ALL INDIA OPEN TEST-1 (AIOT-1)
(JEE MAIN PATTERN)
TARGET : JEE (MAIN+ADVANCED) 2019

DATE : 23-12-2018 | SET-1 | COURSE CODE : JP, JF, JR, EP, EF, ER

HINTS & SOLUTIONS

PART-A : PHYSICS

1. Air has refractive ……………………

Sol. $t = n\lambda_1 = (n + 1)\lambda_2$

$$\frac{n}{n+1} = \frac{\lambda_2}{\lambda_1} = \frac{\mu_1}{\mu_2}$$

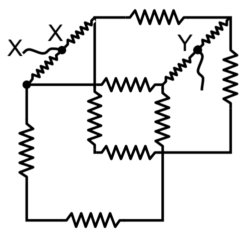
$$= \frac{1}{1.0003}$$

$$\Rightarrow n = \frac{10000}{3}$$

$$\therefore t = \frac{10000}{3} \times 6 \times 10^{-4} \quad mm = 2 \quad mm$$

2. If each resistance ……………………

Sol. Potential of points D and E and H and C are same Hence.



$$R_{eq.} = \frac{\frac{3r}{4} + \frac{r}{2} + \frac{r}{2}}{2} = \frac{7r}{8}$$

3. A particle is ……………………

Sol. $10 = 10\tan\theta\left(1 - \frac{10}{R}\right)$

$$5 = 20\tan\theta\left(1 - \frac{20}{R}\right)$$

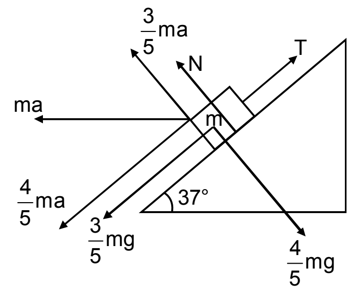
$$2 = \frac{1}{2}\left(\frac{R-10}{R-20}\right) \Rightarrow 4R - 80 = R - 10$$

$$3R = 70 \Rightarrow R = \frac{70}{3} m$$

$$10 = 10\tan\theta\left(1 - \frac{10}{70/3}\right) \Rightarrow \theta = \tan^{-1}\left(\frac{7}{4}\right)$$

4. A body of mass ……………………

Sol. $T = \frac{4}{5}ma + \frac{3}{5}mg$



$$N = \frac{4}{5}mg - \frac{3}{5}ma = \frac{3}{4}mg,$$

$$\frac{3}{5}ma = \left(\frac{4}{5} - \frac{3}{4}\right)mg$$

$$\frac{3}{5}a = \left(\frac{16-15}{20}\right)g$$

$$\frac{3a}{5} = \frac{g}{20} \Rightarrow a = \frac{g}{12}$$

5. A particle moving ……………………

Sol. Let initial velocity is u and constant acceleration is a.

given

$$s_{6-7} = s_7 - s_6 = \left(7u + \frac{1}{2}a(49)\right) - \left(6u + \frac{1}{2}a(36)\right)$$

$$= u + \frac{13}{2}a = 20 \Rightarrow 2u + 13a = 40$$

$$s_{8-9} = s_9 - s_8 = \left(9u + \frac{1}{2}a(81)\right) - \left(8u + \frac{1}{2}a(64)\right)$$

$$= u + \frac{17}{2}a = 24 \Rightarrow 2u + 17a = 48$$

$\Rightarrow a = 2m/s^2$ and $u = 7m/s$

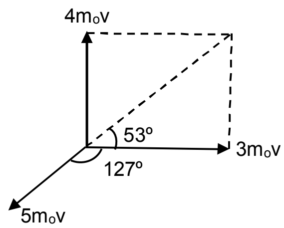
$$s_{9-10} = s_{10} - s_9 = (10u + \frac{1}{2}a(100)) - (9u + \frac{1}{2}a(81))$$

$$= u + \frac{19}{2}a = 26m$$

6. Three particles …………………….

Sol. For maximum loss in perfectly inelastic collision $P_{cm} = 0$

Just before collision



7. Moment of inertia …………………….

Sol. $I = \frac{M}{2}\left(a^2 + b^2\right)$

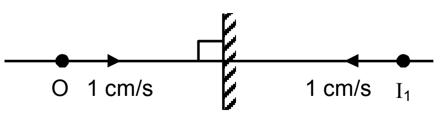
$\Delta I = M\,(a\Delta a + b\Delta b) + \Delta m \left(\frac{a^2 + b^2}{2}\right)$

$A_0 = 74$

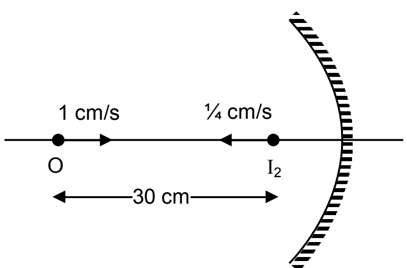
$B_0 = 222.$

8. We have a …………………….

Sol. In case of plane mirror images is at I_1



In case of spherical mirror images is at I_2



$$\frac{1}{v} + \frac{1}{-30} = \frac{1}{-10} \Rightarrow \frac{1}{v} = \frac{1}{30} - \frac{3}{30} \Rightarrow V = -15 \text{ cm}$$

$$\frac{v}{u} = \frac{1}{2} \Rightarrow \frac{dv}{dt} = -\frac{v^2}{u^2}\frac{du}{dt} = -\frac{1}{4}\text{cm/s}$$

Relative speed of approach of I_1 w.r.t. I_2 = $\frac{3}{4}\text{cm/s}$

9. Consider a …………………….

Sol. $\vec{A} = \frac{\pi R^2}{2}(\hat{i} + \hat{j})$

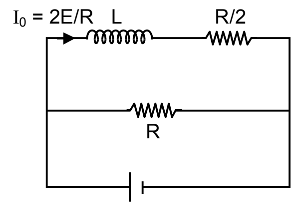
$$\vec{E} = E_0\hat{i} + 2E_0\hat{j} + 3E_0\hat{k}$$

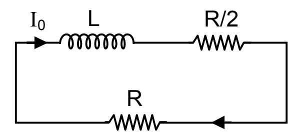
$$\phi = \vec{E}.\vec{A} = \frac{\pi R^2}{2}(E_0 + 2E_0)$$

$$= \frac{3}{2}\pi R^2 E_0$$

10. A solenoid of …………………….

Sol.



