – 5) (2y + 5) = 0$
$\Rightarrow y = 5$ or $y = \frac{-5}{2}$ (1)
Now, putting $y = 5$ in Eq. (i), we get
$\frac{2x+3}{x-3} = \frac{5}{1}$
$\Rightarrow 5x – 15 = 2x + 3$
$\Rightarrow 3x = 18$
$\Rightarrow x = 6$ (1/2)
Again, putting $y = \frac{5}{2}$ in Eq. (i), we get
$\frac{2x+3}{x-3} = \frac{5}{1}$
$\Rightarrow 5x + 15 = 4x + 6$
$\therefore 9x = 9$
$\Rightarrow x = 1$
Hence, the values of x are 1 and 6. (1)

**Sol 31.** Given, linear equations are x - 3y = 2
$\Rightarrow x - 3y = 2$
$\Rightarrow x - 3y - 2 = 0$ …(i)
and $-2x + 6y = 5$
$\Rightarrow -2x + 6y - 5 = 0$ …(ii)
Here, $a_1 = 1$, $b_1 = -3$, $c_1 = -2$
and $a_2 = -2$, $b_2 = 6$, $c_2 = -5$ (1)
Now $\frac{a_1}{a_2} = \frac{1}{-2} = -\frac{1}{2}, \frac{b_1}{b_2} = \frac{-3}{6} = -\frac{1}{2}$
and $\frac{c_1}{c_2} = \frac{-2}{-5} = \frac{2}{5}$
Here, $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ (1)
So, the paths represented by the equations are parallel, i.e. not cross (intersect) each other. (1)

**Sol 32.** Given, $a + \sqrt{b} = c + \sqrt{d}$
If a = c, then $a + \sqrt{b} = a + \sqrt{d}$
$\Rightarrow \sqrt{b} = \sqrt{d}$
$\Rightarrow$ b = d [squaring both sides]
If a ≠ c, then there exists a positive rational number x such that, a = c + x.
Now, $a + \sqrt{b} = c + \sqrt{d}$
$\Rightarrow c + x + \sqrt{b} = c + \sqrt{d}$ [$\because$ a = c + x]
$\Rightarrow x + \sqrt{b} = \sqrt{d}$ ...(i) (1)
$\Rightarrow (x + \sqrt{b})^2 = \left(\sqrt{d}\right)^2$ [squaring both sides]
$\Rightarrow x^2 + b + 2x\sqrt{b} = d$
$\Rightarrow x^2 + 2x\sqrt{b} + b - d = 0$
[$\because (A + B)^2 = A^2 + B^2 + 2AB$]
$\Rightarrow 2x\sqrt{b} = d - b - x^2$
$\therefore \sqrt{b} = \frac{d-b-x^2}{2x}$
Since, d, x and b are rational numbers and x > 0.
So, $\frac{d-b-x^2}{2x}$ is a rational.
Then, $\sqrt{b}$ is a rational number. (2)
Hence, b is the square of a rational number.
From Eq. (i), we get
$\sqrt{d} = x + \sqrt{b}$
Also, $\sqrt{d}$ is a rational.
So, d is the square of a rational number.
Hence, either a = c and b = d or b and d are the squares of rationals. **Hence proved.** (2)

Or

The number of participants in each room must be the HCF of 60, 84 and 108. (1)
Now, prime factors of numbers 60, 84 and 108 are
$60 = 2^2 \times 3 \times 5$,
$84 = 2^2 \times 3 \times 7$
and $108 = 2^2 \times 3^3$
HCF of (60, 84, 108) = $2^2 \times 3 = 12$ (2)
Therefore, in each room maximum 12 participants can be seated,
$\therefore$ Total number of participants = 60 + 84 + 108
= 252
$\therefore$ Number of rooms required= $\frac{252}{12}$ = 21 (2)

**Sol 33**. Table for cumulative frequency is given below

| Class interval | Frequency | Cumulative frequency |
|---|---|---|
| 0-6 | 4 | 4+0 = 4 |
| 6-12 | X | 4 + x = (4 + x) (c f) |
| 12-18 | 5(f) | 5 + (4 + x) = 9 + x |
| 18-24 | Y | y + (9 + x) = 9 + x + y |
| 24-30 | 1 | 1 + (9 + x + y) = 10 + x + y |

(1)

Since, N =20
$\therefore$ 10 + x + y = 20
$\Rightarrow$ x + y = 20 - 10
$\Rightarrow$ x + y = 10 ...(i)
Also, we have, median = 14.4
which lies in the class interval 12-18. (1)
$\therefore$ The median class is 12-18, such that
l = 12, f = 5, c f = 4 + x and h = 6

$\therefore$ Median = $l + \left(\frac{\frac{N}{2} - cf}{f}\right) \times h$

$\Rightarrow$ 14.4 = 12 + $\left[\frac{10-(4+x)}{5}\right] \times 6$

$\Rightarrow$ 14.4 – 12 = $\frac{6-x}{5} \times 6$

$\Rightarrow$ 2.4 = $\frac{36-6x}{5}$

$\Rightarrow$ 12 = 36 – 6x

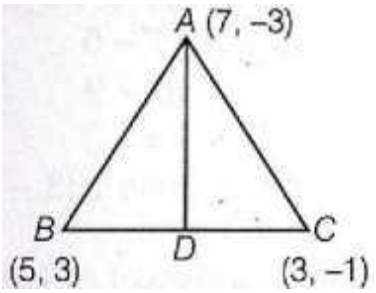
$\Rightarrow$ 6x = 24 $\Rightarrow$ x = 4 (1)

Now, put the value of x in Eq. (i), we get

4 + y = 10 $\Rightarrow$ y = 10 – 4 = 6

Thus, x = 4 and y = 6 (1)

**Sol 34**. The median from a vertex of a triangle bisects the opposite side, to that vertex. So, let AD be the median through A then D be the mid-point of the side BC.




Now, coordinates of D = $\left(\frac{5+3}{2}\frac{3-1}{2}\right) = (4, 1)$

[$\because$ coordinates of mid -point of line segment joining ($x_1$, $y_1$) and ($x_2$, $y_2$) = $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$]

and length of median AD is given by

$AD = \sqrt{(x_2 - x_1)^2 + (y^2 + y_1)^2}$

[by distance formula] (1)

= $\sqrt{(4-7)^2 + (1+3)^2} = \sqrt{(-3)^2 + (4)^2}$

$\sqrt{9+16} = \sqrt{25}$ = 5 units (1)

Also, OA = $\sqrt{(0-7)^2 + (0+3)^2}$

= $\sqrt{749+9} = \sqrt{58}$ units (1)

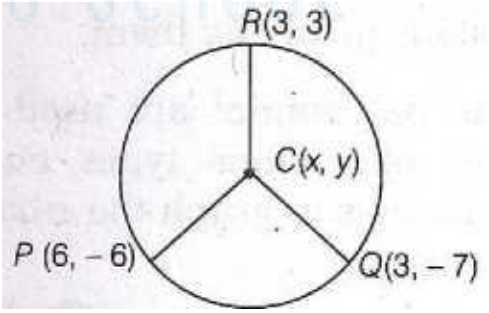
Or

Let C (x, y) be the centre of the circle passing through the points P (6, - 6), Q (3, - 7) and R (3, 3). .

(2)

Then, PC = QC = CP [radii of circle]

Now, PC = QC




$\Rightarrow$ $PC^2 = QC^2$ [squaring both sides]

$\Rightarrow$ $(x - 6)^2 + (y + 6)^2 = (x - 3)^2 + (y + 7)^2$

[$\because$ distance = $\sqrt{(x_2 - x_1)^2 + (y^2 - y_1)^2}$]

$\Rightarrow$ $x^2 – 12.x + 36 + y^2 + 12y + 36$

= $x^2 - 6x + 9 + y^2 + 14y + 49$

[$\because$ $(a – b)^2 = a^2 + b^2 – 2ab$] (1)

$\Rightarrow$ –12x + 6x + 12y -14y + 72 - 58 = 0

$\Rightarrow$ – 6x – 2y + 14 = 0

$\Rightarrow$ 3x + y – 7 = 0

[dividing by – 2] ...(i)

and QC = CR

$\Rightarrow$ QC = CR [squaring both sides]

$\Rightarrow$ $(x – 3)^2 + (y + 7)^2 = (x – 3)^2 + (y – 3)^2$

$\Rightarrow$ $(y + 7)^2 = (y – 3)^2$ (1)

$\Rightarrow$ $y^2 +14y + 49 = y^2 – 6y + 9$

$\Rightarrow$ 20y + 40 = 0

$\Rightarrow$ y = $-\frac{40}{20}$ = – 2 ...(ii)

On putting y = – 2 in Eq. (i), we get

3x – 2 – 7 = 0

$\Rightarrow 3x = 9$
$\Rightarrow x = 3$
Hence, the centre of circle is (3,-2). (1)

**Sol 35**. Given, diameter of hemispherical bowl = 36 cm
$\Rightarrow$ Radius (r) = 18 cm
Volume of liquid in the bowl $= \frac{2}{3}\pi r^3$

$$= \frac{2}{3} \times \pi \times 18 \times 18 \times 18$$

$=3888\pi$ cm$^3$ (1)
Amount of the |iquid wasted $= 3888\pi \times \frac{10}{100}$
$=\frac{3888\pi}{10}$ cm$^3$ (1)
Liquid transferred into the bottles
$=3888\pi - \frac{3888\pi}{10}$ cm$^3$
$=\frac{34992\pi}{10}$ cm$^3$ …(i)
Also, given diameter of bottle = 6 cm
$\Rightarrow$ Radius $(r) = 3$ cm (1)
Let 17 be the height of the bottle
Volume of bottle $= \pi r^2 h = \pi \times 3 \times 3 \times h = 9\pi h$ cm$^3$
Volume of 72 such bottles $= 72 \times 9\pi h$ cm$^3$
$=648\pi h$ (1)
Now, volume of 72 bottles
= Volume of liquid transferred lnto the bottles
$\Rightarrow 648\pi h = \frac{34992\pi}{10}$ [using Eq. (i)]
$\Rightarrow h = 54$ cm
∴ Height of each bottle is 54 cm. (1)

**Sol 36**. (i) Since, graph of given polynomial intersect X-axis at 3 points. So, it has three zeroes. Hence, it is a cubic polynomial.

(ii) The graph of given polynomial intersect X-axis at points -4, –1 and 2. So, zeroes of given polynomial are -4, -1 and 2.
(iii) On comparing given polynomial
$2x^3 – 5x^2 – 4x + 8$ with $ax^3 + bx^2 + cx + d$, we get
a = 2, b = –5, c = –14 and d = 8
Sum of roots, $\alpha + \beta + \gamma = \frac{-b}{a}$
$=\frac{-(-5)}{2} = \frac{5}{2}$
Product of roots, $\alpha\beta\gamma = \frac{-d}{a} = \frac{-8}{2} = -4$

Or

Sum of roots, α + β = -3 = — a
and product of roots, $\alpha\beta = 2 = \frac{c}{a}$
∴ Quadratic polynomial is $x^2 + 3x + 2$.

**Sol 37**. (i) In ∆ABC and ΔLOC, we have
∠CAB = ∠CLO = 90°
∠C = ∠C [common]
∴ By AA-criterion of similarity,
∆CAB ~ ∆CLO
$\Rightarrow \frac{CA}{CL} = \frac{AB}{LO}$

$\Rightarrow \frac{p}{x} = \frac{a}{h} = x = \frac{ph}{a}$ …(i)

(ii) In ΔALO and ΔACD, we have
$\angle ALO = \angle ACD = 90°$
$\angle A = \angle A$ [common]
$\therefore \Delta ALO - -\Delta ACD$ [by AA similarity criterion]
$\Rightarrow \frac{AL}{AC} = \frac{OL}{DC}$
$\Rightarrow \frac{y}{p} = \frac{b}{b} \Rightarrow y = \frac{ph}{b}$ …(ii)
(iii) From Eqs. (i) and (ii), we get
$x + y = \frac{ph}{a} + \frac{ph}{b} = ph\left(\frac{1}{a} + \frac{1}{b}\right)$
$\Rightarrow p = ph\left(\frac{a+b)}{ab}\right) [\because x + y = CL + LA = p]$
$\Rightarrow h = \frac{ab}{a+b} m$

Or

If a = 5 m and b = 10m.
Then, $h = \frac{ab}{a+b} = \frac{5\times10}{5+10} = \frac{50}{15} = \frac{10}{3} m$

**Sol 38.** (i) We have, AR = AB – RB = 18 – 6 = 12 cm
In ΔARS, by using Pythagoras theorem
$AS^2 = AR^2 + RS^2$
$= (12)^2 + (5)^2 = 144 + 25 = 169$
$\Rightarrow AS = \sqrt{169} = 13cm$

(ii) In ΔBRS,
$\tan x = \frac{\text{Perpendicular}}{\text{Base}} = \frac{BR}{RS} = \frac{6}{5}$
(iii) We know that
$\sec x = \sqrt{1 + \tan^2 x}$
$= \sqrt{1 + \left(\frac{6}{5}\right)^2}$
$= \sqrt{1 + \frac{36}{25}}$
$= \sqrt{\frac{61}{25}} = \frac{\sqrt{61}}{5}$

Or

We know that
$\text{cosec } x = \sqrt{1 + \cot^2 x}$
$= \sqrt{1 + \frac{1}{\tan^2 x}}$
$= \sqrt{1 + \left(\frac{5}{6}\right)^2}$
$= \sqrt{\frac{36+25}{36}} = \sqrt{\frac{61}{36}} = \frac{\sqrt{61}}{6}$

**Sol 1**. (d) The mid-point of line segment joining (0, 0) and (–4, –2) is $\left(\frac{(0-4}{2}, \frac{0-2}{2}\right)$ i.e. (–2,–1).

**Sol 2.**. (c) tan 45° cos 60° + sin 60° cot 60°

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

**Sol 3**. (a) Given equation, $2x^2 - \sqrt{5x} + 1 = 0$

On comparing it with $ax^2 + bx + c = 0$, we get

$a = 2$, $b = \sqrt{5}$ and $c = 1$

$\therefore D = \left(\sqrt{5}\right)^2 - 4(2)(1)$ [$\because D = b^2 - 4ac$]

$= 5 - 8 = -3$

**Sol 4**. (b) We have, $\sqrt{3}\sin\theta = \cos\theta$

$\Rightarrow \frac{\sin\theta}{\cos\theta} = \frac{1}{\sqrt{3}}$

$\Rightarrow \tan\theta = \frac{1}{\sqrt{3}}$

$\Rightarrow \tan\theta = \tan 30°$

$\theta = 30°$

**Sol 5.** (d) Given, AB||EW

$\therefore \frac{DA}{AE} = \frac{DB}{BW}$ [by Thales theorem]

$\Rightarrow \frac{DA}{DE-DA} = \frac{DB}{DW-DB}$

$\Rightarrow \frac{4}{12-4} = \frac{D8}{24-DB}$

$\Rightarrow \frac{4}{8} - \frac{DB}{24-DB}$

$\Rightarrow 24 - DB = 2DB$

$\Rightarrow 24 = 3DB$

$\Rightarrow DB = \frac{24}{3} = 8$ cm

**Sol 6**. (b) Let 4 be the event 'getting an even number.'

Clearly, event A occurs, if we obtain anyone of 2, 4, 6 as an outcome.

$\therefore$ Number of outcomes favourable to A = 3

Hence, $P(A) = \frac{3}{6} = \frac{1}{2}$

**Sol 7**. (a) Length of the arc $= \frac{\theta}{360°} \times 2\pi r$

$\Rightarrow 4.4 = \frac{30^o}{360°} \times 2 \times \frac{22}{7} \times r$

$\Rightarrow 4.4 = \frac{1}{12} \times \frac{44}{7} \times r$

$\Rightarrow r = \frac{4.4 \times 12 \times 7}{44} = 8.4\text{cm}$

**Sol 8.** (c) We know that

Product of zeroes $= \frac{\text{Constant term}}{\text{Coefficient of } x^2}$

$\therefore \alpha\beta = \frac{7}{4}$

**Sol 9.** (c) Total number of cards $= 52$
Kings which are red in colour $= 2$
P(king of red colour) $= \frac{2}{52} = \frac{1}{26}$

**Sol 10.** (a) If point $P$ lies inside the circle then no tangent can be drawn.

**Sol 11.** (d) Let $f(x) = 2x^2 + x + k$ ...(i)
Given, 3 is a zero of the polynomial f(x).
Therefore, put x = 3 in Eq. (i) and consider f(3) = 0
$\therefore f(3) = 2(3)^2 + 3 + k = 0$
$\Rightarrow 2 \times 9 + 3 + k = 0$
$\Rightarrow 18 + 3 + k = 0 \Rightarrow k = -21$

**Sol 12**. (a) Class mark, frequency of the class
$x = \frac{\sum fx}{\sum f} = \frac{\sum(A \times B)}{\sum A}$
where B is the class mark.
Class mark = $\frac{1}{2}$ (upper limit + lower limit)
and A is the frequency of the class.

**Sol 13**. (a) Let d be the common difference of the AR According to the question,
$a_{17} - a_{10} = 7$
$\Rightarrow (a + 16d) - (a + 9d) = 7 \Rightarrow 7d = 7 \Rightarrow d = 1$

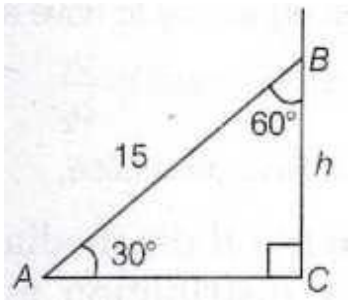
**Sol 14.** (b) The mode is the most frequent observation. Here, the mode is 14 with a frequency of 15.

**Sol 15**. (d) $(x + 2)(3x-5) = 0$
$\Rightarrow x + 2 = 0$ or $3x - 5 = 0$
$\Rightarrow x = -2$ or $x = \frac{5}{3}$
Hence, the roots of the given equation are -2 and $\frac{5}{3}$.

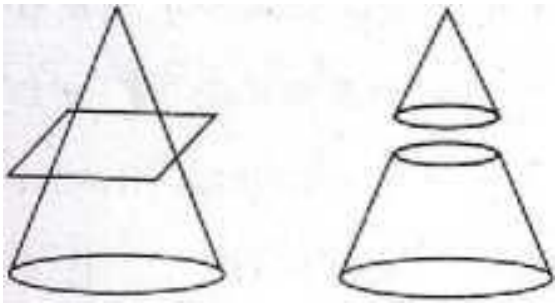
**Sol 16**. (d) Given, equation $2x^2 - 6x + 7 = 0$
On comparing it with $ax^2 + bx + c = 0$, we get
$a = 2, b = -6$ and $c = 7$
$\therefore D = b^2 - 4ac = (-6)^2 - 4(2)(7)$
$= 36 - 56 = -20 < 0$
So, the roots are imaginary.

**Sol 17**. (c) Given, $\angle ABC = 60°$
In $\Delta ASC$, $\angle BAC + \angle ABC + \angle ACB = 180°$
$\Rightarrow \angle BAC = 180° - 90° - 60° = 30°$

So, $\sin 30° = \frac{BC}{AB} = \frac{h}{15}$
$\Rightarrow \frac{1}{2} = \frac{h}{15} \Rightarrow h = \frac{15}{2}$ m



**Sol 18**. (c) Circle



**Sol 19**. (c). Assertion Given x + y – 8 = 0 and x – y – 2 = 0
Here, $a_1 = 1$, $b_1 = 1$, $c_1 = 8$
and $a_2 = 1$, $b_2 = -1$, $c_2 = -2$
So, $\frac{a_1}{a_2} = \frac{1}{1}$, $\frac{b_1}{b_2} = \frac{1}{-1}$ and $\frac{c_1}{c_2} = \frac{-8}{-2} = 4$
$\because \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$
So, the system of equations has a unique solution and the Assertion is true.
**Reason** For equations to have a unique solution,
$\frac{a_1}{a_2}$ should not be equal to $\frac{b_1}{b_2}$.
$\therefore$ The given Reason is false.

**Sol 20**. (a) Reason is clearly true.
Using the relation given in reason, we have
2 Mean = 3 Median – Mode
$= 3 \times 150 - 154$
$= 296$
$\therefore$ Mean $= \frac{296}{2} = 148$, which is true.
Thus, both Assertion and Reason are true and Reason is the correct explanation of Assertion.

**Sol 21.** Given, $x = a\cos\theta$ and $y = b\sin\theta$
$\therefore b^2x^2 + a^2y^2 = b^2(a\cos\theta)^2 + a^2(b\sin\theta)^2$ (1)
$= a^2b^2\cos^2\theta + a^2b^2\sin^2\theta$
$= a^2b^2(\cos^2\theta + \sin^2\theta)$
$= a^2b^2(1)$ [$\because \cos^2 A + \sin^2 A = 1$]
$= a^2b^2$ (1)

**Sol 22**. Let us assume that $\frac{2}{5\sqrt{3}}$ is a rational number.
$\therefore \frac{2}{5\sqrt{3}} = \frac{p}{q}$, where p,q ($q \neq 0$) are integers and p, q are coprimes. (1)
$\Rightarrow \frac{2q}{5p} = \sqrt{3}$
Since, 2, 5, p and q are integers.
$\therefore \frac{2q}{5p}$ is rational, so $\sqrt{3}$ is rational.
But this contradicts the fact that $\sqrt{3}$ is irrational.
Hence, $\frac{2}{\sqrt{3}}$ is an irrational number.
**Hence proved.** (1)

Or

Let us assume that $6 - 2\sqrt{3}$ is rational number.

Then, it will be of the form $\frac{a}{b}$, where a, b are coprime integers and b ≠ 0.

Now, $6 - 2\sqrt{3} = \frac{a}{b}$

On rearranging, we get

$6 - \frac{a}{b} = 2\sqrt{3}$ (1)

Since, 6 and $\frac{a}{b}$ are rational. So, their difference will be rational.

$\therefore 2\sqrt{3}$ is rational.

But we know that, $\sqrt{3}$ is irrational.

So, this contradicts the fact that $\sqrt{3}$ is irrational.

Therefore, our assumption is wrong.

Hence, $6 - 2\sqrt{3}$ is irrational. **Hence proved.** (1)

**Sol 23.** We have, $p(x) = 5x^2 - 7x + 1$, whose zeroes are α and β.

$\therefore$ Sum of zeroes, $\alpha + \beta = -\frac{\text{Coefficent of x}}{\text{Coefficent of x}^2}$

$= -\frac{(-7)}{5} = \frac{7}{5}$ …(i) (1)

and product of zeroes, $\alpha\beta = \frac{\text{Constant term}}{\text{Coefficent of x}^2}$

$= \frac{1}{5}$ …(ii)

Now, $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\beta+\alpha}{\alpha\beta} = \frac{7/5}{1/5}$

[from Eqs. (i) and (ii)]

=7 (1)

**Sol 24.** we have, $\frac{1}{x+1} + \frac{2}{x+2} = \frac{4}{x+4}$

$\Rightarrow \frac{(x+2)+2(x+1)}{(x+1)(x+2)} = \frac{4}{x+4}$ (1)

$\Rightarrow (x + 4)(3x + 4) = 4(x^2 + 3x + 2)$

$\Rightarrow x^2 - 4x - 8 = 0$

On comparing it with $ax^2 + bx + c = 0$, we get

a = 1, b = -4 and c = -8

$\therefore x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$\Rightarrow x = \frac{-(4) \pm \sqrt{16 - 4(1)(-8)}}{2} = x = \frac{4 \pm \sqrt{48}}{2}$

$\Rightarrow x = 2 \pm 2\sqrt{3}$ (1)

**Sol 25.** $\because \Delta AGF \sim \Delta DBG$ ...(i)

[by AA similarity criterion]

Now, in ΔAGF and ΔEFC, we get

$\angle FAG = \angle CEF$ [each 90°]

and $\angle AFG = \angle ECF$

[corresponding angles because GF||BC and AC is the transversal]

$\therefore \Delta AGF \sim \Delta EFC$ ...(ii) (1)

From Eqs. (i) and (ii), we get

$\Delta DBG \sim \Delta EFC$

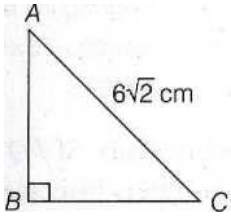
$\Rightarrow \frac{BD}{EF} = \frac{DG}{EC}$

$\Rightarrow \frac{BD}{DE} = \frac{DE}{EC}$ [$\because$ DEFG is a square]

$\therefore DE^2 = BD \times EC$ **Hence proved. (1)**

Or

Let ΔABC be an isosceles right angled triangle, right angled at B having AB = BC.




(1)

In right angled ∆ABC,
$AC^2 = AB^2 + BC^2$

[by Pythagoras theorem]

$\Rightarrow (6\sqrt{2})^2 = AB^2 + AB^2$ [∵ BC = AB]
$\Rightarrow 36 \times 2 = 2\ AB^2$
$\Rightarrow AB^2 = 36$
On taking square root both sides, we get
AB = 6cm
Hence, the length of equal sides of triangle is 6 cm. (1)

**Sol 26**. Length of the fence of a circular field
$= \frac{\text{Total cost}}{\text{Rate}} = \frac{11880}{36}$ = 330 m
So, the circumference of the field is 330 m.
Let r be the radius of the field, then
∴ 2πr = 330
[∵ circumference of circular field = 2πr]
$\Rightarrow 2 \times \frac{22}{7} \times r = 330$
$\Rightarrow r = \frac{330 \times 7}{2 \times 22}$ = 52.5 m
So, the radius of the field is 52.5 m, (1)
Now, area of the field = $\pi r^2 = \frac{22}{7} \times 52.5 \times 52.5$
$= 22 \times 7.5 \times 52.5\ m^2$
Given, cost of ploughing 1 $m^2$ of the field = Rs. 0.60
So, total cost of ploughing the field
= 0.6 × 22 × 7.5 × 52.5 = Rs. 5197.5 (1)

**Sol 27**. Given A circle inscribed in a ∆PQR such that
PQ = PR
**To prove** QT = TR
**Proof** We know that the tangents from an external points to a circle are equal in length.
PS = PU [tangents from P] ...(i)
QS =QT [tangents from O] ...(ii)
RT = RU [tangents from R] ...(iii)
Now, PQ = PR [given] (1 ½)
⇒ PQ - PS = PR-PS
[subtracting PS from both sides]
⇒ PQ – PS = PR – PU [from Eq. (i)]
⇒ QS =RU
⇒ QT = RU [from Eq. (ii)]
⇒ QT = RT [from Eq. (iii)]

Hence proved. (1 ½)

**Sol 28**. There are 6 possible outcomes (1, 2, 3, 4, 5 and 6) in a single throw of a die.
(i) We know that even prime number is only 2.
So, number of favourable outcomes = 1
∴ P (getting an even prime number) = $\frac{1}{6}$ (1 ½)

(ii) The numbers divisible by 2 are 2, 4 and 6.
So, number of favourable outcomes = 3
∴ P (getting a number divisible by 2)
$= \frac{3}{6} = \frac{1}{2}$ 5 (1%)

Or

Number of red cards = 26
Number of queens = 4
But, out of these 4 queens, 2 are red.
∴ Number of queens which are not red = 2
Now, number of cards which are red or queen
= 26 + 2 = 28 (1)
∴ P (getting either red card or queen)
$= \frac{\text{Number of card which are red or queen}}{\text{Total number of cards}}$
$= \frac{28}{52} = \frac{7}{13}$ (1)
Now, P (not getting either red card or queen)
= 1 – P (getting either red card or queen)
$=1 - \frac{7}{13} = \frac{13-7}{13} = \frac{6}{13}$

**Sol 29**. Here, class intervals are not in inclusive form.
So, we first convert them in inclusive form by subtracting h/2 from the lower limit and adding h/2 to the upper limit of each class, where h is the difference between the lower limit of a class and the upper limit of the preceding class.
The given frequency distribution in inclusive form is as follows.

| **Age** (in yr) | 4.5-14.5 | 14.5-24.5 | 24.5-34.5 | 34.5-44.5 | 44.5-54.5 | 54.5-64.5 |
|---|---|---|---|---|---|---|
| **Number of cases** | 6 | 11 | 21 | 23 | 14 | 5 |

(1)

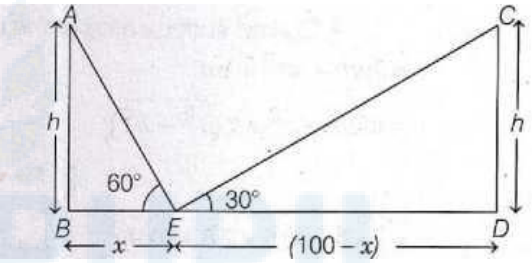
We observe that the class 34.5-44.5 has the maximum frequency.
So, it is the modal class such that
l = 34.5, h = 10, $f_1$ = 23, $f_0$ = 21 and $f_2$ = 14
∴ Mode = $l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$,
⇒ Mode = $34.5 + \frac{23-21}{46-21-14} \times 10$
$= 34.5 + \frac{2}{10} \times 10 = 3631$ (1)

**Sol 30**. The given equations are
10x + 3y = 75 ...(i)
6x - 5y = 11 ... (ii)
Multiplying Eq. (i) by 5 and Eq. (ii) by 3, we get
50x + 15y = 375 ...(iii)
18x - 15y = 33 …(iv) (1)
Adding Eqs. (iii) and (iv), we get
68x = 408
⇒ $x = \frac{408}{68}$ ⇒ x = 6 (1)
Putting x = 6 in Eq.(i), we get
(10 × 6) + 3y = 75
⇒ 60 + 3y = 75
⇒ 3y = 75 – 60
⇒ 3y = 15
⇒ y = 5
∴ x = 6 and y = 5 (1)

Or

The given equations are
11x + 15y + 23 = 0 ... (i)
7x - 2y - 20 = 0 ...(ii)
Multiplying Eq. (i) by 2 and Eq. (ii) by 15 and adding the results, we get
22x + 105x = –46 + 300
⇒ 127x = 254
⇒ x = $\frac{254}{127} = 2$ (1)
Putting x = 2 in Eq. (i), we get
22 + 15y = -23
⇒ 15y = – 23 – 22
⇒ 15y = – 45
⇒ y = $\frac{-45}{15}$ ⇒ y = – 3
Hence, x = 2 and y = – 3 (2)

**Sol 31**. Let AB and CD be two pillars of equal height h and distance between them be BD = 100 m.
Let E be a point on the road such that BE = x,
DE =(100- x), ∠AEB = 60° and ∠CED = 30°.




