JEE MAINS 2026

PAPER SOLUTION

21 JAN, SHIFT 2

Q) Let $f(x) = x^3 + x^2 f'(1) + 2x f''(2) + f'''(3), x \in R$. Then the value of $f'(5)$ is

$a \quad b \quad c$

$f(x) = x^3 + ax^2 + 2bx + c$

(A) $\frac{117}{5}$ **(B)** $\frac{2}{5}$ **(C)** $\frac{62}{5}$ **(D)** $\frac{675}{5}$

$f'(x) = 3x^2 + 2ax + 2b$

$f''(x) = 6x + 2a$

$f'''(x) = 6$

$f'''(3) = 6 = c$

$f''(2) = b = 12 + 2a$

$f'(1) = a = 3 + 2a + 2b$

$a + 2b = -3$

$a + 24 + 4a = -3$

$a = -\frac{27}{5}$

$b = 12 - \frac{54}{5} = \frac{6}{5}$

$f'(5) = 3(25) + 10a + 2b$

$= 75 + 10\left(-\frac{27}{5}\right) + \frac{12}{5}$

$= 21 + \frac{12}{5}$

$= \frac{105 + 12}{5} = \frac{117}{5}$

Ans. (A)

Q) In a circuit there is a battery with internal resistance r and Emf E, which is connected to external load resistance R as shown. Find value of R so that maximum power dissipates across R.

(A) $R = r$

(B) $R = r/2$

(C) $R = \sqrt{2}r$

(D) $R = 2r$

Q) Refractive index of prism is $\sqrt{2}$. What should be angle of incidence for a light ray such that the emerging ray grazes out the surface.

(A) 30°
(B) 45°
(C) 60°
(D) 90°

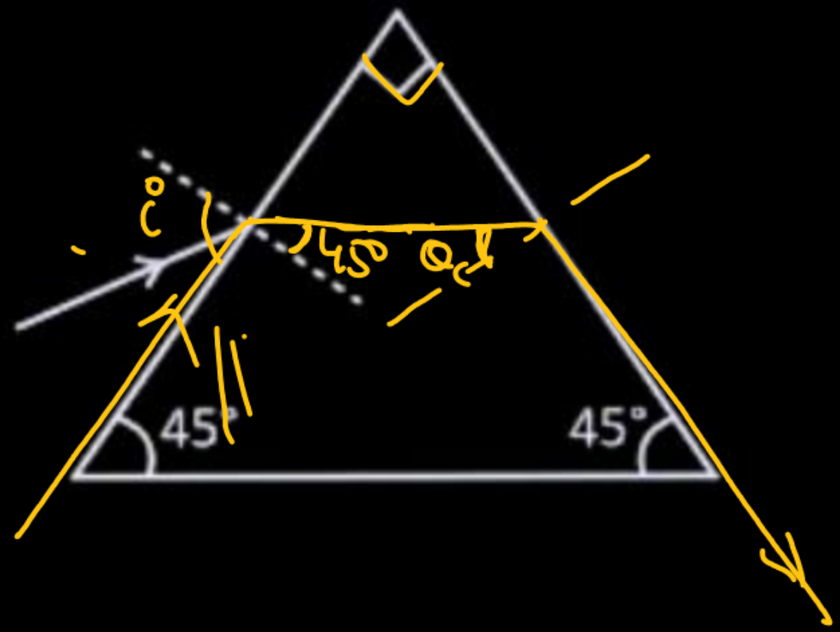
$\sin\theta_c = \frac{1}{\mu}$

$\theta_c = 45°$

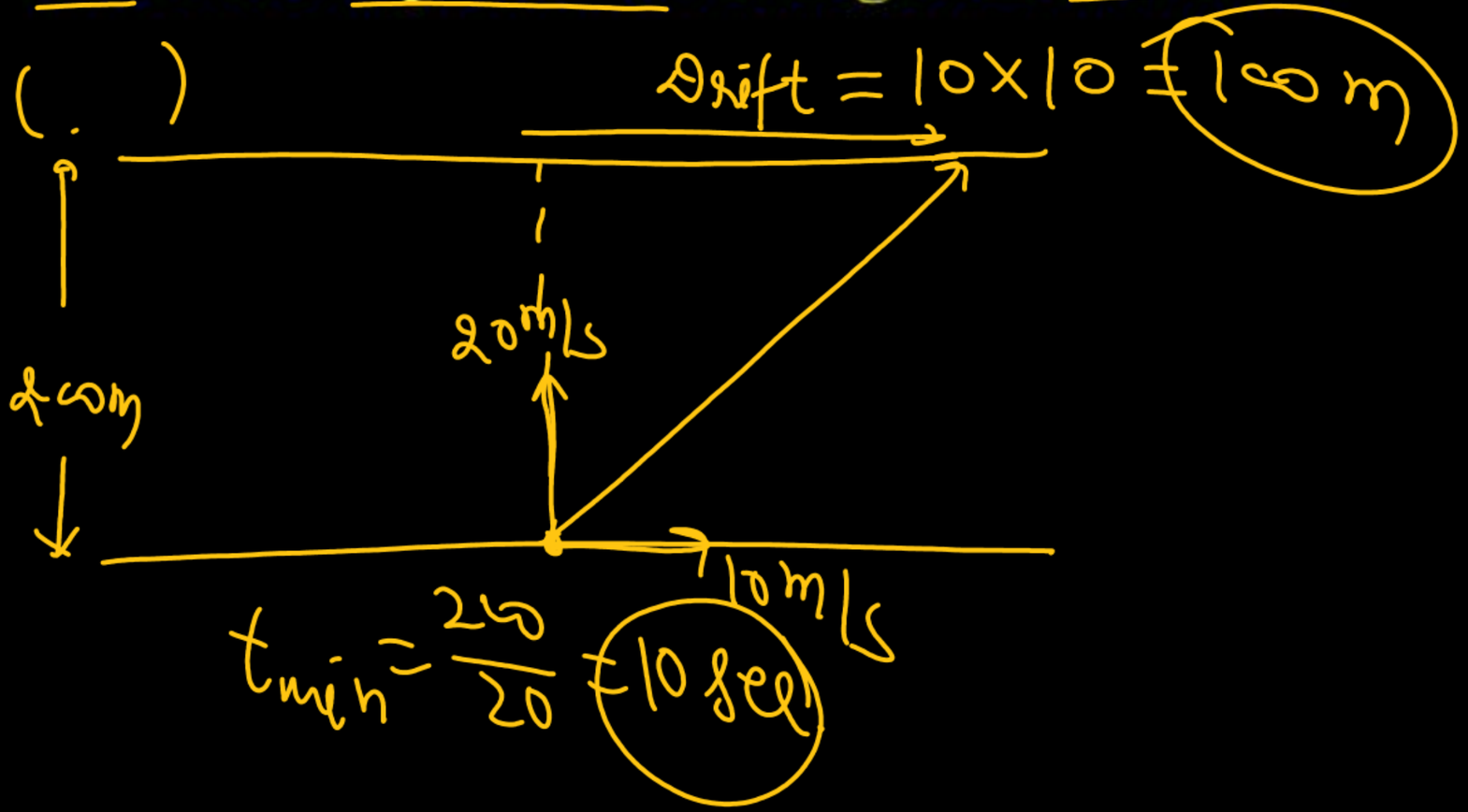
$\sin i = \sqrt{2}\sin 45$

$\sin i = 1$

$i = 90$



Q) Width of river is 200 m flowing with velocity 10m/sec. A boat can move with speed 20m/sec. wrt. river flow. Find minimum time to cross the river and displacement along the river bank.