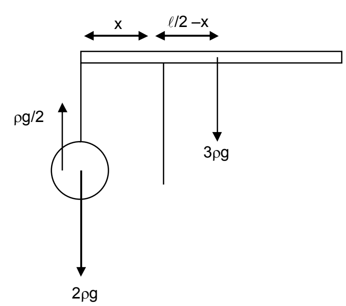


$$I_0 = \frac{2E}{R}, \quad U = \frac{1}{2}L\left(\frac{2E}{R}\right)^2 = \frac{L}{2}\frac{4E^2}{R^2} = \frac{2LE^2}{R^2}$$

$$\frac{H_{sol}}{H_R} = \frac{1}{2}, \quad H_S = \frac{1}{3}U = \frac{2}{3}\frac{LE^2}{R^2}$$

11. A homogeneous …………………….

Sol.



$$3\rho g\left(\frac{\ell}{2} - x\right) = \frac{3}{2}\rho g x$$

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

$$x = \frac{\ell}{3}$$

$$y = \frac{2\ell}{3}$$

$$\frac{y}{x} = 2$$

12. A uniform solid …………………….

Sol. $f_v = 6\pi\eta r v$

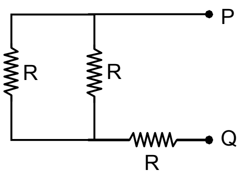
$$6\pi\eta r v^2 = -4\pi\rho L r^2 \frac{dr}{dt}$$

$$r\frac{dr}{dt} = \left(\frac{3\eta}{2\rho L}\right)v^2 \Rightarrow \int_R^{\frac{R}{2}} r\,dr = \frac{-3\eta v^2}{2\rho L}\int_O^T dt$$

$$\frac{3R^2}{8} = \frac{3\eta v^2}{2\rho L}T \Rightarrow T = \frac{\rho L R^2}{4\eta v^2}$$

13. The capacitor …………………….

Sol. During Discharging if $V_{PQ} = V$



$$V_1 = V_2 = \frac{V}{3}$$

$$V_3 = \frac{2V}{3}$$

Total heat generated = $H \alpha \dfrac{V^2}{\frac{3R}{2}}$

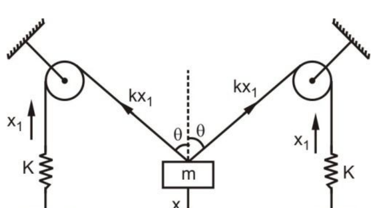
Heat generated in R_1 = $H_1 \alpha \dfrac{V_1^2}{R}$

$$\frac{H_1}{H} = \frac{1}{6}$$

14. In the situation …………………….

Sol. Let block is displaced through a small displacement x in downward direction and elongation in spring = x_1 then

$x\cos\theta = x_1$ … (1)



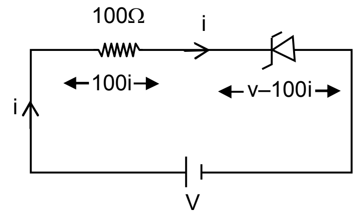
Restoring force $F = 2\,kx_1\cos\theta$

$F = 2k\cos^2\theta\, x$

Hence $T = 2\pi\sqrt{\dfrac{m}{2k\cos^2\theta}} = 2\pi\sec\theta\sqrt{\dfrac{m}{2k}}$

15. An experiment …………………….

Sol.



$P_{zener} = (v-100i)i = 1$

$vi - 100i^2 = 1$

$100i^2 - vi + 1 = 0$

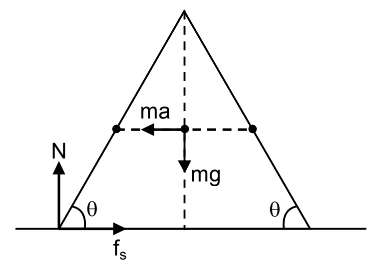
i must be real

$v^2 - 4(100) \geq 0$

$v \geq 20$

16. A V shaped …………………….

Sol. Let acceleration of truck is a when ladder is about to topple.

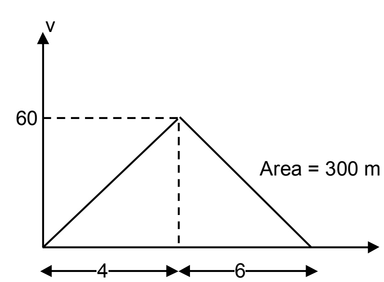


$$ma\frac{\ell}{2}\sin\theta = mg\,\ell\cos\theta$$

$a = 2g\cot\theta = 2g\cot 53 = 20.\dfrac{3}{4} = 15\ m/s^2$

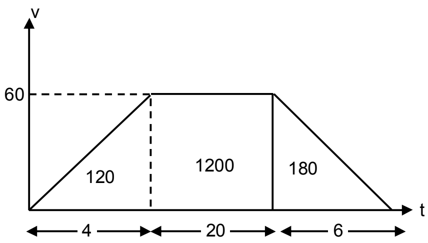
so keeping the ladder at rest w.r.t. truck max acceleration / retardation of truck can be 15 m/s²

v – t graph of truck (during acceleration and retardation)



Since truck is to travel 1500 m

v – t graph



= 1500 m

17. Two uniform solid ……………………

Sol. $\lambda_1 T_1 = \lambda_2 T_2$

$$\frac{T_1}{T_2} = \frac{\lambda_2}{\lambda_1} = 2$$

Rate of heat loss $\dot{Q} = 4\pi r^2 \sigma e T^4$

$$\frac{\dot{Q}_1}{\dot{Q}_2} = \left(\frac{r_1}{r_2}\right)^2 \left(\frac{T_1}{T_2}\right)^4 = 4$$

$$\dot{Q} = -ms\frac{d\theta}{dt} = -\frac{4}{3}\pi r^3 \rho s \frac{d\theta}{dt}$$

$$\frac{\left(\frac{d\theta}{dt}\right)_1}{\left(\frac{d\theta}{dt}\right)_2} = \left(\frac{\dot{Q}_1}{\dot{Q}_2}\right) \left(\frac{r_2}{r_1}\right)^3 = 32$$

