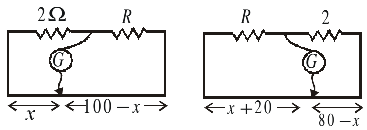
IIT JEE -07 (Paper -I) Solution
(for all codes)

PHYSICS

Q. is A resistance of ......

Ans.(A)



$$\frac{R}{2} = \frac{100-x}{x} \quad ..... (1)$$

$$\frac{R}{2} = \frac{x+20}{80-x} \quad ..... (2)$$

Solve (1) & (2) $R = 3\Omega$

Q. is In an experiment ....

Ans.(B) Image distance > object distance

$\therefore \; f < x < 2f$

Q. is Two particles of mass m ....

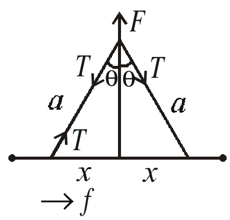
Ans.(B)

$$2T\cos\theta = F$$

$$\Rightarrow \quad T = \frac{F}{2\cos\theta}$$

If f = acceleration

$$T\sin\theta = mf$$



$$\Rightarrow \quad f = \frac{T}{m}\sin\theta = \frac{F}{2m}\tan\theta$$

$$= \frac{F}{2m}\frac{x}{\sqrt{a^2 - x^2}}$$

4.(A) Potential difference depends only on charge on inner cylinder.

Q. is Considera neutral conducting sphere ....

Ans.(D) Net charge on a neutral sphere is zero

Q. is A circuit is connected as shown ....

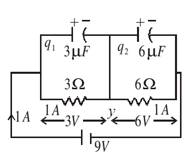
Ans.(C)

$$q_1 = 3\times 3 = 9\mu F$$

$$q_2 = 6\times 6 = 36\mu F$$

$$\Delta q = q_2 - q_1$$

$$= 27\mu F$$



Q. is A ray of light traveling in water .....

Ans.(C) Refracted ray moves away from normal

$$\alpha = 180° - 2\theta - \beta$$

$$(\beta > O^0)$$

Q. is In the options given below ....

Ans.. (A)

$$E\left({}^{236}_{92}U\right) > E\left({}^{137}_{53}I\right) + E\left({}^{97}_{39}Y\right) + 2E(n)$$

Rest mass energy decreases in fission.

Q. is The largest wavelength in the ....

Ans.(B) $\frac{hc}{122} = E_0 - \frac{E_0}{4} = \frac{3}{4}E_0 \quad (E_2 \to E_1)$ ... (1)

smallest λ in infrared is for $(E_\infty \to E_3)$

$$\therefore \quad \frac{hc}{\lambda} = \frac{E_0}{9} \quad ... (2)$$

from (1) & (2) $\lambda = 823nm$.

Assertion - Reason Type

Q. is A block of mass m ....

Ans.(C)

Q. is In an elastic collision....

Ans.(B)

Q. is The formula connecting u, v and f ...

Ans.(C)

Q. is If the accelerating potential ...

Ans.(B)

PASSAGE

Ans.(C) $\frac{1}{2}I(2\omega)^2 = \frac{1}{2}kx_1^2$ & $\frac{1}{2}(2I)\omega^2 = \frac{1}{2}kx_2^2$ Take ratio $x_1 : x_2 = \sqrt{2}$

Ans.(A) Conservation of Angular momentum

$$3I\omega_0 = 2I\omega + 2I\omega \Rightarrow \omega_0 = \frac{4}{3}\omega$$

loss in Angular momentum of A

$$\Delta L_A = 2I\omega - I\frac{4\omega}{3} = \frac{2}{3}I\omega$$

$$\tau_f t = \frac{2}{3}I\omega \Rightarrow \tau_f = \frac{2I\omega}{3t}$$

Ans..(B) $\Delta k = \frac{1}{2}I(2\omega)^2 + \frac{1}{2}(2I)\omega^2 - \frac{1}{2}(3I)(\frac{4}{3}\omega)^2$

$$= \frac{I\omega^2}{3}$$

PASSAGE

A fixed thernmally conducting ....