In right angled ∆ABE,
$\frac{AB}{BE}$ = tan 60°
⇒ $\frac{h}{x}$ = $\sqrt{3}$ [∵ tan 60° = $\sqrt{3}$]
⇒ h = $\sqrt{3}$x ... (i) (1)
In right angled ∆CDE,
$\frac{CD}{DE}$ = tan 30°
⇒ $\frac{h}{100-x} = \frac{1}{\sqrt{3}}$ …(ii) (1)
From Eqs. (i) and (ii); we get
$\sqrt{3} = \frac{100-x}{\sqrt{3}}$
⇒ 3x = 100 – x
⇒ 4x = 100
∴ x = 25
On putting x = 25 in Eq. (i), we get
h = – 3 × 25
= 25 × 1.732
= 43.3 m
Hence, height of each pillar is 43.3 m and position of the point from pillar making an angle of 60° is 25 m. (1)

**Sol 32.** Lets be the total surface area of the remaining solid.

Then, S = Curved surface area of the cylinder + Area of the base of the cylinder + Curved surface area of the cone
= 2 πrh + πr$^2$ + πrl (1)
= π[2rh + r$^2$ + r$\sqrt{r^2 + h^2}$]

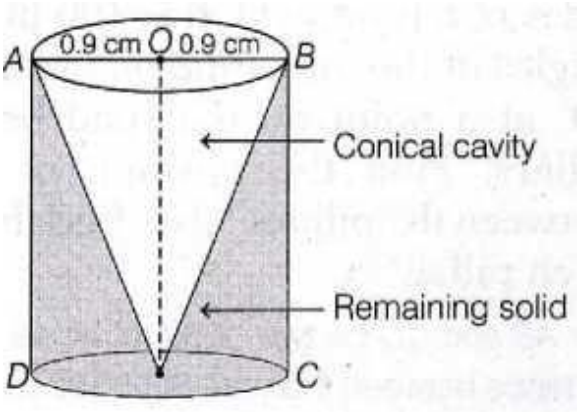
$[\because l = \sqrt{r^2 + h^2}]$

$= \frac{22}{7}[5.04 + 0.81 + 0.9\sqrt{0.81 + 7.84}$

$= \frac{22}{7}[5.85 + 0.9\sqrt{8.65}]$

$= \frac{22}{7}[5.85 + 0.9 \times 2.94]$

$= \frac{22}{7} \times [5.85 + 2.64] = \frac{18678}{7} = 26.68$ cm$^2$ (2)




Or

Given, speed of flow of water = 10 km /h

= 10 × 1000 m/h [∵ 1 km = 1000 m]

⇒ Length of water flow in 1 h = 10 × 1000 m

⇒ Length of water flow in 30 min (i.e. in $\frac{1}{2}$h)

$= \frac{1}{2} \times 10 \times 1000$

= 5000 m (1)

(1)

Now, volume of water flowing in 30 min

= Volume of cuboid of length 5000 m, width 6 m and depth 1.5 m

= 500 × 6 × 1.5 m$^3$ = 45000 m$^3$ (1)

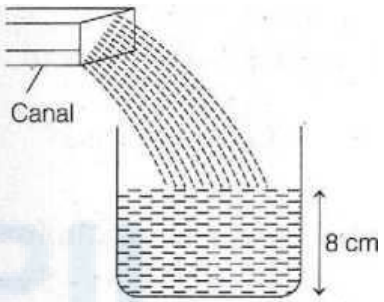
Hence, the required area covered for irrigation with 8 cm or m of standing water

$= \frac{4500}{8} \times 100$

= 562500 m$^2$

$= \frac{562500}{1000}$ hec [∵ 1 hec = 10000 m$^2$]

= 56.25 hec (2)




**Sol 33**. Given, equations are 5x – y = 5 ...(i)

and 3x-y = 3 ...(ii)

Table for 5x – y = 5 or y = 5x – 5 is

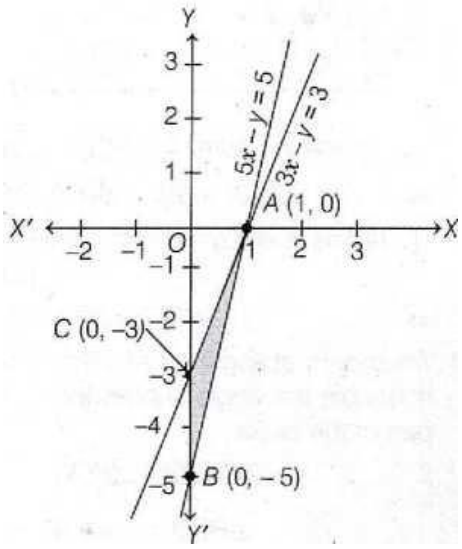
| | | |
|---|---|---|
| **X** | 1 | 0 |
| **Y** | 0 | –5 |
| **Points** | A (1,0) | B (0, – 5) |

Plot the points A(1, 0) and B(0, - 5) on a graph paper and join these points to form line AB. (1)

Table for 3x – y = 3 or y = 3x – 3 is

| | | |
|---|---|---|
| **X** | 1 | 0 |
| **Y** | 0 | -3 |
| **Points** | A (1, 0) | C (0, -3) |

Plot the points A (1, 0) and C (0, -3) on the same graph paper and join these points to form line AC. (1)




(2)

Hence, the triangle formed by given lines is ∆ABC whose vertices are A(1, 0), B(0, - 5) and C(0, – 3). (1)

**Sol 34**. Given, the sum of first n terms,

$S_n = 4n – n^2$ ...(i)

On putting π = 1 in Eq. (i), we get

$S_1 = 4 \times 1 – 1^2 = 4 – 1 = 3$ (1)

Thus, first term = 3

On putting n = 2 in Eq. (i), we get

$S_2 = 4 \times 2 – 2^2 = 8 – 4 = 4$

Thus, sum of first two terms = 4 (1)

Now, on replacing n by n -1 in Eq. (i), we get

$S_n = 4(n -1) - (n -1)^2$

$= 4n - 4 - n^2 + 2n -1$

$= – n^2 + 6n – 5$ (1)

∵ nth term = $S_n – S_{n-1}$

$= 4n – n^2 – (– n^2 + 6n – 5)$

$= 4n – n^2 + n^2 – 6n + 5 = 5 – 2n$ (2)

Or

Let a and d be the first term and common difference of an AP.

Then, a = 5, $T_n = 45$

$\Rightarrow 45 = a + (n – 1)d$ [∵ $T_n = a+ (n – 1)d$]

$\Rightarrow 45 = 5 + (n – 1)d$

$\Rightarrow 40 = [n – 1)d$ ...(i) (1)

We know that sum of n terms of an AP is $S_n = \frac{n}{2}[2a + (n – 1)d]$ (1)

$\Rightarrow 400 = \frac{n}{2}[2 \times 5 + 40]$ [from Eq. (i)]

$\Rightarrow 800 = n[50]$

$\Rightarrow n = \frac{800}{50} = 16$ …(ii) (1)

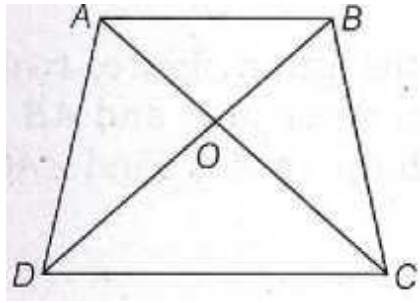
Put n = 16 in Eq. (i) we get

$(16 – 1)d = 40$

$\Rightarrow 15d = 40$

$\Rightarrow d = \frac{40}{15} = \frac{8}{3}$ (2)

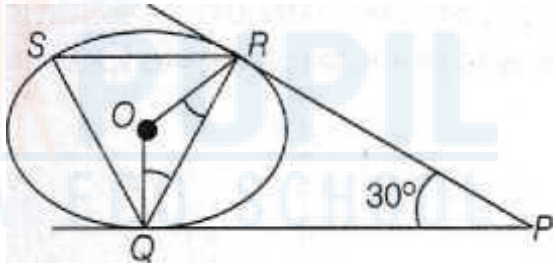
**Sol 35**. Given ABCD is a trapezium in which AB || DC.



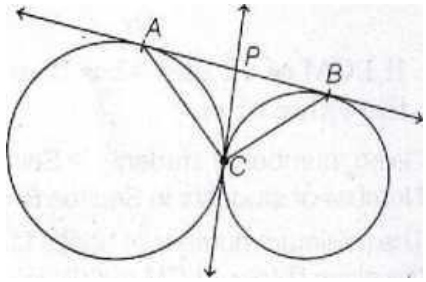

**To prove** $\frac{OA}{OC} = \frac{OB}{OD}$ (2)
**Proof** In ΔOAS and ΔODC, we have
AB || DC
Then, ∠OAB = ∠OCD [alternate interior angles]
∠AOB = ∠DOC
[vertically opposite angles]
and ∠ABO = ∠CDO [alternate interior angles]
∴ ΔOAB ~ ΔOCD [by AAA similarity criterion]
Hence, $\frac{OA}{OC} = \frac{OB}{OD}$
[if two triangles are similar, then their corresponding sides are proportional] **Hence proved**. (1)

**Sol 36**. (i) In quadrilateral POOR, we have

∠QPR + ∠PRO + ∠PQO + ∠ROQ = 360°
⇒ 30° + 90° + 90° + ∠ROQ = 360°
[∵ radius is always perpendicular to the tangent at point of contact]
⇒ ∠ROQ = 360° – 210° = 150°
(ii) We know that angle subtended by an arc at centre is double the angle subtended by it at any other part of the circle.
2 ∠RSQ = ∠ROQ
∠RSQ = $\frac{1}{2}$ ×150° = 75°
(iii) In ΔQOR, OQ = OR [radii]
∠ORQ = ∠OQR
Now, ∠ROQ + ∠ORQ + ∠OQR = 180°
⇒ 2∠OQR = 180° – 150°
⇒ 2 ∠OQR = 30°
⇒ ∠OQR = 15°
Again, ∠OQP = 90°
[∵ OQ ⊥ QP]
⇒ ∠OQR + ∠RQP = 90°
⇒ ∠RQP = 90°-15° =75°




Or
Draw a tangent to the circles at point C. Let it meets AB at P




Then, PA = PC and PS = PC
[the tangents from an external points to a circle are equal in length]
PA = PC ⇒ ∠PAC = ∠PCA
PB = PC ⇒ ∠PBC = ∠PCB
∴ ∠PAC + ∠PBC = ∠PCA + ∠PCB = ∠ACB
⇒ ∠PAC + ∠PBC + ∠ACB = 2∠ACB
⇒ 180° = 2∠ACB
⇒ ∠ACB = 90°

**Sol 37.** (i) Let AB be the monument of height 42 m and C is the point where they are standing. Such that, BC = 42 m.

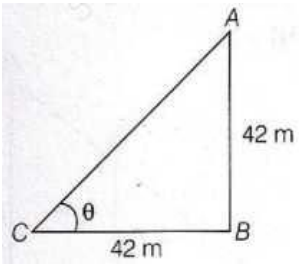
Now, in ΔABC,

$\tan\theta = \frac{AB}{BC}$ [$\because \tan\theta = \frac{\text{Perpendicular}}{\text{Base}}$]

$\Rightarrow \tan\theta = \frac{42}{42} = 1$

$\Rightarrow \tan\theta = 1$

$\Rightarrow \theta = 45°$



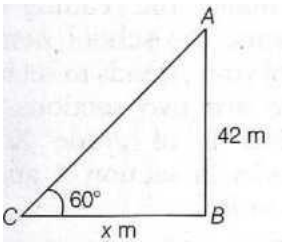

(ii) In ΔABC,

$\tan\theta = \frac{AB}{BC}$ [$\because \tan\theta = \frac{\text{Perpendicular}}{\text{Base}}$]

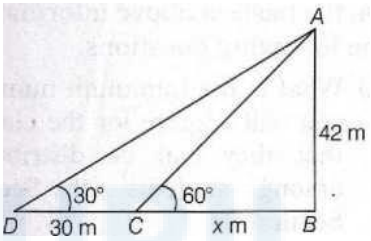
$\Rightarrow \sqrt{3} = \frac{42}{BC}$

$\Rightarrow BC = \frac{42}{\sqrt{3}} = \frac{42\sqrt{3}}{3} = 14\sqrt{3}$

$= 14 \times 1.73 = 24.22$ m




(iii) Let AB be the gate and let BC and BD be the lengths of its shadows when ∠ACB = 60° and ∠ADB = 30°.




In right ΔCBA, $\tan 60° = \frac{AB}{BC} = \frac{42}{x}$

$\Rightarrow \sqrt{3} = \frac{42}{x} \Rightarrow x = \frac{42\sqrt{3}}{3} = 14\sqrt{3}$

$\because$ Lengths of its shadows are $14\sqrt{3}$ m and $(30 + 14\sqrt{3})$m.

So, the sum of lengths of its shadows

$= (30 + 28\sqrt{3})$m

Or

Let AB be the lamp-post and CD be the girl.

Let CE be the shadow of CD.

Then, CD = 1.5 m, CE = 4.5 m and AC = 3 m

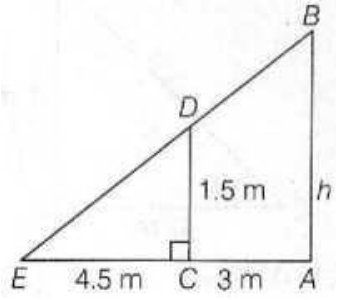
Let AB = h

Now, ΔAEB and ΔCED are similar.

$\therefore \frac{AB}{CD} = \frac{AE}{CE} \Rightarrow \frac{AB}{AE} = \frac{CD}{CE}$

$\Rightarrow \frac{h}{(3+4.5)} = \frac{1.5}{4.5} = \frac{1}{3} \Rightarrow h = \frac{1}{3} \times 7.5 = 2.5$

Hence, the height of the lamp-post is 2.5 m.




**Sol 38**. (i) Given, number of students in Section A = 32

Number of students in Section B = 36

The minimum number of books to be acquired for the class library = LCM of (32, 36)

$= 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3$

$= 2^5 \times 3^2$

$= 32 \times 9$

$= 288$

(ii) The prime factors of 36 are

$36 = 2 \times 2 \times 3 \times 3 = 2^2 \times 3^2$

(iii) We find HCF (867, 255) by using the following steps

**Step** 1 Since, 867 > 255, we divide 867 by 255 to get 3 as quotient and 102 is remainder.
By Euclid's division lemma, we get

867 = 255 × 3 + 102

```
255) 867 (3
     -765
     ----
      102) ) 255 (2
           -204
           ----
            51) 102 (2
               -102
               ----
                 0
```

**Step** 2 Since the remainder $102 \neq 0$, we divide 255 by 102 to get 2 as quotient and 51 as remainder.
By Euclld's division lemma we get

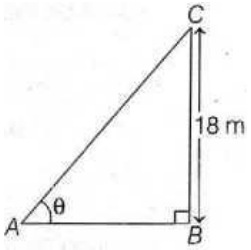
$$255 = 102 \times 2 + 51$$

**Step** 3 Since, the remainder $51 \neq 0$, we divlde 102 by 51 to get 2 as quotlent and 0 as remalnder SInce, the remainder is 0, our procedure stops and the last divisor is the required HCF.
∴ HCF (867, 255) = 51

Or

Given, LCM (12, 42) = 10m + 4
Factors of 12 = 2 × 2 × 3
and factors of 42 = 2 × 3 × 7
Now, LCM (12, 42) = 2 × 2 × 3 × 7 = 84
∴ 84 = 10m + 4
⇒ 84 – 4 = 10m
∴ $\mathrm{m} = \frac{80}{10} = 8$

**Sol 1**. (b) Let AB be the length of the shadow and height of the pole BC = 18 m and elevation ∠BAC = θ.
In right angled ΔABC,
$\tan\theta = \frac{BC}{AB}$ [∵ $\tan\theta = \frac{\text{perpendicular}}{\text{base}}$]
$\Rightarrow \frac{6}{7} = \frac{18}{AB}$
[∵ $\tan\theta = \frac{6}{7}$, given]




$\Rightarrow 6 \times AB = 18 \times 7$
$\Rightarrow AB = \frac{18 \times 7}{6} = 21$
Hence, the length of the shadow is 21 m.

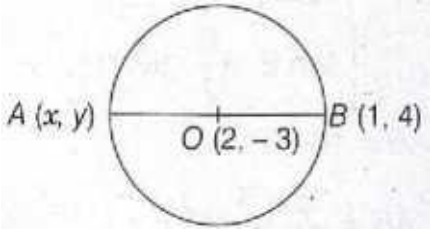
**Sol 2.** (c) Here, $\frac{a_1}{a_2} = \frac{1}{-4}, \frac{b_1}{b_2} = \frac{2}{-8} = \frac{1}{-4}$ and $\frac{c_1}{c_2} = \frac{-5}{20} = \frac{-1}{4}$
This shows $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$
∴ The pair of equations has infinitely many solutions.

**Sol 3**. (b) The total number of cards in a pack of cards is 52.
The total number of face cards in a pack of cards = 12
∴ Probability of getting a face card $= \frac{12}{52} = \frac{3}{13}$

**Sol 4.** (a) Let the radius of the protractor be $r$ cm.
Then, perimeter of protractor $= (\pi r + 2c) = 72$
$\Rightarrow (\pi + 2)r = 72$
$\Rightarrow \left(\frac{22}{7} + 2\right) r = 72$
$\Rightarrow \frac{36}{7} r = 72$
$\Rightarrow r = 72 \times \frac{7}{36} = 14\text{cm}$

**Sol 5**. (a) Let the coordinates of point A be (x, y). As, AS is the diameter and 0 is the centre of a circle. Then, 0 will be the mid-point of AS.

∴ Coordinates of O
= Coordinates of mid-point of AB
$\Rightarrow (2, -3) = \left(\frac{x+1}{2}, \frac{y+4}{2}\right)$
On comparing both sides, we get
$2 = \frac{x+1}{2}$ and $-3 = \frac{y+4}{2}$
$\Rightarrow x + 1 = 4$ and $y + 4 = -6$
∴ $x = 3$ and $y = -10$
Hence the coordinates of point A are $(3, -10)$.




**Sol 6.** (c) $\tan 60° \cot 30° + \tan 30° \cot 60°$
$= \sqrt{3} \times \sqrt{3} + \frac{1}{\sqrt{3}} \times \frac{1}{\sqrt{3}}$
$= 3 + \frac{1}{3} = \frac{9+1}{3} = \frac{10}{3}$

**Sol 7.** (b) Since, $2x$, $x + 10$ and $3x + 2$ are in AP
$\therefore (x + 10) - 2x = (3x + 2) - (x + 10)$
[common difference must be same]
$\Rightarrow -x + 10 = 2x - 8$
$\Rightarrow 3x = 18$
$\therefore x = 6$

**Sol 8**. (b) In $\Delta ABC$, $\angle A + \angle B + \angle C = 180°$
$\Rightarrow 30° + \angle B + 50° = 180°$
$\Rightarrow \angle B = 100°$
Since, $\Delta ABC \sim \Delta DFE$
$\therefore \angle F = \angle B = 100°$ [by CPCT]

**Sol 9**. (c) The number of zeroes of f(x) is 3; as the graph of f(x) intersects the X-axis at three points.

**Sol 10**. (c) Let A (2, 3) and B (4, 1) be the given points. Here, $x_1 = 2$, $y_1 = 3$ and $x_2 = 4$, $y_2 = 1$
Now, AB = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
[by distance formula]
$= \sqrt{(4-2)^2 + (1-3)^2} = \sqrt{(2)^2 + (-2)^2}$
$= \sqrt{4+4} = \sqrt{8} = 2\sqrt{2}$ units

**Sol 11**. (b)

| | |
|---|---|
| 2 | 120 |
| 2 | 60 |
| 2 | 30 |
| 3 | 15 |
| 5 | 5 |
| | 1 |

$\therefore$ Product Of 120 = $2 \times 2 \times 2 \times 3 \times 5 = 2^3 \times 3 \times 5$

**Sol 12.** (a) Clearly, $\angle OAD = 90°$ and $\angle OBD = 90°$
$\Rightarrow \angle AOB + \angle ADB = 180°$
$\Rightarrow 110^o + \angle ADB = 180^o$
$\Rightarrow \angle ADB = 180° - 110° = 70°$

**Sol 13**. (d) We know that the sum of first n natural numbers is given by $S_n = \frac{n(n+1)}{2}$
$\therefore$ Mean of first n natural numbers = $\frac{[n(n+1)/2]}{n}$
$= \frac{n+1}{2}$
Given, mean of first n natural numbers = 18
$\Rightarrow \frac{n+1}{2} = 18$
$\Rightarrow n + 1 = 36$
$\Rightarrow n = 35$

**Sol 14**. (d) Area $= \frac{x}{360°} \times \pi R^2$

**Sol 15**. (a) LCM = Product of the greatest power of each prime factor involved in the number
$= 2^2 \times 3^2 \times 5^3 = 4 \times 9 \times 125 = 4500$

**Sol 16**. (c) Since, x = 2 is a root of the equation.
$\therefore k(2)^2 - 2 - 2 = 0$
$\Rightarrow 4k - 2 - 2 = 0$
$\Rightarrow 4k - 4 = 0$

$\Rightarrow k = 1$

**Sol 17**. (b) Given, $2x^2 - 3x = 0$
$\Rightarrow x(2x - 3) = 0$
$\Rightarrow x = 0$ or $2x - 3 = 0$
$\Rightarrow x = 0$ or $x = \frac{3}{2}$
Hence, the roots are $0, \frac{3}{2}$.

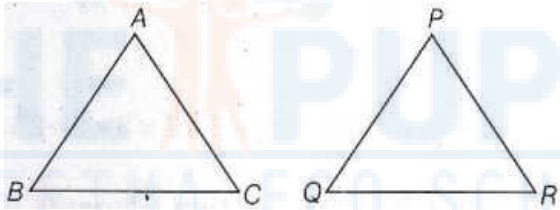
**Sol 18**. (a) Given, AD is a internal bisector of $\angle A$.
Therefore,

$$\frac{AB}{AC} = \frac{BD}{DC} = \frac{BD}{(BC - BD)}$$

$= \frac{5}{(7.5-5)} = \frac{5}{2.5} = \frac{2}{1} = 2 : 1$

**Sol 19.** (b) Assertion Coordinates of the point which divides the line segment joining the points (–3,10) and (6, –8) in the ratio 2 : 7,
$(x, y) = \left(\frac{2\times6 + 7\times(-3)}{2+7}, \frac{2\times(-8)+7\times(10)}{2+7}\right)$
$= \left(\frac{12-21}{9}, \frac{-16+70}{9}\right) = \left(-1, \frac{54}{9}\right) = (-1,6)$
So, the Assertion is true.
Reason Since, in equilateral triangle ABC, all sides are equal.
So, AB = BC = CA
So, the Reason is true but it is not the correct explanation of Assertion.

**Sol 20.** (a) Clearly, Assertion is true.




So, Reason is also true and it is the correct explanation of Assertion.

**Sol 21**. Given, $\frac{2x}{x-3} + \frac{1}{2x+3} + \frac{3x+9}{(x-3)(2x+3)} = 0$
$\Rightarrow \frac{2x(2x+3)+x-3+3x+9}{(x-3)(2x+3)} = 0$
$\Rightarrow 4x^2 + 6x + x - 3 + 3x + 9 = 0$ (1)
$\Rightarrow 4x^2 + 10x + 6 = 0$
$\Rightarrow 2x^2 + 5x + 3 = 0$
$\Rightarrow 2x^2 + 2x + 3x + 3 = 0$
$\Rightarrow (x + 1)(2x + 3) = 0$
$\Rightarrow x = -1$ or $x = -\frac{3}{2}$
As, $x \neq \frac{-3}{2}$
Hence, x = –1. (1)

**Sol 22**. We have,
LHS = $2(\cos^2 45° + \tan^2 60°) - 6(\sin^2 45° - \tan^2 30°)$
$= 2\left\{\left(\frac{1}{\sqrt{2}}\right)^2 + \left(\sqrt{3}\right)^2\right\} - 6\left\{\left(\frac{1}{\sqrt{2}}\right)^2 - \left(\frac{1}{\sqrt{3}}\right)^2\right\}$ (1)

$=2\left(\frac{1}{2}+3\right)-6\left(\frac{1}{2}-\frac{1}{3}\right)=1+6-3+2=6$ = RHS (1)

Or

We have,

LHS = $\frac{\sin 2\,A}{\cos^2 A}+\frac{\cos^2 A}{\sin^2 A}=\frac{\sin^4 A+\cos^4 A}{\sin^2 A\cos^2 A}$.

[taking LCM]

$(\sin^2 A)^2 + (\cos^2 A)^2 + 2\sin^2 A \cos^4 A$

$=\frac{-2\sin^2 A+\cos^2 A}{\sin^2 A\cos^2 A}$ (1)

$=\frac{(\sin^2 A+\cos^2 A)^2-2\sin^2 A\cos^2 A}{\sin^2 A\cos^2 A}$

$=\frac{1-2\sin^2 A\cos^2 A}{\sin^2 A\cos^2 A}$

$=\frac{1}{\sin^2 A\cos^2 A}-2$ = RHS **Hence proved.** (1)

**Sol 23.** Let the radius of circle be r cm.

Then, OA = OT = r cm ...(i)

Since, PT is a tangent to circle at T and OT is a radius.

So, OT⊥ PT

∴ ∠OTP = 90° (1/2)

In right angled ΔOTP,

$OP^2 = OT^2 + PT^2$

[by Pythagoras theorem]

⇒ $(PA + OA)^2 = OT^2 + 6^2$

⇒ $(3+ r)^2 = r^2 + 36$

[from Eq. (i) and PA = 3 cm, PT = 6 cm, (given)] (1/2)

⇒ r + 6r + 9 – r – 36 = 0

[∵ $(a + b)^2 = a^2 + b^2 + 2ab$]

⇒ 6r – 27 = 0

⇒ r = $\frac{27}{6}$ = 4.5

Hence, the radius of the circle is 4.5 cm. (1)

**Sol 24**. If ΔMNO, we have PQ || NO

⇒ $\frac{MP}{PN}=\frac{MQ}{QO}$

[by basic proportionality theorem] (1/2)

⇒ $\frac{MP}{PN}=\frac{MQ}{MO-MQ}$ [∵ $QO = MO - MQ$]

⇒ $\frac{4}{13}=\frac{MO}{20.4-MQ}$ (1/2)

[given, $\frac{MP}{PN}=\frac{4}{13}$ and $MO = 20.4$ cm]

⇒ 4(20.4 – MQ) = 13MQ

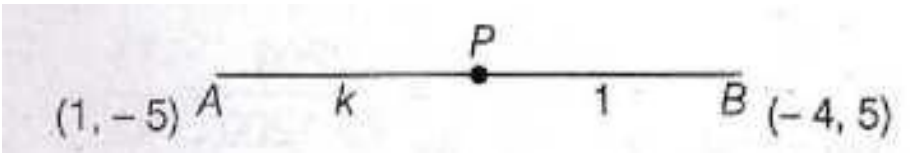
⇒ 81.6 – 4MQ = 13MQ

⇒ 81.6 = 17MQ

∴ $MO = 4.8$ cm (1)

**Sol 25**. For any point on X-axis, y = 0.

Let the ratio be k : 1, then by section formula, the coordinates of the point which divides AB in the, ratio k : 1are$\left(\frac{-4k+1}{(k+1)},\frac{5k-5}{k+1}\right)$ (1)




Thus, point lies on the X-axis, and we know that on the X-axis, the ordinate is zero.

$\therefore \frac{5k-5}{k+1} = 0$

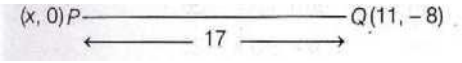
$\Rightarrow 5k - 5 = 0 \Rightarrow k = 1$

Therefore, the required ratio is 1:1. (1)

Or

Let P(x, 0) be the point on X-axis.

Take other point (11, - 8) as Q.




$\Rightarrow \sqrt{(11-x)^2 + (-8-0)^2} = 17$

[$\because$ by using distance formula, distance = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$]

On squaring both sides, we get

$(11 - x)^2 + (-8)^2 = 289$ (1)

$\Rightarrow 121 + x^2 - 22x + 64 - 289 = 0$

$\Rightarrow x^2 - 22x - 104 = 0$

$\Rightarrow x^2 - 26x + 4x - 104 = 0$ [splitting middle term]

$\Rightarrow x(x - 26) + 4(x - 26) = 0$

$\Rightarrow (x - 26)(x + 4) = 0$

$\Rightarrow x - 26 = 0$ or $x + 4 = 0$

$\Rightarrow x = 26$ or $x = -4$

When x = 26, then P = (26,0).

When x = -4, then P = (-4, 0).

So, points are (26, 0) and (-4, 0). (1)

**Sol 26.** v Area of rectangle paper = 40 × 30 = 1200 $cm^2$ (1/2)

$\therefore$ Area of circle = $\pi r^2$

$= \frac{22}{7} \times 10 \times 10 =$ cm (1)

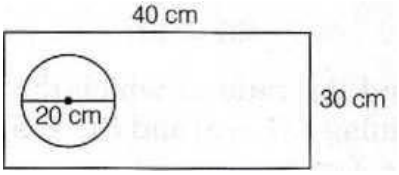
$\therefore$ Total possible outcomes = Area of rectangle paper and number of favourable outcomes

= Area of circle (1/2)

$\therefore$ P (die will fall inside the circle)

$= \frac{\text{Area of circle}}{\text{Area of rectangle paper}}$

$= \frac{2200}{7 \times 1200} = \frac{11}{42}$




**Sol 27**. We know that nth term of an AP is given by $T_n = a + (n - 1)d$

$\therefore$ 6th term, $T_6 = -10$

$\Rightarrow a + 5d = -10$ ...(i)

and 10th term, $T_{10} = -26$

$\Rightarrow a + 9d = -26$ ...(ii) (1/2)

On subtracting Eq. (i) from Eq. (ii), we get

$4d = -16 \Rightarrow d = -4$ (1/2)

On substituting $d = -4$ in Eq. (i), we get

$a + 5(-4) = -10$

$\Rightarrow a - 20 = -10$

$\Rightarrow a = -10 + 20 \Rightarrow a = 10$ (1)
Now, 15th term, $7_{15} = a + 14d = 10 + 14(-4)$
$= 10 - 56 = -46$
Hence, 15th term of the AP is –46. (1)

**Sol 28.** LHS $= \cot^2 A\left(\frac{\sec A-1}{1+\sin A}\right) + \sec^2 A\left(\frac{\sin A-1}{1+\sec A}\right)$
$= \frac{[\cot^2 A(\sec A-1)(1+\sec A)+\sec^2 A(\sin A-1)(1+\sin A]}{(1+\sin A)(1+\sec A)}$ (1)
$= \frac{\cot^2 A(\sec^2 A-1)+\sec^2 A(\sin^2 A-1)}{(1+\sin A)(1+\sec A)}$
$[\because (a-b)(a+b) = a^2 - b^2]$
$= \frac{\cot^2 A \tan^2 A - \sec^2 A(1-\sin^2 A)}{(1+\sin A)(1+\sec A)}$
$[\because 1 + \tan^2\theta = \sec^2\theta]$
$= \frac{\cot^2 A \tan^2 A - \sec^2 A \cos^2 A}{(1+\sin A)(1+\sec A)}$
$= \frac{1-1}{(1+\sin A)(1+\sec A)} = 0 = \text{RHS}$
$[\because \cot\theta \tan\theta = 1$ and $\sec\theta \cos\theta = 1]$
**Hence proved.** (1)

Or

LHS $= \sqrt{\frac{\text{cosec } A-1}{\text{cosec } A+1}} + \sqrt{\frac{\text{cosec } A+1}{\text{cosec } A-1}}$
$= \frac{[(\text{cosec } A-1)(\sqrt{\text{cosec } A-1})+(\sqrt{\text{cosec } A+1})(\sqrt{\text{cosec } A+1})]}{(\sqrt{\text{cosec } A+1})(\sqrt{\text{cosec } A-1})}$
$= \frac{(\sqrt{\text{cosec } A-1})^2+(\sqrt{\text{cosec } A+1})^2}{(\sqrt{\text{cosec } A+1})(\sqrt{\text{cosec } A-1})}$ (1)
$= \frac{(\text{cosec } A-1)+(\text{cosec } A+1)}{\sqrt{\text{cosec}^2 A-1}}$
$[\because (\sqrt{a})^2 = a$ and $\sqrt{a+b} \times \sqrt{a-b} = \sqrt{a^2-b^2}]$
$= \frac{2\,\text{cosec } A}{\sqrt{\cot^2 A}}$ $[\because \text{cosec}^2\theta = 1 + \cot^2\theta]$ (1)
$= \frac{2\,\text{cosec } A}{\cot A} = \frac{2}{\sin A} \times \frac{\sin A}{\cos A}$
$[\because \text{cosec}\,\theta = \frac{1}{\sin\theta}$ and $\cot\theta = \frac{\cos\theta}{\sin\theta}]$
$= \frac{2}{\cos A} = 2\sec A$ $[\because \frac{1}{\cos\theta} = \sec\theta]$
= RHS **Hence proved**. (1)

**Sol 29**. **Given** ΔABC and ΔPQR
CM is the median of ΔABC and RN is the median of ΔPQR.
Also, ΔABC ~ ΔPQR
**To prove** (i) ΔAMC ~ ΔPNR (ii) $\frac{CM}{RN} = \frac{AB}{PQ}$
**Proof**

(i) Given, ΔABC ~ ΔPQR
$\therefore \frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR}$
$[\because$ in similar triangles, corresponding sides are proportional]
and $\angle A = \angle P$, $\angle B = \angle Q$ and $\angle C = \angle R$ ...(ii)
$[\because$ in similar triangles, corresponding angles are equal] (1/2)
We know that the median bisects the opposite side.
$\therefore$ AM = MB
$\Rightarrow$ AB = 2AM
and PN = NQ
$\Rightarrow$ PQ = 2PN (1/2)
From Eq. (i), we have

$\frac{AB}{PC} = \frac{AC}{PR}$
$\Rightarrow \frac{2\,AM}{2\,PN} = \frac{AC}{PR}$
$\Rightarrow \frac{AM}{PN} = \frac{AC}{PR}$ ...(iii)
In ΔAMC and ΔPNR, we have
$\angle A = \angle P$ [from Eq. (ii)]
and $\frac{AM}{PN} = \frac{AC}{PR}$ [from Eq. (iii)]
So, ΔAMC ~ ΔPNR
[by SAS similarity criterion] (1)