18. A photon is ……………………

Sol. In the first excited state the ionization energy is $\frac{13.6}{2^2}$ = 3.4 eV

$k_{max} = hv - W$

$hv = W + k_{max}$

$= 3.4 + 10.7$

$= 14.1$ eV

19. Consider a ……………………

Sol. $\ell_1, \alpha_1 \rightarrow$ steel rod

$\ell_2, \alpha_2 \rightarrow$ Brass rod

As difference in lengths is constant

$\Rightarrow \Delta\ell_1 = \Delta\ell_2$

$\Rightarrow \ell_1\alpha_1\Delta T = \ell_2\alpha_2\Delta T$

$\Rightarrow \ell_1\alpha_1 = \ell_2\alpha_2$ .....(1)

Also $\Rightarrow$ $\ell_1 - \ell_2 = \ell$ .....(2)

From (1) and (2)

$\ell_1 = \frac{\ell\alpha_2}{\alpha_2 - \alpha_1}$ & $\ell_2 = \frac{\ell\alpha_1}{\alpha_2 - \alpha_1}$

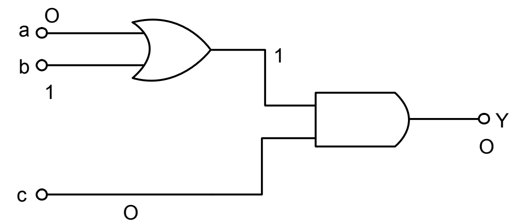
$\Rightarrow$ Sum $= \frac{\ell(\alpha_2 + \alpha_1)}{(\alpha_2 - \alpha_1)} = 80 \times \frac{30}{8}$ = 300 cm = 3 m

20. If unit of mass ……………………

Sol. Magnitude will remain unchanged if sum of dimensions in fundamental quantities is zero.

21. To get an ……………………

Sol. Checking options one by one



We must note that c = 1

and output of OR gate must also be 1

22. Astronomers ……………………

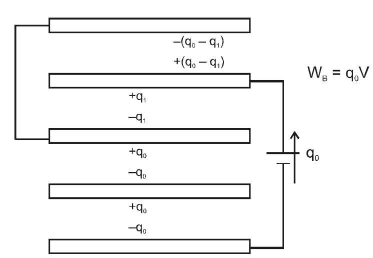
Sol. $L = mVR \qquad V = \frac{2\pi R}{T}$

$$L = mR\left(\frac{2\pi R}{T}\right) = \frac{2\pi m R^2}{T}$$

$$\frac{L_1}{L_2} = \frac{m_1}{T_1}\frac{T_2}{m_2} \Rightarrow \frac{m_1}{m_2} = \frac{T_1}{T_2} = 3$$

23. 5 identical thin ……………………

Sol.



(1) $\frac{q_1}{A\epsilon_0} d - \left(\frac{q_0 - q_1}{A\epsilon_0}\right) d = 0 \Rightarrow q_1 - q_0 + q_1 = 0 \Rightarrow q_1 = \frac{q_0}{2}$

(2) $\frac{q_1 d}{A\epsilon_0} + \frac{q_0 d}{A\epsilon_0} + \frac{q_0 d}{A\epsilon_0} = V$

$$\Rightarrow \frac{d}{\epsilon_0 A}\left(\frac{q_0}{2} + q_0 + q_0\right) = V$$

$$q_0 = \frac{2\epsilon_0 AV}{5d}$$

24. Conductor PQRSTU …………………….

Sol. Due to PQ, TU the field is 0.

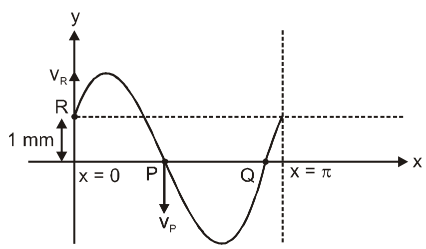
Field due to QR $\vec{B}_1 = \left(\frac{1}{4}\right)\left[\frac{\mu_0 i}{2a}\right]\hat{j}$

Field due to ST $\vec{B}_2 = \left(\frac{1}{4}\right)\left[\frac{\mu_0}{2}\frac{i}{(4a)}\right]\hat{k}$

B = $\frac{\mu_0 i}{8a}(\hat{j} + 0.25\hat{k})$

25. A transverse …………………….

Sol. Wave is heading towards –ve x-direction



equation of R with respect to time = A sin ($\omega t + \frac{\pi}{6}$)

wave equation = A sin ($\omega t + kx + \frac{\pi}{6}$)

given $\left|\vec{V}_P - \vec{V}_Q\right|$ = 2 ωA = 2 cm/s

$\omega\,(2 \times 10^{-3}) = 10^{-2}$ m/s

$\omega\,(2 \times 10^{-1}) = 1 \Rightarrow \omega = 5$ rad/s

from snapshot λ = πm ⇒ $k = \frac{2\pi}{\lambda} = \frac{2\pi}{\pi} = 2\ m^{-1}$

wave equation y = (2×10^{-3}) sin ($5t + 2x + \frac{\pi}{6}$) (m)

26. In the circuit …………………….

Sol. $\frac{4}{3} = \frac{X_L - X_C}{R}$, $\frac{X_C}{R} = \frac{3}{4}$

$Z = \frac{V}{I} = \frac{100}{5} = 20 = \sqrt{R^2 + (X_L - X_C)2}$

$400 = R^2 + \frac{16R^2}{9} = \frac{25R^2}{9}$

R = 12Ω

$\frac{4}{3} = \frac{X_L}{R} - \frac{X_C}{R} \Rightarrow \frac{4}{3} = \frac{X_L}{R} - \frac{3}{4}$

$\frac{X_L}{R} = \frac{16+9}{12} = \frac{25}{12}$

$X_L = \frac{25}{12} \times 12 = 25$

$X_L = \omega L = 25$

$L = \frac{1}{4}$H **Ans.**

27. When a metallic …………………….

Sol. $\frac{hc}{\lambda} = 5\,eV_0 + \phi$

$\frac{hc}{3\lambda} = eV_0 + \phi \Rightarrow \frac{2hc}{3\lambda} = 4eV_0 \Rightarrow \phi = \frac{hc}{6\lambda}$