Ans.(A)

Ans.(D) $P_1V_1 = P_2V_2$

$$\Rightarrow \; P_0 \cdot 2L = P \cdot x \Rightarrow P = \frac{2P_0L}{x} \quad ... (1)$$

$$P\cdot\pi R^2 + Mg = P_0\pi R^2$$

$$\because\ P = \frac{2P_0L}{x}\quad \therefore x = \left(\frac{P_0\pi R^2}{P_0\pi R^2 - Mg}\right)2L$$

Ans.(C) $P(L_0 - H) = P_0L_0 \Rightarrow P = \dfrac{P_0L_0}{L_0 - H}$

$\dfrac{P_0L_0}{L_0 - H} = \rho g(L_0 - H) + P_0$ hence (C)

MATCH THE COLUMN

Q. (A) GM_eM_s - p, q

(B) $3RT/M$ - r, s

(C) F^2/q^2B^2 - r, s

(D) GM_e/R_e - r, s

Q. (A) A charged capacitor - q

(B) The wire is moved - r, s

(C) The wire is placed - s

(D) A battery - p,q,r

Q. (A) Transition between - p, r

(B) Electron emission - q, s

(C) Mosley's law - p

(D) Change of photon - q

CHEMISTRY

Q. is When 20 gm of naphtoic acid ....

.(A) $\Delta T_f = iK_f . m_{nvs}$,

$\Delta T_f = 2K,\ K_f = 1.72$

$$m_{nvs} = \frac{\frac{20}{172}}{50}\times 1000 \Rightarrow i = 0.5$$

Q. is The value of $\log_{10}$K for a ....

Ans (B) $A \rightleftharpoons B$, $\Delta G^o = \Delta H^o - T\Delta S$

$= -54.07\times 10^3 - 298\times 10$,

$= -57050\ J$

Again, $\Delta G^o = -2.303\ RT\ \log\ KC$

$$\log K_C = -\frac{\Delta G^o}{2.303\times 8.314\times 298}$$

$$\log K_C = -\frac{(-57050)}{7505} = -10\ ,\ \log K_C = +10$$

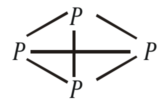
Q. is The number of Structure ....

Ans (C)

1. $CH_3-CH_2-CH_2-CH_2-CH_2-CH_3$
2. $CH_3-CH(CH_3)-CH_2-CH_2-CH_3$
3. $CH_3-C(CH_3)_2-CH_2-CH_3$
4. $CH_3-CH_2-CH(CH_3)-CH_2-CH_3$
5. $CH_3-CH(CH_3)-CH(CH_3)-CH_3$

Q. is The % of p-character in the ......

Ans (D)



sp^3 Hybridisation therefore 75% p-char

Q. is .In the following reaction ....

Ans. B)

$-NH-$ is strong activating group

$-CO-$ is strong deactivating group

$\therefore$ $-NO_2$ goes towards p-positioin of $-NO_2$ group

Q. is The reagents for the ....

Ans (B)

$\underset{Br}{CH_2}-\underset{Br}{CH_2} \xrightarrow{Alc.\,KOH} \underset{\underset{Highlly\ stable}{Br}}{CH}=CH_2$

$\xrightarrow[Strong\ base]{NaNH_2} \underset{Acetylene}{CH\equiv CH}$

Q. is Among the following the paramagnetic ...

Ans (D)

$Na-O-O-Na \rightarrow O_2^{2-}$ Peroxide Diamagnetic

$KO_2 \rightarrow O_2^-$ Superoxide Paramagnetic

$N_2O \rightarrow$ Diamagnetic

Q. is Extaction of Zn, Factual question ....

Ans (B)

Q. is The species having bond order ....

Ans (A)

$B.O\ of\ C\equiv O = 3,\ B.O\ of\ NO^- = 2,$
$B.O\ of\ NO^+ = 3,\ B.O\ of\ CN^- = 3,$