$t_{min} = \frac{200}{20} = 10$ sec

Q) In isobaric expansion work done is 100J. Find heat given to the gas ($\gamma = 1.4$)

$W = 100J = nR\Delta T$

$\Delta Q = ? = nC_p\Delta T$

$= \left(\frac{f}{2}+1\right) nR\Delta T$

$= \left(\frac{f}{2}+1\right) 100$

$\gamma = 1.4 = 1 + \frac{2}{f}$

$\frac{2}{f} = 0.4$

$f = \frac{1}{0.2}$

Q) 1g of an organic compound produce 1.49 of $Mg_2P_2O_7$ determine % of P.

mass of $Mg_2P_2O_7 = 222$, atomic mass of $P = 31$

$\therefore$ % $P = \frac{31 \times 2}{222} \times \frac{1.49}{1} \times 100$

$\simeq$ 42%

Ans. (42)

Q) Match the list I with list II.

List-I Reagent	List-II Name Reaction
(1) H_2/ Pd / $BaSO_4$	(P) Rosamund Reaction
(2) (i) CrO_2Cl_2/ CCl_4	(Q) Etard Reaction
(ii) H_3O^+	
(3) CO + HCl + $AlCl_3$	(R) Gattermann Koch Reaction
(4) $SnCl_2$ + dil. HCl	(S) Stephen's

Ans. ( )

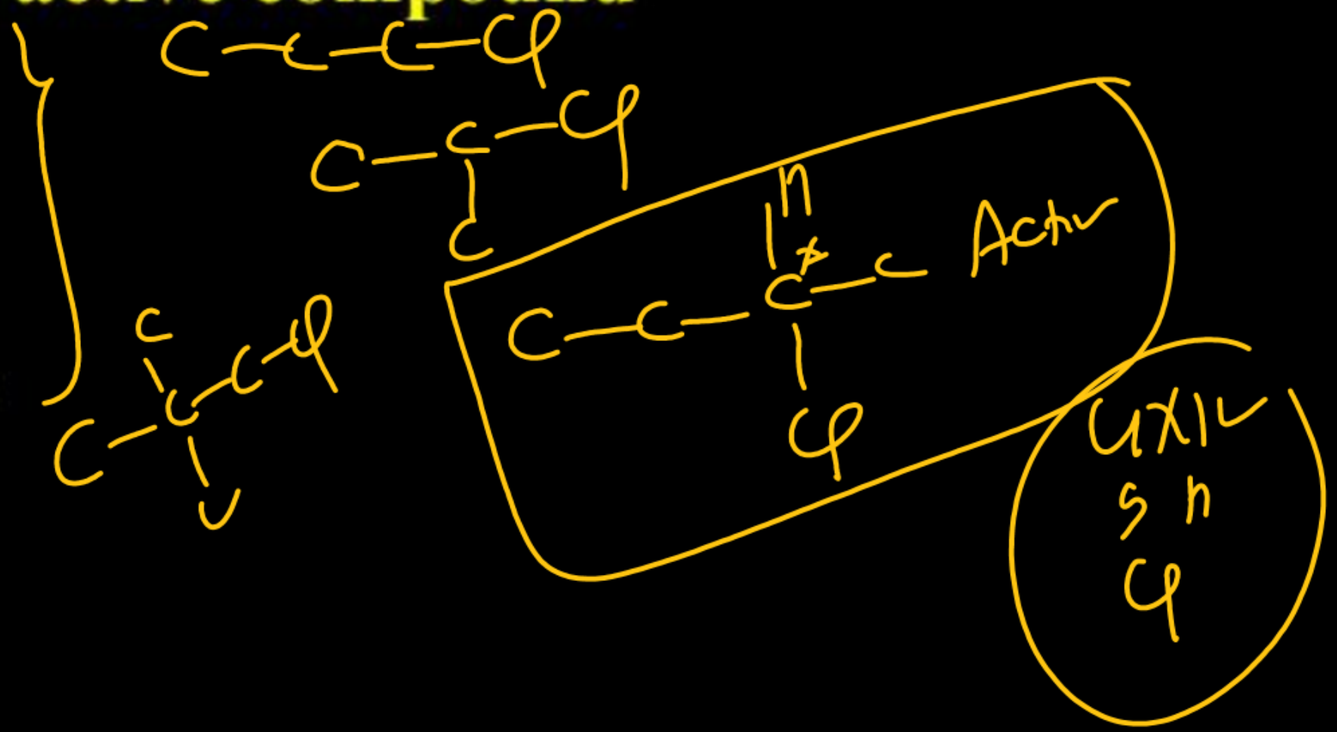
Q) % (c) in given optically active compound

(I) n-propyl chloride

(II) Isopropyl chloride

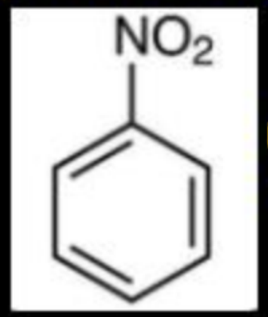
(III) Sec-butyl chloride

(IV) Neopentyl chloride

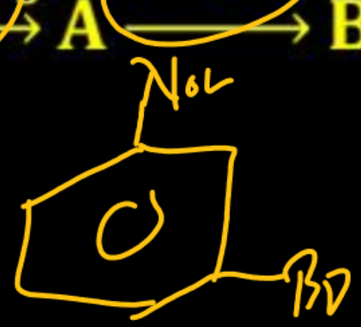


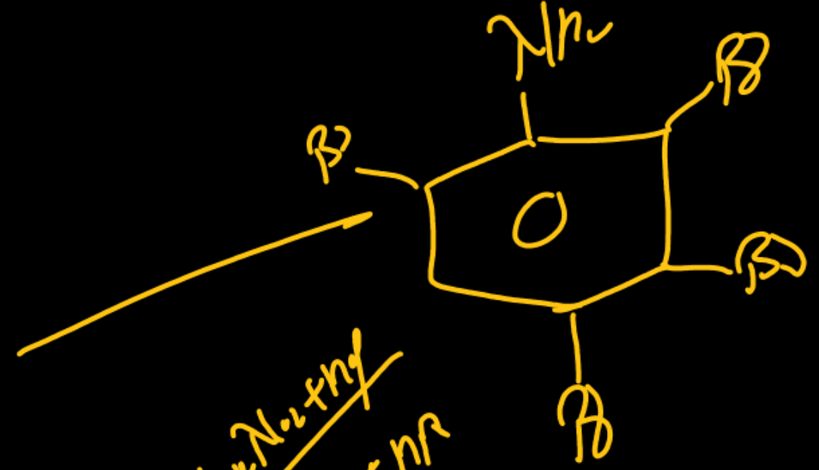
Ans. (52)