28. A body of mass …………………….

Sol. $W_{ext} + W_{CF} = k_f - k_i$

$-10J + (-\Delta U) = \frac{1}{2}(2)(3)^2 - \frac{1}{2}2(5)^2$

$-10J - \Delta U = -16J$

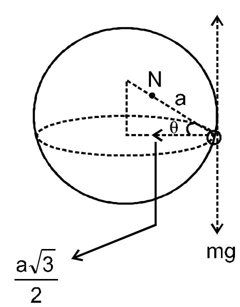
$\Delta U = 6$ J

Ans. **(B)**

29. A small bead …………………….

Sol. N sinθ = mg

N cosθ = $m\omega^2 \frac{a\sqrt{3}}{2}$



When friction in absent ;

∴ $\tan\theta = \frac{2g}{\omega^2 a\sqrt{3}} = \frac{1}{\sqrt{3}}$

$\omega = \left(\frac{2g}{a}\right)^{\frac{1}{2}}$

30. In Young's …………………….

Sol. Angular fringe width $\theta = \frac{b}{D} = \frac{l}{d}$

$\frac{l}{d_0} = \frac{1°}{60} = \frac{p}{180´\ 60}$

$d_0 = l\left(\frac{180´\ 60}{p}\right)$

$= 2 \times 10^{-3}$ m = 2mm.

PART-B : CHEMISTRY

31. A solution is prepared ....

Sol. $\frac{W_{urea}}{W_{water}} = \frac{0.2\times 60}{0.8\times 18} = \frac{5}{6}$

32. Decomposition of ....

Sol.

	$4A(g) \xrightarrow{\Delta} B(g) + 2C(g)$		
t = 0	800	–	–
t = 10 minute,	800 – 4p	p	2p
	800 – p = 650		
	$\therefore$ p = 150		

Pressure of A = 200, so

$\therefore$ 2 x $t_{1/2}$ = 10 minute ($t_{3/4} = 2 \times t_{1/2}$)

$t_{1/2}$ = 5 minute

33. Which of the following ....

Sol. (1) Due to chelate effect A is thermodynamically more stable.

(2) Cis isomer of $[Co(en)_2Cl_2]^+$ shows optical isomerism.

(3) $Co^{+3} = 3d^6$ $\quad t_{2g}^{2,2,2}e_g^{0,0}$

(4) (A) and (B) both are inner orbital complex.

34. For a gaseous reaction ....

Sol. $A + 3B \rightleftharpoons 2C$

$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$

$= -90 - 400 \times (-0.200)$

$= -90 + 80 = -10$ KJ.

$\therefore$ For $\frac{1}{2}A + \frac{3}{2}B \rightleftharpoons C$

$\Delta G^\circ = -5$ KJ

35. The incorrect ....

Sol. Theory based

36. The e.m.f. of a cell

Sol. E°_{cell} = 0.76 volt

Applying nernst equation

$$E_{cell} = E^\circ_{cell} - \frac{0.059}{2}\log\frac{[Zn^{2+}][P_{H_2}]}{[H^+]^2}$$

$$0.169 = 0.76 - \frac{0.059}{2}\log\frac{(0.1)(1)}{[H^+]^2}$$

$$\log\frac{0.1}{[H^+]^2} = \frac{2\times 0.59}{0.059}$$

or $\log 0.1 - \log [H^+]^2 = 20$

or $2pH = 20 - \log 0.1$

$$pH = \frac{21}{2} = 10.5$$

37. $Mn^{2+} + S_2O_8^{2-} + H_2O$ ....

Sol. $Mn^{2+} + S_2O_8^{2-} + H_2O \longrightarrow MnO_4^- + SO_4^{2-} + H^+$

38. The complex ....

Sol. (1) Fe^{2+} changes to brown-coloured ring complex by charge transfer.

(2) $NO \longrightarrow NO^+ + e^-$ $\quad Fe^{2+} + e^- \longrightarrow Fe^+$

(3) $Fe^+ \longrightarrow [Ar]$ $3d^7$: ⇅ ⇅ ↿ ↿ ↿

3 unpaired electrons

Magnetic moment = $\sqrt{n(n+2)}$

$= \sqrt{3\times 5} = \sqrt{15} = 3.87$ B.M.

(4) $\rightarrow$ $\quad sp^3d^2$ hybridisation

39. $(NH_4)_2Cr_2O_7$ on heating...........

Sol. $(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} N_2\uparrow + 4H_2O\uparrow + Cr_2O_3\downarrow$

(1) $NH_4Cl \xrightarrow{\Delta} NH_3\uparrow + HCl\uparrow$

(2) $CuSO_4.5H_2O \longrightarrow CuSO_4 + 5H_2O\uparrow$

(3) $Ba(N_3)_2 \xrightarrow{\Delta} Ba + 3N_2\uparrow$

(4) $NaNO_3 + Zn + OH^- \longrightarrow Zn^{2+} + NH_3\uparrow$

40. Total number of ....

Sol. $\sigma^*_{2p_x}$: 3 nodal plane

41. The graph of compressibility...........

Sol. $Z = 1 + \frac{Pb}{RT}$ (high pressure)

$\frac{dZ}{dP} = \frac{b}{RT} = \frac{1}{2.8}$

$b = \frac{RT}{2.8} = \frac{22.4}{2.8} = 4(N_A \times \frac{4}{3}\pi r^3)$

$(N_A \times \frac{4}{3}\pi r^3)$ =Volume of 1 mol gas molecules $= \frac{5.6}{2.8} = 2$

42. The total number of ....

Sol. $n^2 = 16$

43. 50 mL of 0.2 M ammonia ....

Sol.

$$NH_3 + HCl \longrightarrow NH_4Cl$$

	NH_3	HCl	NH_4Cl
Millimoles	10	5	0
finally	0	0	10

$[NH_4Cl] = \dfrac{10}{100} = 0.1$ M

$pH = 7 - \dfrac{1}{2}pK_b - \dfrac{1}{2}\log C$

$= 7 - 2.35 - \dfrac{1}{2}\log 10^{-1}$

$= 4.15$

44. An element has ....

Sol. $d = \dfrac{ZM}{a^3}$ (M in amu)

$2 = \dfrac{2\times M}{(3)^3}$

M = 27 amu

Mass of unit cell = 54 amu

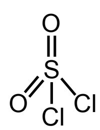
No. of unit cells = $\dfrac{216}{54} = 4$

45. Which of the following...........

Sol. Theory based

47. Which of the following...........

Sol. (1)



(2) 2 (pπ–dπ) bonds

No (pπ–pπ) bonds

(3) $P_4 + 10SO_2Cl_2 \longrightarrow 4PCl_5 + 10SO_2$

(4) $SO_2Cl_2 + H_2O \longrightarrow H_2SO_4 + HCl$

48. Let the plasma cell ....

Sol: In 0.7% solution no osmosis was there. Here the exerted extra pressure is osmotic pressure.