(ii) We have, ΔAMC - ΔPNR
$\Rightarrow \frac{AM}{PN} = \frac{AC}{PR} = \frac{CM}{RN}$
[∵ triangles are similar, so corresponding sides will be proportional]
$\therefore \frac{CM}{RN} = \frac{AC}{PR}$CM _ AC RN~ PR
$\Rightarrow \frac{CM}{RN} = \frac{AB}{PQ}$ [from Eq. (i)]
**Hence proved.** (1)

**Sol 30.** Let $\sqrt{n}$ be a rational number.
Then, assume $\sqrt{n} = \frac{p}{q}$
[where p, q are coprime and q ≠ 0]
$\Rightarrow n = \frac{p^2}{q^2}$ [squaring both sides]
$\Rightarrow p^2 = nq^2$ ...(i)
$\Rightarrow$ n divides $p^2$
$\Rightarrow$ n divides p [by using theorem] ...(ii) (1)
Let p = nm
$\Rightarrow p^2 = n^2m^2$ [squaring both sides]
On putting the value of $p^2$ in Eq. (i), we get
$n_2m^2 = nq^2$
$\Rightarrow q^2 = nm^2$
$\Rightarrow$ n divides $q^2$
$\Rightarrow$ n divides q ...(iii) (1)
From Eq. (ii), n divides p and from Eq. (iii) n divides q. It means n is a common factor of both p and q.
This contradicts the assumption that p and q are coprime.
So, our supposition is wrong.
Hence, fn cannot be a rational number. (1)

Or

Given, length of the room = 8 m 25 cm
= 825 cm [∵ 1 m = 100 cm]
Breadth of the room = 6m 75cm = 675cm
and height of the room = 4 m 50 cm = 450 cm
Clearly, the length of the longest rod (in cm) is the HCF of 825, 675 and 450. (1)
Now,

| | |
|---|---|
| 3 | 825 |
| 5 | 275 |
| 5 | 55 |
| 11 | 11 |
| | 1 |

| | |
|---|---|
| 3 | 675 |
| 3 | 225 |
| 3 | 75 |
| 5 | 25 |
| 5 | 5 |
| | 1 |

| | |
|---|---|
| 2 | 450 |
| 3 | 225 |
| 3 | 75 |
| 5 | 25 |
| 5 | 5 |
| | 1 |

Thus, 825 = $3 \times 5^2 \times 11$,
675 = $3^3 \times 5^2$
and 450 = $2 \times 3^2 \times 5^2$ (1)

Now, HCF (825, 675, 450)
= Product of the smallest power of each common prime factor
= $3 \times 5^2$
= 75
Hence, the required length of the longest rod is 75 cm. (1)

**Sol 31.** Given, 2 is a root of the quadratic equation $3x^2 + px – 8 = 0$.
So, it satisfies the given equation.
$\because 3(2)^2 + p(2) - 8 = 0$
$\Rightarrow 12 + 2p – 8 = 0$
$\Rightarrow 2p = – 4$
$\Rightarrow p = – 2$ (1)
Put p = -2 in the second given equation $4x^2 - 2px + k = 0$, we get
$4x^2 - 2(-2)x + k = 0$
$\Rightarrow 4x^2 + 4x + k = 0$
It is given that, this equation has equal roots.
$\therefore b^2 – 4ac = 0$ (1)
On comparing with $ax^2 + bx + c = 0$, we get
a = 4, b = 4 and c = k.
$\therefore (4)^2 – 4 \times 4 \times k = 0$
$\Rightarrow 16 – 16k = 0$
$\Rightarrow 16k = 16$
$\Rightarrow k = 1$ (1)

**Sol 32**. Since, one card is drawn from 52 well-shuffled cards.
∴ Total number of possible outcomes = 52

(i) Since, there are two queens of black colour.
∴ P (getting a queen of black colour)
$= \frac{2}{52} = \frac{1}{26}$

(ii) In each suit, there are two cards with number 5 and 6, So, total such cards are 4times 2 = 8
∴ P (getting a card with number 5 or 6)
$= \frac{8}{52} = \frac{2}{13}$ (1)

(iii) In each suit, there are six cards with number less than 8, namely 2, 3, 4, 5, 6 and 7
∴ P (getting a card with number less than 8)
$= \frac{4\times6}{52} = \frac{24}{52} = \frac{6}{13}$ (1)

(iv) In each suit, there are six cards with number between 2 and 9, namely 3, 4, 5, 6, 7, 8.
∴ P (getting a card with number between 2 and 9)
$= \frac{4\times6}{52} = \frac{24}{52} = \frac{6}{13}$ (1)

(v) In a pack of cards, there are 12 face cards,
∴ P (getting a face card) = $= \frac{12}{52} = \frac{3}{13}$ (1)

Or

There are 17 cards numbered 1,2, 3, 4, 5 17 in a box.
Out of 17 cards, one card can be drawn in 17 ways,
∴ Total number of outcomes = 17 (1)

(i) There are nine odd numbered cards, namely
1, 3, 5, 7, 9,11, 13,15 and 17.
∴ Number of favourable outcomes = 9

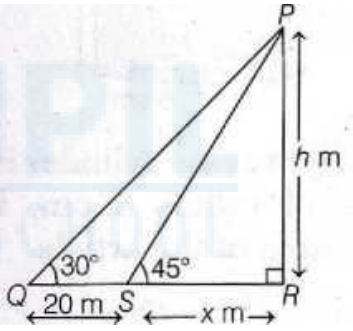
Hence, P (getting an odd number)
$= \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{9}{17}$ (1)

(ii) There are seven prime numbered cards, namely 2,
3, 5, 7, 11, 13 and 17.
Hence, P (getting a prime number)
$= \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{7}{17}$ (1)

(iii) If a number is divisible by 2 and 3 both, then it must be a multiple of 6. In cards bearing number 1, 2, 3, 4, ...., 17, there are only 2 cards which bear a number divisible by 2 and 3 both, i.e. by 6. These cards bearing numbers 6 and 12.
∴ Number of favourable outcomes = 2
Hence, P (getting a card bearing number divisible by 2 and 3 both)
$= \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{2}{17}$ (1)

(iv) There are 7 numbered cards, which are multiple of 3 or 5 namely, 3, 5, 6, 9, 10, 12 and 15.
Number of favourable outcomes = 7
Hence, P (getting a card bearing a number multiple of 3 or 5)
$= \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{7}{17}$ (1)

**Sol 33.** Let the height of the tower PR be h m, the angle of elevation at point 0 is 30° i.e. ∠POR = 30° and S be the position of observer after moving 20 m towards the tower.




According to the question,
∠PSR = ∠PQR + 15°
⇒ ∠PSB = 30° + 15°
⇒∠PSR = 45° (1)
Now, in right angled ΔPRS.
$\tan 45° = \frac{PR}{SH} = \frac{h}{x} \left[\because \tan\theta = \frac{\text{Perpendicular}}{\text{Base}}\right]$
$\Rightarrow \tan 45^o = \frac{h}{x}$
$\Rightarrow 1 = \frac{h}{x}$ $[\because \tan 45^0 = 1]$
$\Rightarrow x = h$ ...(i) (1)
and in right angled ΔPRO
$\tan 30° = \frac{PR}{QR} = \frac{PR}{QS+SR}$ $[\because QR = OS + SR]$
$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{20+x} \left[\because \tan 30^o = \frac{1}{\sqrt{3}}\right]$
$\Rightarrow 20 + x = \sqrt{3}h$ (1)
$\Rightarrow 20 + h = \sqrt{3}h$ [from Eq. (i)]
$\Rightarrow \sqrt{3}h - h = 20$
$\Rightarrow h(\sqrt{3} - 1) = 20$
$\Rightarrow h = \frac{20}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1}$ [by ratlonalising] (1)
$\Rightarrow h = \frac{20(\sqrt{3}+1)}{3-1}$
$= \frac{20(\sqrt{3}+1)}{2}$
$= 10(\sqrt{3} + 1)m$
Hence, the required height of the tower is $(10(\sqrt{3}, +1)m$. (1)

**Sol 34**. Given, base radius of cylinder, r = 5cm and its height, h= 20 cm

Also, radius of hemisphere, r = 5 cm (1)
Now, total surface area of the article
= Curved surface area of the cylinder + 2 (Surface area of a hemisphere)
= 2 πrh + 2(2 πr$^2$) = 2 πr(h + 2r) (2)
$= 2 \times \frac{22}{7} \times 5(20 + 2 \times 5)$
$= \frac{220}{7} \times (20 + 10) = \frac{220 \times 30}{7}$
$= \frac{6600}{7} = 942.86$ cm$^2$ (2)
Or
Let the volume of two spheres are $v_1$ and $v_2$, respectively and correspondlng radii are $r_1$ and $r_2$. Given,
$\frac{v_1}{v_2} = \frac{64}{27} \Rightarrow \frac{\frac{4}{3}\pi r_1^3}{\frac{4}{3}\pi r_2^3} = \left(\frac{4}{3}\right)^3$
[$\because$ volume of the sphere (V) $= \frac{4}{3}\pi r^3$] (1)
$\Rightarrow \frac{r_1^3}{r_2^3} = \left(\frac{4}{3}\right)^3 \Rightarrow \left(\frac{r_1}{r_2}\right)^3 = \left(\frac{4}{3}\right)^3$
$\Rightarrow \frac{r_1}{r_2} = \frac{4}{3}$ [taking cube root]
$\Rightarrow r_1 = \frac{4}{3} r_2$ …(i) (1)
Also given, sum of their radii = 21 cm
$\therefore r_1 + r_2 = 21$ …(ii) (1)
From Eqs. (i) and (it), we get
$\frac{4}{3} r_2 + r_2 = 21$
$\Rightarrow \frac{4r_2 + 3r_2}{3} = 21 \times 3$
$\Rightarrow 7r_2 = 3 \times 3$
$\Rightarrow r_2 = 9$cm (1)
On putting $r_2 = 9$ cm in Eq. (i), we get
$r_1 = \frac{4}{3} \times 9 = 12$ cm
Hence, the radii of the two spheres are 12 cm and 9 cm. (1)

**Sol 35**. The given data may be written as

| **Class** | **Frequency** |
|---|---|
| 0-10 | 14 |
| 10-20 | 22 – 14 = 8 |
| 20-30 | 37 – 22 = 15 |
| 30-40 | 58 – 37 =21 |
| 40-50 | 67 – 58 = 9 |
| 50-60 | 75 – 67 = 8 |

(1)

Here, h = 10
Let assumed mean (A) = Mid-value of (30-40)
= 35 (1/2)
Table for deviation and their product with corresponding frequency is given below

| **Class** | **Frequency ($f_j$)** | **Mid-value ($X_j$)** | **$d_j = x_j$ - A** | **$f_j d_j$** |
|---|---|---|---|---|
| 0-10 | 14 | 5 | -30 | - 420 |
| 10-20 | 8 | 15 | -20 | -160 |
| 20-30 | 15 | 25 | -10 | -150 |
| 30-40 | 21 | 35(A) | 0 | 0 |
| 40-50 | 9 | 45 | 10 | 90 |
| 50-60 | 8 | 55 | 20 | 160 |
| Total | $\sum f_i$ =75 | | | $\sum f_j d_j$ = – 480 |

(2)

Here, $h = 10, \Sigma f_j = 75 \Sigma f_j d_j = -480$ and $A = 35$

$\therefore$ Mean, $\bar{x} = \left\{A + \frac{\Sigma f_j d_j}{\Sigma f_j}\right\} = 35 + \frac{(-480)}{75}$ (1/2)
$=35 + (-6.4) = 35 - 6.4 = 28.6$ (1)

**Sol 36**. (i) We have, $p(x) = x^2 - 24x + 128$
$\Rightarrow p(x) = x^2 - 16x - 8x + 128$
$\Rightarrow p(x) = x(x - 16) - 8(x - 16)$
$\Rightarrow p(x) = (x - 16)(x - 8)$
So, the zeroes of p(x) are given by p(x) = 0
$\Rightarrow (x - 16)(x - 8) = 0$
$\Rightarrow (x - 16) = 0$ and $(x - 8) = 0$
$\Rightarrow x = 16$ and $x = 8$
So, the values of a and β are 8 and 16, respectively.
[$\because 8 < 16$]
(ii) $p(2) = (2)^2 - 24(2) + 128$
$= 4 - 48 + 128 = 132 - 48 = 84$

(iii) Let $q(x) = x^2 + 88x + 125$
Sum of roots = $\alpha + \beta = -88$
and product of roots = $\alpha\beta = 125$
$\therefore \frac{1}{\alpha} + \frac{1}{\beta} = \frac{\beta+\alpha}{\alpha\beta} = \frac{-88}{125}$
Given, $q(x) = kx^2 + 2x + 3k - 2$
Sum of zeroes of q (x) = $\frac{-2}{k}$
Product of zeroes of q (x) = $\frac{3k}{k} = 3$
According to the question,
$\frac{-2}{k} = 3 \Rightarrow k = \frac{-2}{3}$

**Sol 37.** Let the number of questions whose answer is known to the student be x and questions attempted by guessing be y.
Then, $x + y = 120$ ...(i)
and $x - \frac{1}{4}y = 90 \Rightarrow 4x - y = 360$ ...(ii)
On adding Eqs. (i) and (ii), we get
$5x = 480 \Rightarrow x = \frac{480}{5} = 96$
Put x = 96 in Eq. (i), we get
$96 + y = 120 \Rightarrow y = 120 - 96 = 24$

(i) He answered 96 questions correctly.

(ii) He guesses only 24 questions.

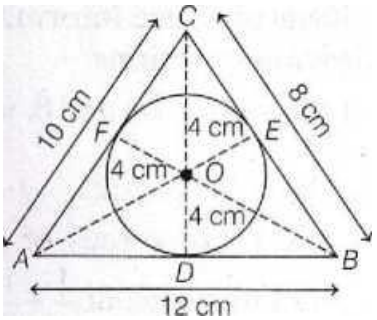
(iii) In out of 120 questions attempted 80 answered are correct and 40 guessing answered are wrong.
Then, he got the marks = $80 - \frac{1}{4}$ of 40
$= 80 - \frac{1}{4} \times 40$
$= 80 - 10 = 70$

Or

According to the given condition,
$x - \frac{1}{4}$ of $(120 - x) = 95$
$\Rightarrow x - \frac{1}{4} x (120 - x) = 95$
$\Rightarrow 4x - 120 + x - 380$
$\Rightarrow 5x = 500$
$\Rightarrow x = 100$

Hence, he answered correctly 100 questions to score 95 marks.

**Sol 38.** Let AD =x - AF [∵ lengths of tangents drawn from an external point to a circle are equal]




Then, SO = BE = AB – AD = 12 – x
and CF = CE = AC – AF = 10 – x
Now, BC = BE + CE
⇒ 8 = 12 – x + 10 – x
⇒ 2x = 14 ⇒ x = 7
(i) AD = x = 7 cm
(ii) BE = 12 – x = 12 – 7 = 5cm
(iii) ar(ΔOAS) = $\frac{1}{2}$ × AS × OD
= $\frac{1}{2}$ ×12 × 4 = 24cm$^2$
ar(ΔOAC) = $\frac{1}{2}$ × AC × OF = $\frac{1}{2}$ × 10 × 4 = 20 cm$^2$
ar(∆OBC) = $\frac{1}{2}$ × BC × OE = 8 × 4 = 16 cm$^2$
ar(∆ASC) = ar(ΔOAS) + ar(ΔOAC) + ar(ΔOBC)
= 24 + 20+ 16 = 60 cm$^2$

Or

CF = 10 – x = 10 – 7 = 3cm
∴ Area of ∆OCF = $\frac{1}{2}$ × CF × OF
= $\frac{1}{2}$ × 3 × 4 = 6 cm$^2$

**Sol 1**. (a) Let α, β, γ are the zeroes of the polynomial f(x). Now, we have
$\alpha\beta\gamma = 4 \Rightarrow \frac{-(-6)}{a} = 4$
$\therefore a = \frac{6}{4} = \frac{3}{2}$

**Sol 2**. (c) We have,
$\tan 5\theta = 1$
$\Rightarrow \tan 5\theta = \tan 45°$
$\Rightarrow 5\theta = 45°$
$\Rightarrow \theta = \frac{45°}{5}$
$= 9°$

**Sol 3**. (c) Given, $T_n = 4n + 3$
$T_1 = 4(1) + 3 = 7$
$T_2 = 4(2) + 3 = 11$
$T_3 = 4(3) + 3 = 15$
$T_3 - T_2 = T_2 - T_1 = 4$
Hence, d is 4.

**Sol 4**. (d) Let $p(x) = (k - 1)x^2 + kx + 1$
Since, – 3 is a zero of polynomial,
$\therefore p(-3) = 0$
$\therefore (k - 1)(-3)^2 + k(-3) + 1 = 0$
$\Rightarrow 9(k - 1) - 3k + 1 = 0$
$\Rightarrow 9k - 9 - 3k + 1 = 0$
$\Rightarrow 6k - 8 = 0 \Rightarrow 6k = 8$
$\therefore k = \frac{8}{6} \Rightarrow k = \frac{4}{3}$

**Sol 5**. (a) Given, the circumference of a quadrant is 20 cm
$\Rightarrow \frac{2\pi r}{4} = 20$
$\Rightarrow \pi r = 40$
$\Rightarrow r = \frac{40}{\pi}$
Now, area of a quadrant $= \frac{\pi r^2}{4} = \frac{\pi}{4} \times \left(\frac{40}{\pi}\right)^2$
$= \frac{\pi}{4} \times \frac{1600}{\pi^2}$
$= \frac{400}{\pi}$ cm$^2$

**Sol 6**. (b) ∵ Mode = 3 Median – 2 Mean
$\Rightarrow 38 = 3 \times 32 - 2 \times$ Mean
$\Rightarrow 2$ Mean $= 3 \times 32 - 38 = 96 - 38 = 58$
$\Rightarrow$ Mean $= \frac{58}{2} = 29$

**Sol 7.** (b) Total number of possible outcomes = 1, 2, 3, 4, 5, 6
Let E = Event of getting a prime number = 2, 3, 5
$\therefore P(E) = \frac{3}{6} = \frac{1}{2}$

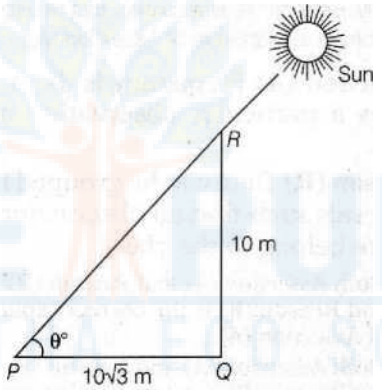
**Sol 8.** (b) Given, ∠OAP = 90°

$\angle OBP = 90°$
$\therefore \angle AOB + \angle APB = 180°$
$\Rightarrow 115° + \angle APB = 180^o$
$\Rightarrow \angle APB = 180° - 115^o = 65^o$

**Sol 9.** (c) In $\Delta ABC$, we have
PQ || BC
$\Rightarrow \frac{AQ}{QC} = \frac{AP}{PB}$
$\Rightarrow \frac{AQ}{6} = \frac{6}{4}$
$\Rightarrow AQ = \frac{6\times6}{4} = 9$ cm

**Sol 10.** (d) Given, $\sin A = \frac{\sqrt{3}}{2}$ and $\cos B = \frac{\sqrt{3}}{2}$
$\Rightarrow \sin A = \sin 60° \left[\because \sin 60° = \frac{\sqrt{3}}{2}\right]$
and $\cos B = \cos 30^o$ [$\because \cos 30^o = \frac{\sqrt{3}}{2}$]
$\Rightarrow A = 60°$ and $B = 30°$
$\therefore A + B = 60° + 30° = 90°$

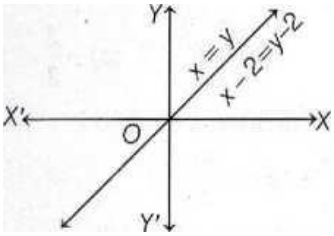
**Sol 11.** (b) Let the angle of elevation of the sun be 8 from $\Delta PQR$.




In APQR, $\tan \theta = \frac{QR}{QP} = \frac{10}{10\sqrt{3}} = \frac{1}{\sqrt{3}} \Rightarrow \theta = 30°$

**Sol 12.** Given in $\Delta ABC$, $\frac{AB}{AC} = \frac{BD}{DC}$
$\angle B = 60°$ and $\angle C = 60°$
We know that sum of angles of a triangle is 180°.
In $\Delta ABC$, $\angle A + \angle B + \angle C = 180°$
$\Rightarrow \angle A + 60° + 60° = 180°$
$\Rightarrow \angle A = 180° - 120° = 60°$
Now, $\frac{AB}{AC} = \frac{BD}{DC}$ [given]
Therefore, AD bisects BC.
[by angle bisector theorem]
Then, $\angle BAC = \frac{1}{2} \angle A = 30°$
Hence, the value of $\angle BAD$ is 30°.

**Sol 13.** (a) We have, x = y and x – 2 = y – 2 $\Rightarrow$ x = y




On graphical representation, we get a pair of coincident lines.[1]

**Sol 14**. (c) Let A be the event of rain tomorrow.
Then, P(A) = 0.3 We know that
P(A) + P(A) = 1
Then, probability that it will not rain tomorrow
= 1 – 0.3 = 07

**Sol 15**. (c) As, $\sqrt{27} = \sqrt{3 \times 3 \times 3} = 3\sqrt{3}$
So, if we multiply it by $\sqrt{3}$ it will become
$3\sqrt{3} \times \sqrt{3} = 3 \times 3 = 9$
i.e a rational number.

**Sol 16**. (d) Smallest prime number = 2
Smallest composite number = 4
Since, product of HCF and LCM
= Product of numbers
∴ HCF × LCM = 2 × 4 = 8

**Sol 17**. (c) From option (c), $(\sqrt{3}x + 7)^2 = 3x^2 + 5$
$\Rightarrow 3x^2 + 49 + 14\sqrt{3}x = 3x^2 + 5$
$\Rightarrow 14\sqrt{3}x + 44 = 0$
∵ The highest power of x is 1, so it is a linear equation.

**Sol 18**. (a) Given, quadratic equation
$5x^2 + 15x + \frac{25}{4} = 0$
We know that if a and β are roots of quadratic equation, then
$\alpha + \beta = -\frac{b}{a}$
Here, $\alpha = -\frac{5}{2}$ and a = 5, b = 15
Then, $\alpha + \beta = -\frac{15}{5} = -3 \Rightarrow \beta = -3 + \frac{1}{2}$
$\therefore \beta = -\frac{5}{2}$

**Sol 19**. (b) Given, number of observations is 10 (even).
∴ .... Median $= \frac{x + (x+4)}{2} = \frac{2x+4}{2} = x + 2$
$\Rightarrow 68 = x + 2 \Rightarrow x = 66$
So, Assertion (A) is true.
Clearly, Reason (R) is also true. But Reason (R) is not the correct explanation of Assertion (A).

**Sol 20**. (b) Both Assertion (A) and Reason (R) are correct,but Reason (R) is not the correct explanation, of Assertion (A).

**Sol 21.** The year 1993 is a non-leap year. Both friends can have their birthday on any one of the 365 days.
So, total number of outcomes = 365 (1)

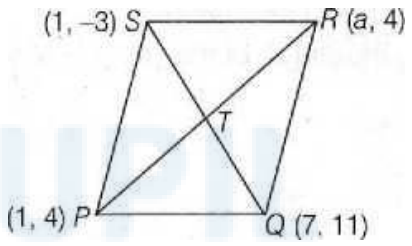
Favourable outcomes = 1
∴ P(E) = $\frac{1}{365}$ (1)

**Sol 22.** Given, vertices of triangle are P (– 5, 6), Q (– 4, – 2) and R (7, 5).
Now, PQ = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
[by distance formula]
= $\sqrt{(-4+5)^2 + (-2-6)^2}$
= $\sqrt{1+64} = \sqrt{65}$ units (1/2)
QR = $\sqrt{(7+4)^2 + (5+2)^2}$
= $\sqrt{121+49}$
= $\sqrt{170}$ units (1/2)
and $PR = (7+5)^2 + (5-6)^2$
= $\sqrt{144+1} = \sqrt{145}$ units (1/2)
Here, PQ ≠ QR ≠ PR
Hence, the given triangle is a scalene triangle. (1/2)

Or

Let P(1,4), Q(7,11), R(a, 4) and S(1, - 3) be the vertices of a parallelogram PQRS, respectively.
Join PR and QS. Let PR and OS intersect at the point T.

(1)




We know that the diagonals of a parallelogram bisect each other.
So, T is the mid-point of PR as well as that of OS.
∴ Mid-point of PR = Mid-point of QS
⇒ $\left(\frac{1+a}{2}, \frac{4+4}{2}\right) = \left(\frac{7+1}{2}, \frac{11-3}{2}\right)$
⇒ $\left(\frac{1+a}{2}, 4\right)$ = (4, 4)
On comparing x-coordinate from both sides, we get
$\frac{1+a}{2}$ = 4 ⇒ 1 + a = 8 ⇒ 7
Hence, the value of a is 7. (1)

**Sol 23.** Given, ∆ABC ~ ∆PQR with AB = 5.5 cm
and PQ = 11 cm
Since, ∆ABC ~ ∆PQR, so corresponding sides are proportional.
∴ $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR} = \frac{55}{11} = \frac{55}{110} = \frac{1}{2}$
⇒ $\frac{AB}{PQ} = \frac{1}{2}$, $\frac{BC}{QR} = \frac{1}{2}$ and $\frac{AC}{PR} = \frac{1}{2}$ (1)
⇒ $AB = \frac{1}{2}PQ$, $BC = \frac{1}{2}$ QR and $AC = \frac{I}{2}PR$
Also [given perimeter of $\Delta ABC = 70$ cm
⇒ $AB + 8C + CA = 70$
⇒ $\frac{1}{2}PQ + \frac{1}{2}QR + \frac{1}{2}PR = 70$
∴ PQ + QR + PR = 140 cm
Hence, perimeter of ∆PQR is 140 cm (1)

**Sol 24** Given, polynomial is
$f(x) = 8x^2 - 2 = \left(2\sqrt{2}x\right)^2 - \left(\sqrt{2}\right)^2$
$=\left(2\sqrt{2}x - \sqrt{2}\right)\left(2\sqrt{2}x + \sqrt{2}\right)$
$[\because a^2 - b^2 = (a-b)(a+b)]$
To determine zeroes, put f(x) = 0
⇒ $\left(2\sqrt{2}x - \sqrt{2}1\right)\left(2\sqrt{2}x + \sqrt{2}\right) = 0$

$\Rightarrow x = \frac{1}{2}$ and $x = -\frac{1}{2}$

Hence, zeroes of $f(x)$ are $\frac{1}{2}$ and- $\frac{1}{2}$ (1)

Now, sum of zeroes $= \frac{1}{2} - \frac{1}{2} = 0$

$$= -\frac{\text{Coefficient of x}}{\text{Coefficient of x}^2}$$

and product of zeroes $= \frac{1}{2}\left(-\frac{1}{2}\right)$

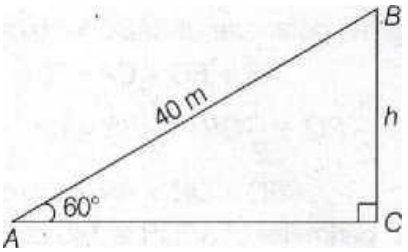
$=-\frac{1}{4} \times \frac{2}{2} = -\frac{2}{8}$

$= \frac{\text{Coefficient of x}}{\text{Coefficient of x}^2}$

Hence, its verify the relationship between zeroes and coefficient. (1)

**Sol 25**. Let BC be the vertical pole and AB be the rope which is tightly stretched and tied from the top of pole to the ground.

Then, AB = 40 m




Let h m be the height of the vertical pole BC.

Then, angle of elevation = $\angle BAC = 60°$ (given). (1)

From right angled $\Delta ABC$, we get

$\sin 60° = \frac{BC}{AB} = \frac{\sqrt{3}}{2} \Rightarrow h = 20\sqrt{3}$

Hence, the height of the pole is $20\sqrt{3}$ m. (1)

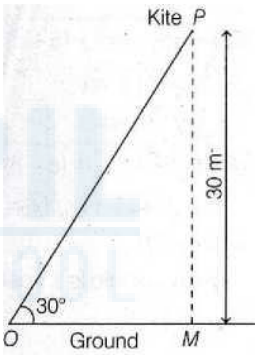
Or

Let P be the kite and the height of the kite, MP = 30m.

Let the string be held at the point O,

then $\angle MOP = 30°$ (given)

and OP is the length of the string.




(1)

From right angled $\Delta OMP$,

$\sin 30° = \frac{MP}{OP} \Rightarrow \frac{1}{2} = \frac{30}{OP}$

$\Rightarrow$ OP = 60 m

Hence, the length of the string is 60 m. (1)

**Sol 26**. Given, diameter of the base (d) = 10 cm

$\therefore$ Radius of the base (r) = $\frac{10}{2}$ = 5 cm

Slant height of the cone (l) = 13 cm

(i) Let the height of the cone = h

We know that

$l^2 = r^2 + h^2$ [using Pythagoras theorem]

$\Rightarrow (13)^2 = (5)^2 + h^2$

$\Rightarrow 169 = 25 + h^2$

$\Rightarrow h^2 = 769 - 25 = 144$

$\therefore h = \sqrt{144} = 12$ cm

[taking positive square root]

Hence, height of the cone is 12 cm. (1 1/2)

(ii) Volume of solid = Volume of hemisphere + Volume of cone

$= \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h$

$= \frac{1}{3}\pi r^2 (2r + h)$

$= \frac{1}{3} \times \frac{22}{7} \times 5 \times 5(2 \times 5 + 12)$

[∵ r = 5 cm and b = 12 cm]
$= \frac{22\times25}{21}(10 + 12)$
$= \frac{22\times25}{21}(22) = \frac{12100}{21}$
$= 576.19\ cm^3$
Hence, the volume of solid is 576.19 $cm^3$. (1 1/2)

**Sol 27.** As the class 4050 has maximum frequency, so it is the modal class.
∴ l = 40, h = 10, $f_1 = 28$, $f_0 = 12$ and $f_2 = 20$. (1)
Mode, $M_0 = 1 + \left\{h \times \frac{f_1 - f_0}{(2f_1 - f_0 - f_2)}\right\}$
$= 40 + \left\{h \times \frac{(28-12)}{(2\times28-12-20)}\right\}$ (1)
$= 40 + \left\{10 \times \frac{16}{24}\right\} = 40 + 40 + \frac{20}{3}$
$= 40 + 6.67 = 46.67$
Hence, mode is 46.67. (1)

**Sol 28**. Given, $\frac{1}{x+4} - \frac{1}{x+7} = \frac{3}{10}$
$\therefore \frac{x+7-(x+4)}{(x+7)(x+4)} = \frac{3}{10}$
$\Rightarrow \frac{3}{(x^2+11x+28)} = \frac{3}{10}$
$\Rightarrow \frac{1}{x^2+11x+28} = \frac{1}{10}$ (1 1/2)
$\Rightarrow x^2 + 11x + 28 = 10$
$\Rightarrow x^2 + 11x + 18 = 0$
$\Rightarrow x^2 + 9x + 2x + 18 = 0$
$\Rightarrow x(x + 9) + 2(x + 9) = 0$
$\Rightarrow (x + 9)(x + 2) = 0$
$\Rightarrow x = -9, -2$ (1 1/2)

Or

Given, equation is $9x^2 - 3(a + b)x + ab = 0$.
On comparing with $Ax^2 + Bx + C = 0$, we get
A = 9, B = –3(a + b) and C = ab
Discriminant, $D = B^2 - 4AC$
$= 9 (a + b)^2 - 4(9) (ab)$
$= 9\{(a + b)^2 - 4ab\}$
$= 9 (a - b)^2$
$[\because (a + b)^2 - 4ab = (a - b)^2]$ (1)
Therefore, the two real roots of the equation are given by
$x = \frac{-B\pm\sqrt{D}}{2A}$ [by quadratic formula]
$= \frac{3(a+b)\pm3(a-b)}{18}$
$= \frac{(a+b)\pm(a-b)}{6}$ (1)
$\Rightarrow x = \frac{(a+b)+(a-b)}{6}$
$\Rightarrow x = \frac{(a+b)+(a-b)}{6}$
or $x = \frac{(a+b)-(a-b)}{6}$
$\Rightarrow x = \frac{2a}{6}$ or $x = \frac{2b}{6}$
$\therefore x = \frac{a}{3}$ or $x = \frac{b}{3}$
Hence the two roots are $\frac{a}{b}$ and $\frac{b}{3}$ (1)

**Sol 29.** LHS $= \frac{(1+\cot A+\tan A)(\sin A-\cos A)}{\sec^3 A-\operatorname{cosec}^3 A} = \left(\frac{\left(1+\frac{\cos A}{\sin A}+\frac{\sin A}{\cos A}\right)(\sin A-\cos A)}{[(\sec A-\operatorname{cosec} A)(\sec^2 A+\sec A\operatorname{cosec} A+\operatorname{cosec}^2 A)]}\right.$ (1)

$$\left[\because \begin{array}{c} \cot\theta = \frac{\cos\theta}{\sin\theta}, \tan\theta = \frac{\sin\theta}{\cos\theta} \\ \text{and } a^3 - b^3 = (a-b)(a^2+b^2+ab) \end{array}\right]$$

$$= \frac{\sin A \cos A + \cos^2 A + \sin^2 A)(\sin A - \cos A)}{\sin A \cos A}$$

$$\frac{}{(\sec A - \operatorname{cosec} A)\left(\frac{1}{\cos^2 A} + \frac{1}{\cos A \sin^2 A} + \frac{1}{\sin^2 A}\right)}$$

$$= \frac{(\sin A \cos A + 1)\left(\frac{\sin A}{\sin A \cos A} - \frac{\cos A}{\sin A \cos A}\right)}{(\sec A - \operatorname{cosec} A)\left(\frac{\sin^2 A + \sin A \cos A + \cos^2 A}{\sin^2 A \cos^2 A}\right)}$$

$[\because \sin^2\theta + \cos^2\theta = 1]$ (1)

$$= \frac{(\sin A \cos A + 1)(\sec A - \operatorname{cosec} A)}{(\sec A - \operatorname{cosec} A)(1 + \sin A \cos A)} \times \sin^2 A \cos^2 A$$

$[\because \sin^2\theta + \cos^2\theta = 1]$

= $\sin^2 A \cos^2 A$ = RHS **Hence proved**. (1)

**Sol 30**. It is given that when dividing 398 by the required number, then there is a remainder of 7. This means that 398 – 7 = 391 is exactly divisible by the required number. In other words, required number is a factor of 391. (1)

Similarly, the required positive integer is a factor of 436 – 11 = 425 and 542 – 15 = 527.