Q) Number in bromine in final product



$\xrightarrow{Br_2+FeBr_3}$ A $\xrightarrow{Sn+HCl}$ B $\xrightarrow{Br_2+H_2O}$ C

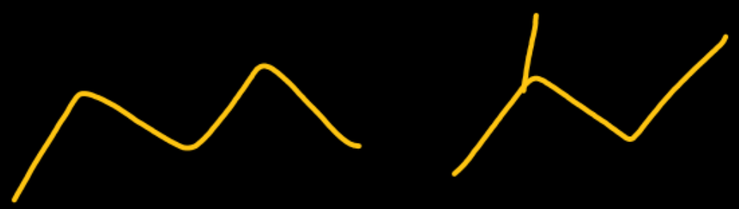




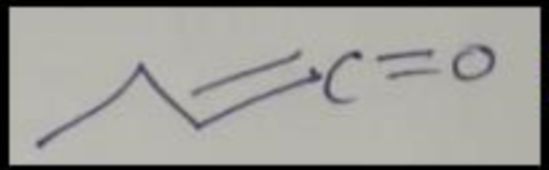
Ans. ( )

Q) Match the list-I with list-II

List-I	List-II
(A) Cis 2-butene, Trans 2-butene	(P) F.I.
(B) Butanoic acid , Isopropyl methanoate	(Q) Stereoisomer
(C) 1-butene, 2-butene	(R) P.I
(D) n-pentane, isopentane	(S) C.I.



Q) Assertion :- In aromatic comp. compound should be cyclic and planar with all C- should be sp^2 with un hybrid P-orbitals and follow Hückels rules.

Reason :- In given compound  2 carbon is sp^3 & 1 is sp^2 .

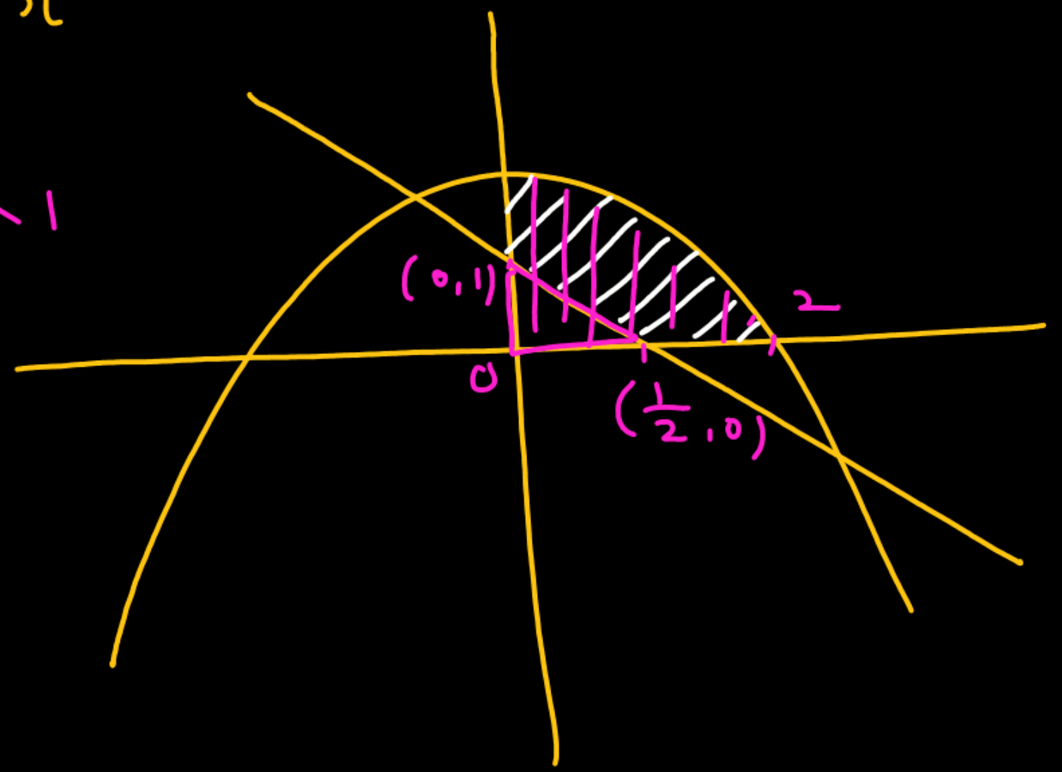
Ans. ( )

Q) If area bounded by the curve $1-2x \le y \le 4-x^2, x \ge 0, y \ge 0$ is m/n, then value of m + n is

$y = 1-2x$ $\quad y = 4-x^2$

$$A = \int_{x=0}^{x=2} (4-x^2)\,dx - \frac{1}{2} \times \frac{1}{2} \times 1$$

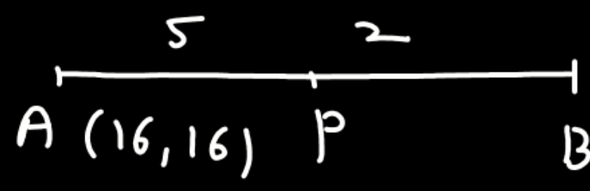
$$= \frac{67}{12} = \frac{m}{n}$$



Ans. (73) $\quad m+n = 73$

Q) Let one end of a focal chord of the parabola $y^2 = 16x$ be (16, 16). If $P(\alpha, \beta)$ divides this focal chord internally in the ratio 5 : 2 ; then the minimum value of $\alpha + \beta$ is equal to:

(A) 7 **(B) 5** **(C) 22** **(D) 16**

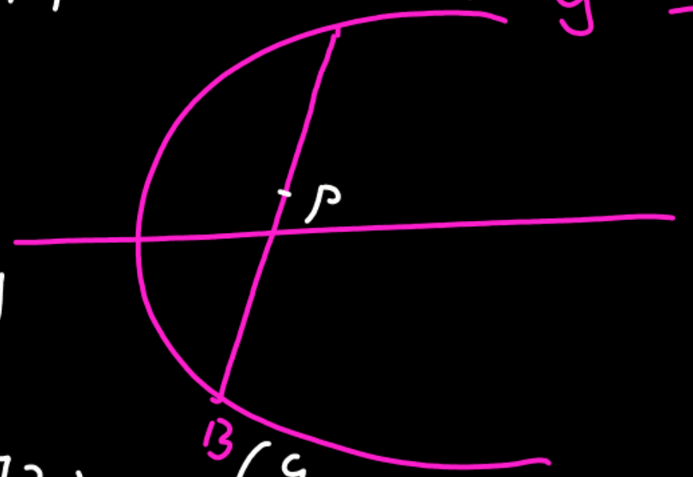


$P\left(\frac{37}{7}, \frac{12}{7}\right)$ $\alpha+\beta = 7$

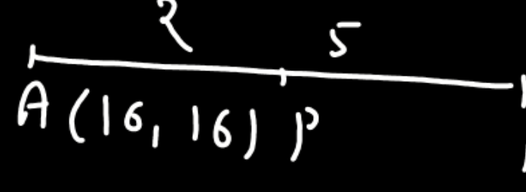
$A(at^2, 2at) \equiv A(16,16)$ $y^2 = 16x$

$a = 4$

$t = 2$



Ans. (A)



$P\left(\frac{80}{7}, \frac{72}{7}\right)$ $\alpha+\beta = 152/7$

$B\left(\frac{4}{t^2}, -\frac{2a}{t}\right) \equiv B(1,-4)$

Q) The largest $n \in N$, for which 7^n divides 101! is:

$$(101)! = \frac{2^{\alpha_1} \cdot 3^{\beta_1} \cdot 5^{\gamma_1} \cdot 7^{\delta_1} \cdots}{7^n} = \frac{7^{16}}{7^n}$$

$$\text{Exponent of } 7 \text{ in } (101)! = \left[\frac{101}{7^1}\right] + \left[\frac{101}{7^2}\right] + \left[\frac{101}{7^3}\right] + \cdots$$

$$= 16$$

∴Ans. (16)

Q) If three vectors are given as shown.

If angle between vector $\vec{p}$ and $\vec{q}$ is q where $\cos\theta = \frac{1}{\sqrt{3}}$

and $|\vec{p}| = 2\sqrt{3}, |\vec{q}| = 2.$

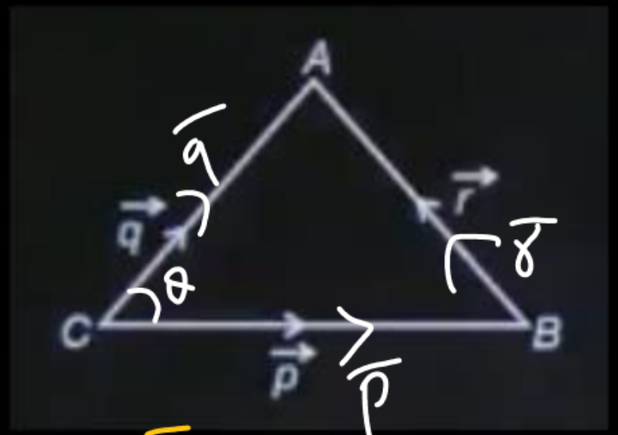
Then the value of $|\vec{p} \times (\vec{q} - 3\vec{r})|^2 - 3|\vec{r}|^2$ is

$\sin^2\theta = 1 - \frac{1}{3} = \frac{2}{3}$

$|\bar{p} \times (\bar{q} - 3(\bar{q} - \bar{p}))|^2$

$|\bar{p} \times (-2\bar{q} + 3\bar{p})|^2$

$|-2(\bar{p} \times \bar{q})|^2$



$\bar{p} + \bar{\gamma} = \bar{q}$

$\bar{\gamma} = \bar{q} - \bar{p}$

$|\bar{\gamma}|^2 = |\bar{p}|^2 + |\bar{q}|^2 - 2|\bar{p}||\bar{q}|\cos\theta$

$|\bar{\gamma}|^2 = 12 + 4 - 2(2\sqrt{3})(2)\frac{1}{\sqrt{3}}$

$= 8$

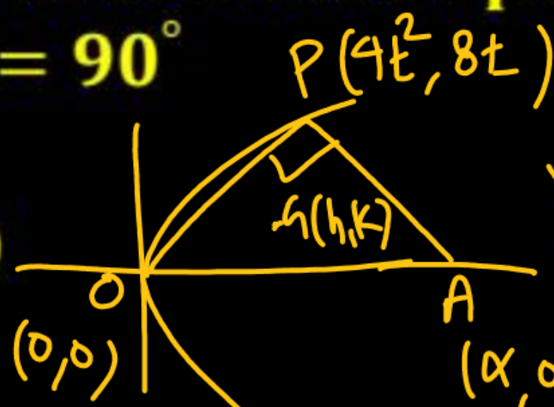
Ans. (104) $4|\bar{p}|^2|\bar{q}|^2\frac{2}{3} - 3(8)$

$4 \times 12 \times 4 \times \frac{2}{3} - 24$

$= 8(13) = 104$

Q) Let O be the vertex of the parabola $y^2 = 16x$. The locus of centroid of ΔOPA when P lies on parabola and A lies on x-axis and $\angle OPA = 90^\circ$

(A) $y^2 = 8(3x - 16)$
(B) $9y^2 = 8(3x - 16)$
(C) $y^2 = 8(3x + 16)$
(D) $9y^2 = 8(3x + 16)$



$4a = 16$
$a = 4$

$m_{OP}\, m_{AP} = -1$

$\frac{8t}{4t^2}\left(\frac{8t}{4t^2-\alpha}\right) = -1$

$-16 = 4t^2 - \alpha$

$\alpha = 4t^2 + 16$

$h = \frac{0 + 4t^2 + 4t^2 + 16}{3}$

$K = \frac{0 + 8t + 0}{3}$

$t = \frac{3K}{8}$

$3h - 16 = 8\left(\frac{3K}{8}\right)^2$

$3x - 16 = \frac{9y^2}{8}$

$9y^2 = 8(3x - 16)$

Ans. (B)

Q) When 8.74 g MnO_2 is treated with HCl, then what will be the weight of Cl_2 (g) obtained? Molar mass of MnO_2 = 87.4g/mol