Q. is B always forms covalent ....

Ans (A

Q. is In water orthoboric acid .....

Ans (C)

$\underset{LA}{(HO)_3B} \leftarrow \underset{LB}{\overset{+}{O}H_2} \xrightarrow{-H^{\oplus}}$ Water gives proton

Q. is p-hydroxybenzoic acid ....

Ans (D}

p-hydroxybenzoic acid has intermolecular H-bonding $\therefore$ it has higher boiling point than $O-$ hydroxy benzoicacid , $O-$ Hydroxybenzoic acid in tramolecular H-bonding

Q. is Miscelles are formed bysurfactant ...

Ans (A)

Both statement & reason are correct.

Passage: The noble gas

Ans (A) Ar is inert in nature.

Ans (C) XeO_3 sp^3 and pyramidal shape
Ans (A) Factual question

Passage: Electrochemistry

Ans (B) No. of mole of $NaCl$ in its aqueous solution

$$4\times 0.5 = 2\ mole,\quad \underset{2\ mole}{NaCl} \rightarrow Na + \underset{1\ mole}{\frac{1}{2}Cl_2}$$

Ans (D) 2 mole $NaCl$ contains 46 gm Na

2 mole of $Hg = 400\,gm$

$\therefore$ Maximum wt of the amalga $= 400 + 46 = 446\ gm$

Ans (D) Total no. of gm. eq. wt. of Na deposited = 2

$\therefore$ Charge $= 96500 \times 2 = 193000\ Coulomb$

Match the Column

Q. is **Gaseous State** ....

Ans. $(A) \rightarrow P, S$, $B \rightarrow r$, $C \rightarrow q, p$, $D \rightarrow s, p$

Q. is **Biomolecules,Polymers** ....

Ans. $A \rightarrow p, s,\ B \rightarrow r, q,\ C \rightarrow p, r,\ D \rightarrow p, s$

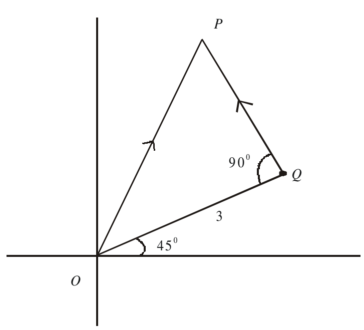
Q. is **Isomerism**

Ans. $A \rightarrow s, p, q,\ B \rightarrow s, p, r,\ C \rightarrow s, q,\ D \rightarrow s, q$

MATHEMATICS

Q. is **A man walks a distance of 3 units ....**

Ans. (D) = $(3+4i)e^{i\pi/4}$.



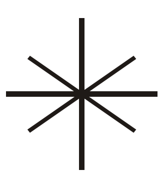
Position of $P = \overrightarrow{OP} = \overrightarrow{OQ} + \overrightarrow{PQ}$

$$= 3e^{i\pi/4} + 4e^{i3\pi/4} = e^{i\pi/4}\left(3 + 4\ e^{i\pi/2}\right) = e^{i\pi/4}\left(3 + 4i\ \right)$$

Q. is **The number of solutions of the pair of equations**

Ans (C) = two

Sol.
$$2\sin 2\theta - \cos^2\theta = 0 \ ......(1)$$
$$2\cos^2\theta - 3\sin\theta = 0 \ ......(2)\ \ in\ \ 0, 2\pi$$



from (1)