$NaCl \rightleftharpoons Na^+ + Cl^-$

Here van't Hoff factor $i = 1 + (2-1)\alpha = (1+\alpha)$

$\therefore \Delta T_f = \dfrac{K_f W_1 1000}{M_1 W_2}(1+\alpha)$

or, $(1+\alpha) = \dfrac{\Delta T_f M_1 W_2}{K_f W_1 1000} = \dfrac{0.418\times 58.5\times W_2}{1.86\times 1000\times W_1}$

as it is 0.7% solution of NaCl $\therefore \dfrac{W_2}{W_1} = \dfrac{99.3}{0.7}$

$\therefore (1+\alpha) = 1.86$

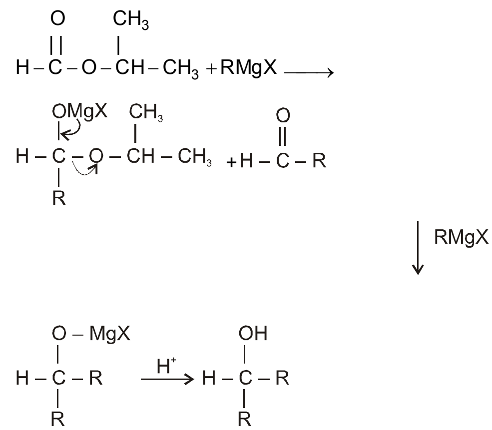
assuming dilute solution 100 gm H_2O = 100 mL H_2O

$\therefore \pi V = inRT$ or या $\pi = \dfrac{(1+\alpha)\times nRT}{V} = \dfrac{(1+\alpha)W_1RT}{M_1V}$

or $\pi = \dfrac{1.86\times 0.7\times 0.08\times 298}{58.5\times 0.1} = 5.30$ atm

49. When grignard reagent ....

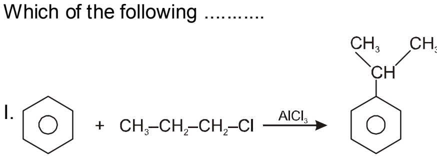
Sol.



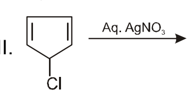
(2° Alcohol)

50. Which of the following ....

Sol. I.

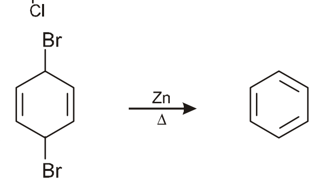


II.

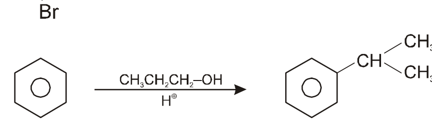


reaction not possible.

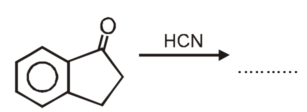
III.



IV.

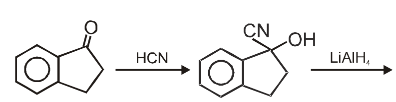


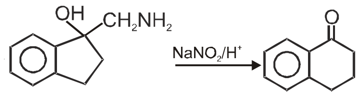
51.



....

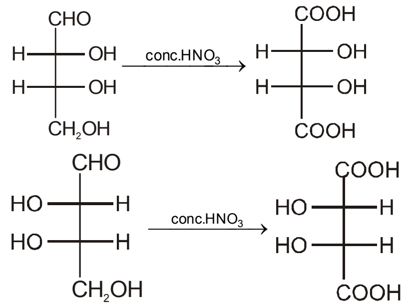
Sol.





52. An optically active ....

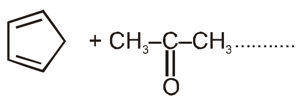
Sol.



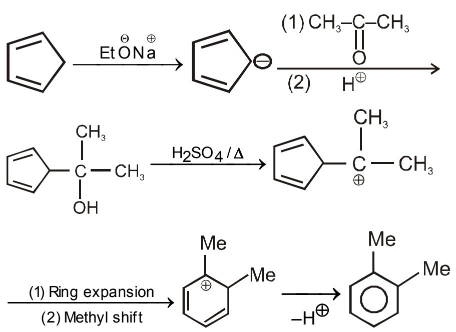
53. Consider the following ....

Sol. $Ph\text{–}COOH \xrightarrow{PCl_5} PhCOCl \xrightarrow{NH_3}$

$PhCONH_2 \xrightarrow{POCl_3\,/\,\Delta} PhCN \xrightarrow{H_2/Ni} PhCH_2NH_2$

54.  ....

Sol.

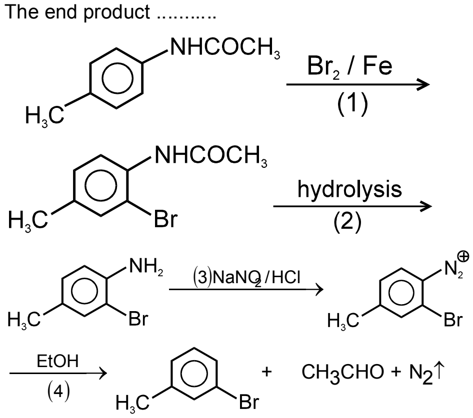


55. Which of the ....

Sol. Ascorbic acid is one form of vitamin C

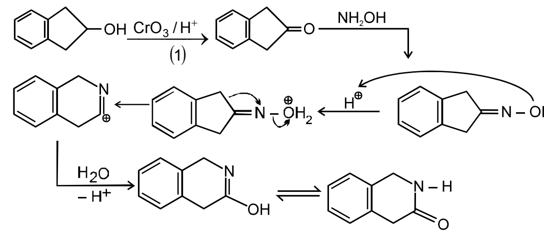
59. The end product ....

Sol.



