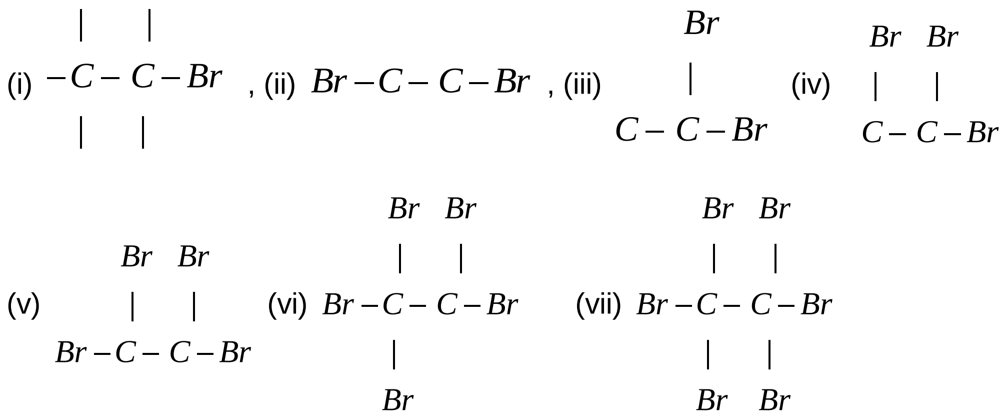
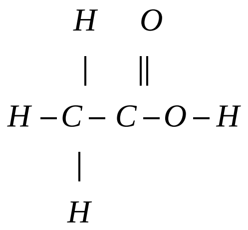
SECTION – I : CHEMISTRY

PART – A

1. **C**

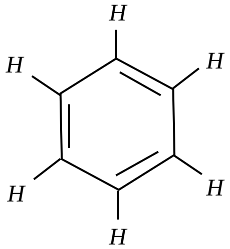


2. **D** Mnt increase Boiling point increase.
3. **D**
4. **B** $Mg_2C_3 + 2H_2O \rightarrow 2Mg(OH)_2 + C_3H_4$
5. **D**
6. **A**
7. **D**
8. **C**
9. **D** $Ca\left(HCO_3\right)_2 + Ca\left(OH\right)_2 \rightarrow CaCO_3 + CO_2 + H_2O$
10. **A**



PART–C(Integer Answer Type)

1. **3**



2. **1** $C_nH_{2n} + H_2 \rightarrow C_nH_{2n+2}$

3. **1** $CH_4 + Cl_2 \xrightarrow{hv} CH_3Cl + HCl$

4. **2** $\underset{}{H-C\equiv C-H} + \underset{(+NH_4OH)}{AgNO_3} \longrightarrow \underset{(Write\ PPt)}{Ag-C\equiv C-Ag} + \underset{(+H_2O)}{NH_4NO_3}$

5. **2**

6. **4**

(i) $C-C-C-C-Br$

(ii)
$C-C-C-Br$
$\quad |$
$\quad C$

(iii)
$C-C-C-C$
$\qquad |$
$\qquad Br$

(iv)
$\quad C$
$\quad |$
$C-C-C$
$\quad |$
$\quad Br$

7. **9**

8. **3**

(i) $C-C-C-OH$ (ii) $C-C-O-C$ (iii)
$C-C-C$
$\quad |$
$\quad OH$

9. **4**

10. **1** $C-C=C=C$

SECTION – II: MATHEMATICS

PART – A

1. A

Since, ABCD is square, quadrilateral MDOB and quadrilateral ALCN are parallelograms so, quadrilateral PQRS is also a square

$MB^2 = 10^2 + 20^2$

$MB = \sqrt{500} = 10\sqrt{5}$

$Let\ MP = x$

$DS = 2x (by\ M.P.T.)$

$SN = x\ (\Delta DSN\ is\ congruent\ to\ \Delta APM)$

$4x^2 + x^2 = 100$

$5x^2 = 100$

$x = \sqrt{20}$

$side\ of\ PQRS = SR = DS = 2x = 2\sqrt{20}$

$area\ of\ PQRS = 2\sqrt{20} \times 2\sqrt{20} = 4 \times 20 = 80\ sq.units$

2. B

Tangent drawn from E are equal (let x) then DE = 2 – x , CE = 2 + x. Now apply Pythagoras theorem.

3. B

Use tangent secant theorem and the Pythagoras theorem.

4. B

Let P(x, y) be equidistant from the points A(7, 1) and B(3, 5)

∴ AP = BP ⇒ AP2 = BP2

∴ (x – 7)2 + (y – 1)2 = (x – 3)2 + (y – 5)2

i.e. x – y = 2.

5. A

Let the point C divide AB in the ratio λ : 1.