(A) 7.1g (B) 17.1g (C) 14.2g (D) 3.55g

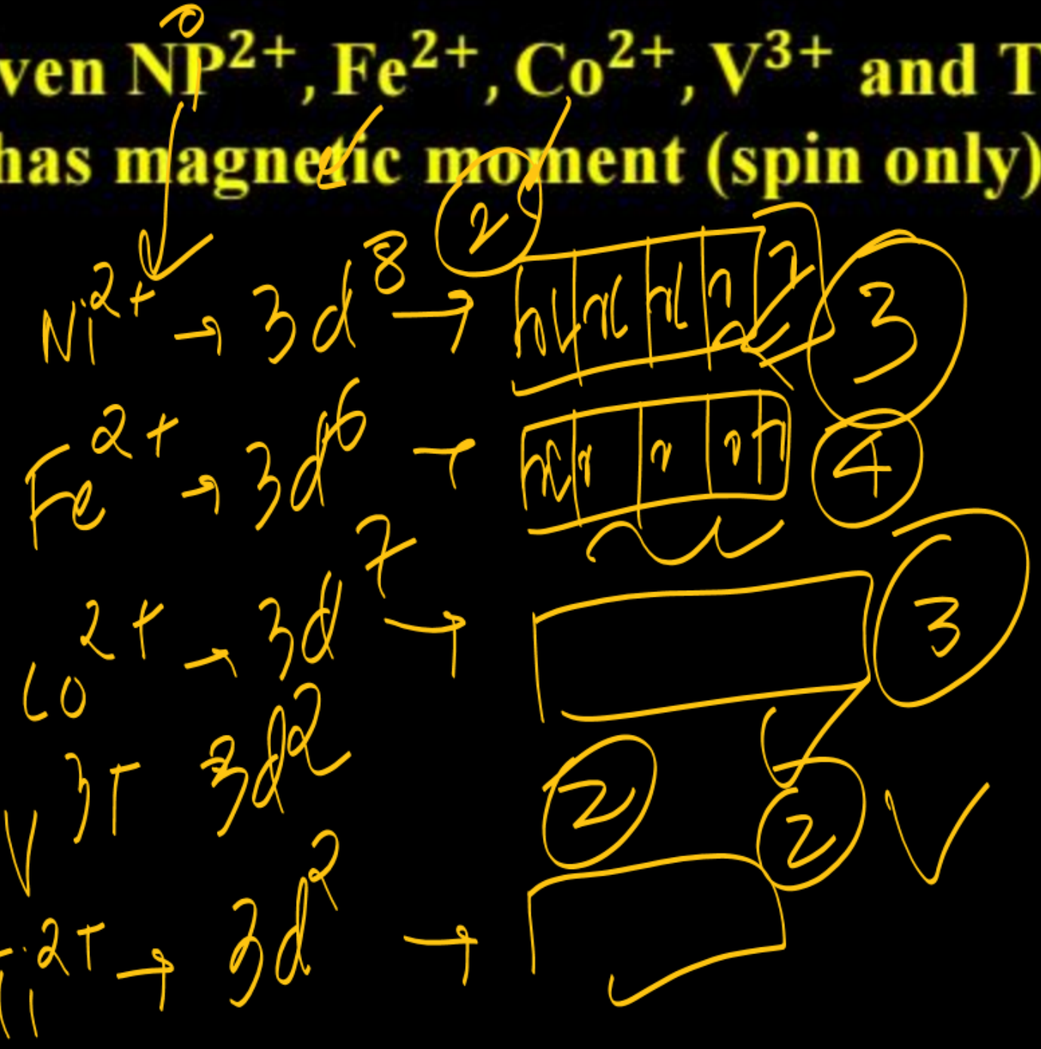
$$MnO_2 + 4HCl \longrightarrow MnCl_2 + Cl_2 + 2H_2O$$

$$\frac{8.74}{87.4} = 0.1 \text{ mol}$$

0.1 mol

Mass = $0.1 \times 71 = 7.1$ gm

Q) Some species are given Ni^{2+}, Fe^{2+}, Co^{2+}, V^{3+} and Ti^{2+}
How many species has magnetic moment (spin only) less than 3 BM.



Q) Given below are two statements

Statement-I : The correct order for radius is $Al > Mg > Mg^{2+} > Al^{3+}$

Statement-II : Atomic size always depends on electronegativity.

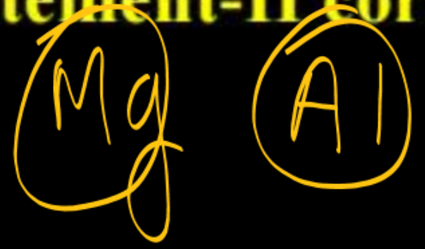
In the light of the above statements, choose the correct option.

(A) Statement-I and II are correct

(B) Both Statement-I and II are incorrect

(C) Statement-I is correct but Statement-II incorrect

(C) Statement-I incorrect but Statement-II correct



Q) Find concentration of X^{2-} at equilibrium in 0.1 M H_2X.

Given $Ka_1 = 2.5 \times 10^{-7}$ $Ka_2 = 1 \times 10^{-13}$

(A) 2.5×10^{-7}

(B) 1×10^{-13}

(C) 6×10^{-12}

(D) 5×10^{-10}

$HX^- \rightleftharpoons H^+ + X^{2-}$

$[X^{2-}] = K_{a_2}$

Q) What will be the ratio of wavelength of 3rd line at Paschen Series to 2nd line of Balmer series of H-atom?

(A) $\frac{9}{4}$ (B) $\frac{3}{2}$ (C) $\frac{2}{3}$ (D) $\frac{16}{4}$

$$\frac{(\lambda_3)_P}{(\lambda_2)_B} = \frac{\frac{1}{(\lambda_2)_B}}{\frac{1}{(\lambda_3)_P}} = \frac{\frac{1}{2^2} - \frac{1}{4^2}}{\frac{1}{3^2} - \frac{1}{6^2}}$$

Q) Osmotic pressure of a solution is 12 atm. What is the concentration of NaCl solution which is isotonic to the given solution at 300 K.

$R = 0.082$ Lit–atm $K^{-1}L^{-1}$ mol^{-1}

Assume 100% dissociation.

(A) 0.4878 M (B) 0.02439 M

(C) 0.2439 M (D) 0.04878 M

$\pi_1 = \pi_2$

$\pi = CRTi$

12 atm

? .082 2

300 K

Q) $K_2Cr_2O_7$ is heated with KCl in pressure of H_2SO_4. Find the correct match of product with their oxidation state.

(A) CrO_2Cl_2, +6
(B) $Cr_2O_2Cl_2$, +6
(C) Cr_2O_2Cl, +5
(D) CrO_2Cl_2, +5

$Cl^- + Cr_2O_7^{2-} \rightarrow CrO_2Cl_2$ red
+NaOH
↓
CrO_4^{2-}
↓Pb
$PbCrO_4$↓
yellow

$Cr_2O_7^{2-} + H_2O_2$
↓
CrO5

$ye^{-2\sin x} = \dfrac{(2+3\sin x)e^{-2\sin x}}{-2} - \dfrac{3}{4}e^{-2\sin x} + C$

Q) Consider the differential equation $\sec x \dfrac{dy}{dx} - 2y = 2 + 3\sin x$.