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

$$\Rightarrow\ \sin^2\theta = \frac{1}{4}\ \Rightarrow \sin\theta\ = \pm\frac{1}{2}$$

from (2)

$$2 - 2\sin^2\theta - 3\sin\theta = 0$$

$$\Rightarrow\ 2\sin^2\theta + 3\sin\theta - 2 = 0$$

$\sin\theta = -2, \frac{1}{2}$ $\quad\therefore$ No of sol = Two

Q. is **A hyperbola, having the transverse axis of length** $2\sin\theta$ **...........**

Ans (A) $= x^2\text{cosec}^2\theta - y^2\sec^2\theta = 1$

Sol. Length of hyperbola

$$2a = 2\sin\theta$$

Given efflipse is $3x^2 + 4y^2 = 12$

$$e^2 = 1 - \frac{3}{4} \Rightarrow\ \text{e}=\frac{1}{2}$$

$\therefore$ *foci* are $(\pm 1, 0)$

Eccentricity of hyperbola

$$e' = \frac{2}{2\sin\theta} = \text{cosec}\ \theta$$

$$\therefore\ \text{cosec}^2\theta = 1 + \frac{b^2}{\sin^2\theta} \Rightarrow \frac{\cos^2\theta}{\sin^2\theta} = \frac{b^2}{\sin^2\theta}$$

$$\therefore\ \text{b}^2 = \cos^2\theta$$

$$\therefore\ Eq.\ is\ \left(\cos ec^2\theta\right)x^2 - \left(\sec^2\theta\right)y^2 = 1$$

Q. is **The number of distinct real values of** λ **....**

Ans (C) = two

The vectors will be coplaner if

$$\begin{vmatrix} -\lambda^2 & 1 & 1 \\ 1 & -\lambda^2 & 1 \\ 1 & 1 & -\lambda^2 \end{vmatrix} = 0$$

$$\Rightarrow \begin{vmatrix} -\lambda^2+2 & 1 & 1 \\ -\lambda^2+2 & -\lambda^2 & 1 \\ -\lambda^2+2 & 1 & -\lambda^2 \end{vmatrix} = 0\ \Rightarrow \left(2\text{-}\lambda^2\right)\begin{vmatrix} 1 & 1 & 1 \\ 1 & -\lambda^2 & 1 \\ 1 & 1 & -\lambda^2 \end{vmatrix} = 0$$

$$\Rightarrow \left(2-\lambda^2\right)\begin{vmatrix} 0 & 1 & 1 \\ 0 & -\lambda^2 & 1 \\ 1+\lambda^2 & 1 & -\lambda^2 \end{vmatrix} = 0 \Rightarrow \left(2-\lambda^2\right)\left(1+\lambda^2\right)^2 = 0$$

$\Rightarrow \lambda^2 = 2, -1 \quad \Rightarrow \lambda = \pm\sqrt{2}$ $\quad$ Two real values

Q. is **The tangent to the curve** $y = e^x$ **.........**

Ans (A) = on the left of $x = c$

Q. is $\lim_{x \to \frac{\pi}{4}} \frac{\int_2^{\sec^2 x} f(t)\,dt}{x^2 - \frac{\pi^2}{16}}$ = **Ans (A)** $= \frac{8}{\pi} f(2)$

Sol. $\lim_{x \to \frac{\pi}{4}} \frac{2\int^{\sec^2 x} f(t)\,dt}{x^2 - \frac{\pi^2}{16}}$

$= \lim_{x \to \frac{\pi}{4}} \frac{2\sec x(\sec x \tan x) f(\sec^2 x) - 0}{2x}$

$= \frac{\sec\left(\frac{\pi}{4}\right)\left(\sec\frac{\pi}{4}\tan\frac{\pi}{4}\right) f(\sec^2 \pi/4)}{\pi/4} = \frac{8}{\pi} f(2)$

Q. is $\lim_{t \to x} \frac{t^2 f(x) - x^2 f(t)}{t - x} = 1$ .....

Ans (A) $= \frac{1}{3x} + \frac{2x^2}{3}$

Sol. $\lim_{t \to x} \frac{t^2 f(x) - x^2 f(t)}{t - x} = 1$

$\Rightarrow \lim_{t \to x} \frac{2tf(x) - x^2 f'(t)}{1} = 1$

$\Rightarrow 2x f(x) - x^2 f'(x) = 1$

$\Rightarrow x^2 f^1(x) - 2x\, f(x) = -1$

$\Rightarrow f^1(x) - \frac{2}{x} f(x) = -\frac{1}{x^2}$

Q. is **One Indian and four American men and their wives .....** **Ans (C)**

Sol.