Then the coordinates of C are $\left(\frac{-3\lambda+3}{\lambda+1}, \frac{-2\lambda+5}{\lambda+1}\right)$

$\therefore \frac{-3\lambda+3}{\lambda+1} = \frac{3}{5}$ and $\frac{-2\lambda+5}{\lambda+1} = \frac{11}{5}$

⇒ –15λ + 15 = 3λ + 3 and –10λ + 25 = 11λ + 11

⇒ 18λ = 12 and 21λ = 14

$\Rightarrow \lambda = \frac{2}{3}$.

6. B

Area of quadrilateral ABCD = |Area of ΔABC| + |Area of ΔACD|

Area of ΔABC = $\frac{1}{2}|(1\times -3 + 7\times 2 + 12\times 1) - (7\times 1 + 12\times(-3) + 1\times 2)|$

Area of ΔABC = $\frac{1}{2}|(-3 + 14 + 12) - (7 - 36 + 2)|$ = 25 sq. units.

Area of ΔACD = $\frac{1}{2}|(1\times 2 + 12\times 21 + 7\times 1) - (12\times 1 + 7\times 2 + 1\times 21)|$

$= \frac{1}{2}|(2+252+7)-(12+14+21)|$

$= \frac{1}{2}|261-47| = 107$ sq. units.

Area of quadrilateral = 25 + 107 = 132 sq. units.

7. B

Let centre be O(x, y)

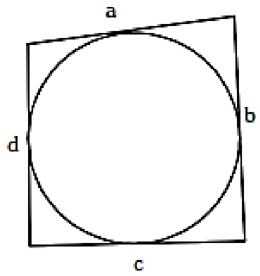
OA = OB = OC

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

On solving above equation x = 0 and y = 1 centre (0,1)

8. B

Area of cyclic quadrilateral = $\sqrt{(s-a)(s-b)(s-c)(s-d)}$



as circle is inscribed in a quadrilateral

a + c = b + d

2s = a + b + c + d

s = a + c = b + d

area = $\sqrt{(s-a)(s-b)(s-c)(s-d)}$

$\sqrt{c.d.a.b} = \sqrt{abcd}$

9. A

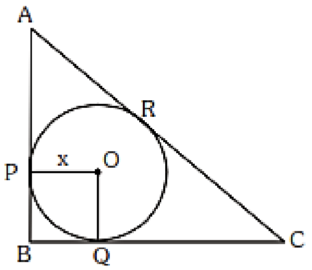
Let radius of circle = x

since quadrilateral PBQO is square

PB = BQ = x

area of $\Delta ABC = \frac{1}{2}x(AB)+\frac{1}{2}x(BC)+\frac{1}{2}x(AC)$

$$\frac{\text{circumference of circle}}{\text{area of circle}} = \frac{2\pi x}{\frac{7\pi}{2}x} = \frac{4}{7}$$



10. C

Given series can also be written as $1^2, 2^2, 3^2, 4^2, \ldots, n^2$.

$\therefore\ 1^2 + 2^2 + 3^2 + \ldots + n^2 = \Sigma n^2$.

$$\sum n^2 = \frac{n(n+1)(2n+1)}{6}$$

mean = $\frac{\Sigma n^2}{n} = \frac{n(n+1)(2n+1)}{6n}$

mean = $\frac{(n+1)(2n+1)}{6}$

PART–C(Integer Answer Type)

1. 9

2. 2

$\operatorname{cosec}\theta + \sin\theta = 2$

$\Rightarrow \frac{1}{\sin\theta} + \sin\theta = 2$

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

$\Rightarrow \sin^2\theta - 2\sin\theta + 1 = 0$

$\Rightarrow (\sin\theta - 1)^2 = 0$

$\Rightarrow \sin\theta = 1$

$\Rightarrow \operatorname{cosec}\theta = 1$

$\therefore \quad \operatorname{cosec}^{50}\theta + \sin^{50}\theta = 1 + 1$

$\operatorname{cosec}^{50}\theta + \sin^{50}\theta = 2$

3. 1

cosec4x = sec 5x

As cosec and sec are complementary trigonometric ratios

$\therefore$ cosec 4x = cosec (90º–5x)

$\Rightarrow$ 4x = 90º – 5x

$\Rightarrow$ 9x = 90º

$\Rightarrow$ x = 10º

Thus sin3x + cos6x

= sin30º + cos60º

$= \frac{1}{2} + \frac{1}{2}$

= 1

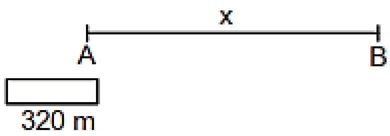
4. 1

$\alpha \times \frac{1}{\alpha} = \frac{2K}{K+1}$

= 2K = K + 1

K = 1

5. 1



Speed of train = 120 km/hr = $120 \times \frac{5}{18} = \frac{100}{3}$ m/s

Time = $\frac{\text{Distance}}{\text{Speed}}$

$24 = \frac{320 + x}{\frac{100}{3}}$

$320 + x = 24 \times \frac{100}{3}$

x = 480 m

Speed of man = $\frac{480}{240} = 2$ m/s

6. 3

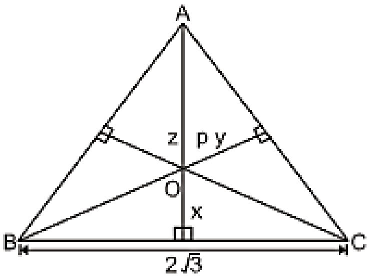
Ar(ΔABC) = Ar(ΔAOB + ΔAOC + ΔBOC)