$y = -\dfrac{(2+3\sin x)}{2} - \dfrac{3}{4} + Ce^{2\sin x}$

$y\left(\dfrac{\pi}{6}\right) = \dfrac{-2-3/2-3}{4}$

If $y(0) = \dfrac{-7}{4}$ then find $y\left(\dfrac{\pi}{6}\right)$.

$\sin x = t$

(A) –5/2 **(B) 0** **(C) 1** **(D) 3/2**

$\dfrac{dy}{dx} - 2y\cos x = (2+3\sin x)\cos x$

$I.F = e^{\int -2\cos x\,dx}$

$= e^{-2\sin x}$

$ye^{-2\sin x} = \int e^{-2\sin x}(2+3\sin x)\cos x\,dx$

$= \int (2+3t)e^{-2t}\,dt$

$ye^{-2\sin x} = \dfrac{(2+3t)e^{-2t}}{-2} + \dfrac{1}{2}\int 3e^{-2t}\,dt$

Ans. (A)

Q) Let A = {2, 3, 5, 7, 9}. Consider a relation defined as
$R = \{(x, y) : 2x \leq 3y, x \in A, y \in A\}$.
l = total number of elements in relation R
m = Number of elements required in R to make it symmetric.
Find l + m.

(A) 18 (B) 25 (C) 27 (D) 30

Ans. (B)

Q) If the product

$$\left(\frac{1}{{}^{15}C_0}+\frac{1}{{}^{15}C_1}\right)\left(\frac{1}{{}^{15}C_1}+\frac{1}{{}^{15}C_2}\right)\cdots\left(\frac{1}{{}^{15}C_{12}}+\frac{1}{{}^{15}C_{13}}\right)=\frac{\alpha^{13}}{({}^{14}C_0\cdot{}^{14}C_1\cdot{}^{14}C_2\cdots{}^{14}C_{12})}$$

then 30α is equal to

(A) 16 **(B) 32** **(C) 15** **(D) 28**

$$\frac{{}^{15}C_0+{}^{15}C_1}{{}^{15}C_0\cdot{}^{15}C_1}=\frac{{}^{16}C_1}{{}^{15}C_0\cdot{}^{15}C_1}=\frac{16}{1\cdot{}^{15}C_1}$$

$$\frac{16}{2}\frac{1}{{}^{15}C_2}\cdot\frac{16}{3}\frac{1}{{}^{15}C_3}\cdots\frac{16}{13}\frac{1}{{}^{15}C_{13}}$$

$$=\frac{(16)^{13}}{13!\,({}^{15}C_1\cdot{}^{15}C_2\cdots{}^{15}C_{13})}$$

Ans. (B)

$${}^{15}C_1 \cdot {}^{15}C_2 - - -$$

$$\frac{15}{1}\cdot({}^{14}C_0)\cdot\left(\frac{15}{2}\right)({}^{14}C_1\cdot)\left(\frac{15}{3}\right)({}^{14}C_2) - - -\left(-\frac{15}{13}\right)({}^{14}C_{12})$$

$$\frac{(15)^{13}}{13!}\left({}^{14}C_0\cdot{}^{14}C_1 - - - {}^{14}C_{12}\right)$$

$$= \left(\frac{16}{15}\right)^{13}\left(\frac{1}{\quad}\right)$$

$$\alpha = \frac{16}{15}$$

$$30\alpha = 32$$

Q) Pulley is made up of a ring and two rods, find acceleration of blocks, pulley in pure rotation