Clearly, required number is the HCF of 391, 425 and 527. (1)

Using prime factorisations of 391, 425 and 527 as follows

391 = 17 × 23, 425 = $5^2$ × 17 and 527 = 17 × 31

∴ HCF of 391, 425 and 527 = 17

Hence, 17 is the required number. (1)

Or

Given numbers are 156, 208 and 260.

The prime factor of given numbers are

156 = $2^2$ × 3 × 13, 208 = $2^4$ × 13

and 260 = $2^2$ × 5 × 13

∴ HCF of (156, 208, 260) = $2^2$ × 13 = 52 (2)

Thus, HCF of 156, 208 and 260 is 52.

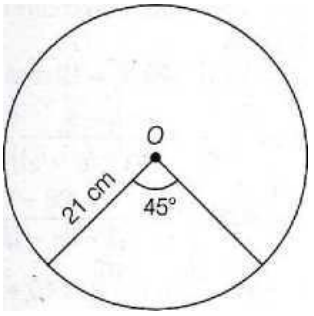
Hence, the minimum number of buses

$$= \frac{156}{52} + \frac{208}{52} + \frac{260}{52}$$

= 3 + 4 + 5 = 12 (1)

**Sol 31.** Given, r = 21 cm and θ = 45°

(1)




= Arc length = $\frac{\theta}{360^o} \times 2\pi r$

= $\frac{45^\circ}{360^o} \times 2 \times \frac{22}{7} \times 2$

= $\frac{1}{4} \times 22 \times 3$

= 165 cm (1)

Now, area of sector = $\frac{1}{2} \times l \times r$

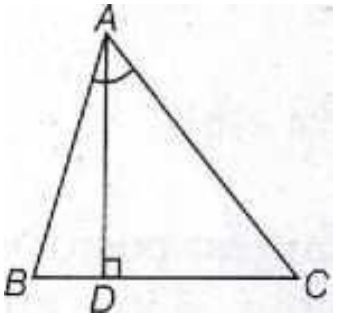
[where l = are length]

= $\frac{1}{2} \times 165 \times 21$

= $173.25 cm^2$ (1)

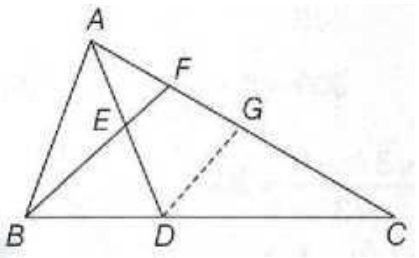
**Sol 32**. Draw ∆ABC such that D is a point on BC and join AD.

In ΔABC and ΔDAC, we have
∠BAC = ∠ADC [given] (1)
and ∠ACB = ∠DCA [common angle]
∴ ΔABC ~ ΔDAC [by AA similarity criterion]
$\Rightarrow \frac{AC}{DC} = \frac{CB}{CA}$ (1)
[since, corresponding sides of two similar triangles are proportional]
or $\frac{CA}{CD} = \frac{CB}{CA}$ (1)
⇒ CA × CA = CB × CD
⇒ $CA^2$ = CB × CD **Hence proved**. (1)




Or

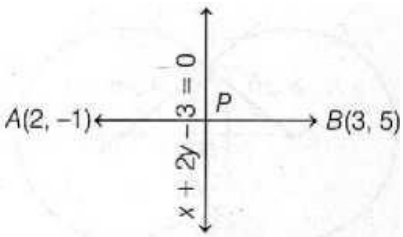
Given In ΔABC, mid-point of BC is D and mid-point of AD is E.
Construction Draw DG || BF,
**To Prove** AF = $\frac{1}{3}$ AC




(1)
Proof in $\Delta CBF$, $DG||BF$
$\therefore \frac{CG}{GF} = \frac{CD}{BD}$
[by Basic proportionality theorem] (1)
$\Rightarrow \frac{CG}{GF} = 1$ [∵ D is mid-point of BC]
⇒ CG = GF ...(i)
In ΔADG, EF || DG
$\therefore \frac{AE}{ED} = \frac{AF}{FG}$
[by Basic proportionality theorem] (1)
$\Rightarrow 1 = \frac{AF}{FG}$ [∵ E is mid-point of AD]
⇒ AF = FG ...(iii) (1)
From Eqs. (i) and (ii), we get
$AF = FG = CG$
$\therefore AF = \frac{1}{3}AC$ **Hence proved**. (1)

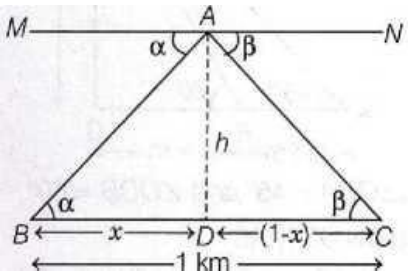
**Sol 33.** Let the line x + 2y – 3 = 0 divides the line segment joining the points A(2, -1)and B(3, 5)in the ratio X: 1 at the point P.

(1)
Coordinates of P = $\left(\frac{3\lambda+2}{\lambda+1}, \frac{5\lambda-1}{\lambda+1}\right)$
[∵ using section formula i.e. $\left(\frac{m_1x_2+m_2x_1}{m_1+m_2}, \frac{m_1y_2+m_2y_1}{m_1+m_2}\right)$] (1)
But P lies on x + 2y - 3 = 0.
So, coordinates of P satisfy the equation x + 2y – 3 = 0.
$\therefore \frac{3\lambda+2}{\lambda+1} + 2\left(\frac{5\lambda-1}{\lambda+1}\right) - 3 = 0$ (1 ½)
⇒ 3λ + 2 + 10λ – 2 = 3k + 3
$\Rightarrow \lambda = \frac{3}{10}$
So, the point P divides the iine segment in the ratio 3:10. (1 ½)




**Sol 34**. Let A be an aeroplane flies above h km from the road and angles of depressions on both sides of road B and C from A are tan α and β, respectively.

∵ Distance between two stones B and C = 1 km [given]




Now, MN || BC

∴ ∠MAB = ∠ABD = α [alternate angles]

and ∠NAC = ∠ACD = β [alternate angles] (1)

Let BD = x km, then DC = (1 - x) km

In right angled ∆ADB,

$\tan \alpha = \frac{\text{Perpendicular}}{\text{Base}} = \frac{AD}{BD}$

$\Rightarrow \tan \alpha = \frac{h}{x}$

$\Rightarrow h = x \tan \alpha$

[using cross-multiplication] ...(i) (1)

In right angled ∆ADC,

$\tan \beta = \frac{\text{Perpendicular}}{\text{Base}} = \frac{AD}{DC}$

$\Rightarrow \tan \beta = \frac{h}{(1-x)}$

$\Rightarrow \tan\beta = \frac{x\tan\alpha}{(1-x)}$ [from Eq. (i)] (1)

$\Rightarrow \tan \beta(1 - x) = x \tan \alpha$ [using cross-multiplication]

$\Rightarrow \tan \beta - x \tan \beta = x \tan \alpha$

$\Rightarrow \tan\beta = x\tan\alpha + x\tan\beta$

[on transposition]

$\Rightarrow \tan\beta = x (\tan\alpha + \tan\beta)$

$\Rightarrow x = \frac{\tan\beta}{\tan \alpha+\tan\beta}$ ...(ii) (1)

On putting the value of x in Eq. (i), we get

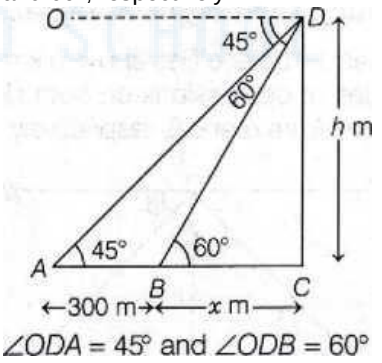
$h = \frac{\tan \beta}{\tan \alpha+\tan\beta} \cdot \tan\alpha = \frac{\tan\alpha \cdot \tan\beta}{\tan\alpha+\tan\beta}$

Hence, the height of aeroplane is $\frac{\tan\alpha \cdot \tan\beta}{\tan\alpha+\tan\beta}$

**Hence proved.** (1)

Or

Let D be an aeroplane flying at height hm. A and B are two houses and distance between them is AB = 300 m. The angles of depression from D to A and B are 45° and 60°, respectively. (1)




Now, draw OD || AC.

Then, ∠DAC = ∠ODA = 45° [alternate angles]

and ∠DBC = ∠ODB = 60° [alternate angles]

Again, let BC = x m.

Then, AC = AB + BC = (300 + x) m

In right angled ΔDCB,

$\tan 60° = \frac{DC}{BC}$ [∵ $\tan \theta = \frac{\text{Perpendicular}}{\text{Base}}$]

$\Rightarrow \sqrt{3} = \frac{h}{x}$ [∵ $\tan 60° = \sqrt{3}$]

$\Rightarrow x = \frac{h}{\sqrt{3}}$ ...(i) (1)

In right angled ΔDCA,

$\tan 45° = \frac{DC}{AC}$

$\Rightarrow 1 = \frac{DC}{AB+BC}$

$\Rightarrow 1 = \frac{h}{300+x}$ [∵ $\tan 45° = 1$]

$\Rightarrow 300 + x = h$ [using cross-multiplication] (1)

On putting the value of x from Eq. (i), we get

$300 + \frac{h}{\sqrt{3}} = h$

$\Rightarrow 300 = h - \frac{h}{\sqrt{3}}$ [on transposition]

$\Rightarrow \frac{\sqrt{3}h-h}{\sqrt{3}} = 300$

$\Rightarrow \frac{h(\sqrt{3}-1)}{\sqrt{3}} = 300$

$\therefore h = \frac{300\sqrt{3}}{(\sqrt{3}-1)} = \frac{300\sqrt{3}}{(\sqrt{3}-1)} \times \frac{(\sqrt{3}+1)}{(\sqrt{3}+1)}$

[on rationalisation] (1)

$= \frac{300\sqrt{3}(\sqrt{3}+1)}{(\sqrt{3})^2-(1)^2}$ [$\because (a-b)(a+b) = a^2 - b^2$]

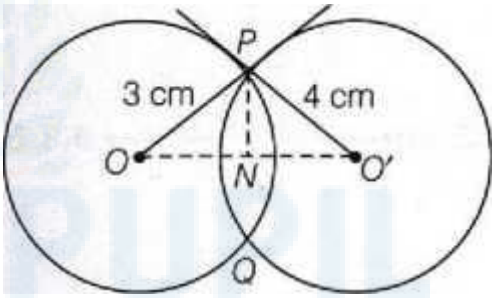
$= \frac{300\sqrt{3}(\sqrt{3}+1)}{3-1} = \frac{300(3+\sqrt{3})}{2}$

$= 150(3 + 1.732) = 150 \times 4.732$ $[\sqrt{3} \Rightarrow 1.732]$

$= 709.800 = 709.8$

Hence, the height of an aeroplane is 709.8 m. (1)

**Sol 35.** Here, two circles of radii
OP = 3 cm and PO' = 4 cm
These two circles intersect at P and Q.
Here, OP and PO' are two tangents drawn at point P.
But these two tangents make an angle 90°.
Join OO' and PN. (1)




In right ∆OPO',
$(OO')^2 = (OP)^2 + (PO')^2$
[by Pythagoras theorem]
$= (3)^2 + (4)^2 = 25$
$\Rightarrow$ OO' = 5 cm (1)
Also, PN $\perp$ OO'
Let ON = x, then NO' = 5 – x
In right angled ∆OPN,
$(OP)^2 = (ON)^2 + (NP)^2$
$\Rightarrow (NP)^2 = 3^2 - x^2 = 9 - x^2$ ...(i) (1)
and in right angled ΔPNO',
$(PO')^2 = (PN)^2 + (NO')^2$
$\Rightarrow (4)^2 = (PN)^2 + (5 - x)^2$
$\Rightarrow (PN)^2 = 16 - (5 - x)^2$ ...(ii)
From Eqs. (i) and (ii), we get
$9 - x^2 = 16 - (5 - x)^2$
$\Rightarrow 7 + x^2 - (25 + x^2 - 10x) = 0$
$\Rightarrow 10x = 18$
$\Rightarrow x = 1.8$ (1)
Again, in right angled ∆OPN,
$OP^2 = (ON)^2 + (NP)^2$
$\Rightarrow 3^2 = (1.8)^2 + (NP)^2$
$\Rightarrow (NP)^2 = 9 - 3.24 = 5.76$
$\Rightarrow (NP) = 2.4$
$\therefore$ Length of common chord,
PQ = 2PN = 2 × 2.4 = 4.8 cm (1)

**Sol 36**. (i) Labour charges for each subsequent metres are
150,150 + 50,150 + 2 × 50 + 150 + 3 × 50 i.e, 150, 200, 250, 300....
Thus, amount of labour charge form an AP with
a = 150 and d = 50
Total depth = 10 m
$\therefore$ Labour charge for 10 m depth
$= 150 + (10 - 1) \times 50 = 600$
Hence, Rs. 600 should be paid to the labour.
(ii) Ram saves = 600 – 550 = Rs. 50

(iii) First term, a = 4(1) – 10 = 4 –10= – 6
Second term, b = 4(2) – 10 = 8 – 10 = – 2
∴ Common difference, d = b – a = – 2 – (– 6)
= –2 + 6 = 4
So, 16th term = a + (n – 1)d
= – 6 + (16 – 1) × 4
= – 6 + 60 = 54

Or

Given, nth term of the AP = – 62
Here, a = 10, d =7 – 10 = –3
∴ a + (n – 1)d = – 62
⇒ 10 + (n -1)(–3) = –62
⇒ 10 – 3n + 3 = – 62
⇒ 3n = 13 + 62
⇒ n = $\frac{75}{3}$ = 25
So, there are total 25 terms,
Middle term of the AP = $\left(\frac{25+1}{2}\right)$
= 13th term
So, 13th term = 10 + (13 – 1) × (–3)
= 10 – 36
= – 26

**Sol 37.** (i) Base area of cube = $(\text{Side})^2$
= $(12)^2$ = 144 $cm^2$
(ii) Radius of hemispherical portion = $\frac{4.2}{2}$ = 2.1 cm
(iii) Total surface area of hemisphere = $3\pi r^2$
= $3 \times \frac{22}{7} \times (2.1)^2 = 3 \times \frac{22}{7} \times 2.1 \times 2.1 = 41.58$ $cm^2$
Total surface area of cube = $6\ (\text{edge})^2$
= $6 \times (12)^2 = 6 \times 144$
= 864 $cm^2$

Or

Total surface area to covering the packing paper of the decorative block
= Total surface area of cube – Area of base of hemisphere block + Curved surface area of hemisphere
= $864 – \pi r^2 + 2\pi r^2$
= $864 + \pi r^2$
= $864 + \frac{22}{7} \times (2.1)^2$
= $864 + \frac{22}{7} \times 2.1 \times 2.1$
= 864 + 13.86
= 877.86 $cm^2$

**Sol 38**. (i) Let x be the number of rides on the giant wheel and y be the number of times hoopla played by Palak.
Then, y = $\frac{x}{2}$ and 3x + 4y = 20
Rewrite the above equations to represent algebraically
x – 2y = 0 ...(i)
3x + 4y = 20 ...(ii)
(ii) If the pair of equations intersect at only one point. Then the pair of equations has a unique solution and hence consistent,
(iii) From Eq. (i), x = 2y
Put x = 2y in Eq. (ii), we get
3(2y)+ 4y = 20
⇒ 10y = 20
⇒ y = 2

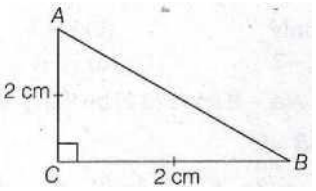
$\Rightarrow x = 2 \times 2 = 4$
Hence, the intersection point is (4, 2).

Or

For intersection point of the line 3x+ 4y =20 on X-axis.
Put y = 0 in Eq. (ii), we get
3x + 0 = 20
$x = \frac{20}{3}$
$\therefore$ The intersection point is $\left(\frac{20}{3}, 0\right)$
For intersection point of the line 3x + 4y = 20 on Y-axis.
Put x = 0 in Eq. (ii), we get
$0 + 4y = 20 \Rightarrow y = 5$
$\therefore$ The intersection point is (0, 5).

**Sol 1**. (a) A polynomial is an algebraic expression containing two or more terms.
Also, it requires the exponents of the variables in each term should be positive integer.
(a) $2x^{-3} - 5 + 3x^{-1}$, it is not polynomial, because it has negative power in second term.
(b) $x^3 + 2x - 9$, it is a polynomial.
(c) $(x - 2)^2 + 3x = x^2 + 4 - 4x + 3x = x^2 - x + 4$, it is a polynomial.
(d) $\frac{2x+10}{x+5} \times (x^2 - 25) = \frac{2(x+5)}{(x+5)} \times (x^2 - 25) = 2x^2 - 50$, it is a polynomial.

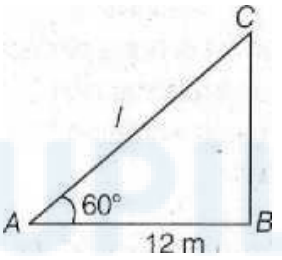
**Sol 2**. (c) Given, ΔACB right angled at C.
We have, AC = CB = 2 cm




By Pythagoras theorem,
$(AB)^2 = (AC)^2 + (CB)^2 = 2^2 + 2^2 = 4 + 4$
$\Rightarrow (AB)^2 = 8$
$\Rightarrow AB = 2\sqrt{2}$ cm
∴ Hypotenuse (AB) = $2\sqrt{2}$ cm

**Sol 3**. (b) The distance between two parallel tangents to a circle of radius 7 cm is 2 × 7 = 14cm.

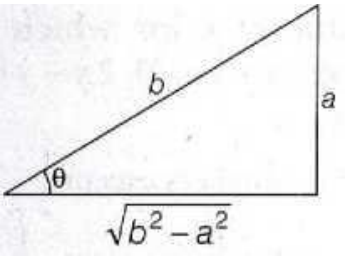
**Sol 4**. (d) Let length of ladder is AC is l m.




In right ΔABC,
$\cos 60° = \frac{AB}{AC} \Rightarrow \frac{1}{2} = \frac{12}{l}$
$\Rightarrow l = \frac{12}{1/2} \Rightarrow$ l = 24 m

**Sol 5.** (a) Radius of the smaller circle = 21 cm
Radius of the bigger circle = 21 + 3.5 = 24.5 cm
∴ Area of the path = $[\pi(24.5)^2 - \pi(21)^2]$
$= \pi[(24.5)^2 - (21)^2]$
$= \pi(24.5 + 21)(24.5 - 21)$
$= \frac{22}{7} \times 45.5 \times 35$
$= 500.5 \text{ cm}^2$

**Sol 6**. (b) Given, $\sin\theta = \frac{b}{\sqrt{b^2-a^2}}$ and $\tan\theta = \frac{a}{\sqrt{b^2-a^2}}$




∴ $\sec\theta + \tan\theta = \frac{b}{\sqrt{b^2-a^2}} + \frac{a}{\sqrt{b^2-a^2}}$
$= \frac{a+b}{\sqrt{b^2-a^2}}$
$= \frac{a+b}{\sqrt{(b-a)(b+a)}}$
$= \sqrt{\frac{b+a}{b-a}}$

**Sol 7**. (a) Given, 47x + 31y = 18 ...(i)
and 31x + 47y = 60 ...(ii)
On adding Eqs. (i) and (ii), we get
78x + 78y = 78
⇒ x + y = 1 [divide both sides by 78]

**Sol 8**. (d) Discriminant = $b^2 - 4ac = (t + 1)^2 - 4(t + 4) \times 1$
$= t^2 - 2t - 15$
For equal roots, discriminant = 0
$\Rightarrow t^2 - 2t - 15 = 0$
$\Rightarrow t^2 - 5t + 3t - 15 = 0$
$\Rightarrow t(t - 5) + 3(t - 5) = 0$
$\Rightarrow (t + 3)(t - 5) = 0$
$\therefore t = 5$ or $t = -3$
Hence, the values of Ms 5, — 3.

**Sol 9**. (b) $\frac{2\sin 30^o}{1-\cos^2 60^0} \Rightarrow \frac{2\times\frac{1}{2}}{1-\left(\frac{1}{2}\right)^2}$
$= \frac{1}{1-\frac{1}{4}} = \frac{1}{3/4} = \frac{4}{3}$

**Sol 10**. (b) Given system of equations is
$x + ky = 0$ and $2x - y = 0$
On comparing these equations with
$a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we get
$a_1 = 1, b_1 = k, c_1 = 0$
and $a_2 = 2, b_2 = -1, c_2 = 0$
Condition for unique solution,
$\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \Rightarrow \frac{1}{2} \neq \frac{k}{-1} \Rightarrow k \neq -\frac{1}{2}$

**Sol 11**. (c) Total number of elementary events = 4
(HT, TH, HH, TT)
No head is obtained i.e. TT
$\therefore$ Favourable number of elementary elements = 1
$\therefore$ Required probability = $\frac{1}{4}$

**Sol 12**. (d) Let A(a, -1) and B(3, 2) be the given points, then AB =5
$\Rightarrow \sqrt{(a-3)^2 + (-1-2)^2} = 5$
$\Rightarrow (a - 3)^2 + (-3)^2 = 25$
$\Rightarrow a^2 + 9 - 6a + 9 = 25$
$\Rightarrow a^2 - 6a + 18 - 25 = 0$
$\Rightarrow a^2 - 6a - 7 = 0$
$\Rightarrow (a - 7)(a + 1) = 0$
$\Rightarrow a = 7$ or $a = -1$

**Sol 13**. (c) Given, $3x^2 + 6x + 1 = 0$
$a = 3, b = 6$ and $c = 1$
Discriminant, $D = b^2 - 4ac$
$= (6)^2 - 4 \times 3 \times 1$
$= 36 - 12$
$= 24 > 0$
We know that 24 is not a perfect square, so the roots will contain an irrational part.
Hence, the given equation has two distinct real and irrational roots.

**Sol 14**. (b) $\therefore$ OP$\perp$QP and OR$\perp$OR
In quadrilateral OPQR,
$\angle OPQ + \angle PQR + \angle QRO + \angle ROP = 360°$
$\Rightarrow 90° + 25° + 90° + \angle ROP = 360°$
$\Rightarrow \angle ROP = 360° - 180° - 25°$

= 155°

**Sol 15**. (b) In AABC, DE||BC
Let EC = x cm,
then $\frac{AD}{DB} = \frac{AE}{EC}$
[by basic proportionality theorem]
$\Rightarrow \frac{5}{8} = \frac{10}{x}$
$\Rightarrow x = \frac{10 \times 8}{5}$
= 16cm
∴ EC = 16 cm

**Sol 16**. (b) From the figure, the required triangle is ∆ACD.
Here, base of triangle = 6 – 1 = 5
Height of triangle =2
We know that,
Area of ∆ACD = $\frac{1}{2}$ × base × height
= $\frac{1}{2}$ × 5 × 2
= 5 sq units

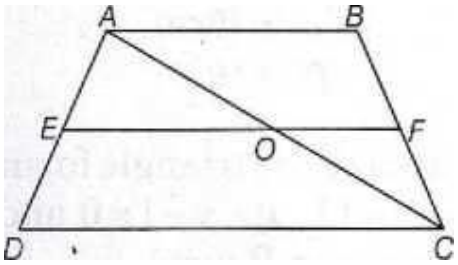
**Sol 17**. (b) In ∆ASC, ∠A + ∠B + ∠C = 180°
[sum of all angles of a triangle is 180°]
83° + 58° + ∠C = 180°
⇒ ∠C = 180° – (83° + 58°)
⇒ ∠C = 39°
Now, In ΔPQR,
∠P + ∠Q + ∠R = 180°
⇒ 58° + ∠Q + 39° = 180°
⇒ ∠Q = 180° – (58° + 39°)
⇒ ∠Q = 83°
Now, In ∆ABC and ∆QPR,
∠A = ∠Q – 83°
∠B = ∠P = 58°
∠C = ∠R = 39°
∆ABC ~ ∆QPR [by AAA similarity criterion]

**Sol 18**. (d) We have numerator and denominator of the fraction be x and y respectively.
Sum of numerator and denominator = 8
i.e. x + y = 8
Since, denominator is increased by 1
i.e New, denominator = y + 1
∴ New fraction is = $\frac{x}{y+1} = \frac{1}{2}$
Hence, algebraically the situation can be represented as
x + y = 8 and $\frac{x}{y+1} = \frac{1}{2}$

**Sol 19.** (a) Both Assertion (A) and Reason (R) are true and
Reason (R) is the correct explanation of Assertion (A).

**Sol 20**. (a) Given, EF\\AB
∴ OE || AB || CD [∵ AB||CD]

In ΔACD,
$\frac{AE}{ED} = \frac{AO}{OC}$ [by BPT] ...(i)
Similarly in ΔABC,
$\frac{AO}{OC} = \frac{BF}{FC}$ …(ii)
From Eqs. (i) and (ii),
$\frac{AE}{ED} = \frac{BF}{FC}$



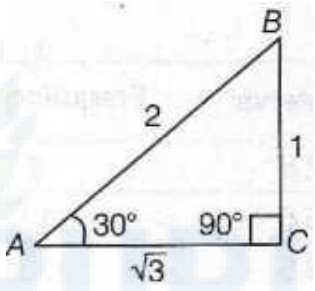

∴ Any line parallel to parallel sides of a trapezium divides the non-parallel sides proportionally.
Both Statement I and II are True and Statement II is the correct explanation of Statement I

**Sol 21.** Required time = LCM (15, 20). (1)
By using prime factorisation method,
Now, 15 = 3 × 5
and 20 = 2 × 2 × 5 = $2^2$ × 5
∴ LCM (15, 20) = $2^2$ × 3 × 5 = 60 min
In every 60 min, tour leaves at the same time. (1)

**Sol 22**. Given, $\sqrt{3}$tan 2x = cos60° + sin45°cos45°
∴ $\sqrt{3}$ tan 2x = $\frac{1}{2} + \frac{1}{\sqrt{2}} \times \frac{1}{\sqrt{2}}$ (1)
⇒ tan 2x = $\frac{1}{\sqrt{3}}\left(\frac{1}{2} + \frac{1}{2}\right)$
⇒ tan 2x = $\frac{1}{\sqrt{3}}$ ⇒ tan 2x = tan 30°
⇒ 2x = 30° ⇒ x = 15° (1)

Or

Given, tan A = $\frac{1}{\sqrt{3}}$ ⇒ A = 30°




⇒ $\tan A = \frac{BC}{AC} = \frac{1}{\sqrt{3}}$
⇒ BC = k, AC = $\sqrt{3}$k
in right ΔABC,
AB = $\frac{1}{\sqrt{(AC)^2+(BC)^2}}$
= $\frac{1}{\sqrt{(\sqrt{3}k)^2+(k)^2}} = \sqrt{3k^2 + k^2} = 2k$ (1)
In right ΔABC, ∠A + ∠B + ∠C = 180°
⇒ $\angle B = 180° - (30° + 90^o) = 60°$
Now, cos B = $\frac{BC}{AB} = \frac{1}{2}$
Now, sin A cos $B = \sin 30° \times \frac{1}{2} = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ (1)

**Sol 23.** Let assumed mean, A = 145
Table for deviation is given below

| Height (in cm) | Number of girls ($f_j$) | Class marks $x_j$ | $d_j = x_j - A$ | $f_i d_j$ |
|---|---|---|---|---|
| 120-130 | 2 | 125 | -20 | -40 |
| 130-140 | 8 | 135 | -10 | -80 |
| 140-150 | 12 | 145 = A | 0 | 0 |
| 150-160 | 20 | 155 | 10 | 200 |
| 160-170 | 8 | 165 | 20 | 160 |
| Total | $\sum f_j = 50$ | | | $\sum f_i d_j = 240$ |

(1)
Here, $\sum f_i = 50$ and $f_i d_j = 240$

. ∑fdi 240

∴ Mean = A + $\frac{\sum f_j d_j}{\sum f_j} = 145 + \frac{240}{50}$

= 145 + 48 = 149.8 (1)

**Sol 24.** Let the two numbers be x and y (x > y).

According to the question,

x - y = 26 ...(i)

and x = 3y ...(ii)

On substituting the value of x from Eq. (ii) in Eq. (i), we get 3y – y = 26

⇒ 2y = 26 ⇒ y = 13 (1)

On substituting y = 13 in Eq. (ii), we get

x = 3 ×13 ⇒ x = 39

Hence, the two numbers are 39 and 13. (1)

**Sol 25.** Let a be the first term and d be the common difference of an AP.

∵ The nth term of an AP is $a_n = a + (n - 1)d$

∴ $a_3 = a + 2d = 4$ [∵ $a_3 = 4$, given] ...(i)

and $a_9 = a + 8d = -8$ [∵ $a_9 = -8$, given] ...(ii)

On subtracting Eq. (i) from Eq. (ii), we get

$6d = -12 \Rightarrow d = \frac{-12}{6} = -2$ (1/2)

On putting the value of d in Eq. (i) we get

$a + 2 \times (-2) = 4 \Rightarrow a - 4 = 4 \Rightarrow a = 4 + 4 = 8$ (1/2)

Let the nth term of this AP be zero,

i.e. $a_n = 0$

$\Rightarrow a + (n - 1)d = 0$

$\Rightarrow 8 + (n - 1)(-2) = 0$ [∵ $a = 8, d = -2$]

$\Rightarrow (n - 1)(-2) = -8$

$\Rightarrow n - 1 = \frac{-8}{-2} = 4$

$\therefore n = 4 + 1 = 5$

Hence, 5th term of this AP is zero. (1)

Or

Let a be the first term andd be the common difference of an AP.