$$\frac{\left(2\sqrt{3}\right)^3 \sqrt{3}}{4} = \frac{1}{2}x.2\sqrt{3} + \frac{1}{2}y.2\sqrt{3} + \frac{1}{2}z.2\sqrt{3}$$

$$\frac{12\sqrt{3}}{4} = \frac{1}{2}2\sqrt{3}[x + y + z]$$

$$3\sqrt{3} = \sqrt{3}[x + y + z]$$

$$3 = x + y + z$$



7. 0

8. 5

9. 7

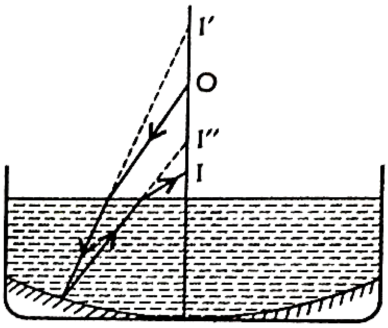
10. 1

SECTION – III : PHYSICS

PART – A

1. A

For refraction through water surface,



$$\frac{4/3}{v} + \frac{1}{60} = \frac{\left(\frac{4}{3} - 1\right)}{\infty} = 0$$

$\therefore$ $v = -80$ cm

I' is seen as object for the mirror for which

$u' = 80 + 20 = 100$ cm

$$\therefore \quad \frac{1}{v'} + \frac{1}{-100} = -\frac{1}{20}$$

$\therefore$ $v' = -25$ cm

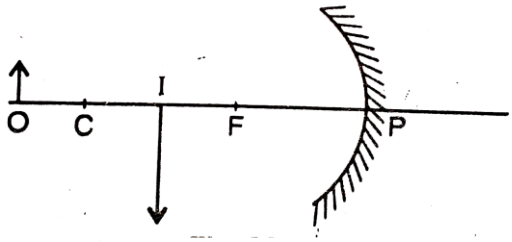
I'' will serve as an object for plane surface.

$$\frac{1}{v} - \frac{(4/3)}{5} = \frac{\left(1 - \frac{4}{3}\right)}{\infty}$$

$\therefore$ $v = +3.75$ cm

2. C

As the image is real it will be inverted and so



$u = -\text{ve}, \quad v = -\text{ve}, \quad f = -\text{ve}$

In magnitude, $m = -(v/u) = -n$, *i.e.*, $v = nu$

$$\therefore \quad \frac{1}{v} + \frac{1}{u} = \frac{1}{f} \quad \text{or} \quad \frac{1}{nu} + \frac{1}{u} = \frac{1}{+f}$$

$$\text{or} \quad \frac{(1+n)}{nu} = +\frac{1}{f} \quad \text{or} \quad u = +\frac{(n+1)}{n} f$$

i.e., object is in front of mirror at a distance $[(n+1)f/n]$

3. A

Since, prism is equilateral, hence angle of prism = 60°

Also $i - i' = 20°$ ...(1)

$\because$ $\delta = i + i' - A$

$\therefore$ $\delta + A = i + i'$

or $i + i' = 40° + 60° = 100°$ ...(2)

Adding equations (1) and (2),

$2i = 120°$

or $i = 60°$

4. **A, B**

5. **A,B,C**

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$$

or, $$1-\frac{v}{u}=\frac{v}{f} \quad ...(1)$$

Since, m is +ve in given figure, therefore, m represents magnitude of the magnification. In fact, if a real image is formed by a convex lens then the image and object will be on opposite sides of the lens. It means, if v is positive then u will be negative. Therefore,

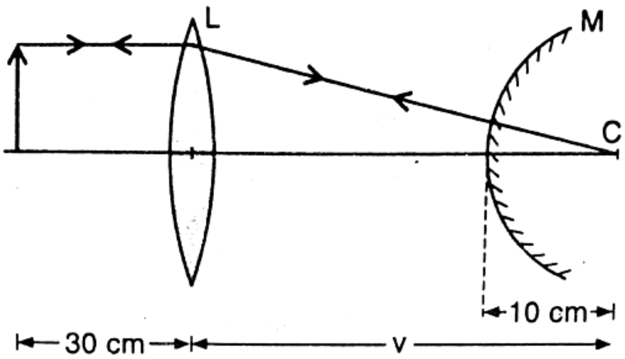
$$m=\left|\frac{v}{u}\right|=-\frac{v}{u}$$

Hence, equation (1) becomes

$$m=\frac{v}{f}-1 \quad ...(2)$$

It means, the graph between m and v will be a straight line having intercept -1 on m-axis and slope of the line tan θ is equal to $(1/f)$. Hence, options (b) and (c) are correct. Putting $m=0$ in eq. (2), $v=f$. Hence, (a) is also correct. Obviously (d) is wrong.