$a = \alpha R$

$T_2 - mg = ma$

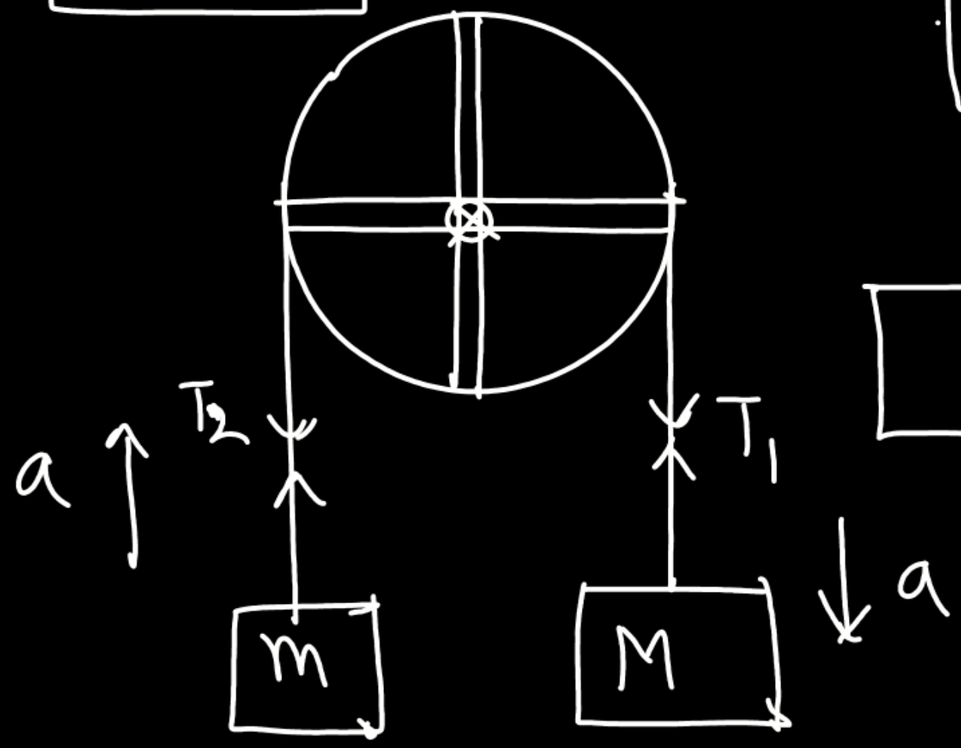
$Mg - T_1 = Ma$

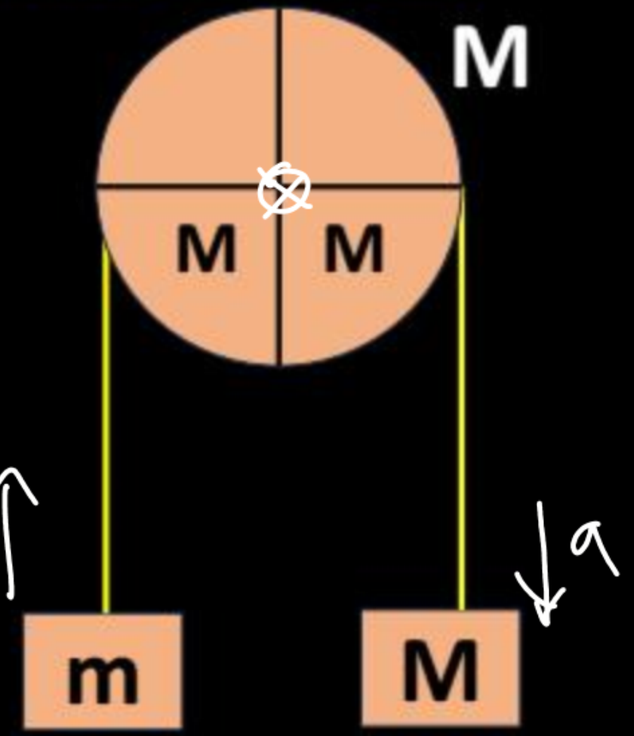
$f_s = (T_1 - T_2)$

$R(T_1 - T_2) = I\alpha$

$I = \left[\frac{MR^2}{2} + 2\frac{M(2R)^2}{12}\right]$

$a = ?$





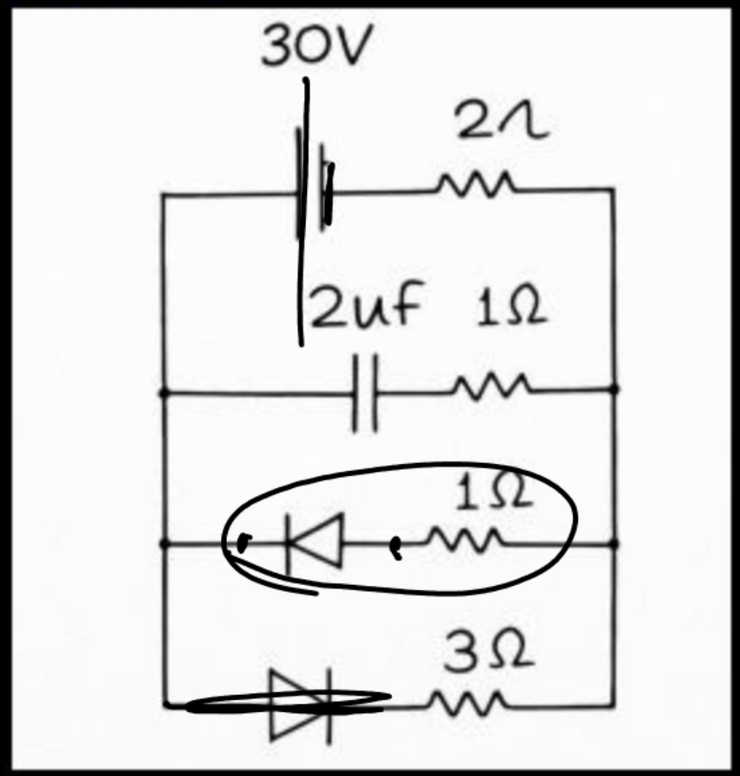
Q) Diodes are ideal at steady state, find charge on capacitor

$q = 18 \times 2$

$\Rightarrow 36$

$i = \frac{30}{3+2}$

$= 6\ \text{Amp}$



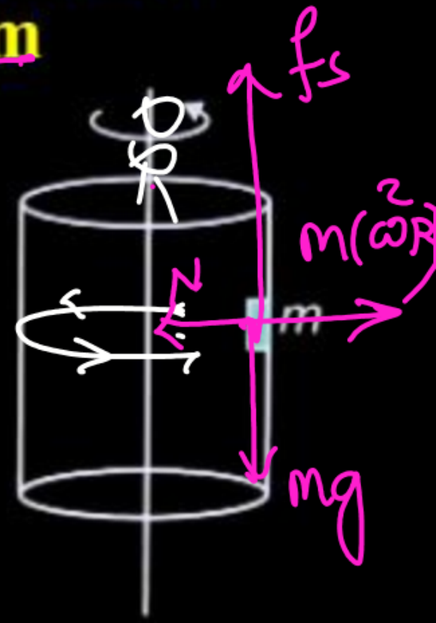
Q) A block of mass m is at rest w.r.t. hollow cylinder which is rotating with angular speed ω. Radius of cylinder is R. Find minimum coefficient of friction between block and cylinder.

(A) $\frac{g}{4\omega^2 R}$

(B) $\frac{3g}{2\omega^2 R}$

(C) $\frac{g}{\omega^2 R}$

(D) $\frac{2g}{\omega^2 R}$



$N = m(\omega^2 R)$

$f_s = mg$

$(f_s)_{max} = \mu_s N = \mu_s m\omega^2 R = mg$

$\mu_s = \left(\frac{g}{\omega^2 R}\right)$

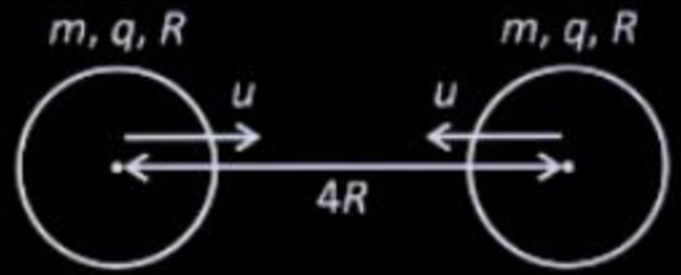
Q) Two spheres having equal mass m, charge q and radius R, are moving towards each other. Both have speed u at an instant when distance between their centers is 4R. Minimum value of u so that they touch each other is

(A) $\sqrt{\frac{q^2}{4\pi\varepsilon_0 mR}}$

(B) $\sqrt{\frac{q^2}{8\pi\varepsilon_0 mR}}$

(C) $\sqrt{\frac{q^2}{16\pi\varepsilon_0 mR}}$

(D) $\sqrt{\frac{q^2}{\pi\varepsilon_0 mR}}$



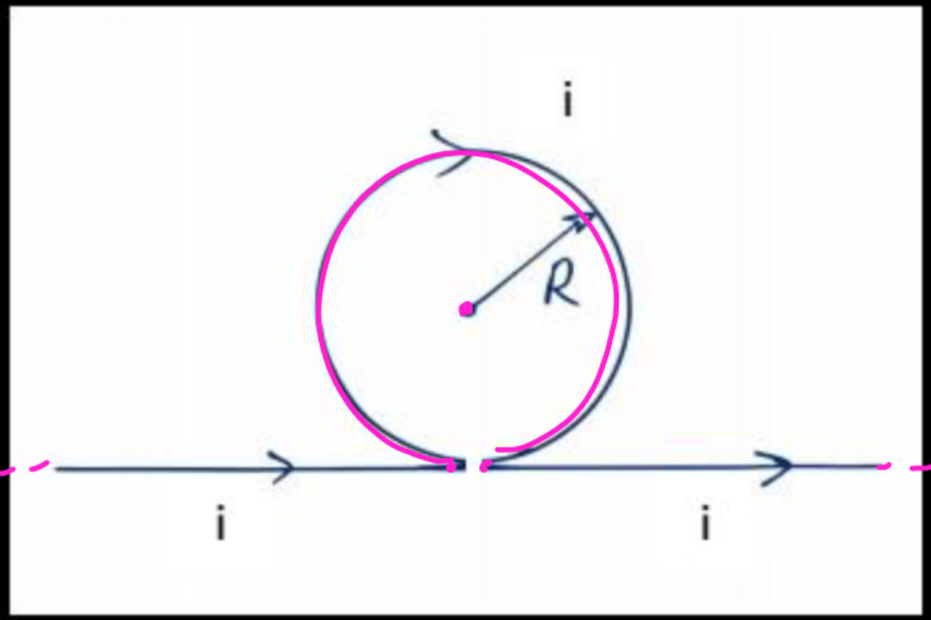
$\frac{Gm^2}{R}$

$-\frac{Gm^2}{4R} + \frac{q^2}{4\pi\varepsilon_0(4R)} + \frac{1}{2}mv^2 \times 2 = \frac{q^2}{4\pi\varepsilon_0(2R)} - \frac{Gm^2}{2R}$