Then, nth term, $T_n = a + (n - 1)d$

Given, 8th term, $T_8 = \frac{17}{6} \Rightarrow a + 7d = \frac{17}{6}$

$\Rightarrow \frac{1}{2} + 7d = \frac{17}{6}$ $\left[\because a = \frac{1}{2}\right]$

$\Rightarrow 7d = \frac{17}{6} - \frac{1}{2} \Rightarrow 7d = \frac{14}{6} \Rightarrow d = \frac{1}{3}(1)$

Now, 4th term, $T_4 = a + 3d = \frac{1}{2} + 3\left(\frac{1}{3}\right) \Rightarrow \frac{1}{2} + 1 = \frac{3}{2}$

And 350th term, $T_{50} = a + 49d = \frac{1}{2} + 49 \times \frac{1}{3} = \frac{101}{6}$

Required ratio = $\frac{3/2}{101/6} = \frac{3}{2} \times \frac{6}{101} = 9:101$ (1)

**Sol 26**. Let $p(x) = x^2 - 2x - 15$

On comparing with $ax^2 + bx + c$, we get

a = 1, b = -2 and c = – 15 (1/2)

Given, α and β are the zeroes of p(x).

∴ Sum of zeroes, $(\alpha + \beta) = -\frac{b}{a}$

$\Rightarrow \alpha + \beta = -\frac{(-2)}{1}$

⇒ α+ β = 2 ...(i) (1/2)

and product of zeroes, $(\alpha \cdot \beta) = \frac{c}{a}$

$\Rightarrow \alpha\beta = \frac{-15}{1}$

⇒ αβ = –15 …(ii) (1/2)
We have to form a polynomial whose zeroes are 2α and 2β.
∴ Sum of zeroes = 2α + 2β = 2(a + β)
= 2 × 2 = 4 [using Eq. (i)]
and product of zeroes = 2 α · 2 β (1/2)
= 4α β = 4 × (–15)
= –60 [using Eq, (ii)]
∴ Required polynomial
= $x^2$ – (Sum of zeroes) x + (Product of zeroes)
= $x^2$ – 4x + (–60) = $x^2$ – 4x – 60 (1)

**Sol 27**. The given series is in inclusive form. Converting it to exclusive form and preparing the cumulative frequency table is given below

| **Class interval** | **Frequency ($f_j$)** | **Cumulative frequency** |
|---|---|---|
| 159.5-162.5 | 15 | 15 |
| 162.5-165.5 | 117 | 132 |
| 165.5-168.5 | 136 | 268 |
| 168.5-171.5 | 118 | 386 |
| 171.5-174.5 | 14 | 400 |
| **Total** | N = $\sum f_j$ = 400 | |

(1)
Here, $N = 400$
Now, $\frac{N}{2} = \frac{400}{2} = 200$
The cumulative frequency just greater than 200 is 268 and the corresponding class is 165.5-168.5.
Thus, the median class is 165.5-168.5.
∴ l = 165.5, h = 3, f = 136 and C = 132 (1/2)
∴ Median = $l + \left\{ b \times \frac{\frac{N}{2} - C}{f} \right\}$ (1/2)
= $165.5 + \left\{ 3 \times \frac{200-132}{136} \right\}$
= $\{65.5 + \frac{3 \times 68}{136} = 1855 + 15 = 167$
Hence, the median height is 167 cm. (1)

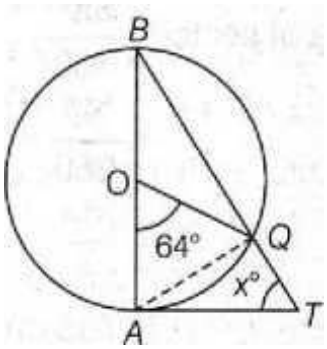
**Sol 28**. Let a be the first term and d be the common difference of an AP.
Then, $a_3$ = 7 and $a_7$ =3$a_3$ + 2
⇒ a + (3 – 1)d =7
and a + (7 – 1)d = 3[a + (3 – 1)d] + 2
[∵ $a_n$ = a(n – 1)d] (1)
⇒ a + 2d = 7 and a + 6d = 3 [a + 2d ] + 2
⇒ a + 2d = 7 and 2a + 2 = 0
⇒ a + 2d = 7 and a = –1
Put the value of a, we get
⇒ – 1 + 2d = 7
⇒ 2d = 8
⇒ d = 4 (1)
Sum of first 22 terms,
$S_{22} = \frac{22}{7}$[2 × (-1) + (22 – 1) × 4]
∵ $S_n = \frac{n}{2}$ [2a + (n – 1)d
= 11 [– 2 + 84] = 11 × 82 = 902 (1)

Or

Annual salary received by Anjali in 2001, 2002, 2003,
….. is Rs. 5000, Rs. 5200, Rs. 5400, ….. .
Clearly, it is an arithmetic progression with first term a = 5000 and common difference, d =200.
Suppose Anjali annual salary reaches to Rs. 8000 in nth years. (1)

Then, nth term of the above AP = Rs. 8000
⇒ a + (n -1)d = 8000
⇒ 5000 + (n -1)200 = 8000 ⇒ (n -1)200 = 3000 = 3000
⇒ n – 1 = $\frac{3000}{200}$
⇒ n – 1 = 15 ⇒ n = 16 (1)
Thus 16th annual salary received by Anjali will be Rs. 8000. This means that after 15 yr i.e. in the year 2016 his annual salary will reach to Rs. 8000. (1)

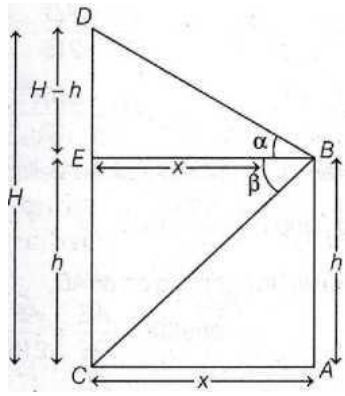
**Sol 29**. Given O is the centre of a circle AB is diameter and AT is tangent at A. Also, ∠AOQ = 64°
∵ OA is radius and AT is tangent.
∴ ∠OAT = 90°




(1)
Also, ∠AOQ = 64° [given]
⇒∠BOQ = 180° – ∠AOQ
= 180°- 64° = 116° ...(i)
[linear pair axiom]
But OB = OQ [radii]
⇒∠OQB = ∠OBQ
[∵ angle opposite to equal sides of a triangle are equal]
But ∠OBQ + ∠OQB + ∠BOQ = 180°
[by angle sum property of a triangle] (1)
⇒ ∠OBQ + ∠OQB = 180° – 116° = 64°
[using Eq. (i)]
⇒ ∠OBQ + ∠OBQ = 64°
⇒ ∠OBQ = 32°
∠OQB = 32° [∵ ∠OBQ = ∠OQB]
Now, in ΔBAT,
∠ABT + ∠BAT + ∠ATB = 180°
⇒ 32° + 90° + x° = 180°
[∵ ∠BAT = ∠OAT = 90°]
⇒ x° = 180° – 32° – 90°
⇒ x° = 58° (1)

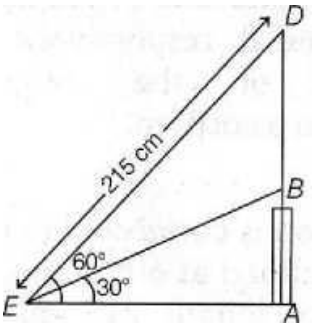
**Sol 30**. Let B be the position of the window.

(1/2)
.-. AB = h metre
Let CD = H metre be the height of another house which is situated on the opposite side of the lane.
From the position of window B, the elevation and depression are ∠EBD = a and ∠EBC = β
Draw a perpendicular line BE to the CD. (1/2)
Let AC = BE = x
In right angled Δ$EBD$,
$\tan\alpha = \frac{DD}{BE}$
$\Rightarrow \tan\alpha = \frac{H-h}{x}$
$x = (H - b)\cot\alpha$ …(i) (1)
In right angled Δ$ABC$,
$\tan\beta = \frac{AB}{CA}$
$\Rightarrow \tan\beta \equiv \frac{h}{x}$
$\Rightarrow \tan\beta = \frac{h}{(H-h)\cot\alpha}$ [from Eq. …(i)]
$(H - h) = h\tan\alpha\cot\beta$
$\therefore H = h(1 + \tan\alpha\cot\beta)$ (1)



Or

Let D be the position of the balloon, when it is inclined at angle of 60° and AB be the height of the pole.




(1/2)

Given, length of cable,

DE = 215 m

In right angled ΔEAD,

$\sin 60° = \frac{AD}{ED}$

$\Rightarrow \frac{\sqrt{3}}{2} = \frac{AD}{215} \left[\because \sin 60^o = \frac{\sqrt{3}}{2}\right]$

$\Rightarrow AD = \frac{215\sqrt{3}}{2}$ m (1/2)

Hence, initial height of the balloon from the ground is $\frac{215\sqrt{3}}{2}$m.

Again, in right angled $\Delta EAD$,

$\cos 60° = \frac{AE}{DE} = \frac{AE}{215}$

$\Rightarrow \frac{1}{2} = \frac{AB}{215}$

$\Rightarrow AE = \frac{215}{2}$ m (1)

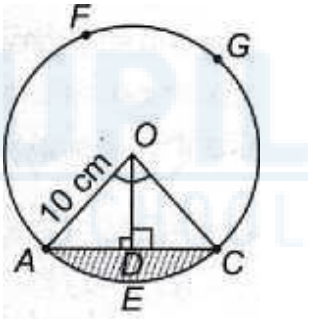
In right angled ΔEAB,

$\tan 30^o = \frac{AB}{AE}$

$AB = \frac{215}{2\sqrt{3}} = \frac{215\sqrt{3}}{6}$m (1)

**Sol 31.** Given, radius of a circle AO = 10 cm

A perpendicular is drawn from centre of circle to the chord of the circle, which bisects the chord.




∴ AD = DC

Also, ZAOD = ZCOD = 45°

ZAOC - ZAOD + ZCOD = 45° + 45° = 90°

In right angled ΔAOD,

Also, $\angle AOD = \angle COD \equiv 45^0$

$\therefore \angle AOC = \angle AOD + \angle COD$

$= 45^o + 45° = 90^o$

In right angled ΔAOD,

$\sin 45^o = \frac{AD}{AO}$

$\Rightarrow \frac{1}{\sqrt{2}} = \frac{AD}{10}$

$\Rightarrow AD = 5\sqrt{2}$ cm

and $\cos 45^o = \frac{OD}{AO}$

$\Rightarrow \frac{1}{\sqrt{2}} = \frac{OD}{10}$

$\Rightarrow OD = 5\sqrt{2}$ cm (1)

Now, AC = 2 AD = 2 × $5\sqrt{2}$ =10 $\sqrt{2}$ cm

Now, area of ΔAOC = $\frac{1}{2}$ AC × OD

$= \frac{1}{2} \times 10\sqrt{2} \times 5\sqrt{2}$

= 50 $cm^2$

Now, area of sector $= \frac{\theta \pi r^2}{360^o}$

$= \frac{90}{360} \times 314 \times (10)^2$

$= \frac{314}{4}$

= 7.85 $cm^2$ (1)

(i) ∴ Area of minor segment AEC

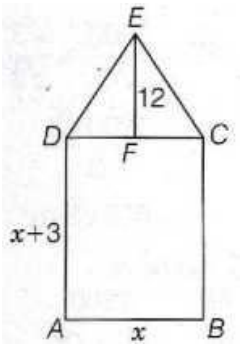
= Area of sector OAEC – Area of ∆AOC
= 78.5 – 50 = 28.5 $cm^2$

(ii) ∴ Area of major sector OAFGCO = Area of circle – Area of sector OAEC
= $\pi r^2$ – 78.5 = 3.14 × $(10)^2$ – 78.5
= 314 – 78.5 = 235.5 $cm^2$ (1)

**Sol 32**. Let the usual speed of aeroplane be × km/h
Then, increased speed of aeroplane = [x + 250) km/h
∴ Total distance = 1500 km [given]
∴ Time taken to cover 1500 km by usual speed
= $\frac{1500}{x}$ Km
[∵ speed = $\frac{\text{distance}}{\text{time}} \Rightarrow$ time = $\frac{\text{distance}}{\text{speed}}$] (1)
and time taken to cover 1500 km after increased the speed = $\frac{1500}{x+250}$ km
According to the question,
$\frac{1500}{x} - \frac{1500}{x+250} = \frac{1}{2}\left[\because 30 \text{ min } = \frac{1}{2}\text{h}\right]$ (1)
$\Rightarrow 1500\left[\frac{1}{x} - \frac{1}{x+250}\right] = \frac{1}{2}$
$\Rightarrow 1500\left[\frac{x+250-x}{x(x+250)}\right] = \frac{1}{2}$ [taking LCM]
$\Rightarrow \frac{1500\times250}{x^2+250x} = \frac{1}{2}$
$\Rightarrow x^2 + 250x = 750000$
[using cross-multiplication] (1)
$\Rightarrow x^2 + 250x - 750000 = 0$
By using factorisation method,
$x^2 + (1000 - 750)x - 750C00 = 0$ (1)
[$\because 750000 \times 1 = 750000$ and $1000 \times 750 = 750000$,
$1000 - 750 = 250$]
$\Rightarrow x^2 + 1000x - 750x - 750000 = 0$
$\Rightarrow x(x + 1000) - 750(x + 1000) = 0 \Rightarrow$
$(x + 1000)(x - 750) = 0$
$\Rightarrow x + 1000 = 0$ and $x - 750 = 0$
$\Rightarrow$ x = – 1000 and x = 750
x = 750
[∵ speed cannot be negative]
Hence, the usual speed of an aeroplane is 750 km/h. (1)

Or

Let breadth of the rectangular park be x m.
So, its length = (x + 3) m
Therefore, the area of the rectangular park
= Length × Breadth
= x × (x + 3) = $(x^2 + 3x)m^2$ (1)

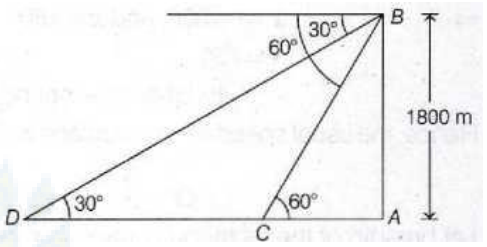



In the figure, AB = DC = x (1)
Now, area of ∆DEC = $\frac{1}{2}$ × DC × EF
= $\frac{1}{2}$ × x × 12 = $6xm^2$
According to the given condition,
Area of rectangular park = Area of an isosceles triangle + 4
$\Rightarrow x^2 + 3x = 6x + 4 \Rightarrow x^2 - 3x - 4 = 0$ (1)
By using, quadratic formula,

$$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4 \times 1 \times (-4)}}{2(1)}$$

$= \frac{3\pm\sqrt{9+16}}{2} = \frac{3\pm5}{2} = \frac{8}{2}$ or $-\frac{2}{2} = 4$ or – 1 (1)
But x ≠ – [∵ x cannot be negative]
Therefore, x = 4,
So, the breadth of the park = 4 m
and its length will be = 4 + 3 = 7 m (1)

**Sol 33**. Let the aeroplane is at B and let the two ships are at point C and D such that their angles of depression from B are 60° and 30°, respectively.
We have, AB = 1800 m. (1)
Now, in ∆BAC, we have
$\Rightarrow \tan 60° = \frac{AB}{AC}$ [∵ $\tan\theta = \frac{\text{perpendicular}}{\text{base}}$
$\Rightarrow \sqrt{3} = \frac{1800}{AC}$ [∵ $\tan 60° = \sqrt{3}$]
$\Rightarrow AC = \frac{1800}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$
$= \frac{1800\sqrt{3}}{3}$
$= 600\sqrt{3}$ m (1)
and in ∆BAD, we have
$\tan 30° = \frac{AB}{AD} = \frac{1800}{AC+CD}$ [∵ AD = AC = CD]
$= \frac{1}{\sqrt{3}} = \frac{1800}{600\sqrt{3}+CD}$ [∵ $\tan 30° = \frac{1}{\sqrt{3}}$
$\Rightarrow CD + 600\sqrt{3} = 1800\sqrt{3}$
$\Rightarrow CD = 1800\sqrt{3} - 600\sqrt{3}$
$= 1200\sqrt{3}$m
Hence, the distance between the two ships is $1200\sqrt{3}$m. (2)




**Sol 34**. On a die, there are six numbers 1, 2, 3, 4, 5 and 6.
∴ Total number of possible outcomes = 6 (1/2)

(i) Let $E_1$ = Event of getting a even prime number
Then, $E_1$ would consist of one outcome namely 2.
∴ Number of outcome favourable to $E_1$ = 1
Probability of getting a prime number,
$P(E_1) = \frac{1}{6}$ (1 ½)

(ii) Let $E_2$ = Event of getting a number lying between 2 and 6
Then, $E_2$ would consist of three outcomes, namely 3, 4 and 5.
∴ Number of outcomes favourable to $E_2$ = 3
Probability of getting a number lying between 2 and 6,
$P(E_2) = \frac{3}{6} = \frac{1}{2}$ (1 ½)

(iii) Let E3 = Event of getting an odd prime number Favourable outcomes = 3, 5
∴ Number of favourable outcomes = 2
Probability of getting an odd number,
$P(E_3) = \frac{2}{6} = \frac{1}{3}$ (1 ½)

Or

Total number of cards in one deck of cards is 52.
∴ Total number of outcomes = 52 (1)

(i) Let $E_1$ = Event of getting a king of red colour
∴ Number of outcomes favourable to $E_1$ = 2
[∵ there are four kings in a deck of playing cards out of which two are red and two are black]

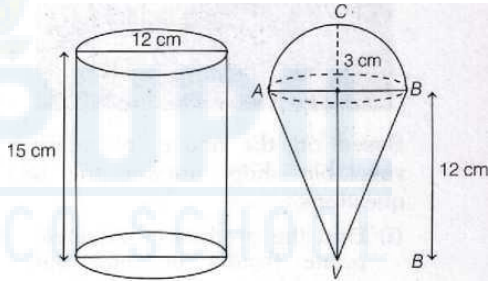
Hence, probability of getting a king of red colour,
$P(E_1) = \frac{2}{52} = \frac{1}{26}$ (1)

(ii) Let $E_2$ = Event of getting a face card
∴ Number of outcomes favourable to $E_2$ = 12
[∵ in a deck of cards, there are 12 face cards, namely 4 kings, 4 jacks, 4 queens]
Hence, probability of getting a face card,
$P(E_2) = \frac{12}{52} = \frac{3}{13}$ (1)

(iii) Let $E_4$ = Event of getting a jack of heart
∴ Number of outcomes favourable to $E_4$ = 1
[∵ there are four jack cards in a deck, namely 1 of heart, 1 of club,1 of spade and 1 of diamond]
Hence, probability of getting a jack of heart,
$P(E_4) = \frac{1}{52}$ (1)

(iv) Let $E_5$ = Event of getting a spade
∴ Number of outcomes favourable to $E_5$ = 13
[∵ in a deck of cards, there are 13 spades, 13 clubs, 13 hearts and 13 diamonds]
Hence, probability of getting a spade,
$P(E_5) = P(E_2) = \frac{13}{52} = \frac{1}{4}$ (1)

**Sol 35.** Let $V_1$ be the volume of the given ice-cream container.




Then, $V_1 = \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h$
$= \pi\left[\frac{2}{3} \times (3)^3 + \frac{1}{3} \times 3^2 \times 12\right]$
$= \pi\,[18 + 36] = 54\pi\ cm^3$ (1)

Let $V_2$ be the volume of ice-cream filled in the shape of circular cylinder having diameter 12 cm and height = 15cm (1)
∴ $V_2 = \pi r^2{}_1 h_1$
$= \pi(6)^2(15)$
$= 540\ \pi$ (1)
Let the total number of cones that can be filled with ice-cream given in the container be n. Then,
Volume of ice-cream in n cones
= Volume of ice-cream in the container
⇒ $nV_1 = V_2$ (1)
⇒ $n \times 54\pi = 540\pi$
⇒ $n = 10$ (1)

**Sol 36**. (i) Distance of the girl from lamp-post after 6 s,
BD = 2.0 × 6 = 12 m
(ii) In ∆ABC and ∆EDC
∠B = ∠D = 90°
∠C = ∠C [common angle]
∴ By AA similarity criterion
∆ABC ~ ∆EDC

(iii) $\left(\frac{ED}{AB}\right)^2 = \left(\frac{12}{5}\right)^2$

$= \frac{1.44}{25} \times \frac{4}{4}$
$= \frac{5.76}{100}$
= 0.0576

Or

From (ii), we have ∆ABC ~ ∆EDC
$\Rightarrow \frac{BC}{DC} = \frac{AB}{ED}$
$\Rightarrow \frac{12 + x}{x} = \frac{5}{1.2}$
⇒ 14.4 + 12.x = 5x
⇒ 3.8x = 14.4
$\Rightarrow x = \frac{14.4}{3.8}$ = 3.8 m. [approx]

**Sol 37**. (i) The coordinates of R is (6, 5) as the point is 6 units on X-axis and 5 units on V-axis.

(ii) The coordinates of Q are (3, 2) and R are (6, 5).
∴ The distance between points Q and R is
QR = $\sqrt{(6-3)^2 + (5-2)^2}$
= $\sqrt{(3)^2 + (3)^2} = \sqrt{9+9} = 3\sqrt{2}$ units

(iii) Since, coordinates of vertices of a $\Delta POR$ are
Now, PQ, = $\sqrt{(3-4)^2 + (2-6)^2}$
= $\sqrt{(-1)^2 + (-4)^2}$
= $\sqrt{1+16} = \sqrt{17}$ units
PR = $\sqrt{(6-4)^2 + (5-6)^2}$
= $\sqrt{(2)^2 + (-1)^2}$
= = $\sqrt{4+1} = \sqrt{5}$ units
and QR = $3\sqrt{2}$
Here, PQ ≠ QR ≠ PR
Hence, ∆PQR is a scalene triangle.

Or

The centroid of ∆PQR is $\left(\frac{4+3+6}{3}, \frac{6+2+5}{3}\right)$
i.e. $\left(\frac{13}{3}, \frac{13}{3}\right)$.

**Sol 38.** (i) Since, total number of vegetables is 550 Prime factorisation of 550 = 2 × 5 × 5 × 11
= $2^1 \times 5^2 \times 11^1$
The exponents are 1, 2 and 1.
∴ Product of exponents = 1 × 2 × 1 = 2

(ii) Prime factor of 420 = $2^2 \times 3 \times 5 \times 7$
and 130 = 2 × 5 × 13
HCF (420, 130) = 2 × 5 = 10
So, the number of vegetables that can be placed in each stack for this purpose is 10.

(iii) The number of vegetables that can be placed in each stack = 10
Prime factor of 10 = $2^1 \times 5^1$
The exponents are 1 and 1.
∴ Sum of exponents = 1 + 1 = 2 Or
Total number of vegetables = 550
Number of vegetables that can be placed in each stack = 10
∴ Number of rows of vegetables = $\frac{550}{10}$ = 55

**Ans 1.** (b) The gas evolved in the given experiment is sulphur dioxide ($SO_2$).

**Ans 2.** (c) Carbon has 4 electrons in its valence shell, while hydrogen has one electron in its valence shell. To complete their octet and duplet respectively, they form covalent bonds. Carbon utilises its 4 valence electrons and forms 4 covalent bonds with 4 hydrogen atoms, using one valence electron with each hydrogen atom.

**Ans 3**. (a) The given set up is of electrolysis of water. The gases formed at two electrodes go on collecting in the top parts of the inverted test tubes. Oxygen is evolved at anode whereas hydrogen is present at cathode. Hence, evolved gas A is oxygen.

**Ans 4.** (c)
(a) $SO_2$ is acidic oxide because S is non-metal and non-metals form acidic oxide.
(b) is a neutral oxide.
(c) $AI_2D_3$ is an amphoteric oxide which behaves as acid as well as base.
(d) CaO is basic oxide because Ca is a metal and metals form basic oxide.

**Ans 5**. (d) Gold has all given properties which make it suitable for making jewellery. Gold is ductile, malleable and lustrous. It can be drawn into thin sheets and wires and has shiny appearance.

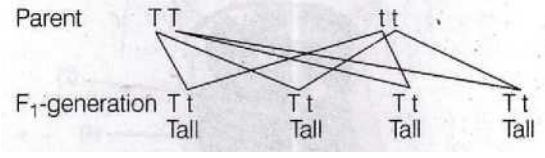
**Ans 6**. (a) Lime juice is acidic in nature because it contains citric acid. Human blood is slightly basic (i.e. having pH 7.8). Limewater and antacid are basic in nature as they contain hydroxide ($OH^-$) ion.

**Ans 7.** (b) 1 is stomach, which secretes pepsin in gastric juice.
2 is pancreas, which secretes trypsin and amylase.
3 is small intestine in which lipase and peptidase are secreted while 6 is salivary gland which secretes amylase in saliva.

**Ans 8**. (b) The colours of both Q and R regions when tested with iodine solution appeared brown. This indicates that there was no starch in both regions.
In both regions Q and R photosynthesis did not occur, since part Q of the leaf was covered by the cut part of the cork, while part R was exposed to KOH kept in the flask to absorb $CO_2$.
In the absence of light (for Q) and $CO_2$ (for R), photosynthesis did not occur, thus starch was not formed and regions Q and R tested negative with iodine (A positive test for starch converts the leaf blue black with iodine).

**Ans 9**. (c) Unsaturated hydrocarbons have double or triple bond in their structure. Both (ii) and (iv) have double carbon-carbon bonds in their structures.

**Ans 10**. (a) In $F_1$-generation, the cross between TT and tt will result into all tall plants as shown in the figure. Thus, tallness is the dominant trait which expresses itself regardless of its presence in homozygous or heterozygous state.




**Ans 11**. (a) Above figure shows, regeneration (asexual reproduction) in Planaria which can regenerate

into a complete individual from a single segment of their body part.

**Ans 12**. (d) A is cerebrum, which is responsible for reasoning, speech, hearing, intelligence and usage of information.
B is cranium, which protects brain while C is medulla oblongata that controls involuntary actions, such as breathing, blood pressure (BP), etc.

**Ans 13**. (b) The resistance of a wire is given by

$R = \rho \cdot \frac{l}{A} = \rho \frac{l^2}{A \cdot l} = \rho \cdot \frac{l^2}{V}$

$\therefore R \propto l^2$ ($\because$ Volume remains constant, when we are stretching the wire)

Now, $l_2 = 2l_1$

$\therefore \quad \frac{R^2}{R^1} = \left(\frac{l_2}{l_1}\right)^2 = \left(\frac{2l_1}{l_1}\right)^2 = 4$

$\therefore \quad R_2 = 4R_1$

Hence, the resistance will become 4 times of its original value.

**Ans 14.** (c) The magnetic field lines due to a bar magnet is from North to South outside the magnet and from South to North inside the magnet.
When two bar magnets are placed close to each other by facing their same poles, then magnetic field lines will be of repulsive nature.

**Ans 15**. (c) The resistance of a wire is given by

$$R = \rho \cdot \frac{l}{A}$$

$\therefore \quad \frac{R_1}{R_2} = \frac{\rho \cdot \frac{l_1}{A_1}}{\rho \cdot \frac{l_2}{A_2}} = \frac{l_1}{A_1} \times \frac{A_2}{l_2} = \frac{l_1}{l_2} \times \left(\frac{d_2}{d_1}\right)^2 = \left(\frac{l}{l/2}\right) \times \left(\frac{2d}{d}\right)^2 = 2 \times 4 = 8, R_1 = 8R_2$

**Ans 16**. (d) The direction of induced electric current in a conductor, when it is placed in a varying magnetic field be assessed by "Fleming's right hand rule".

**Ans 17**. (a) Both A and R are true and R is the correct explanation of A.
A graphite crystal consists of various layers of carbon atoms in which each carbon atom is joined to three other atoms by strong covalent bonds. The various layers of carbon atoms in graphite are held together by weak van der Waals' forces making, it slippery to touch.

**Ans 18.** (c) A is true, but R is false
Forelimbs of vertebrates are homologous organs. Analogous organs have different origin but show similar appearance and perform similar functions.

**Ans 19**. (b) Both A and R are true, but R is not the correct explanation of A.
Blood pressure is much greater in arteries because of the faster pumping action of the heart which sends blood rapidly in arteries.

**Ans 20.** (c) The magnetic field produced by a current carrying solenoid is independent of its length and area of cross-section. It only depends on the number of turns and current flowing through the solenoid.
So, **Assertion** is true.
The magnetic field produced inside a current carrying solenoid is uniform. So, Reason is false.

**Ans 21**. A reaction in which a single reactant breaks down to form two or more products, is known as **decomposition reaction.**

e.g., $CaCO_3(s) \xrightarrow{\Delta} CaO(s) + CO_2(g)$

Calcium carbonate → Calcium oxide + Carbon dioxide

(i) $Mg(s) + 2HNO_3(aq) \longrightarrow Mg(NO_3)_2(aq) + H_2(g)$

Magnesium + Nitric acid → Magnesium nitrate + Hydrogen gas

(ii) $2Na(s)+2H_20(/)$ → $H_2(g)$ + $2NaOH(aq)$
Sodium → Hydrogen gas + Sodium hydroxide

**Ans 22**. Insulin and glucagon are the two hormones secreted by β-celis and α-cells of islet of Langerhans. The function of insulin hormone Is to lower the blood sugar, level or recognition of glucose by cells for absorption and conversion of glucose into glycogen in liver and muscles.
Glucagon's role in the body is to prevent blood glucose levels dropping too low. It acts on the liver and stimulates the conversion of stored glycogen, which can be released into bloodstream.

**Ans 23.** HCI (Hydrochloric acid) is the acid secreted inside the stomach. It is important for the body because
(i) It makes medium inside the stomach acidic, which is necessary for the activation of an enzyme called pepsin.
(ii) It also kill any bacteria, entering the stomach along with food.

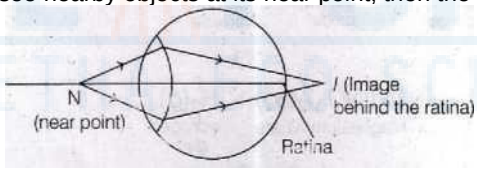
**Ans 24**.

| Respiration in Plants | Respiration in Animals |
|---|---|
| (i) Plants do not possess respiratory system | Animals have respiratory system |
| (ii) Diffusion of respiratory gases directly takes place into the cells | The respiratory gas are transported upto the tissue cells |

**Ans 25**. The given diagram shows a defective eye which is unable to see distant object at its far point. So, this defect is known as myopia or near/short sightedness. This defect can be removed by using a spectacle fitted with concave lens.
There are following two main reasons for this defect ot vision.
(i) Elongation of eyeball.
(ii) Excessive curvature of eye lens.

Or

It is a defect of vision in which a person can see distant objects clearly, but cannot see nearby objects clearly. This type of defect can be removed by using a spectacle fitted with concave lens.
When the hypermetropic eye see nearby objects at its near point, then the ray diagram will be as follow




**Ans 26**. In a food chain, about 90% of the energy gets lost at each trophic level. This mean that in long food chains, very little energy from the producer is available to the top carnivore. For example,
Maize → Goat → Man
(100 units) (10 units) (1 unit)
But in shorter food chains, less energy is lost.
Maize → Man
(100 units) (100 units)
Hence, vegetarian food habits where nutrition is derived directly from producers, can sustain a large number of people.

**Ans 27**. (a) Zinc displaces copper from copper sulphate because zinc is more reactive than copper as it is placed above copper in the reactivity series of metals.
(b) This reaction will not occur as iron is less reactive than zinc as it is placed below zinc in the reactivity series of metals.
(c) Zinc displaces iron because zinc is more reactive than iron as it is placed above iron in the reactivity series of metals.

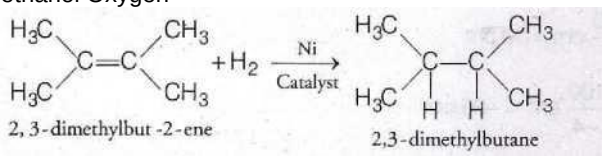
**Ans28.** $CH_3COOH$ + NaOH → $CH_3COONa$ + $H_2O$

(a) Acetic acid, Sodium hydroxide, Sodium ethanoate, Water

(b) $2C_2H_5OH + 6O_2 \rightarrow 4CO_2 + 6H_2O$ + Heat + Light

ethanol, Oxygen, Carbon dioxide, Water

(c)




2, 3-dimethylbut -2-ene — 2,3-dimethylbutane

**Ans 29**. Arteries are thick-wailed blood vessels, which carry oxygenated blood from heart to all parts of the body. They have thick walls because blood emerges from the heart under high pressure. In comparison, veins are thin-walled blood vessels, which carry deoxygenated blood from all parts of the body back to the heart. They do not need thick walls because blood flowing through them is no longer under high pressure. Instead, they have valves, which prevent the backflow of blood.