6. **C**



This is possible when the rays are incident on the mirror normally, *i.e.*, the image by the lens is formed at the centre of curvature of the mirror.

Now, $\frac{1}{f}=\frac{1}{v}-\frac{1}{u}$ or $\frac{1}{20}=\frac{1}{v}+\frac{1}{30}$

$\therefore$ $\frac{1}{v}=\frac{1}{20}-\frac{1}{30}=\frac{1}{60}$ or $v=60$

From figure, the distance of mirror from lens

$$LM=LC-MC=60-10=50 \text{ cm}$$

7. **D**

$$\frac{1}{f}=(\mu-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$$

Here, $$\frac{1}{f_1}=(1.5-1)\left(\frac{1}{20}+\frac{1}{20}\right)=\frac{0.5}{10}$$

and $$\frac{1}{f_2}=-0.6\left(\frac{1}{20}+\frac{1}{20}\right)=-\frac{0.6}{10}$$

$$\frac{1}{f}=\frac{1}{f_1}+\frac{1}{f_2}=-\frac{0.1}{10}=-\frac{1}{100}$$

$\therefore$ $f=-100$ cm

8. **A,C,D**
9. **C,D**
10. **A,C**

PART–C(Integer Answer Type)

1. **2**

For magnification +2, $u=-x$, $v=-2x$ and $f=2.0\,\text{m}$

From $\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$, we have

$$-\frac{1}{2x}+\frac{1}{x}=\frac{1}{2}$$

$$x=1.0\,\text{m}$$

For magnification of –2 , $u=-y$, $v=+2y$, $f=2.0\,\text{m}$

$$\frac{1}{2y}+\frac{1}{y}=\frac{1}{2}$$

$$y=3.0\,\text{m}$$

$$(y-x)=2.0\,\text{m.}$$

2. **9**

When object is placed at the focus of the lens, *i.e.*, at 22 cm from the lens, image will be formed at infinity.

$$25-22=\left(1-\frac{1}{\mu}\right)t$$

$$3=\left[1-\frac{1}{1.5}\right]t$$

$$t=\frac{(3)(1.5)}{0.5}=9\text{cm.}$$

3. **3**

From $\frac{\mu_2}{v}-\frac{\mu_1}{u}=\frac{\mu_2-\mu_1}{R}$

$$\frac{1}{v}-\frac{1.5}{(-u)}=\frac{1-(1.5)}{(-R)}$$

$$\frac{1}{v}+\frac{3}{2u}=\frac{1}{2R}$$

For v to be positive, $\frac{1}{2R}>\frac{3}{2u}$

or $u>3R$

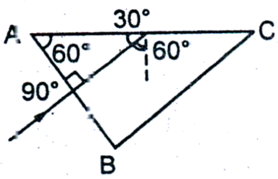
So, $I=3$.

4. **4**

5. **3**

Critical angle between glass and liquid,

$$\sin\theta_C = \frac{\mu}{(3/2)} = \frac{2\mu}{3}$$



Angle of incidence on AC = 60°

For TIR, $i > \theta_C$

$$\sin 60° > \frac{2}{3}\mu$$

$$\mu < \frac{3\sqrt{3}}{4} = \frac{I\sqrt{3}}{4} \qquad \text{(given)}$$

So, $I = 3$.

6. **9**

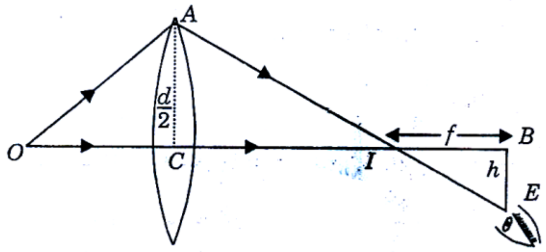
7. **4**

8. **4**

9. **2**

10. **4**

As is clear from figure., ΔACI and ΔEBI are similar. Therefore, their sides are proportional.



$$\therefore \quad \frac{h}{d/2} = \frac{f}{2f}$$

$$\text{or} \quad \frac{2h}{d} = \frac{1}{2}$$

or $h = d/4 \quad \therefore \; n = 4$