60. The most probable ....

Sol.



PART-C : MATHEMATICS

61. The equation ………….

Sol. Let equation of plane be

$a(x - 1) + b(y - 2) + c(z - 3) = 0$ …….. (1)

$\because$ it contains z-axis

$\therefore a(-1) + b(-2) + c(-3) = 0$

$\Rightarrow a + 2b + 3c = 0$ ……… (3)

and $a.0 + b.0 + 1.c = 0$

$\Rightarrow c = 0$

$\therefore a = -2b$

$\therefore -2(x - 1) + y - 2 = 0$

$2x = y$

62. The value of………….

Sol. $I = \int_0^1 \frac{x^2 - 1}{x^2 + 1} dx + 2\int_0^1 \sqrt{\frac{1 - x}{1 - x}}\, dx$

$= 2\int_0^1 \frac{x^2 + 1 - 2}{x^2 + 1} dx + 2\int_0^1 \frac{1 - x}{\sqrt{1 - x^2}} dx$

$= 2\int_0^1 1\, dx - 4\int_0^1 \frac{1}{1 + x^2} dx + 2\int_0^1 \frac{1}{\sqrt{1 - x^2}} dx$

$+ \int_0^1 (1 - x^2)^{-1/2}(-2x)\, dx$

$= 2 - 4\times \frac{\pi}{4} + 2\times \frac{\pi}{2} + 2\left[\sqrt{1 - x^2}\right]_0^1$

$= 2 - \pi + \pi + 2[0 - 1] = 0$

63. If $A = \begin{bmatrix} 2 & 1 & -1 \\ 0 & 1 & 4 \\ 0 & 0 & 3 \end{bmatrix}$ ………….

Sol. $\because |A| = 6$

$\because adj(adj\ A) = |A|^{(n-2)} A = |A|\ A = 6A$

$\therefore tr(adj(adj\ A)) = tr(6A) = 6\ tr(A) = 6 \times 6 = 36$

64. Let w_1 and w_2 be………….

Sol. $\because$ A : Word selected contains two like letters together

E_1 : set w_1 is selected $P(E_1) = \frac{1}{2}$

E_2 : set w_2 is selected $P(E_2) = \frac{1}{2}$

$$P\left(\frac{A}{E_1}\right) = \frac{\frac{8!}{2!}+\frac{8!}{2!}-7!}{\frac{9!}{2!\,2!}} = \frac{8!-7!}{\frac{9!}{4}} = \frac{4(8\times7!-7!)}{9!}$$

$$= \frac{4\times7!\times7}{9\times8\times7!} = \frac{7}{18}$$

$$P\left(\frac{A}{E_2}\right) = \frac{7!}{\frac{8!}{2!}} = \frac{2}{8} = \frac{1}{4}$$

$$P(A) = P(E_1).\,P\left(\frac{A}{E_1}\right) + P(E_2)\,.\,P\left(\frac{A}{E_2}\right) = \frac{23}{72}$$

$\therefore$ (q – 3p) = 3

65. Let $\vec{a}, \vec{b}, \vec{c}$............

Sol. $\because [abc]^2 = \begin{vmatrix} \vec{a}.\vec{a} & \vec{a}.\vec{b} & \vec{a}.\vec{c} \\ \vec{b}.\vec{a} & \vec{b}.\vec{b} & \vec{b}.\vec{c} \\ \vec{c}.\vec{a} & \vec{c}.\vec{b} & \vec{c}.\vec{c} \end{vmatrix} = \frac{|\vec{a}|^2|\vec{b}|^2|\vec{c}|^2}{2}$

$\therefore |[a\ b\ c]| = \frac{|a||b||c|}{\sqrt{2}}$ $\therefore v = \frac{1}{6}|[a\ b\ c]|$

$= \frac{|a||b||c|}{6\sqrt{2}}$

$\because 4|a|^2 + 3|b|^2 + 2|c|^2 = 144$

$\because$ A.M $\geq$ G.M

$\Rightarrow \frac{4|a|^2+3|b|^2+2|c|^2}{3} \geq (4|a|^2 . 3|b|^2 . 2|c|^2)^{1/3}$

$(48)^3 \geq 4|a|^2.3|b|^2.2|c|^2$

$\therefore |a|^2 |b|^2 |c|^2 \leq 2(48)^2 \leq 2(48)^2$

$\therefore (|a|\ |b|\ |c|)_{max} = 8 \times 6\sqrt{2} = 48\sqrt{2}$

$\therefore v_{max.} = 8$

66. Let $S_n = \binom{n}{0}\binom{n}{1}$ +............

Sol. $\because S_n = {}^nC_0.\,{}^nC_{n-1} + {}^nC_1.\,{}^nC_{n-2} + \ldots\ldots + {}^nC_{n-1}\,.\,{}^nC_0$

$\therefore S_n = {}^{2n}C_{n-1}$ $\therefore S_{n+1} = {}^{2n+2}C_n$

$\therefore \frac{S_{n+1}}{S_n} = \frac{15}{4} \Rightarrow \frac{{}^{2n+2}C_n}{{}^{2n}C_{n-1}} = \frac{15}{4}$

$$\frac{(2n+2)!}{n!(n+2)!} \times \frac{(n-1)!(n+1)!}{(2n)!} = \frac{15}{4}$$

$\Rightarrow \frac{(2n+2)(2n+1)}{(n+2)n} = \frac{15}{4}$

$\Rightarrow 8(2n^2 + 2n + 1) = 15n^2 + 30n$

$\Rightarrow n^2 – 6n + 8 = 0 \Rightarrow$ sum = 6

67. Let p(x) be a real............

Sol. $p'(x) = \lambda(x – 2)(x – 4) = \lambda(x^2 – 6x + 8)$

$p(x) = \lambda(x^3/3 – 3x^2 + 8x) + \mu$

68. Let f and g be............

Sol. $\because \phi(x) = f^2(x) – g^2(x) \Rightarrow \phi'(x) = 2f(x)\,f'(x) – 2g(x)g'(x)$

$= 2f(x)\,g(x) – 2g(x)\,f(x) = 0$

$\Rightarrow f^2(x) – g^2(x)$ = constant (let k)

$\Rightarrow f^2(3) – g^2(3) = k$ $\because f(3) = 5 \therefore g(3) = f'(3) = 4$