Or

Osmosis is the process by which water enter into root hair cells.

It is defined as the movement of water molecules from its region of higher concentration to the region of its lower concentration through a semipermeabfe membrane.

**Plasmolysis** The phenomenon of shrinkage of protoplasm from the cell when the cell is kept in hypertonic solution. As a result of this process, the cells lose water.

**An application** of plasmolysis is addition of salt to pickles to prevent fungal/bacterial growth in them.

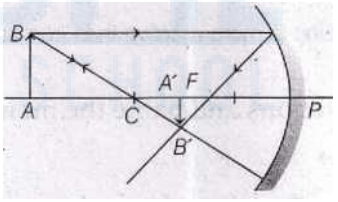
**Ans 30.** (a) Given, object distance, u = - 50 cm, image distance, v = - 30 cm

From mirror formula, $\frac{1}{f} = \frac{1}{V} + \frac{1}{u} = \frac{1}{-30} + \frac{1}{(-50)}$

$= -\left[\frac{5+3}{150}\right] = \frac{-8}{150}$

f = -18.75 cm

(b) The ray diagram for image formation by concave mirror is shown below




(c) ∴ Magnification of the mirror,

$m = \frac{f - v}{f} = \frac{-18.75 - (-30)}{-1875} = \frac{-11.25}{18.75} = -0.6$

or $m = \frac{V}{u} = \frac{-(30)}{(-50)} = -0.6$

**Ans 31.** Given, $P_1 = 5D \Rightarrow f_1 = \frac{100}{P_1}$ cm $= \frac{100}{5}$ cm = 20 cm

$P_2 = -4\ D \Rightarrow f_2 = \frac{100}{P_2}$ cm $= \frac{100}{-4}$ cm = -25 cm

Let F be the focal length of combination of both lenses, then

$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2} = \frac{1}{20} - \frac{1}{25} = \frac{5-4}{100}$

$\Rightarrow \quad \frac{1}{F} = \frac{1}{100}$

F = 100 cm

Power of combination of both lenses,

$P = \frac{1}{F(\text{in m})} = \frac{100}{F(\text{cm})}$

$P = \frac{100}{100}$

∴ P = 1D

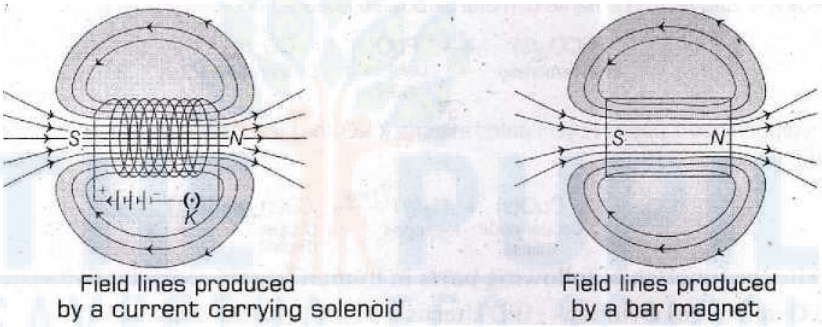
**Alternate solution**

Given, power of convergent lens, $P_1 = 5D$
Power of divergent lens, $P_2 = -4$ D
∴ Power of combination of both lenses, $P = P_1 + P_2 = 5D - 4D = 1D$
∴ Focal length of combination of both lenses, $F = \frac{1}{P} = \frac{1}{1}m = 1m = 100$ cm

**Ans 32**. (a) The drifting of free electrons of a conductor in a definite direction causes'the current to flow through it.
When such a conductor is placed in a uniform magnetic field, each drifted electron of a conductor experiences a magnetic force. This force is collectively experienced by the conductor as a whole. Hence, a current carrying conductor kept in a magnetic field experiences a force.
(b) The direction of force exerted on a current carrying conductor placed in uniform magnetic field is determined by "Fleming's left hand rule".
(c) The direction of magnetic force depends on
(i) the direction of current flowing through the conductor and
(ii) the direction of magnetic field.

Or

(a) A solenoid is a long coil of circular loops of insulated copper wire. Magnetic field lines are produced around the solenoid when a current is allowed to flow through it. The field lines produced by it are similar to the field lines produced by a bar magnet, which can be seen in the figure given below



Field lines produced by a current carrying solenoid

Field lines produced by a bar magnet

(b) The solenoid behaves like a temporary magnet, which is formed by placing a soft iron core inside it. The magnetism of this magnet lasts so long as there is current flowing through it and loses its magnetic property when the current in the solenoid is stopped. It is also known as electromagnet.

**Ans 33**. Pesticides are poisonous chemical substances, which are sprayed over crop plants to protect them from pests and diseases.
These chemical pesticides mix up with soil and water from where they are absorbed by the growing plants along with water and other minerals. These chemicals enter the environment through the food chains, in following manner.
When herbivorous animals eat plants, then these poisonous chemical pesticides enter into their bodies through the food chain. When the carnivorous animals eat herbivorous, then the pesticides get transferred to their bodies. In this process of transfer of food through food chains, these harmful chemicals get concentrated at each subsequent trophic level.

**Ans 34**. (a) $2Cu(NO_3)_2(s) \xrightarrow{\text{Heat}} 2CuO(s) + 4NO_2(g) + O_2(g)$

| | | | | |
|---|---|---|---|---|
| | Copper nitrate | (II) | (Black) Copper oxide | (Brown) Nitrogen dioxide (X) | Oxygen |

(b) The brown gas X evolved is nitrogen dioxide, $NO_2$. The pH of its aqueous solution is less than 7. pH <7

(c) **Thermal decomposition** These reactions use the energy in the form of heat for decomposition of the reactant.

Or

(a) Metal X is lead (Pb), The name of metal carbonate is lead carbonate ($PbCO_3$).

$PbCO_3(s) \xrightarrow{\Delta}$ $PbO(s)$ + $CO_2(g)$

Lead carbonate → Lead oxide (Yellow) + Carbon dioxide

(b) If hydrogen gas is passed over heated material (CuO) the black coating on the surface turns brown and copper is obtained.

$CuO(s) + H_2(g) \xrightarrow{Heat} Cu(s) + H_2O(l)$

Copper oxide (Black) + Hydrogen → Copper (Brown) + Water

**Ans 35**. (a)

| Parts of female reproductive system | Functions |
|---|---|
| (i) Ovaries | Produce an ova or egg cell every month. Secrete female sex hormones like oestrogen and progesterone |
| (ii) Oviduct (Fallopian tube) | Carries ova or egg from ovary to the uterus. It is the site of fertilisation |
| (iii) Uterus (Womb) | Here, the growth and development of foetus take place. Rhythmic contractions of the muscles in the uterus helps in ejection of fully developed foetus. |

(b) **Structure of Placenta** Placenta is a disc between uterine wall and embryo which is embedded in the uterine wall. It contains villi on the embryo's side of the tissue. On the mother's side, blood spaces are present, which surround the villi.

**Functions of Placenta** It provides a large surface area for glucose and oxygen to pass from the mother to the embryo. It also removes the waste generated by embryo, transferring it to mother's blood.

Or

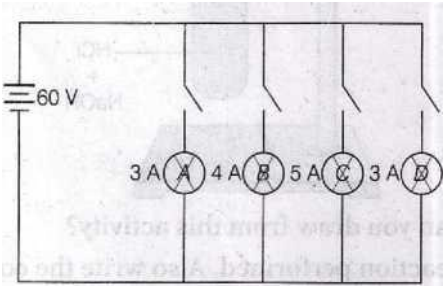
(a) Mendel choose garden pea plant for his experiment because
(i) The life cycle of pea plant is short and is easy to grow
(ii) Pea plant produces large number of seeds
(iii) The flower structure of pea is such that it to allows controlled breeding. Although, plant is self-pollinated, but can be crossed manually.

| | Sexual reproduction | Asexual reproduction |
|---|---|---|
| (i) | It involves two parents | Usually it involves only one parent |
| (ii) | Fusion of gametes takes place | Fusion of gametes does not take place |
| (ii) | Genetic variations occurs in the off springs | Off springs are identical to one another |

**Ans 36**. The given circuit is shown below

(a) In the circuit, all the lamps have same voltage, i.e. 60 V but each lamp is having different current. So, the lamps are arranged in parallel combination.
(b) The two advantages of lamps in parallel combination are
(a) if one lamp is fused, it will not affect the working of other lamps.
(b) in parallel combination of lamps, each lamp will use the full potential of the battery.
(c) The lamp with the highest power will glow the brightest.
As, power = voltage × current
In this case, all the lamps have same voltage i.e., 60 V.

For lamp A, current = 3 A
∴ Power = 60 × 3 = 180 W
For lamp B, current = 4 A
∴ Power = 60 × 4 = 240 W
For lamp C, current = 5 A
∴ Power = 60 × 5 = 300 W
For lamp D, current = 3 A
∴ Power = 60 × 3 = 180 W
As, the lamp C is having the maximum power, so it will glow the brightest.




(d) Let R be the total resistance of the circuit.
Total current in the circuit, I = 3 + 4 + 5 + 3 = 15A
Voltage, V = 60 V
Using Ohm's law, V = IR
$\Rightarrow$ $R = \frac{V}{I} = \frac{60}{15} = 4\ \Omega$

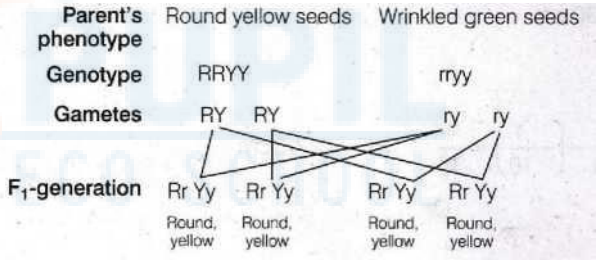
**Ans 37**. (a) The conclusion drawn from this activity is that acid nullified the effect of a base and base nullified the effect of an acid.
(b) The reaction performed is known as **neutralisation reaction.** The equation involved is as follow:

| HCl + | NaOH | | NaCl + $H_2O$ |
|---|---|---|---|
| Hydrochloric acid | Sodium hydroxide | ⟶ | Sodium chloride | Water |

Or

(b) Phenolphthalein is used as an indicator in this experiment. Salt and water are formed when acid reacts with base.
Acid + Base $\rightarrow$ Salt + Water

**Ans 38** . (a) Round-green (A-D).
(b) A(round) and B(yeliow) are dominant traits.
(c) A-B type of seeds are round in shape and yellow in colour as round and yellow both constitute the dominant character, hence expressed in $F_1$-generation.




Or

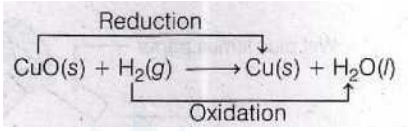
(a) A-D in minimum number
(b) A-B in maximum number

**Ans 39**. (a) Convex mirrors are used as rear view mirrors in vehicles as they give an erect image and have a wider field of view.
(b) The images formed by a plane mirror and also for convex mirror are always erect, for all positions of object.
(c) Given, object distance, u = -10 cm
Radius of curvature, R = 60 cm
∴ Focal length, f = R/2 = $\frac{60}{2}$ = 30 cm
∵ By mirror formula, $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$
$\Rightarrow$ $\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{30} - \left(-\frac{1}{10}\right) = \frac{4}{30}$ $\Rightarrow$ v = 7.5cm

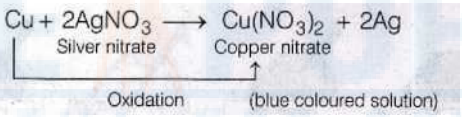
Or

Given, f =12 cm
As, radius of curvature, R = 2f $\Rightarrow$ R = 2 × 12 = 24cm

**Ans 1**. (b) The given experiment is carried out between concentrated sulphuric acid and sodium chloride, which react with each other to form HCI gas. HCI being acidic turns blue litmus red.
**Ans 2**. (d) In displacement reaction, one element takes the place of another element in a compound. A more reactive element displaces a less reactive element from its compounds.
$A + BC \rightarrow AC + B$
Here, A is more reactive than S; therefore displaces it from its compound.
**Ans 3**. (c) In experiments I, II and III, he would observe the solid deposition because Al, Zn and Fe are more reactive than Cu, therefore, displace copper from its$CuSO_4$ solution. Hence, Cu will be deposit as solid in the test tubes I, II and III.
**Ans 4.** (b) In the given reaction, both oxidation and reduction processes take place as



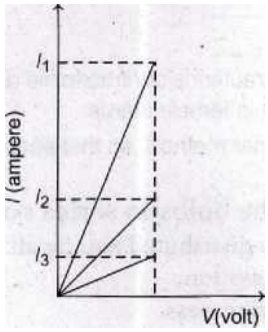

Hence, $H_2$ gets oxidised into $H_2O$ whereas CuO gets reduced to form Cu(s).
**Ans 5**. (c) Plaster of Paris reacts with water and turns into solid hard mass known as gypsum which is used to fix or treat fractures.
**Ans 6.** (d) Zn reacts with strong acid ($H_2SO_4$) to form $ZnSO_4$ (zinc sulphate) and hydrogen gas is evolved.
**Ans 7.** (a) When copper turnings are added to silver nitrate solution, a blue coloured solution is formed after sometime because, copper is oxidised to $Cu^{2+}$ ions and forms copper nitrate. It displaces silver from its solution and forms blue coloured solution of $Cu(N0_3)_2$.




**Ans 8**. (c) Digestion of protein begins in stomach (q) and most absorption occurs in small intestine.
**Ans 9**. (b) The part of leaf which is outside of the jar will perform photosynthesis. The part inside the jar will not perform photosynthesis as the KOH solution in the jar will absorb the carbon dioxide. The uncovered part of leaf will also perform photosynthesis. Therefore, option
(b) shows the correct result of iodine test on the leaf.

**Ans 10**. (d) The main factors which are responsible for speciation include geographical isolation, natural selection, genetic drift (in small populations) and reproductive isolation.
**Ans 11**. (b) In the given diagram, X refers to insulin, whereas Y is glucagon. Both these hormones are secreted by endocrine cells of pancreas (islets of Langerhans). Insulin is responsible for lowering the blood glucose level whereas glucagon is opposite in function. Hence, deficiency of insulin in the body leads to diabetes mellitus.
**Ans 12**. (d) P refers to Copper-T which is a intrauterine contraceptive device that is made up of copper. This can be placed for long period (upto 5 years) in female uterus.
Q is condom that act as external barrier method, so that sperm does not reach the egg.
**Ans 13**. (c) In series combination, the applied voltage is distributed among all the bulbs. So , the bulbs will glow with less brightness.
**Ans 14**. (b) The N-pole of the resultant magnet is close to face A, because the magnetic field lines enter in loop from B and come out from A.
Also, as a matter of fact magnetic lines come out of the N-pole of magnet. Therefore, face close to A represents N-pole. The currents in A and B are same.

**Ans 15.** (c) At given voltage, current / is inversely proportional to resistance, i.e. I' $\propto \frac{1}{R}$. At given voltage, current I is maximum for $R_1$ therefore, $R_2$ is minimum.




At given voltage, $I_1 > I_2 > I_3$
∴ $R_1 < R_2 < R_3$
or $R_3 > R_2 > R_1$

**Ans 16**. (c) The strength of magnetic field inside a long current carrying straight solenoid is uniform or same at all points. Therefore, correct option is (c).
**Ans 17**. (a) Carbon burns in oxygen (air) to form carbon dioxide and water. During reaction, a large amount of heat and light released. Hence, they used as fuels. Carbon and its compounds keep burning without the requirement of additional energy.

$$\underset{\text{Carbon}}{C} + \underset{\text{Oxygen}}{O_2} \longrightarrow \underset{\text{dioxide}}{\underset{\text{Carbon}}{CO_2}} + \text{heat} + \text{light}$$

**Ans 18**. (b) Both A and R are true, but R is not the correct explanation of A
Dominant allele is an allele whose phenotype will be expressed even in the presence of another allele of that gene. It is represented by a capital letter, e.g. T.
**Ans 19**. (b) Both A and R are true, but R is not the correct explanation of A
Platelets clump together and form a plug around the site at injury thus, prevent the leakage of blood from the site of an injury
**Ans 20**. (b) The Earth's magnetic field is towards North and velocity of electron is downwards. By applying, Fleming's left hand rule, the direction of force is towards West. Also, electron has a negative charge,
∴ Both A and R are true but R is not correct explanation of A.
**Ans 21.** (a) We should always purchase the gold jewellery from a branded shop with proper receipt and hallmark certificate.
(b) Government insists on purchasing hallmarked jewellery as it contains the gold and its alloyed metal, (i.e. copper or silver) in a fixed ratio.

Or

Let the atomic weight of alkali metal A be x. When it reacts with water, it forms a compound B having molecular mass 40.
Let, the reaction be

$$2A + 2H_2O \longrightarrow 2AOH + H_2 \uparrow$$

According to the question,
$x + 16 + 1 = 40$ (given)
∴ $x = 40 - 17 = 23$
Therefore, the alkali metal (A) is Na and the reaction is

$$\underset{\text{Sodium (A)}}{2Na(s)} + 2H_2O(l) \longrightarrow \underset{\text{hydroxide (S)}}{\underset{\text{Sodium}}{2NaOH\ (aq)}} + Ha(g)$$

So, the compound B is sodium hydroxide (NaOH).
Sodium hydroxide reacts with aluminium oxide ($Al_2O_3$) to give sodium aluminate ($NaAlO_2$). Thus, C is

sodium aluminate ($NaAlO_2$).
The reaction involved is

| | | | |
|---|---|---|---|
| $Al_2O_3(s)$ + | $2NaOH(aq)$ | $2NaAlO_2(aq)$ + | $H_2O(l)$ |
| Aluminium oxide | Sodium hydroxide | Sodium aluminate (C) | Water |

**Ans 22**. Auxin promote cell elongation and are present at the shoot tip. When tendril comes in contact with a support, auxin stimulates faster growth of the cells on the oppsite sides. Thus, the tendril coils around the support.
The other plant hormones are cytokinins, gibberellins and abscisic acid.
**Ans 23**. In higher animals, the energy need is very high to maintain homeostasis. Because of which the requirement of $0_2$ is very high. Thus, they need fully saturated blood with oxygen without mixing it with deoxygenated blood, so their separation is necessary.
**Ans 24**. Platelets are responsible for blood clotting. Nucleus is the parameter to differentiate between lymphocytes and neutrophils.
Lymphocytes - Nucleus is large with a dent - like depression
Neutrophils - 3-4 lobed nucleus
**Ans 25**. The statement observed by the student is incorrect because the student is stating the nature of colours in reverse order, i.e., 3 represents the colour of gold metal (i.e., yellow) and 5 represents the colour of the sky (i.e., blue).

Or

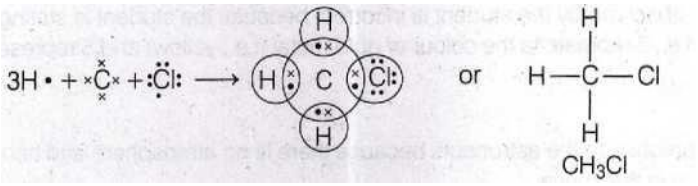
(i) Sky appears dark to the astronauts because there is no atmosphere and hence, no scattering of light takes place in the space.
(ii) At sunrise and sunset, the sun and the sky appears red. Light from the sun near the horizon passes through thicker layers of air and covers larger distance in the atmosphere before reaching our eyes. Near the horizon, most of the blue light and shorter wavelengths are scattered away by the particles. Therefore, the light that reaches our eyes is of longer wavelengths, This gives rise to the reddish appearance of the sun and the sky.
**Ans 26**. The smallest amount of energy transferred is represented by arrow 2 because as we go above in food chain, the amount of energy transformed is reduced by 10% and the largest amount of energy lost is represented by arrow 3 because plant have maximum amount of energy. Hence, loss of energy during energy transfer will also be maximum.
**Ans 27**. Carbon has 4 electrons in its valence shell. To complete its octet, it either needs four electrons or lose 4 electrons to the same other atom. Both these processes are impossible therefore, carbon atom achieve noble gas configuration by sharing 4 electrons with other atoms of itself or atoms of other elements. The bonds that are formed by showing electrons are known as covalent bonds.
In covalent bonding, both atoms share the valence electrons i.e. the shared electrons belong to the valence shells of both the atoms. $CH_3CI$ is called chloromethane which contains 1 carbon atom, 3 hydrogen atoms and 1 chlorine atom.

K L
Electronic configuration of carbon (6) = 2, 4

K
Electronic configuration of hydrogen (1) = 1

K L M
Electronic configuration of chlorine (17) = 2, 8, 7

Carbon atom has four outermost electrons, each hydrogen atom has one electron and chlorine has seven outermost electrons. Carbon shares its four outermost electrons with 3 hydrogen atoms and 1 chlorine atom to form $CH_3CI$ as follows :




**Ans 28**. (a) Bulb A and B do not glow but bulb C glows.

(b) Glucose and alcohol solutions do not conduct electricity as they do not give ions.
Dil. hydrochloric acid gives ions, so the flow of ions is responsible for the flow of current.

(c) After replacement, bulb glows in B as sodium hydroxide solution gives ions ($Na^+$ and $OH^-$ ions).

**Ans 29**. Photosynthesis It is a process by which phototrophs convert light energy into chemical energy, which is later used to fuel cellular activities.
The three events that occur during the process of photosynthesis are

(i) **Absorption** of light energy by chlorophyll.

(ii) **Conversion** of light energy to chemical energy and splitting of water molecules into hydrogen and oxygen.

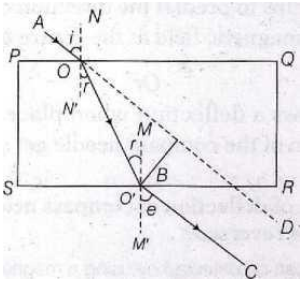
(iii) **Reduction** of carbon dioxide to carbohydrates.

**Role of stomata** These help in the gaseous exchange between the plant and the atmosphere around it. Thus, it assists the continuous supply of carbon dioxide to the plant leaves, essential 'for photosynthesis.

Or

Movements in Mimosa pudica (touch me-not ore sensitive plant) occur in response to touch.
In such movements, plant cells change shape by changing the amount of water in them resulting in folding up and drooping of leaves. This movement is independent of growth.
Plants respond to a stimulus by growing in a particular direction. These movements are due to the growth of plant. This growth is directional. Movement of shoots toward light indicates phototropism, i.e. movement occurs in response to light.

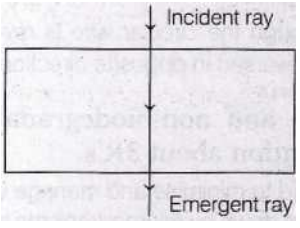
**Ans 30.** (a) Ray diagram of refraction through a glass slab.




In the above figure,
$\angle N'OO' = \angle r$ = angle of refraction
$\angle MO'O = \angle r$ = angle of refraction
Distance, O'B = lateral displacement or shift

(b) Since the extent of bending of the ray of light after refraction at the opposite faces of the rectangular glass slab is equal and opposite, so emergent ray is parallel to incident ray.

(c) If the ray of light falls normally on the surface of glass slab, it will not refract/deviate and thus,
$\angle I = \angle e = 0°$.



**Ans 31.** (i) The two positions in which a concave mirror produces a magnified image are as follows
(a) Between centre of curvature and focus of the mirror (real image).
(b) Between pole and focus of the mirror (virtual image).

**Differences between real and virtual images are as follows**

| Real Image | Virtual Image |
|---|---|
| Real image can be obtained on the screen. | Virtual image cannot be obtained on the screen. |
| Real images are always inverted and are formed when light rays after reflection or refraction converge to a point. | Virtual images are erect with respect to objects and are formed when tight rays after reflection appear to be coming from a point. |

(ii) Refractive index of glass with respect to air, ${}^{a}n_{g} = \frac{3}{2}$

Refractive index of air with respect to glass, ${}^{g}n_{a} = \frac{1}{{}^{a}n_{g}}$

$= \frac{1}{3/2} = \frac{2}{3}$

**Ans 32.** (a) The existence of this field can be detected by using a magnetic compass needle,
(b) The direction of magnetic field is predicted by using Maxwell's right hand thumb rule.
It states that, if you hold a current carrying conductor in right hand, such that the thumb points in the direction of electric current, then the direction in which fingers encircle, gives the direction of magnetic field.

(c) The pattern of magnetic field at the centre of current carrying circular wire is straight line.

Or

(a) If the current in the wire is increased, then the deflection increases. The strength of magnetic field is directly proportional to the magnitude of current passing through the straight conductor.

(b) If the direction of current through the circular wire is reversed, then the direction of deflection of compass needle will be also reversed in opposite direction.

**Ans 33.** 3R is an initiative which can be used to minimise and manage waste generation, usage, and its disposal.
Biodegradable materials are broken down by microorganisms in nature into simple harmless substances. Non-biodegradable materials need a different treatement like heat and temperature for disposal and hence, both should be discarded in two different dustbins.
1**. Reduce** This means to cut back on the amount of trash we generate.
2. **Reuse** It means to find new ways to use things that otherwise would have been thrown out.
3. **Recycle** This means to turn something old and useless like plastic into something new and useful (like picnic benches, to make roads, etc.)

**Ans 34.** (a) Metal X = Ag (Silver)

(b) Silver reacts with some sulphur compounds as hydrogen sulphide to form black layer of silver sulphide.

$$\underset{\text{Silver}}{2Ag} + \underset{\text{Hydrogen sulphide}}{H_2S} \longrightarrow \underset{\text{Silver sulphide}}{Ag2S} + H_2\uparrow$$

This phenomenon is known as corrosion.
(c) The black substance formed is silver sulphide and its formula is $Ag_2S$.

Or

(a) $CO_2$ is not a pollutant as it is present in the atmosphere upto a certain percent. However, it helps to maintain the temperature of the Earth. Combustion of coke is harmful as it increases the concentration of $CO_2$ in the atmosphere which causes global warming (greenhouse effect).
(b) Reaction of calcium with oxygen gives quicklime (CaO) which combines with water to form slaked lime, $Ca(OH)_2$ which after putting on the walls, combines with $CO_2$ of the air to form $CaCO_3$.

$2Ca(s) + O_2(g) \longrightarrow 2CaO(s)$ Quick lime

$CaO(s)+H_2O(l) \longrightarrow Ca(OH)_2(aq)$ Slaked lime

$Ca(OH)_2(aq) + CO_2(g) \longrightarrow CaCO_3(s) + H2O(l)$ Calcium carbonate

**Ans 35**. (a) Mensturation occurs when the egg is not feotilised. Every month, uterus prepares itself to receive a fertilised egg. In case, egg is not fertilised, this lining breaks and discharges out from the body through vagina in the form of blood. This is called as mensturation.

(b) Ways to avoid pregnancy are called contraceptive methods. It includes
(i) Mechanical barrier (ii) Drugs (pills)
(iii) IUCD e.g. copper-T
(iv) Surgical method for permanent contraception.

**Condoms** It is a fine rubber balloon-like structure worn over the penis during sexual intercourse. Semen is collected in it and not discharged into vagina. This method also prevents the spread of STD's such as AIDS.

Or

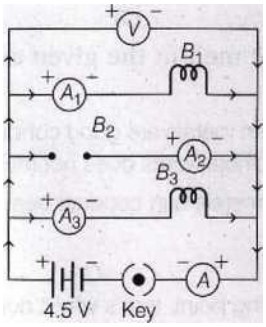
(a) The two parents involved in sexual reproduction produce gametes, which fuse together forming a zygote. It gradually develops into a young child showing certain similarities with the parents. Since, a child inherits its characters from both the parents the resemblance with them is very close. The grandparents and the child resemble less closely because a gap of gene pool is created by the parents of the child.
Variations of two generations mixing together and addition of new variations from parents, increases the difference between them to a greater extent. Hence, a child resembles more closely to its parents than the grandparents.

(b) The male and female reproductive cells divide by meiosis to form haploid gamates. These gametes have equal genetic material.
The zygote formed by the fusion of male and female gamete, i.e., it has equal genetic contribution from male and female parents as both parents contribute equal content of chromosomes. The individual is devoloped from zygote thereafter.

**Ans 36.** (a) Since all the bulbs are connected in parallel combination

$$\therefore \quad \frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{4.5} + \frac{1}{4.5} + \frac{1}{4.5} = \frac{3}{4.5}$$

$$\therefore \quad R_{eq} = \frac{4.5}{3} = 1.5\ \Omega$$




(b) As, voltmeter reads potential difference across resistor. So, it is connected in parallel with all the resistors. Ammeter is always connected in series.
The circuit diagram connected with voltmeter is shown in figure below.

(c) When bulb $B_2$ gets fused, then the current in bulb $\theta_2$ will become zero and current in bulbs B↑ and $S_2$ will remain same.

$\therefore$ Total current, $I = I_1 + I_2 + I_3$

$= 1A + 0 + 1A = 2\ A$

(d) The instruments with higher range and less value of least count would be the best choice for carrying out the experiment.
In this case, milliammeter $A_1$ and voltmeter $V_1$ have the higher ranges and lesser least counts, so they will be the best choice for the experiment.

(e) For ammeter $A_1$, bulb $B_1$ is connected in series with ammeter $A_1$.
∴ $I_1$ = current recorded by ammeter $A_1$

$$= \frac{V}{R_1} = \frac{4.5}{4.5} = 1A$$

**Ans 37**. (a) This experiment shows that given metals are good conductors of heat. Metals also have high melting points in most of the cases (as metal wires does not melt on heating).
(b) It is the property due to which metals can conduct heat. e.g. Cu, Al, Fe etc are good conductors of heat.

Or

Aluminium metal has high melting point, that's why it does not melt in the given experiment.
**Uses of Al**
(i) It is used in making kitchen utensils.
(ii) It is used in making window frames.

**Ans 38**. (a) Red colour gene will be the dominant.
(b) R for red and r for white petals
(c) If $F_1$-generation is self-pollinated, then the genotypic ratio of $F_2$-generation will be

| 1 | : | 2 | : | 1 |
|---|---|---|---|---|
| RR | | Rr | | rr |

So, out of 2400 plants, 600 (rr) will be having white petals and 1800 (RR, Rr) will be having red petals.

Or

If $F_1$-generation is cross-pollinated with rr, then the Phenotypic ratio of $F_2$-generatioπ will be
Rr : rr, 1 : 1
So, out of 2400 plants, 1200 (Rr) will be having white petals and 1200 (rr) will be having red petals.

**Ans 39.** (a) Absolute refractive index (μ) = $\frac{\text{Speed of light in vacuum (c)}}{\text{Speed of light in that medium } (v_m)}$
(b) Since, 8 has the least refractive index, it indicates that B is much optically rarer than all other medium, hence light travels fastest in medium B.
(c) Refractive index of A

$$= \frac{\text{Speed of light in air}}{\text{Speed of light in that medium}} = \frac{3\times10^8}{2.5\times10^8} = 1.2$$

Given, ${}_Q\mu_P = 2$
∴ Refractive index of Q w.r.t. P is,
${}_P\mu_Q = \frac{1}{{}_Q\mu_P} = \frac{1}{2} = 0.5$

**Ans 1.** (c) The correct match for A, B, C and D are cone. H2SO4, Fe, $NH_3$ and $Pb(NO_3)_2$ respectively.

The reactions involved are given as follows

$2NaCl$ + $H_2O_4$ (Conc.) → + $Na2SO_4$
Sodium chloride — Sulphuric acid (A) — Sodium sulphate

HCl + Fe → $FeCl_2$ $H_2$
Hydrochloric acid — Iron (8) — Iron (II) chloride — Hydrogen

$4HCl$ + $NH_3$ → $NH4Cl$
Hydrochloric acid — Ammonia (C) — Ammonium Chloride

$2HCl$ + $Pb(NO_3)_2$ → $PbCl_2$ + $2HNO_3$
Hydrochloric acid — Lead nitrate (D) — Lead chloride — Nitric acid

**Ans 2**. (c) The given reaction is an example of both combination and exothermic reaction because calcium oxide and water are combined together to form single product, i.e. calcium hydroxide and produces heat during reaction.

**Ans 3**. (b) A white salt of lead on heating decomposes to give brown fumes and yellow coloured residue is left behind.

Lead nitrate (White salt) $\xrightarrow{\Delta}$ Lead oxide (Residue) + Nitrogen dioxide (Brown fumes) + Oxygen

It is an endothermic as well as a decomposition reaction.