q V=0 V=0 q

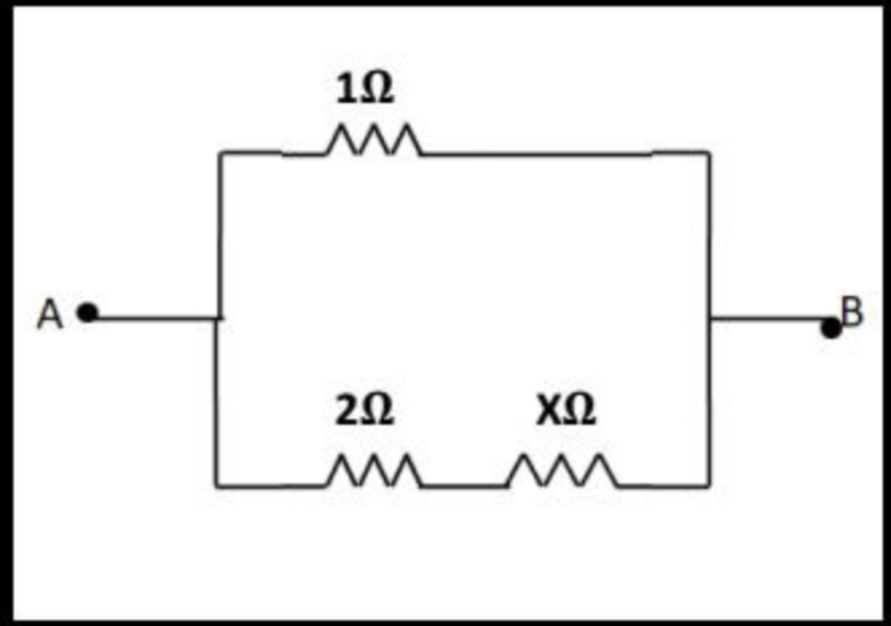
Q) Determine B at center.

$$2\left(\frac{\mu_0}{4\pi}\right)\left(\frac{I}{R}\right) - \frac{\mu_0 I}{2R}$$



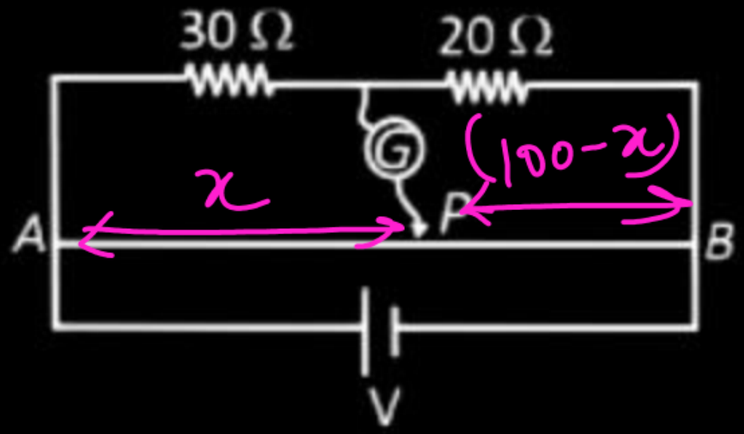
Q) if equivalent Resistance of circuit between A & B is x Ω. Determine value of x?

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



Q) In a meter bridge two balancing resistances are 30 Ω and 20 Ω. If galvanometer shows zero deflection for the Jockey's shows zero deflection for the jockey's contact point P. Then find the length A.P.

(A) 70 cm (B) 60 cm
(C) 40 cm (D) 30 cm



$$\frac{30}{20} = \frac{x}{100-x}$$

AB 100 cm

Q) Statement-1: Angular fringe width increase if separation between slits and screen increase.

Statement-2: Angular fringe width increase if source of higher wavelength is Used.

(A) Statement-1 is true Statemetnt-2 is True,Statement-2 is a correct explanation for statement -1 .

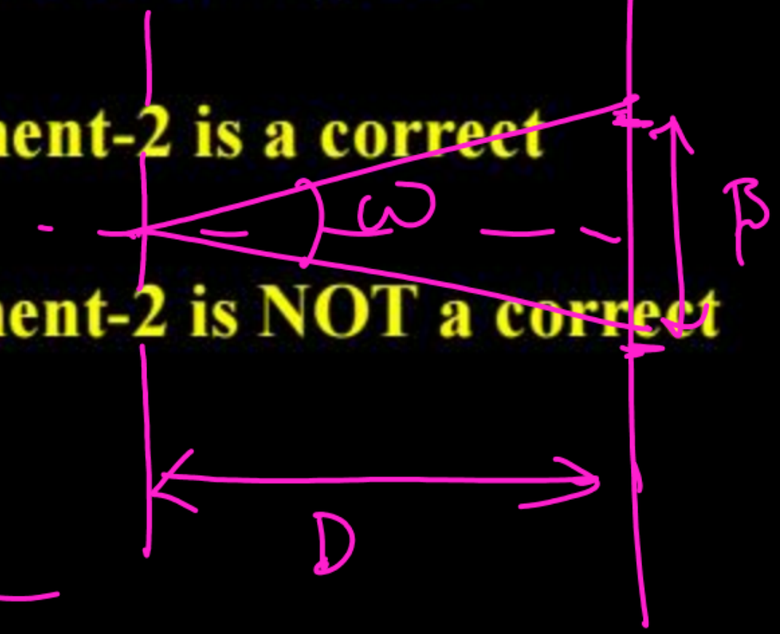
(B) Statement-1 is true Statemetnt-2 is True,Statement-2 is NOT a correct explanation for statement -1 .

(C) Statement-1 is true, statement-2 is false

(D) Statement-1 is False, statement-2 is True.

$\beta = \frac{\lambda D}{d}$

$\omega = \frac{\beta}{D} = \frac{\lambda}{d}$



$\frac{\beta}{D}$

1 → false

2 - True