$\Rightarrow 5^2 – 4^2 = k = 9$

$\therefore f^2(\pi) – g^2(\pi) = 9$

69. For each m $\in$ R............

Sol. $\because y = (m – 1)x + n + 2$

$\Rightarrow (y – (n + 2)) + (1 – m)x = 0$ .... (1)

for $\forall$ m $\in$ R (1) always pass through (0, n + 2)

$\therefore n + 2 = 3 \Rightarrow n = 1$

70. The absolute............

Sol. numerator = $\int_0^{\pi/2}(x\cos x\, e^{\sin x} + e^{\sin x})\,dx = [x e^{\sin x}]_0^{\pi/2}$

$= \frac{\pi}{2} \times e$

Denominator = $\int_0^{\pi/2}(x\sin x\, e^{\cos x} - e^{\cos x})\,dx$

$= (-x e^{\cos x})_0^{\pi/2} = -\frac{\pi}{2}$

71. The number of............

Sol. E, I, I, O R V S N

Case-1 : E I I V, O, R, S, N = 5! × 2! = 240

Case-1 : E I O V, I, R, S, N = 5! × 2! × 2! = 480

$\therefore$ total = 720

72. $\lim_{x\to0^-} \frac{|x|}{2\tan^{-1}x - \cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)}$ ....

Sol. $\lim\limits_{x \to 0^-} \dfrac{-x}{2\tan^{-1}x - (-2\tan^{-1}x)}$

$= -\dfrac{1}{4} \lim\limits_{x \to 0^-} \dfrac{x}{\tan^{-1}x} = -\dfrac{1}{4}$

73. If $4a^2 + 9b^2 + 16c^2$............

Sol. $\because 4a^2 + 9b^2 + 16c^2 - 6ab - 12bc - 8ca = 0$

$\dfrac{1}{2}[(2a - 3b)^2 + (3b - 4c)^2 + (4c - 2a)^2] = 0$

$\Rightarrow 2a = 3b = 4c = k$ (let)

$\Rightarrow a = \dfrac{k}{2}$; $b = \dfrac{k}{3}$; $c = \dfrac{k}{4}$

$\therefore \dfrac{2}{k}, \dfrac{3}{k}, \dfrac{4}{k}$ are in A.P.

$\therefore$ a, b, c are in the H.P.

74. If the variance............

Sol. Let 2, 4, 5, 6, 8, 17 is x_i

then 5, 11, 14, 17, 23, 50 can be represented by $(3x_i - 1)$

$\therefore$ required variance = 9 × 23.33

= 209.97

75. Equation of line............

Sol. $\because$ point of intersection of line and plane is (3, 2, 0)

Let a, b, c are dr's of line

$\therefore a + 3b - c = 0,\ 2a + b - c = 0$

$\Rightarrow \dfrac{a}{-3+1} = \dfrac{b}{-2+1} = \dfrac{c}{1-6} \Rightarrow \dfrac{a}{-2} = \dfrac{b}{-1} = \dfrac{c}{-5}$

$\Rightarrow \dfrac{a}{2} = \dfrac{b}{1} = \dfrac{c}{5}$

76. Let f(x) is continuous............

Sol. by using LMVT

$\dfrac{f(4) - f(2)}{4 - 2} = f'(c) \quad f'(c) \geq -3$

$\Rightarrow \dfrac{f(4) - f(2)}{2} \geq -3 \quad \Rightarrow \dfrac{f(4) - 10}{2} \geq -3$

$f(4) \geq 4$

77. If the range of............

Sol. $\because f'(x) = 4\cos 2x + 3\sin 2x - (a^2 + a - 7) \geq 0\ \forall\ x \in R$

$\Rightarrow -(a^2 + a - 7) + (4\cos 2x + 3\sin 2x) \geq 0\ \forall\ x \in R$

$\Rightarrow -(a^2 + a - 7) - 5 \geq 0$

$\Rightarrow a^2 + a - 7 + 5 \leq 0$

$a^2 + a - 2 \leq 0$

$a \in [-2, 1] \quad \therefore |p + q| = 1$

78. The area bounded............

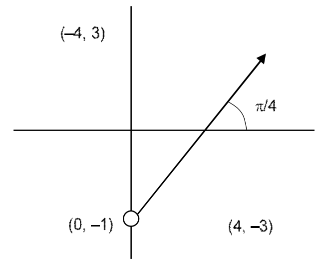
Sol. $\because f(x) = \cos^{-1}\left(\sin\left(\dfrac{\pi}{2} - 1 - [\sin x]\right)\right)$

$= \cos^{-1}(\cos(1 + [\sin x])) = 1 + [\sin x]$

$\because$ Required area = π sq.unit

79. If z lies on the............

Sol.



$|z - (-4 + 3i)| + |z - (4 - 3i)|$ will be minimum

when z, $-4 + 3i$, $4 - 3i$ are collinear

$\therefore$ minimum value $\sqrt{(4+4)^2 + (3+2)^2} = 10$

80. Let ABC be an............

Sol. $\because$ c,a,b are in A.P. $\therefore$ Let c = 14 – x and b = 14 + x

$\cos B = \dfrac{5}{13} = \dfrac{a^2 + c^2 - b^2}{2ac} \Rightarrow x = 1$

$\Rightarrow a = 14, b = 15, c = 13$

$\because r = \dfrac{\Delta}{s} = \dfrac{84}{21} = 4$

81. If α, β are roots............

Sol. let $\alpha = a$, $\beta = a + d$, $\gamma = a + 2d$, $\delta = a + 3d$

$\therefore \alpha + \beta = 2p \Rightarrow 2a + d = 2p\ \&\ \gamma + \delta = 2r$

$\Rightarrow 2a + 5d = 2r$

$\Rightarrow 2d = (r - p)\ \&\ 4a = (5p - r)$

$\therefore s - q = \gamma\delta - \alpha\beta = (a + 2d)(a + 3d) - (a)(a + d)$

$= 4ad + 6d^2 = r^2 - p^2$

82. A tangent to the............

Sol. Equation of chord of $\dfrac{x^2}{2} - \dfrac{y^2}{1} = 1$ whose mid point is

(x_1, y_1) is $\dfrac{xx_1}{2} - yy_1 = \dfrac{x_1^2}{2} - y_1^2$

$\because$ It is tangent to circle $x^2 + y^2 = 4$

$\therefore \left|\dfrac{-\left(\dfrac{x_1^2}{2} - y_1^2\right)}{\sqrt{\dfrac{x_1^2}{4} + y_1^2}}\right| = 2$

$\therefore$ locus $\left(\frac{x^2}{2}-y^2\right)^2 = 4\left(\frac{x^2}{4}+y^2\right)$

$\Rightarrow$ $(x^2 - 2y^2)^2 = 4(x^2 + 4y^2)$

$\therefore \lambda = 4$

83. An ellipse with............

Sol. The given two tangents are perpendicular and intersect at (1, 1)

$\therefore$ (1,1) lies on directors circle.