**Ans 4.** (a) The compound X is NaOH (sodium hydroxide).
Chemical formulae of A. B and C are
A ⟶ $Na_2ZnO_2$ (Sodium zincate)
B ⟶ NaCl (Sodium chloride)
C ⟶ $CH_3COONa$ (Sodium acetate)

**Ans 5.** (a) Nitric acid ($HNO_3$) on reacting with metals (except Mn and Mg) does not give hydrogen gas. Because it is a strong oxidising agent so, as soon as hydrogen gas is formed in the reaction between metal and dil. $HNO_3$. the nitric acid oxidises this hydrogen to water.

**Ans 6**. (b) In first test tube, the following reaction involves:

$CaCO_3$ + $2HCl$ → $CO_2$ + $H_2O$ + $CaCl_2$
Calcium carbonate — Hydrochloric acid — Carbon dioxide — Calcium chloride

$CO_2$ gas is evolved here.
In second test tube, the following reaction takes place

$Zn$ + $2HCl$ → $ZnCl_2$ + $H_2$
Hydrochloric acid — Zinc chloride

Here, $H_2$ gas is evolved.

**Ans 7**. (c) When lead nitrate reacts with potassium iodide solution, then insoluble solid precipitates of lead iodide are formed along with potassium nitrate solution.

$Pb(NO_3)2(aq)$ + $2KI(aq)$ → $PbI_2(s)$ + $KNO_3(aq)$
Lead nitrate — Potassium iodide — Lead iodide — Potassium nitrate

**Ans 8.** (c) A high concentration of oxygen in the alveolar of air and low concentration in blood create a

higher diffusion gradient. Blood leaving the alveolus contain a higher concentration of oxygen.

**Ans 9.** (d) 1. Pulmonary artries - carries blood to lungs.
2. Vena cava - carries blood from body.
3. Aorta - carries blood from heart to body.
4. Pulmonary veins - carries blood from lungs to heart.

**Ans 10.** (d) When a new plant is formed as a result of cross-pollination from different varities of plant, newly formed plant is hybrid as it contains alleles from two different plant. So, it exhibit characteristics of both the plants.

**Ans 11.** (c) The labelled X in diagram represents node of Ranvier.
These nodes of Ranvier are gaps along the myelin sheath that covers the axon of neuron cells. They function to speed up impulse transmission that runs along the axon.

**Ans 12.** (a) A is Bryophyllum, it reproduces by vegetative propagation.
B is Plasmodium, it reproduces by multiple fission.

**Ans 13.** (b) The household wiring should be done in parallel combination. As in parallel combination each appliance can be operated individually.

**Ans 14.** (b) The magnetism of a bar magnet is maximum near the poles and minimum at the centre of magnet.

**Ans 15.** (b) The given circuit, represents two lamps, one cell and a switch connected in series combination.

**Ans 16.** (d) Proton is a charged particle. When it moves in a magnetic field, a magnetic force acts on the proton due to its velocity and hence the momentum changes.

**Ans 17.** (c) A is true but Reason is false. Photosynthesis is considered as an endothermic reaction because energy in the form of sunlight is absorbed by the green plants.

**Ans 18.** (b) Both A and R are true, but R is not the correct explanation of A
Dominant allele is an allele whose phenotype will be expressed even in the presence of another allele of that gene. It is represented by a capital letter, e.g. T. It can be expressed itself in both homozygous and heterozygous conditions.

**Ans 19.** (d) Assertion is false, but Reason is true Pyruvate is a 3 carbon molecule.

**Ans 20.** (a) When a charged particle enters in the direction of magnetic field, then no magnetic force acts on charged particle, hence it moves on a straight path without deviation in a uniform magnetic field.
Both A and R are true and R is the correct explanation of A

**Ans 21.** This relationship between diamond and graphite is called **allotropy.** The physical properties are different because the carbon-carbon bonding in both the allotropes varies.
Diamond is hard because in it one carbon atom is bonded with four other carbon atoms with strong covalent bond, while graphite is soft in which each C-atom is joined to three other C-atoms by strong covalent bonds to form flat hexagonal rings.
The various layers of C-atoms in graphite are quite far apart so that covalent bonds can exist between them. The various layers of carbon atom in graphite are held together by weak van der Waals' forces. They can slide over one another.

Or

A homologous series, is the family of organic compounds having the same functional group, similar chemical properties but the successive (adjacent) members of the series are differ by a $CH_2$ unit or 14 mass units.
Consecutive members of the homologous series of alcohols are

$CH_3OH$, $C_2H_5OH$ → They differ by — $CH_2$ unit.

The physical properties are determined by alkyl group/ hydrocarbon part/part other than the functional group. The chemical properties are determined by functional group such as —OH group.

**Ans 22**. Feedback mechanism is the mechanism of body to maintain the levels of hormones in the body in desired limit.

For example, if the sugar level in blood rises, cells of pancreas detect and responds by producing more insulin in blood. As the sugar level falls, insulin secretion is reduced.

**Ans 23.** Nephrons are the structural and functional units of kidney.

Kidney dialysis machine acts in the similar way as a normal kidney by regulating the normal concentration of the blood. The water and excess mineral salts in the body diffuses from patient blood across the selectively permeable walls of the tubules into the dialysis fluid. Hence, the blood is filtered,

**Ans 24.** Anaerobic respiration takes place in the absence of oxygen.

In an yeast cells, the end products formed during fermentation (anaerobic respiration) are ethyl alcohol, carbon dioxide and energy. It can be summarised by the given equation

$$\text{Glucose} \xrightarrow[\text{In cytoplasm}]{\text{Glycolysis}} \text{Pyruvate} \xrightarrow[\text{Yeast fermentation}]{\text{In the absence of } O_2} \underset{\text{Ethanol}}{2C_2H_5OH} + \underset{\text{Carbon dioxide}}{2CO_2} + 2ATP$$

However, in human muscles, the end products of anaerobic respiration are lactic acid and energy, it can be summarised by the given equation

$$\text{Glucose} \xrightarrow[\text{In cytoplasm}]{\text{Glycolysis}} \text{Pyruvate} \xrightarrow{\text{In the absence of } O_2} \text{Lactic acid} + 2ATP$$

**Ans 25.** (I) The incident beam of light after refraction through prism splits into a band of seven colours which are violet, indigo, blue, green, yellow, orange and red (VIBGYOR). These coloured rays emerge out of the prism along different directions and become distinct. Therefore, dispersion of white light takes place.

(II) When the incident beam passes through the first prism, it gets splitted into the band of seven colours. But those coloured rays are incident on an identical inverted prism. Then, recombination of the coloured rays takes place. This emergent light is parallel to the incident beam but slightly shifted outward.

Or

(a) The blue colour of water in deep sea is due to scattering of light, as the blue colour being of shorter wavelength scattered most by water molecules.

(b) Twinkling of stars is due to atmospheric refraction of light by different layers of varying refractive indices.

**Ans 26.** The study of food chain in an area or habitat helps in

(i) understanding the energy transfer through organisms.

(ii) understanding the ecological balance in a habitat or ecosystem.

(iii) understanding harmful human activities and disruption of ecological balance, if any.

An example of four steps of food chain operating in a large lake is as follows

Protozoan → Algae → Small fish → Big fish.

**Ans 27**. Element A is calcium (Ca). When it reacts with water, it forms calcium hydroxide. These, compound B is calcium hydroxide [$Ca(OH)_2$], which is used in white washing.

$$\underset{\text{Calcium (A)}}{Ca(s)} + 2H_2O(l) \longrightarrow \underset{\text{Calcium hydroxide (B)}}{Ca(OH)_2(aq)} + \underset{\text{Hydrogen gas}}{H_2(g)}$$

Compound B on heating gives CaO.

$$\underset{\text{Calcium hydroxide (B)}}{Ca(OH)_2(ag)} \xrightarrow{\Delta} \underset{\text{Calcium oxide}}{CaO(s)} + H_2O(l)$$

(C)

Thus, C is calcium oxide (CaO).

C (CaO) on treatment with water gives back B [$Ca(OH)_2$],

$$\underset{\text{Calcium oxide}}{CaO(s)} + H_2O(l) \longrightarrow \underset{\text{Calcium hydroxide (B)}}{Ca(OH)_2(ag)}$$

(C)

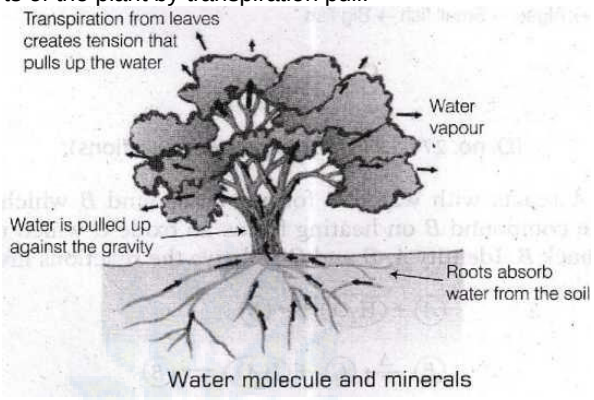
**Ans 28**. (i) Most reactive metal is Q as it has replaced both P and R from their compounds.

(ii) Element R is least reactive as it has been replaced by both P and Q.

(iii) Displacement reaction

**Ans 29.** Transpiration is loss of water in the form of water vapours from aerial parts of the plant.

The loss of water in transpiration creates a suction which pulls water from xylem cells of roots. Thus, water reaches to the upper parts of the plant by transpiration pull.




Xylem of plants helps in upward unidirectional flow of water.

Or

The cells surrounding the stomata are guard cells.

These cell perform following functions.

(a) Protect the inner tissues from external factors, pathogenic attacks, etc.

(b) They regulate the opening and closing of stomatal cells,

Opening and closing of stamata occurs due to the changes in the turgor pressure of the guard cells. When guard cells are turgid, stomatal pores are open, while in flaccid form, the stomatal pores are closed.

**Ans 30. (**a) When the incident ray falls normally on the glass slab, it will refract without deviation, i.e., along the normal in the glass slab, $\angle i = \angle r = 0$.

(b) When the refraction through a glass slab takes place, then the emergent ray becomes parallel to the incident ray. So, angle between incident ray and emergent ray will be zero.

(c) Given, refractive index of glass slab = 1.5 We know that,

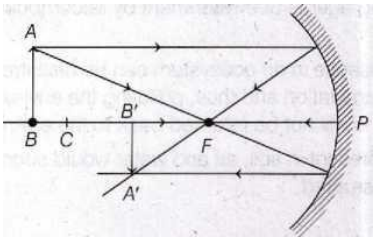
$$n = \frac{\text{Velocity of light in air}}{\text{Velocity of light in glass slab}}$$

$$\Rightarrow \quad 1.5 = \frac{3\times10^8}{v}$$

$$\Rightarrow \quad v = \frac{3\times10^8}{1.5} = 2 \times 10^8 \text{ m/s}$$

$$\therefore \quad v = 2 \times 10^8 \text{m/s}$$

**Ans 31.** (i) Since, the magnification is $-\frac{1}{5}$, the image will be real and inverted, so the spherical mirror is a concave mirror.



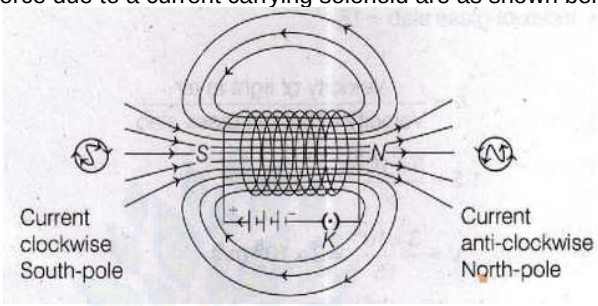

(ii) $m = \frac{h_i}{h_0} = -\frac{1}{5} \Rightarrow h_j = -\frac{h_o}{5}$

Therefore, the image formed is of smaller size than the object placed in front of the mirror.

The object should be placed beyond C to get the magnification of $-\frac{1}{5}$.

**Ans 32**. (a) Pole formation at the ends of the solenoid can be explained by looking at one face of the coil. If the direction of current through the coil is clockwise, then that face has South polarity and if the direction of current is anti-clockwise, then that face has North polarity.

(b) Magnetic field lines force due to a current carrying solenoid are as shown below




(c) The magnitude of magnetic field due to a current carrying solenoid is independent of its dimensions. So, the magnetic field due to current carrying solenoid is independent of its diameter.

Or

(a) A tangent drawn on any point on magnetic field line indicates the direction of force. Then, if two lines intersect each other at a point, it means that force is acting in two directions at that point, i.e. there are two directions of the magnetic field at the point of intersection which is not possible at the same time. Thus, the two magnetic field lines can never intersect each other.

(b) The direction of field lines outside a magnet is from North-pole to South-pole while it is from South to North inside the magnet and thus, forms closed curves.

**Ans 33**. Organisms which breakdown the complex organic compounds present in dead and decaying matter into simpler inorganic materials are called **decomposers,** e.g. certain bacteria and fungi.

Decomposers act as cleaning agents of environment by decomposing dead bodies of plants and animals. The consequence of their absence in an ecosystem can be disastrous. The dead bodies would persist for long, leading to their accumulation and thus, polluting the environment. The biogeՈetic nutrients associated with these remains will not be returned back to the environment.

As a result, all the nutrients present in soil, air and water would soon be exhausted and the whole life cycle of organisms will be disrupted.

**Ans 34.** The container made up of copper or aluminium is suitable for storing these solutions.

This can be decided by studying their reactions with Cu and Al (which also depend on the respective position in activity series).

(i) **Reactions of copper with**

(a) **Dil. HCl** $Cu + HC1 \rightarrow$ No reaction
(Dil.)

So, it can be stored in Cu container,

(b) **Dil. $HNO_3$** Being a strong oxidising agent, dil. $HNO_3$ reacts with copper, so it cannot be stored in copper container.

(c) **$ZnCl_2$** Copper is less reactive than zinc, so it does not react with $ZnCl_2$ solution. Therefore, it can be stored in copper container.

(ii) **Reactions of aluminium with**

(a) **Dil. HCl** Al reacts with dil. HCl, so it cannot be kept in aluminium container.

$$2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2 \uparrow$$

(b) **Dil.** $HNO_3$ When dil. $HNO_3$ is kept in Al container, it forms a protective layer of aluminium oxide on it, which prevents aluminium from further reaction therefore, it can be kept in Al container.

**(c) $ZnCl_2$** Al is more reactive than zinc, so $ZnCl_2$ solution cannot be kept in aluminium container.

$$2Al + 3ZnCl_2 \rightarrow 2AlCl_3 + 3Zn$$

Or

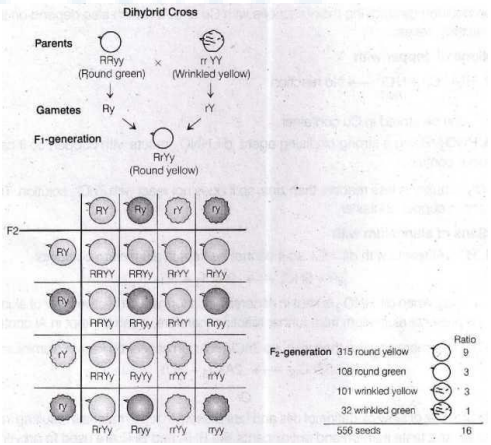
(a) It is the process of slow oxidation of oils and fats present in food materials resulting in the production of foul odour and taste in them and antioxidants like BHA and BHT are used to prevent rancidity.

(b) Methods by which rancidity can be prevented are as follows
(i) Keeping the food materials in air-tight containers.
(ii) Refrigeration of cooked food at low temperature.
(iii) Packing of food like wafers, potato chips in packets containing nitrogen gas instead of air.

**Ans 35**. (a) The ratio of chromosome number between egg and its zygote is 1 : 2.
An egg is a female gamete and it has haploid number of chromosomes. During fertilisation, it fuses with male gamete (also having haploid number of chromosomes) to form a zygote, which has now diploid number of chromosomes.
Sperms and eggs are genetically different in terms of nature of sex chromosome. The sperm contains either X or Y chromosome, whereas an egg will always have an X-chromosome.

(b)

When pea plants with two contrasting characters, i.e. one with a green round seeds and the other with a yellow wrinkled seeds are crossed, all the $F_1$ progeny obtained had round and yellow seeds.
When the $F_1$ progeny is self-crossed to obtain-$F_2$ progeny, four types of seeds were obtained as round yellow, round green, wrinkled yellow and wrinkled green in ratio 9:3:3:1, respectively.
Hence, the phenotypic ratio of $F_2$ progeny is 9 : 3 : 3 : 1.




Or

(a) Use of a condom is beneficial for both the sexes involved in a sexual act. It is because of the following facts
(i) It prevents pregnancy, which is not desired by a couple.
(ii) It saves both the partners from sexually transmitted diseases like AIDS, etc.

(b) Oral contraceptives are the hormonal pills which are taken by the females after their menstruation ends up. It is taken for 21 days daily. It changes the cyclic events of ovulation. So, mature ovum is not available for fertilisation. No, oral contraceptives donot prevent the transmission of sexually transmitted diseases, pills only changes events of ovulation. No methods of contraception can fully prevent the transmission of

STD's. However, the only safe methods that can be used is condoms,

**Ans 36.** (a) **In series circuit (a)**
Equivalent resistanc e in series combination, $R_s = R + R + R = 3R$, Voltage = V
Let current through each bulb in series combination be I. (∵ Current remains same in series combination)
By Ohm's law,
$V = I \times 3R \Rightarrow I = \frac{V}{3R}$
∴ Power consumption of each bulb in series combination,
$P_1 = I^2 (3R) = \left(\frac{V}{3R}\right)^2 \times 3R$
$P_1 = \frac{V^2}{3R}$ …(i)
**In parallel circuit (b)**
The resistance of each bulb = R
Voltage across each bulb = V (∵ voltage remains same in parallel combination)
Power consumption of each bulb in parallel combination,
$P_2 = \frac{V2}{R}$ …(ii)
Hence, from Eqs. (i) and (ii), we get
$= \frac{V^2}{R} \times \frac{3R}{V^2} = 3$
$P_2 = 3P_1$
Therefore, each bulb in parallel combination glows 3 times brighter to that of each bulb in series combination.

(b) As, power, $P = \frac{V^2}{R}$ or $R = \frac{V^2}{P}$
For same voltage, $P \propto \frac{1}{P}$
i.e., More the power, lesser will be the resistance. $R_2 < R_1$

(c) Given, P = 100 W and t = 1 min = 60 s
$P = \frac{\text{Work done}}{\text{Time}} = \frac{\text{Energy spent}}{t}$
Energy spent = P × t = 100 × 60 = 6000 J

**Ans 37.** (a) Alcohol decolourises $KMnO_4$ but acid does not. In excess of $KMnO_4$, alcohol gets completely converted into acid which does not decolourises $KMnO_4$.

(b) Oxidation reaction is involved in the conversion of alcohol to carboxylic acid. Equation of this reaction is as follows

$CH_3H_2$—OH $\xrightarrow[\Delta]{\text{Alk.KMnO}_4}$ $CH_3COOH$
Ethanol Ethanoic acid

Or
In this given experiment ethanoic acid ($CH_3COOH$) is formed. Here, $KMnO_4$ acts as oxidising agent which oxidises alcohol to carboxylic acid.

**Ans 38.** (a) The phenotype of all the plants in the $F_1$-generation would be tall.
(b) When crossed with homozygous recessive parent the genotypic ratio would be Tt: tt; 1:1. (1 +1)
(c) In experiment 'A', the phenotypic ratio of tall and dwarf plants would be Tall: Dwarf :: 3:1, whereas the genotypic ratio would be, TT : Tt: tt : 1:2:1

Or

The phenotypic character that is capable of expressing in the $F_1$-generation is described as 'dominant'. The contrasting character, i.e. dwarfness is the recessive character.

**Ans 39.** (a) Radius of curvature of a mirror is defined as the radius of sphere from which the spherical mirror was cut.

(b) The mirror is convex mirror, because it always forms erect and diminished image irrespective of the position of the object.

(c) By observing the images produced by mirror for different positions of object, its nature can be identified as follows

• If the image formed by the mirror is of same size as that of object for different positions of object, then the mirror is a plane mirror.

• If the image formed by the mirror is diminished for all positions of an object, then the mirror is a convex mirror.

• If the image is formed behind the mirror is longer than the object, then the mirror is a concave mirror

Or

The third concave mirror will form an image of same size as that of object because in third concave mirror, f = 0.1 m, so radius of curvature R = 2f = 0.2 m and a same size image is formed when object is at the centre of curvature.

**Ans 1.** (a) Hydrochloric acid and bleach are important products that are obtained from the chlor-alkali process.

**Ans 2.** (b) When base $Ca(OH)_2$ combines with ammonium salt, $NH_4CS$, then it liberates ammonia gas and forms calcium chloride, $CaCI_2$ and water.

$Ca(OH)_2(ag) + 2NH_4CI(g) \rightarrow CaCI_2(s) + 2H_2O(l) + 2NH_3(g) \uparrow$

So, X = $NH_4CI$ and Y = $H_2O$

**Ans 3.** (a) The decomposition of limestone ($CaCO_3$) to make quick lime (CaO) is an endothermic process as it is necessary to heat limestone to a high temperature for this reaction to occur.

$CaCO_3$ (Limestone) $\xrightarrow{\Delta}$ CaO (Quicklime) + $CO_2$ Carbon dioxide

When water is added to the quicklime, slaked lime is produced along with the release of heat. Therefore, this reaction is exothermic.

CaO (Quicklime) + $H_2O$ $\rightarrow$ $Ca(OH)_2$ + Heat (Slaked lime)

**Ans 4.** (a) Iron (Fe) on exposure to moist air ($H2O+ O_2$), forms a reddish brown compound ($Fe_2O_3$) which is called rust.

Fe (Iron) + $H_2Or + O_2$ (Moist air) $\rightarrow$ $Fe_2O_3$ (Reddish brown rust)

**Ans 5.** (d) Graphite can not be used for making insulated plates, as it is a good conductor of electricity.

**Ans 6.** (d) When dilute sulphuric acid treated with iron sulphide, then hydrogen sulphide gas is evolved and iron sulphate is formed.

| | | | |
|---|---|---|---|
| $FeS(s)$+ | $HgSO_2(aq)$ | $FeSO_4(aq)$ | + $HsS(g)$ |
| Iron sulphide | Sulphuric acid | Iron(li) sulphate | Hydrogen sulphide |

**Ans 7.** (c) Benzene molecule contains alternate single and double bonds. Its formula is $C_6H_6$.
In structure (a), double bonds are not at alternate positions. In structure (b), the formula is $C_6H_{12}$ and in structure (d), the formula is $C_6H_8$.

**Ans 8.**(b) The correct labelling are as follows:
(i) - Upper epidermis (ii) -Chloroplast
(iii) - Guard cell (iv) - Lower epidermis
Chloroplasts are plant cells organelles which are the site for the photosynthesis. .It contains the photosynthetic pigment, chlorophyll that captures sunlight.

**Ans 9**. (b) The correct labelling are as follows
(i) - Mouth
(ii) - Stomach
(iii) - Small intestine
Mouth secretes salivary amylase which breaks down starch into sugars.
Stomach secretes pepsin enzyme which breaks down proteins into smaller peptides and amino acids, in small intestine, bile emulsifies fats while lipase break them.

**Ans 10.** (c) If pea plants having round green seeds and wrinkled yellow seeds are crossed, phenotypic ratio of 9:3:3: Twill be obtained in $F_2$ progen

**Ans 11**. (a) The leaves Mimosa pudica responds to stimuli such as touch, blow or mechanical shack by folding their leaflets and lowering their leaves. This effect is caused by a change in the turgidity of the

leaflets brought about by the the movement of water into and out of parenchymatous cells of the swollen leaf base.

**Ans 12.** (a) A-Ovary, B-Uterus, C-Cervix, D-Vagina

**Ans 13.** (b) The advantage of doing household wiring in parallel combination is that if any device or appliance gets damaged or faulty, there would be no effect on the working of other devices. This is because the current across each device would be different in parallel combination.

**Ans 14.** (b) According to right hand thumb rule, when conductor is held in right hand, keeping thumb from East to West as shown in given figure, the curve of the finger will be from North to South at a point lying directly below the wire.

**Ans 15.** (c) Since, slope of given graph represents the value of resistance R, i.e. $R = \frac{V}{I}$.
As, the slope of graph at temperature $T_2$ is greater than the slope of graph at temperature $T_1$ Hence, graph at $T_2$ has higher resistance, i.e. $R_2 > R_1$. Resistance and temperature are directly proportional to each other for conductors, i.e. the .resistance of a conductor increases with rise in temperature. Therefore, $T_2 > T_1$.

**Ans 16**. (d) Properties of magnetic field lines are as following
(a) Magnetic field lines are closed and continuous curves.
(b) Magnetic field lines never intersect with each other.
(c) Magnetic field lines are crowded near the poles.
Hence, option (d) is correct.

**Ans 17**. (a) Both A and R are true and R is the correct explanation of A.
Catenation is the bonding of atoms of the same element into a series called as chain. Catenation occurs more readily with carbon, which forms strong covalent bond with other C-atoms to form long chains and structures.

**Ans 18.** (a) Both A and R are true and R is the correct explanation of A
Females are homogametic with two X chromosomes. That is why, all human female gametes will have only X chromosomes.

**Ans 19.** (b) Both A and R are true, but R is not the correct explanation of A
Amoeba is an omnivore organism. It feeds upon both plant and animal matter. Its mode of nutrition is holozoic. Lion is a carnivore organism because it eats other animals (meat eaters)

**Ans 20.** (a) The magnitude of magnetic field is
(i) directly proportional to the current I passing through the wire.
(ii) inversely proportional to the distance r from the wire.
The magnetic field is stronger at a point which is nearer to the conductor and goes on decreasing on moving away from the conductor.
∴ Both A and R are true and R is the correct explanation of A.

**Ans 21**. Aluminium only reacts with steam but does not react with hot or cold water.
The chemical equations involved are as follows

$$Al + H_2O \xrightarrow[(Hot/cold)]{} X$$

$$2Al + 3H_2D \xrightarrow[Steam]{} Al_2O_3 + 3H_2\uparrow$$

Aluminium oxide

Or

(i) $CuO(s) + H_2O(l) \longrightarrow Ca(OH)_2(aq)$
Quicklime → Slaked lime
It is a combination reaction.
(ii) $2Cu(s) + O_2(g) \longrightarrow 2CuO$

Black (in colour)

It is a combination reaction.

**Ans 22**. The endocrine and neural system works in coordination for the normal functioning of our body. The synthesis and release of certain hormones is regulated by the neural system. Also, the release of certain hormones influences the activity of nerves.
For example, The presence of food in our stomach, distends the gastric wall. This results in secretion of gastric hormone which stimulates gastric juice secretion in stomach. Likewise, increase in the concentration of adrenaline stimulates the respiratory centre of the brain. This inturn leads to increase in the breathing rate of an individual.

**Ans 23**. The main components of the transport system in highly organised plants are xylem and phloem.
(i) **Xylem** consists of tracheids and vessels. It conduct water and minerals (obtained from the soil) to the leaves.
(ii) **Phloem** consists of sieve tubes and companion cells. It helps to transport food materials, etc. from leaves to various parts of the plant.

**Ans 24.** The distribution of all essential substances such as food, oxygen and water throughout the body is carried out through the system of transportation. It also displaces excretory wastes collected from the cells of body to the excretory organs from where they are expelled out from the body. Thus, transportation of materials is necessary to carry out various life processes.

**Ans 25. Advanced sunrise and delayed sunset** The figure below shows the actual position of the sun S at the time of sunrise and S' the apparent position of sun. The advanced sunrise and delayed sunset is because of atmospheric refraction.
The light rays starting from the Sun travel from rarer to denser layers. They bend more and more towards the normal.
However, an observer on earth sees an object in the direction of the rays reaching his eyes. The Sun which is actually in a positions below the horizon, appears in the position S' above the horizon for him. Thus, the Sun appears to rise early by about 2 minutes and set late by about 2 minutes. This increases the length of the day by about 4 minutes.

Or

(i) (a) White colour of the sunlight is scattered by the dust particles in the atmosphere.
(b) Blue colour of the sunlight is scattered by the air molecules in the atmosphere.
(ii), (a) Sky appears blue.
(b) Sun appears red at sunrise and sunset.

**Ans 26.** Carbon monoxide has great affinity with haemoglobin of our blood. Due to this, it gets mixed with haemoglobin almost 300 times more than oxygen. Thus, culting off the suppy of oxygen leads to less oxygen available for our body. This is why, it is dangerous when inhaled.

**Ans 27. Decomposition reaction** A reaction in which a single reactant breaks down to form two or more products is known as decomposition reaction.

(i) When a decomposition reaction is carried out by heating then it is known as thermal decomposition reaction.

| $CaCO_3(s)$ | Heat ⟶ | $CaO(s)$ | $+ CO_2(g)$ |
|---|---|---|---|
| Calcium carbonate (Limestone) | | Calcium oxide (Quicklime) | Carbon Dioxide |

(ii) A decomposition reaction in which energy is supplied in the form of light, is known as photochemical decomposition reaction.

$$2AgCl(s) \xrightarrow{\text{Sunlight}} 2Ag(s) + Cl_2$$

| Silver chloride | | Silver | Chlorine |
|---|---|---|---|
| | | (Greyish white) | (Yellowish green) |

(iii) A decomposition reaction in which energy is supplied in the form of electricity is known as electrolytic decomposition reaction.

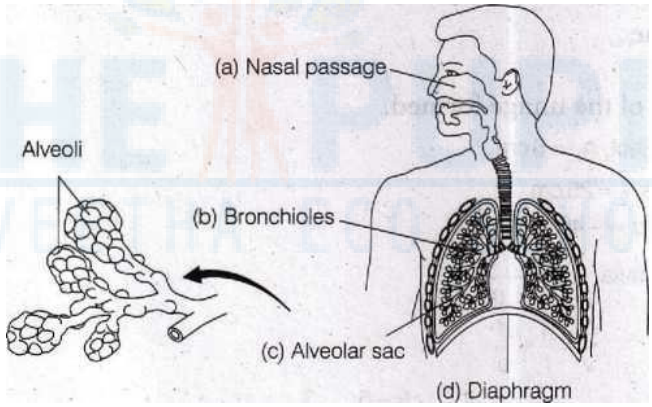
| $2H_2O(l)$ | Electrical current | $2H_2(g)$ | $+ O_2(g)$ |
|---|---|---|---|
| Water | | Hydrogen | Oxygen |

**Ans 28.** (a) Graphite is an allotrope of carbon which is a good conductor of electricity so it is cheap, in insoluble in water, do not react with acids and bases, and is non-corrosive material.
Due to these properties, it is used in making electrodes,
(b) Polyvinyl chloride (PVC) or a rubber-like material are insulators and hence do not allow electrons to flow. Hence, these are used in coating the electrical wires.
(c) Metals and metal alloys are generally sonorous in nature, i.e. they produce sound. Due to this property, they are used for making bells and strings of musical instruments.

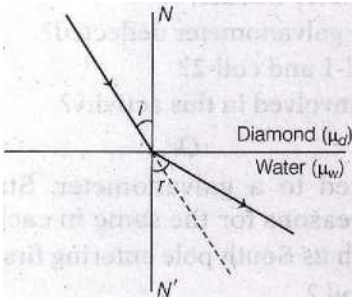
**Ans 29.** The transport of soluble products of photosynthesis (sugar) from the leaves to other parts of the plant is termed as **translocation.** Besides sugar, transportation of amino acids, hormones, etc., also takes place. The translocation of substances takes place in sieve tubes with the help of adjacent companion cells in both upward and downward directions.
The translocation in phloem occurs mainly by utilising energy. Materials like sucrose is transferred into phloem tissue using energy in the form of ATP, which increases the osmotic pressure of tissue causing water to move in the pressure then moves the material in the phloem to tissues with less pressure. This allows phloem to move material according to the plant needs.

Or

The diagram of the human respiratory system with the labelled parts is as follows

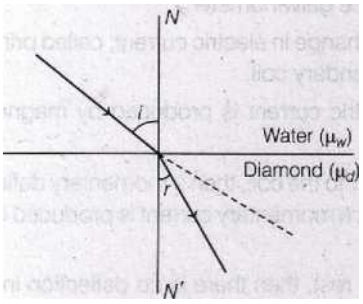



**Ans 30.** (a) Given, $\mu_d = 2.42$ and $\mu_w = 1.33$
As $\mu_d > \mu_w$, this means light would travel from denser to rarer medium. Thus, it will bend away from normal (NN') as shown in the figure below.