A $\Rightarrow$ American men is adjacent to wife

B $\Rightarrow$ Indian man is adjacent to wife

$= P\left(\frac{B}{A}\right) = \frac{P(A \cap B)}{P(A)}$

$= \frac{(5-1)! \times (2!)^5}{(6-1)! \times (2!)^4}$

$= \frac{41 \times 32}{51 \times 16} = \frac{32}{80} = \frac{2}{5} = \frac{2}{5}$

Q. is **Let** α, β **be the roots of the equation**

$x^2 - px + r = 0$ **.........**

Ans (D) $= \frac{2}{9}(2p - q)(2q - p)$

Sol. $x^2 - px + r = 0$ $\quad$ $x^2 - qx + r = 0$

$\alpha.\beta = r$ $\quad$ $\frac{\alpha}{2}\, 2\beta = r$

$\alpha + \beta = p$ $\quad$ $\frac{\alpha}{2} + 2\beta = q$

Solving - $\beta = \frac{2q - p}{3}$ $\quad$ $\alpha = p - \frac{2q - p}{3}$

$\therefore r = \left(\frac{4p - 2q}{3}\right)\left(\frac{2q - p}{3}\right)$ $\quad$ $= \frac{4p - 2q}{3}$

$= \frac{2}{9}(2p - q)\ (2q - p)$

ASSERTION/ REASON

Q. is **Let** $H_1, H_2 ....H_n$ **be mutually exclusive ....**

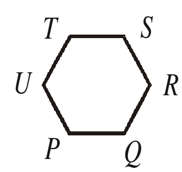
Ans (B) Statement-1 is True , Statement-2 is True , but '2' is n't correct explanation of '1'.

Q. is **Tangents are drawn from the point (17,7) to ....**

Ans. (A) Statement -1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

Q. is **Let the vectors** $\overrightarrow{PQ}, \overrightarrow{QR}, \overrightarrow{RS}, \overrightarrow{ST}, \overrightarrow{TU}$ **and** $\overrightarrow{UP}$ **....**

Ans(C) Statement-1 is True, Statement-2 is False



$\overline{PQ} \times (\overline{RS} + \overline{ST})$

$\overline{PQ} \times \overline{RS} + \overline{PQ} \times \overline{ST}$

Statement 1 is true $\because$ $\overline{PQ} \times \overline{ST} = 0$

Statement 2 is false $\because$ $\overline{PQ} \times \overline{RS} \neq 0$

Q. is **Let** $F(x)$ **be an indefinite integral of** $\sin^2 x$ **....**

Ans(D) Statement-1 is False, Statement-2 is True

PASSAGE

Q. i s **The sum** $V_1 + V_2 + ... + V_n is$

Ans (B) $\frac{1}{12} n(n+1)(3n^2 + n + 2)$

Sol. $Vr = \frac{r}{2}\left[2r + (r-1)(2r-1)\right]$

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

$V_1 + V_2 + ... + V_n = \sum_{r=1}^{h} Vr$

$= \sum r^3 - \frac{\sum r^2}{2} + \frac{1}{2}\sum r$

$= \left(\frac{n(n+1)}{2}\right)^2 = \frac{n(n+1)(2n+1)}{2.6} + \frac{n(n+1)}{2.2}$

$= \frac{n(n+1)\left(3n^2+n+2\right)}{12}$ Ans.

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

$= \frac{r(4r+1)}{2} + \frac{2r^2+3r+2-4}{2}$

$= \frac{6r^2+4r-2}{2} = \frac{2\left(3r^2+2r-1\right)}{2}$

$Qr = \left(3(r+1)^2 + 2(r+1) - 1\right) - \left(3r^2+2r-1\right)$

$= 6r+5$ (Ans.)