Let (h, k) be the centre of an ellipse

$\therefore \sqrt{(h-1)^2+(k-1)^2} = \sqrt{a^2+b^2} = \sqrt{4^2+3^2}$

$\Rightarrow$ $(x + y)^2 + (y - 1)^2 = 25$

84. If $(x + y^3)\frac{dy}{dx}$ = ...

Sol. $\because \frac{dx}{dy} = \frac{x+y^3}{y} = \frac{x}{y}+y^2$

$\frac{dx}{dy} - \frac{x}{y} = y^2$ $\quad\therefore$ I.F. $= \frac{1}{y}$

$\therefore x\left(\frac{1}{y}\right) = \frac{y^2}{2} + c$ $\quad\because y(0) = 2 \quad\therefore c = -2$

$x = \frac{y^3}{2} - 2y \Rightarrow y^3 - 2x - 4y = 0$ put x = 1

$y^3 - 4y - 2 = 0$

$\therefore$ sum of all possible value(s) of y is 0

85. Let A and B ....

Sol. $\because P(A \cup B) = P(A) + P(B) - P(A)P(B)$

$= \frac{1}{3} + \frac{1}{4} - \frac{1}{3} \times \frac{1}{4} = \frac{1}{2}$

$P(A \cup \overline{B}) = P(A) + P(\overline{B}) - P(A)P(\overline{B})$

$= \frac{1}{3} + \frac{3}{4} - \frac{1}{3} \times \frac{3}{4} = \frac{5}{6}$

$P\left(\frac{A}{A \cup \overline{B}}\right) = \frac{P(A \cap (A \cup \overline{B}))}{P(A \cup \overline{B})} = \frac{P(A)}{P(A \cup \overline{B})} = \frac{2}{5}$

$P(\overline{A} \cup B) = P(\overline{A}) + P(B) - P(\overline{A})P(B)$

$= \frac{2}{3} + \frac{1}{4} - \frac{2}{3} \times \frac{1}{4} = \frac{3}{4}$

86. Let $f : R \to R$............

Sol. $\because f(x) = x^3 + 2x^2 + 4x + \sin\left(\frac{\pi x}{2}\right)$ ....(i)

$\therefore f'(x) = 3x^2 + 4x + 4 + \frac{\pi}{2}\cos\left(\frac{\pi x}{2}\right)$

$\because g'(y) = \frac{1}{f'(x)}$ from equation (i) if y = 8 then x = 1

$\therefore g'(8) = \frac{1}{f'(1)} = \frac{1}{3+4+4} = \frac{1}{11}$

87. Equation............

Sol. $S_1 - S_2 = 0 \quad \Rightarrow 7x - 8y + 16 = 0$

$S_2 - S_3 = 0 \quad \Rightarrow 2x - 4y + 20 = 0$

$S_3 - S_1 = 0 \quad \Rightarrow 9x - 12y + 36 = 0$

On solving centre (8, 9)

Length of tangent = $\sqrt{S_1} = \sqrt{64+81-16+27-7}$

$= \sqrt{149}$ $= (x - 8)^2 + (y - 9)^2 = 149$

$= x^2 + y^2 - 16x - 18y - 4 = 0$

90. The number of............

Sol. $-101 \le 20p + 35 \le 101$

$-6.8 \le p \le 3.3$

$\therefore$ Number of integral values of p is 10

ALL INDIA OPEN TEST-1 (AIOT-1)
(JEE MAIN PATTERN)
TARGET : JEE (MAIN+ADVANCED) 2019

DATE : 23-12-2018 | SET-1 | COURSE CODE : JP, JF, JR, EP, EF, ER

ANSWER KEY

SET-1

PHYSICS

1.	(2)	**2.**	(1)	**3.**	(2)	**4.**	(4)	**5.**	(1)	**6.**	(2)	**7.**	(3)
8.	(1)	**9.**	(1)	**10.**	(3)	**11.**	(2)	**12.**	(1)	**13.**	(1)	**14.**	(2)
15.	(3)	**16.**	(1)	**17.**	(2)	**18.**	(4)	**19.**	(3)	**20.**	(4)	**21.**	(4)
22.	(4)	**23.**	(2)	**24.**	(2)	**25.**	(2)	**26.**	(4)	**27.**	(1)	**28.**	(2)
29.	(2)	**30.**	(1)										

CHEMISTRY

31.	(1)	**32.**	(2)	**33.**	(4)	**34.**	(2)	**35.**	(3)	**36.**	(4)	**37.**	(1)
38.	(4)	**39.**	(4)	**40.**	(3)	**41.**	(2)	**42.**	(3)	**43.**	(1)	**44.**	(3)
45.	(3)	**46.**	(2)	**47.**	(2)	**48.**	(3)	**49.**	(2)	**50.**	(2)	**51.**	(1)
52.	(2)	**53.**	(2)	**54.**	(1)	**55.**	(2)	**56.**	(4)	**57.**	(2)	**58.**	(4)
59.	(4)	**60.**	(4)										

MATHEMATICS

61.	(2)	**62.**	(4)	**63.**	(3)	**64.**	(2)	**65.**	(3)	**66.**	(2)	**67.**	(2)
68.	(4)	**69.**	(1)	**70.**	(1)	**71.**	(4)	**72.**	(4)	**73.**	(3)	**74.**	(3)
75.	(1)	**76.**	(4)	**77.**	(3)	**78.**	(1)	**79.**	(2)	**80.**	(3)	**81.**	(1)
82.	(2)	**83.**	(3)	**84.**	(3)	**85.**	(2)	**86.**	(3)	**87.**	(1)	**88.**	(4)
89.	(2)	**90.**	(3)										