Here, r > i

(b) As $\mu_d > \mu_w$, this means light would travel from rarer to denser medium. Thus, it will bend towards the 'normal (NN') as shown in the figure below.




Here, i > r

(c) Refractive index of diamond with respect to water is given by

$$\mu_{dw} \frac{\mu_d}{\mu_w} = \frac{2.42}{1.33} = 1.82$$

$\therefore$ $\mu_{dw} = 1.82$

**Ans 31**. Given, height of object, $h_0 = 6$ cm
Focal length of lens, f = 25cm
Distance of object, u = - 40 cm
(i) Using lens formula, $\frac{1}{f} = \frac{1}{v} = \frac{1}{u}$

$$\frac{1}{v} = \frac{1}{f} = \frac{1}{u}$$
$$= \frac{1}{25} + \frac{1}{(-40)} = \frac{8-5}{200} = \frac{3}{200}$$
$$v = \frac{3}{200} = 66.67 \text{ cm } 3$$

(ii) $\therefore$ Magnification, $m = \frac{h_j}{h_o} = \frac{v}{u}$

$h_j = \frac{v}{u} \times h_o = \frac{200}{3 \times (-40)} \times 6 = -10$ cm

**Ans 32**. (a) Whenever the electric current through the coil-1 is changing (starting or stopping), a potential difference and hence, an electric current is induced in the coil-2. This induced current is responsible for the deflection of the needle of the galvanometer.

(b) The coil-1 in which there is a change in electric current, called primary coil. The coil-2 in which there is an induced current, called secondary coil.

(c) In the given activity, an electric current is produced by magnetism. This phenomenon is known as electromagnetic induction.

Or

(a) When South pole is pushed into the coil, then a momentary deflection is observed in the alvanometer. This deflection indicates that a momentary current is produced in the coil. The direction of current in the coil is clockwise.

(b) When the magnet is held at rest, then there is no deflection in the galvanometer. It indicates that no current is produced in the coil in this case.

**Ans 33.** Insecticides are non-biodegradable chemicals added to crop fields to stop the growth of insects infecting the crops.
Modern insecticides are being developed keeping in mind, the harm they cause to the environment and its components.

Biodegradable insecticides can be decomposed into harmless substances, which will subsequently be dispersed in their specific pathways and cause no pollution.
Non-biodegradable insecticides buildup in the fat tissues of the body and pass on to organisms that feed on them.
Hence, they accumulate along the food chain resulting in significant amounts in the tissues of consumers at the highest trophic level.
The property of newly developed insecticide includes that it can easily get decomposed into simpler components by soil bacteria.

**Ans 34**. (a) The reddish brown coloured metal used in electric wires is **copper.**
When copper is heated strongly in air, it combines with oxygen to form copper (II) oxide, a black oxide,

(b) Copper is used in electrical wires.

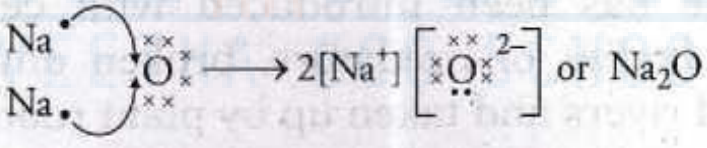
(c) $2Cu + O_2 \xrightarrow{\Delta} 2CuO$
Copper (Black) Copper (II) oxide

$CuO + H_2 \longrightarrow H_2O + Cu$
Copper
(Reddish brown)

Or

(a) Ionic compounds are formed by the transfer of electrons from one atom to another. These compounds are composed of positively charged metal cations and negative charged anion, e.g. sodium oxide $Na_2O$.

$2Na \rightarrow 2Na^+ + 2e$
(2, 8, 1) (2, 8)
$O + 2e \rightarrow O^{2-}$
(2, 6) (2, 8)




Properties of ionic compounds are
(i) These compounds are water soluble.
(ii) These compounds have high melting and boiling points.
(iii) These compounds conduct electricity in molten form or in the form of aqueous solution.

(b) X is potassium (K).
Potassium being soft can be cut with a knife and being lighter than water hence, it will float at the surface. The heat produced during reaction with water will melt it.

**Ans 35.** (a) Differences between pollination and fertilisation are as follows

| | **Pollination** | **Fertilisation** |
|---|---|---|
| (i) | It is the transfer of pollen grains from anther to the stigma of the same or different flower. | It is the fusion of a male and a female gamete. |
| (ii) | It carries male gamete producing pollen grain to the female sex organs. | It leads to the formation of zygote. |
| (iii) | It is a physical process. | It is a biological process. |
| (iv) | It occurs in seed plants only. | It occurs in both plants and animals. |

| | | |
|---|---|---|
| (v) | It is an external process. | It can either be internal or external. |
| (vi) | This process leads to fertilisation. | It leads to formation of seeds. |

(b) When plants with two contrasting characters (e.g. tall and dwarf) are crossed, only one character is visible in Regeneration and other character is suppressed. It shows dominance of one character over other. $F_1$ hybrid when selfed, produced plants with both dominant and recessive phenotypes. It slowed that the two unit factors of a character which remain together in an individual do not get mixed up, or get contaminated and keep their distinct identity. They separate or segregate during gamete formation.

Or

(a) Mendel used the pea plant for his experiments.

Seven pairs of contrasting characters in pea plant studied by Mendel.

| **Character** | **Dominant trait** | **Recessive trait** |
|---|---|---|
| Seed shape | Round | Wrinkled |
| Seed colour | Yellow | Green |
| Flower colour | Violet | White |
| Pod shape | Full | Constricted |
| Pod colour | Green | Yellow |
| Flower position | Axial | Terminal |
| Stem height | Tail | Dwarf |

The progeny produced from them ($F_1$-generation) plants were all tall.
Then Mendel then allowed $F_1$ progeny plants to undergo self- pollination. In the $F_2$-geпeration, he found that all plants were not tall, three quarter were tall and one quarter of them were short. The ratio he obtained in $F_2$-generatioՈ plants is 3 : 1.

(b) All the living organisms need energy for their survival and growth.
It is basically important for continuity of the generation of an organism or species as DNA copying during reproduction helps to produce similar individuals as their parents to maintain stability of a species.

**Ans 36**. (a) Electrons are flowing through the conductors from its lower potential end to its higher potential end.

(b) The relation between potential difference, work done and charge moved is given by

Potential difference = $\frac{\text{Work done}}{\text{Charge moved}}$

i.e. $V = \frac{W}{q}$

(c) Given, V = 12 V and I = 0.5 A
As power, P = V × I = 12 × 0.5 = 6W

(d) Given, $R_1 = 5\Omega$, $R_2 = 10\Omega$, V = 6V
(i) For parallel combination, $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$

$= \frac{1}{5} + \frac{1}{10} = \frac{2+1}{10} = \frac{3}{10} \Rightarrow R = \frac{10}{3}\ \Omega$

∴ Total current in the circuit, $I = \frac{V}{R} = \frac{6\times3}{10} = 18$ A
(ii) For series combination, $R = R_1 + R_2 = 5 + 10 = 15\Omega$
∴ Total current in the circuit, $I = \frac{V}{R} = \frac{6}{15} = 0.4$A

**Ans 37.** (a) Given experiment concludes that combustion (exothermic) reaction takes place which accompanied by the evolution of heat and light. Also, here oxidation of magnesium occurs.
(b) The reaction between magnesium and oxygen to form magnesium oxide is a combination reaction. The reaction involved in as follow

$$2Mg + O_2 \longrightarrow 2MgO$$

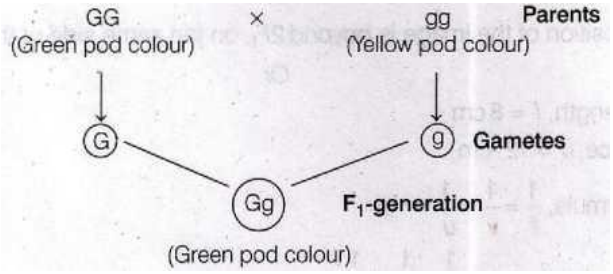
Magnesium + Oxygen → Magnesium oxide

Or

When MgO is dissolved in water, it forms magnesium hydroxide which is basic in nature, i.e. it turns red litmus blue because of its basic nature.

**Ans 38**. (a) One contrasting trait, i.e. tall and dwarf plants were taken by Mendel in his monohybrid crosses.

(b)




As per Mendel's law of a dominance, in a cross of parents that are pure for contrasting traits, only one form of the trait will apear in $F_1$-generation that is dominant in the phenotype, i.e. green pod colour.

(c) The first law of Mendel is law of dominance, which states that the when two alleles of an inherited pair is heterozygous, then the allele that is expressed in dominant, whereas the allele that is not expressed in recessive.

Or

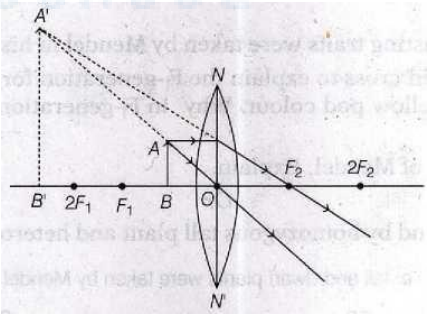
Homozygous tall plant will have two identical copies of single gene, i.e. TT.

Heterozygous tall plant will have two different copies of single gene, i.e. Tt.

**Ans 39.** (a) The convex lens has the property to converge the parallel beam of light rays at a point, i.e., focus of the lens. Hence, the image will be formed at the focus.

(b) The nature of the image formed by convex lens. In this case, is virtual and erect. The size of the image is larger than that of the object i.e., magnified image will be formed.

(c) The formation of image is as shown below:




Hence, the position of the image is beyond $2F_1$, on the same side of the object.

Or

Given, focal length, f = 8cm

Object distance, u =12 cm

Using lens formula, $\frac{1}{f} = \frac{1}{v} = \frac{1}{u}$

$\Rightarrow \quad \frac{1}{8} = \frac{1}{v} - \frac{1}{12}$

$\Rightarrow \quad v = \frac{24}{5}$ = 4.8 cm

Hence, the image wilt be formed at a distance 4.8 cm from optical centre.

**Ans 1.** (a) Metal like potassium and sodium react violently with cold water.

$$2Na + \underset{\text{(Cold water)}}{2H2Q} \longrightarrow 2NaOH + H_2 + \text{Heat}$$

Metal like aluminium, iron and zinc do not react either with cold or hot water. They react with steam and form the metal oxide and hydrogen gas.

$$2Al + 3H_2O \xrightarrow[\text{(Steam)}]{} Al_2O_3 + 3H_2$$

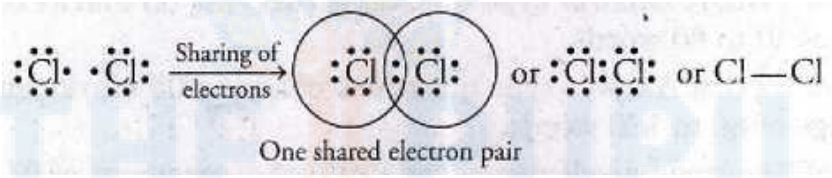
$$3Fe + 4H_2O \xrightarrow[\text{(Steam)}]{} Fe_3O_4 + 4H_2$$

Lead, copper, silver and gold do not react with water at all.

**Ans 2.** (a) By equating the number of atoms both sides, the balanced equation will be

$$Cu + 4HNO_3 \rightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$$

**Ans 3.** © In chlorine molecule, both chlorine atoms contribute one electron and thus, share single electron pair to form single covalent bond. As electrons are shared by both atoms, they acquire inert gas configuration of argon atom in valence shell.




**Ans 4**. (a) Al represents the correct picture of possible and impossible reactions. Aluminium is more reactive than copper, iron and zinc. Hence, it displaces all them from their salt solution whereas copper and iron are less reactive than aluminium, therefore, gives no reaction with them. Zinc being more reactive than iron, can displace iron from $FeSO_4$ solution,

**Ans 5.** (a) Structure (i) is n-butane.
Structure (iii) is iso-butane.
Since, molecular formula is same, only structures are different.
So, (i) and (iii) are isomers while structure (ii) and (iv) have molecular formula $C_4H_a$.

**Ans 6**. (b) When lime stone (also called calcium carbonate) is heated, then it decomposes into calcium oxide and carbon dioxide. Calcium oxide is also known as quick lime.

$$\underset{\text{(Lime stone)}}{CaCO_3} \xrightarrow{\Delta} \underset{\text{(Quick lime)}}{CaO} + \underset{\text{(Carbon dioxide)}}{CO_2\uparrow}$$

**Ans 7.** (b) $4Na + O_2 \rightarrow 2Na_2O$
In this reaction, two elements sodium and oxygen participate and form sodium oxide. However, in other reactions, the compounds are combined together and form a single product.

**Ans 8.** (a) A - 2, B - 4, C -1, D - 3
The correct labelling are as follows

A - Bowman's capsule B- Tubular part of nephron
C - Branch of renal vein D- Collecting duct

**Ans 9**. (b) Amoeba takes in food using temporary finger-like extensions of the cell surface, which fuses over the food particle forming a food vacuole. Inside the vacuole, complex substances are broken down into simpler ones which then diffuse into the cytoplasm. The remaining undigested material is moved to the surface of the cell and thrown out.

**Ans 10**. (c) Lets take, the homozygous recessive as tt and heterozygous dominant as Tt. So, the cross will be

| | T | t |
|---|---|---|
| t | Tt | Tt |
| t | tt | tt |

So, phenotype of the $F_1$-generation is
Tt (tall) : tt(dwarf)
1 : 1
i.e., 50% dominant and 50% recessive.

**Ans 11**. (b) The sequence of events in reflex arc are as follows
(D) Receptor organ like skin percieve the stimulus and activates a sensory nerve impulse.
(A) Sensory (afferent) nerve carries message in the form of sensory impulse to the spinal cord.
(B) The neurons of spinal cord (relay neurons) analyse sensory impulses and transmit them to motor neuron.
(C) Motor (efferent) nerve conducts these impulses from central nervous system to the effectors.
(E) Effector like muscles respond by pulling back the organ away from the stimulus.
**Ans 12**. (c) in the given diagram of germination of seed,
A represents cotyledons, it stores food for seed germination, β represents plumule, it grows into future shoot of a plant,
C represents radicle, it grows into future root of a plant.

**Ans 13.** (b) According to Ohm's law, the potential difference across any conductor is directly proportional to the current flowing through it, i.e.,
$V \propto I$
Hence, on increasing the potential difference, current will also increase and vice-versa.
$\Rightarrow$ The graph of I versus V is a linear graph, i.e., a straight line graph passing through origin.

**Ans 14.** (a) In the given figure, the proton and electron are moving in opposite direction to each other and in perpendicular to the direction of magnetic field. Now, we know that the direction of current is taken opposite to the direction of motion of electron.

**Ans 15**. (b) Given, radius of wire, $r = \frac{\text{Diameter}}{2}$

$= \frac{0.5}{2} = 0.25 \text{ mm} = 0.25 \times 10^{-3} \text{ m}$

$\rho = 1.6 \times 10^{-8}\ \Omega\text{-m}$ and $R = 10\Omega$

As, resistance, $R = \frac{\rho l}{A} = \frac{\rho l}{\pi r^2}$

$\Rightarrow l = \frac{R\pi r^2 l}{\rho} = \frac{10 \times 3.14 \times (0.25 \times 10^{-3})^2}{1.6 \times 10^{-8}} = 122.66 \text{ m} = 123 \text{ m}$

**Ans 16**. (d) The magnetic field lines due to a straight current carrying wire are concentric circles with their centres on the wire.

**Ans 17.** (c) Denatured alcohol is not suitable for drinking purpose because it contains some poisonous substances like methanol, copper sulphate etc. which results in coagulation of protoplasm causing nausea, blindness and even death. Hence, A is true but R is false.

**Ans 18**. (b) Both A and R are true, but R is not the correct explanation of A

Genes present in every cell of an organisms control the traits of the organisms. It is a specific segment of DNA occupying specific position on a chromosome. There is a specific gene for every protein.

**Ans 19**. (c) A is true, but R is false
Respiration is defined as the process of biochemical oxidation of nutrients at cellular level during which energy is released where as photosynthesis is synthesis of glucose molecule.

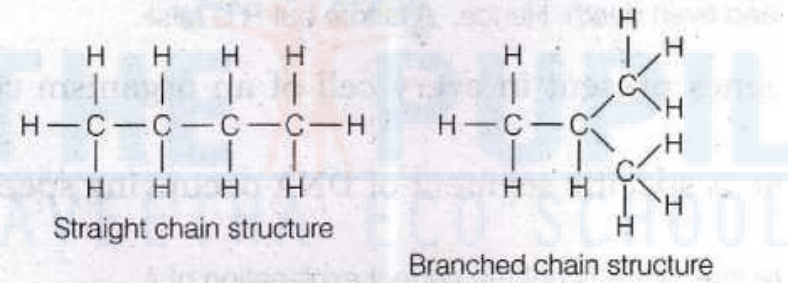
**Ans 20**. (b) When a current carrying conductor is placed in a magnetic field, it experiences a force except when it is placed parallel to the magnetic field. The force acting on a current carrying conductor depends on magnetic field produced by the current carrying conductor and external magnetic field.
Thus, both A and R are true but R is not correct explanation of A,

**Ans 21**. $CH_3OH$; IUPAC name—Methanol
The general formula of an alcohol can be written as R—OH (where, R is an alkyl group).
Here, $CH_2$ and $(CH_2)_2$ are added to $CH_3OH$, the next two members are
$C_2H_5$—OH; IUPAC name—Ethanol
$C_3H_7$—OH; IUPAC name—Propanol

An acid which present in ants is HCOOH; IUPAC name—Methanoic acid Next two members are (in the same manner as before)
$CH_3COOH$; IUPAC name—Ethanoic acid
$C_2H_5$—COOH; IUPAC name—Propanoic acid

Or

Organic compounds with same molecular formula but different chemical and physical properties are called isomers. This phenomenon is called isomerism, e.g. two structural isomers are possible for butane ($C_4H_{10}$).




**Ans 22. Thyroid gland** It secretes thyroxine hormone, which regulates the metabolism of carbohydrates, fats and proteins in body. Iodine is essential for the synthesis and secretion of throxine.
**Pituitary gland** It is known as the master gland of the human body as it controls the functioning and secretions of other glands.
It secretes many hormones, one of which is
**Growth hormone** It regulates growth and development of bones and muscles.

**Ans 23. Leaves** Plants can accumulate some of their wastes in leaves. These leaves fall off and the plant gets rid of the waste.
**Glomerulus** In nephrons filters the blood passing through it.
**Ureter** Transports urine from kidney to urinary bladder.
**Ans 24.** Heart of mammals and birds is four-chambered. It helps them in various ways as these are warm-blooded animals. Their metabolism is complex and the body temperature is to be maintained throughout. For all above the energy is constantly required. The separation keeps oxygenated and deoxygeпated blood from mixing allowing a highly efficient supply of oxygen to the body.

**Ans 25**. A narrow beam of white light incident on one prism emerges as white light out of an identical prism placed in an inverted position with respect to the first prism as shown in the figure given below.

This is recombination of spectrum (VIBGYOR) of white light and known as reverse of dispersion.
The phenomenon of splitting of white light into its constituent colours when it passes through a prism is called dispersion.

Or

(i) It is because of atmospheric refraction. When the Sun is slightly below the horizon, the light coming from it travels from less dense to more dense air and is refracted downwards. Thus, the Sun appears to be raised and can be seen 2 minutes before actual sunrise and 2 minutes after actual sunset.

(ii) Intensity I of scattered light is directly proportional to the square of the amplitude a of scattered light.
i.e., $I \propto a^2$

**Ans 26**. Effective segregation of waste as biodegradable and noՈ-biodegradable is much easier to recycle. Biodegradable waste used to make manure out of compost, whereas ποn-biodegradable waste could be recycled and reused for various purposes. Also effective segregation of wastes means that less waste goes to landfill, which makes it cheaper and better for people and environment.

**Ans 27.** (a) Most reactive metal is Q as it has replaced both P and R from their compounds.
(b) Element R is least reactive as it has been replaced by both P and Q.
(c) Displacement reaction.

**Ans 28**. (a) Anode is made up of impure copper whereas cathode is a strip of pure copper.
(b) This process is known as electrolytic refining.
(c) This method is most widely used for refining impure metals.

**Ans 29**. Each kidney is made up of thousands of tiny filteration units or tubules called **nephron.** It is the structural and functional unit of kidney. Blood at high pressure travels into these tubules by blood capillaries called **glomerulus,** which are surrounded by a cup-shaped capsule called **Bowman's capsule.**

Formation and removal of urine takes place by the following processes

Ultrafiltration occurs in glomerulus under high pressure forcing many of the substances dissolved in blood into the Bowman's capsule.

↓

The blood then passes through the tubular part of nephron where useful substances such as glucose, amino acids, salts and major amount of water are selectively reabsorbed.

↓

The urine formed in each kidney enters a long tube called the ureter, which connects the kidneys with the urinary bladder.

↓

Urine is stored in the urinary bladder until the pressure of the expanded bladder causes the urge to pass it out through the urethra.

Or

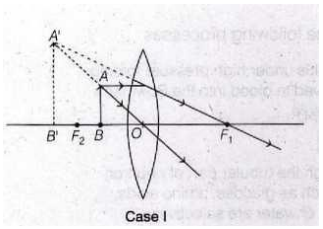
**Heart** It is a muscular pump. It pushes the blood into the blood vessels. It has four chambers separated by septum, to prevent the mixing of oxygenated and deoxygenated blood.

**Lymph** It is a colourless fluid that is present between the tissues. It carries digested and absorbed food from intestine. It drains excess fluid from extracellular space back to the blood.

**Blood vessels** These are the tube-like structure which transport the blood between the heart and different parts of the body. These are of three types, e.g. arteries, veins and capillaries.

**Ans 30.** (a) Given, focal length of lens, f = 10 cm
Distance of the object, u = ?
∴ Magnification, $m = \frac{v}{u} = \pm 2 \qquad \Rightarrow v = \pm 2u$

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$



Case I

**Case** I If v = + 2 u, then

$$\frac{1}{10} = \frac{1}{2u} - \frac{1}{u}$$

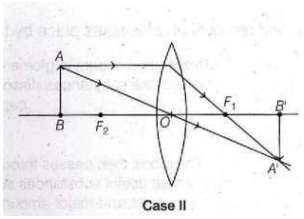
$\Rightarrow$ $\frac{1}{10} = \frac{1-2}{2u} = \frac{-1}{2u}$ $\Rightarrow$ u = – 5cm

**Case II** If v = – 2u, then

$$\frac{1}{10} = \frac{1}{-2u} - \frac{1}{u} = \frac{-1-2}{2u} = \frac{-3}{2u}$$

$\Rightarrow$ u = – 15 cm

(b)



Case II

(c) Based on the image formation in Case I, a converging lens can be used as a magnifying glass.

**Ans 31**. As, the image is formed on the screen, thus the image formed is real and inverted in nature.
Here, $h_i$ = – 60 cm, $h_o$ = 30 cm
Let the object be kept at a distance x cm from the lens.
Image distance from the lens, y = (40 - x), f = ?
As we know, magnification, m = $\frac{h_i}{h_o} = \frac{v}{u}$
$\Rightarrow \frac{-60}{30} = \frac{(40-x)}{-x}$
or –60x = –1200 + 30x
or 1200 = 90x
or x = $\frac{40}{3}$ cm
$\therefore$ u = –x $-\frac{40}{3}$ cm
and v = 40 – x = 40 – $\frac{40}{3} = \frac{80}{3}$ cm

**Ans 32.** (a) When a magnetic compass is placed near a current carrying conductor, then the position of compass needle changes. This phenomenon is known as magnetic effect of current.
(b) The change in position of compass needle near a current carrying conductor indicates that a magnetic field is produced around the conductor.
(c) If we reverse the direction of current through the wire, then the change observed in position of compass needle is also in opposite direction.

Or

(a) The magnetic field produced by current carrying circular wire at a given point is directly proportional to the amount of current and number of turns of the wire.
(b) Proton is a charged particle. When it moves in a magnetic field, a magnetic force is applied due to its velocity and hence the momentum changes.

**Ans 33**. Ozone is a triatomic molecule, i.e. made up of three atoms of oxygen joined together. Its molecular formula is $O_3$. It can affect any ecosystem in the following ways
(i) It protects against ultraviolet rays if, present in stratosphere.
(ii) Ozone dissipates the energy of UV rays by undergoing dissociation followed by reassociation.

$O_2 \xrightarrow{UV} O + O$ ; $O \rightarrow O_2 \longrightarrow O_3$ (Ozone)

(iii) Because of its depletion, UV rays enters the atmosphere. It is highly toxic and causes injury to mucous membranes, eye irritation and internal haemorrhages in animals and humans.

**Ans 34**. (a) Reaction of caustic soda, (NaOH) with ZnO, $CO_2$ and HCl takes place as follows

(i) **Reaction with ZnO**

$ZnO(s) + 2NaOH(aq) \rightarrow Na_2ZnO_2(s) + H_2O(l)$

Zinc oxide — Sodium hydroxide — Sodium zincate — Water

(ii) **Reaction with $CO_2$**

$2NaOH(aq) + CO_2(g) \rightarrow Na_2CO_3(s) + H_2O(l)$

Sodium hydroxide — Carbon dioxide — Sodium carbonate — Water

(iii) **Reaction with HCl**

$HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$

Hydrochloric acid — Sodium hydroxide — Sodium chloride — Water

(b) Caustic soda (sodium hydroxide, NaOH) is used
- for mercerising cotton fabrics in textile industry,
- to manufacture the soap, paber, dyes etc,
- in petroleum refining.

Or

(a) Tap water contains ions, which are responsible for the conduction of electricity, whereas distilled water does not contain any ions.

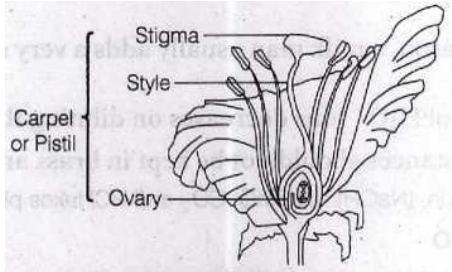
(b) Dry HCI does not produce ions but dilute HCI gives $H^+$ and CF, thus turns blue litmus red.

(c) Baking soda does not allow milk to change into lactic acid, which makes milk sour.

(d) An acid dissociates into hydronium ions ($H_3O^+$)and corresponding anions when dissolved in water. On diluting an acidic solution, the volume of the solution increases but the number of ions remains the same and thus, the concentration of $H_3O^+$ ions per unit volume decreases.

(e) Curd and sour substances contain acid which react with Cu and brass to form certain salts that are poisonous in nature and can cause food poisoning.

**Ans 35**. (a) (i) Barrier method It involves the usage of certain products or devices which prevent the meeting of gametes and help in birth control, e.g. condom, diaphragm.
(ii) Chemical method It involves the usage of chemicals called spermicides, which are applied in vagina in order to kill sperms. It can only be used with condoms or diaphragm.
(b) Carpel or Pistil is the female reproductive part and is present in the centre of a flower.
It is made up of the following three parts
(i) Stigma is the sticky terminal part of the carpel which helps in receiving the pollen grains.
(ii) Style is the middle elongated part of the carpel which helps in attachment of stigma to the ovary.
(iii) Ovary is the swollen bottom part of the carpel which contains ovules having an egg cell.

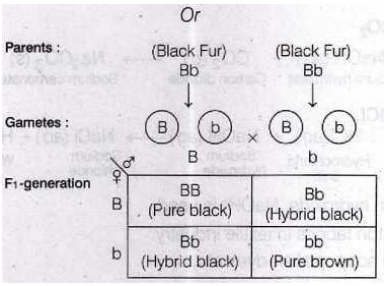


Longitudinal section of flower

(a)

| | | | | |
|---|---|---|---|---|
| **Phenotype** | 3 Black | : | 1 Brown | |
| **Genotype** | 1 : Pure black | 2 : Hybrid black | | 1 Pure brown |

Therefore, the phenotypic ratio of black fur and brown fur offspring is 3 : 1. The genotypic ratio of offspring is 1 : 2 :1.




(b) If the egg is not fertilised, it lives for about one day. Since, the ovary releases one egg every month, the uterus also prepares itself every month to receive a fertilised egg. Its lining becomes thick and spongy, which is required for nourishing the embryo. If fertilisation does not take place this lining is not needed and it slowly breaks and comes out through the vagina as blood and mucus. This cycle takes place roughly every month and is known as menstruation cycle and usually lasts for about 2-8 days.

**Ans 36**. (a) Equivalent resistance of the circuit,

$R_{eq} = R_1 + R_2 + R_3$ [For series combination]

$= 2 + 5 + 3 = 10\Omega$

Current, $I = \frac{V}{R_{eq}} = \frac{16}{10} = 1.6A$

∴ Voltage across $R_1$, $R_2$ and $R_3$ are $V_1$, $V_2$ and $V_3$ respectively, then

$V_1 = IR_1 = 1.6 \times 2 = 32$ V

$V_2 = IR_2 = 1.6 \times 5 = 8.0$ V

$V_3 = IR_3 = 1.6 \times 3 = 4.8$ V

**Alternate solution**

Using voltage division rule,

Voltage or potential difference across resistance $R_1$,

$$V_1 = \frac{R_1}{R_1+R_2+R_3} \times V$$

$$V_1 = \frac{2}{2+5+3} \times 16 = 3.2 \text{ V}$$

Voltage across resistance $R_2$,

$$V_2 = \frac{R_2}{R_1+R_2+R_3} \times V = \frac{5}{2+5+3} \times 16 = 8 \text{ V}$$

Voltage across resistance $R_3$,

$$V_3 = \frac{R_3}{R_1+R_2+R_3} \times V$$

$$= \frac{3}{2+5+3} \times 16 = 4.8 \text{ V}$$

(b) Since, $P = I^2R$

Current after increased by 100% = $I + \frac{100I}{100} = 2I$

$P' = (2I)^2 R = 4I^2R$

∴ Percentage increase in power dissipation = $V_1 = \frac{P'-P}{P} \times 100$

$= \frac{4I^2R-I^2R}{I^2R} \times 100$

$\frac{3I^2R}{I^2R} \times 100$

$= 3 \times 100 = 300\%$

(c) Charge, g = 3 C

Potential at point A $V_A = 128$ V

Potential at point S, $V_B = 138$ V

Potential difference, $\Delta V = V_B - V_A$

$= 138V - 128V = 10$ V

Work done, $W = \Delta V \times q$

$= 10 \times 3 = 30$ J

(d) Given, P = 100 W, V = 220 V

As, Power = Voltage × Current

i.e., $P = VI$

$\Rightarrow I = \frac{P}{V} = \frac{100}{220} = 0.45$ A

**Ans 37.** (a) He concluded that the reaction is vigorous and highly heat producing.
(b) The reaction takes place is known as combination reaction which is exothermic in nature.

Or

(b) Chemical equation is as follows

$$\underset{\text{Quicklime}}{CaO(s)} + \underset{\text{Water}}{H_2O(l)} \longrightarrow \underset{\text{Slaked lime}}{Ca(OH)_2(aq)} + \text{Heat}$$

Quicklime (CaO) is used for white washing.

**Ans 38.** (a) AB type of seeds were round green in colour.
(b) According to third law, the segregation of a pair of allele during the reduction division is independent of the segregation of the other pair of allele.
(c) The genotypic ratio obtained in ^-generation is 1 : 2 :1 as shown in figure

Parents : RRYY × rryy

Gametes : RY ry

$F_1$-generation

| ♀ \ ♂ | RY | ry |
|---|---|---|
| RY | RRYY | RrYy |
| ry | RrYy | rryy |

AD and CB varieties will turn out to be wrinkled green and wrinkled yellow.

**Ans 39.** (a) The pencil partly immersed in water appears to be bent due to refraction of light.
(b) Refractive index of glass,

$$n = \frac{\text{Speed of light in vacuum}}{\text{Speed of light in glass}}$$

$\Rightarrow 1.50 = \frac{3 \times 10^8}{v} \Rightarrow v = 2 \times 10^8$ ms

(c) When the light ray goes from one medium to another medium, then its frequency remains unchanged.

Or

(d) When the light ray goes from air to water then, it bends towards the normal.