Q. is T_r **is always ......**

Ans(D) A composite number

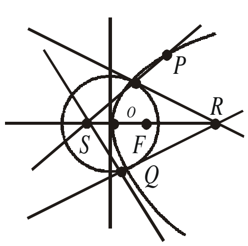
Q. is **Which is correct**

Ans. (B) $Q_1, Q_2, Q_3, ...$ are A.P. with common difference 6

PASSAGE

$x^2 + y^2 = 9$ and $y^2 = 8x$ **............**

Sol.



meet at

$9 - x^2 = 8x$

$\Rightarrow$ x =1

$\therefore P\left(1, 2\sqrt{2}\right), Q\left(1, -2\sqrt{2}\right)$

Tangent to circle at P

$x + 2\sqrt{2}y = 9 \quad \therefore R\ is\ (9,0)$

Tangent to Parbole at P

$2\sqrt{2}\ y = 8\left(\frac{x+1}{2}\right)$

$\Rightarrow \quad 4x - 2\sqrt{2}y + 4 = 0 \quad \therefore \ S\ is\ = \ (-1,0)$

$\frac{Area\ \Delta\ PQR}{Area\ \Delta\ PQR} = \frac{2}{8} = \frac{1}{4}$

Circum radius of $\Delta\ PRS$

$R = \frac{abc}{4\Delta} = \frac{2\sqrt{3}\times 10\times\sqrt{72}}{4\times\frac{1}{2}\times 10\times 2\sqrt{2}} = 3\sqrt{3}$

In circle of ΔPQR

$r = \frac{\Delta}{5} = \frac{\frac{1}{2}\times 2\sqrt{2}\times 2\times 8}{\left(\frac{4\sqrt{2}+12\sqrt{2}}{2}\right)} = 2$

Q. is **The ratio of the areas of the triangle** $PQS\ and\ PQR$ **is ....**

Ans (C) 1:4

Q. is **The radius of the circumcircle of the triangle** PRS **is ....**

Ans (B) $3\sqrt{3}$

Q. is **The radius of the incircle of the triangle** PQR **is ....**

Ans. (D) 2

MATCH THE COLUMN

Ans. $\int_{-1}^{1}\frac{dx}{1+x^2} = \frac{\pi}{2}$, $\quad \int_{0}^{1}\frac{dx}{\sqrt{1-x^2}} = \frac{\pi}{2}$

$\int_{2}^{3}\frac{dx}{1-x^2} = \frac{1}{2}\log\left(\frac{2}{3}\right)$, $\quad \int_{1}^{2}\frac{dx}{x\sqrt{x^2-1}} = \frac{\pi}{3}$

Ans. $x|x|$ = continous, differentiable, increasing (-1,1)

$\sqrt{|x|}$ = continous and not differentiable at least at one point in (-1,1)

$x + [x]$ = increasing and not differentiable at least at one point in (-1,1)

$|x-1| + |x+1|$ = continous and differentiable in (-1,1)

Ans. $a+b+c \neq 0$ and $a^2+b^2+c^2 = ab+bc+ca$, identical planes

$a+b+c=0$ and $a^2+b^2+c^2 \neq ab+bc+ca$,
identical planes

$a+b+c \neq 0$ and $a^2+b^2+c^2 \neq ab+bc+ca$,
planes meeting only at a single point

$a+b+c=0$ and $a^2+b^2+c^2 = ab+bc+ca$,
whole of the three dimensional space

$$\Delta = \begin{vmatrix} a & b & c \\ b & c & a \\ c & c & b \end{vmatrix} = -(a+b+c)\left(a^2+b^2+c^2-ab-bc-cc\right)$$

$$= \frac{-(a+b+c)\ \left((a-b)^2+(b-c)^2+(c-a)^2\right)}{2}$$

$\Delta = 0 \qquad \therefore (A) \longrightarrow (r)$

$\Delta = 0 \qquad \therefore (B) \longrightarrow (r)$

$\Delta \neq 0 \qquad (c) \longrightarrow (p)$

$(d) \longrightarrow (s)$