FIITJEE **JEE(Main)-2019**

ALL INDIA TEST SERIES

ANSWERS, HINTS & SOLUTIONS
PART TEST – I
(Main)

Q. No.	PHYSICS	Q. No.	CHEMISTRY	Q. No.	MATHEMATICS
1.	A	31.	B	61.	B
2.	A	32.	C	62.	C
3.	A	33.	B	63.	A
4.	D	34.	B	64.	B
5.	A	35.	B	65.	A
6.	A	36.	C	66.	B
7.	B	37.	D	67.	D
8.	D	38.	B	68.	B
9.	D	39.	C	69.	C
10.	C	40.	D	70.	A
11.	A	41.	B	71.	D
12.	C	42.	A	72.	C
13.	B	43.	C	73.	C
14.	D	44.	D	74.	B
15.	D	45.	B	75.	D
16.	B	46.	B	76.	B
17.	C	47.	C	77.	D
18.	B	48.	C	78.	A
19.	A	49.	B	79.	A
20.	B	50.	B	80.	D
21.	A	51.	C	81.	C
22.	C	52.	A	82.	C
23.	A	53.	D	83.	B
24.	A	54.	C	84.	B
25.	A	55.	D	85.	C
26.	C	56.	B	86.	C
27.	A	57.	D	87.	B
28.	D	58.	C	88.	B
29.	B	59.	D	89.	B
30.	C	60.	C	90.	A

Physics

PART – I

SECTION – A

1. $\vec{v}_{rm} = \vec{v}_r - \vec{v}_m$

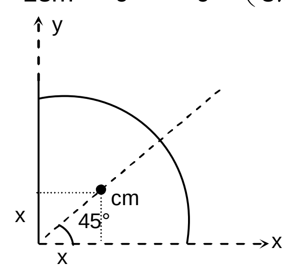
$$\frac{\int v_{rm}dt}{\int dt} = \frac{\int \vec{v}_r dt}{\int dt} - \frac{\int \vec{v}_m dt}{\int dt}$$

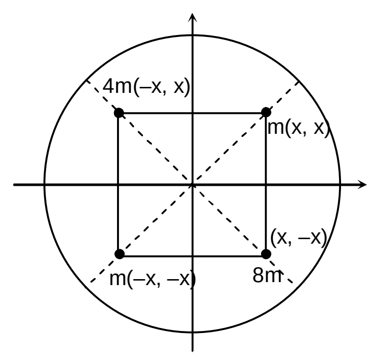
$< \vec{v}_{rm} > = \vec{v}_r - 0$.

2. $$x_{cm} = \frac{m(x) + 4m(-x) + 5m(-x) - 8m(x)}{m + 4m + 5m + 8m} = 0$$

$$y_{cm} = \frac{m(x) + 4m(x) + 5m(-x) + 8m(-x)}{18m}$$

$$= -\frac{8mx}{18m} = \frac{-4}{9}x = \frac{-4}{9} \times \left(\frac{4R}{3\pi}\right) = -\frac{16R}{27\pi}$$





3. Vector along the normal of plane is

$-\hat{i} - \hat{j}(1-b)$

Coefficient of $\hat{k}$ is zero always also it becomes $\hat{i}$ when b = 1.

4. $I_0 = Kmb^2$

$$I' = K.(m).\left(\frac{b}{2}\right)^2$$

$$I' = (Kmb^2)\frac{1}{4}$$

$$\Rightarrow \quad I' = \frac{I_0}{4}.$$

5. $$\frac{v\sqrt{3}}{2} = 50 \times \frac{4}{5} \Rightarrow v = \frac{80}{\sqrt{3}}$$

Now using conservation of mechanical energy

$$\frac{(80)^2}{3} - (50)^2 = -2gh$$

$$\Rightarrow \quad \frac{-6400 + 7500}{3} = 2gh$$

$\Rightarrow \quad \frac{1100}{3\times10\times2} = h \Rightarrow h = \left(\frac{55}{3}\right)m$

6. $v^2 + x = 10$
$2va + v = 0$
$\Rightarrow \quad a = -\frac{1}{2}ms^{-2}$

7. $p_1 = p_2$
$V_1 < V_2$
$\frac{p^2}{2m} = E$
$\Rightarrow \quad E_1 < E_2$

8. $I = k \,.\, ma^2$
$\Delta I = \frac{2kma^2.\Delta a}{a}$
$= \frac{2I.\Delta a}{a}$

9. Basic concept of FBD and equilibrium

10. Basic concept of pseudo force

11. $KE = \frac{1}{2}mv^2 = \frac{1}{2}\times5\times10^4\times10^2 = 2.5\times10^5 J$.
10% of this is stored in the spring.
$\frac{1}{2}kx^2 = 2.5\times10^4$
x = 1 m
$k = 5 \times 10^4$ N/m.

12. Basic concept of projectile

13. $X_{cm} = \frac{\lambda L^{n+2}}{(n+2)}.\frac{n+1}{\lambda L^{n+1}} = \frac{3L}{4}$.
$\frac{n+1}{n+2} = \frac{3}{4}$
n = 2

14. With equal initial kinetic energy, one can write for these rotating disks that KE = ½ $I\omega^2 = L^2/2I$. As a result L = $\sqrt{2I(KE)}$ which means $L_X < L_y$ as object Y has more mass. By applying the same force on the outside of each disk, the torque from the centre of each disk is the same. From the angular impulse momentum theorem, $(\tau)\Delta t = \Delta L$ and since the torques and times are equal, the change in angular momentum is the same for each. Consequently, $L_X < L_Y$ after the push as well. The kinetic energy depends on the total distance through which each force acted. Since disk X is rotating at a higher rate than disk Y and the applied force will increase the angular speed of each disk, there will be a greater angle swept out by a disk X compared to disk Y. As a result, the kinetic energy change for disk X is greater than for disk Y meaning that after the pus, $K_X > K_Y$.

15. $\vec{a}_{CM} = \dfrac{\vec{F}_{net}}{\Sigma mi}$

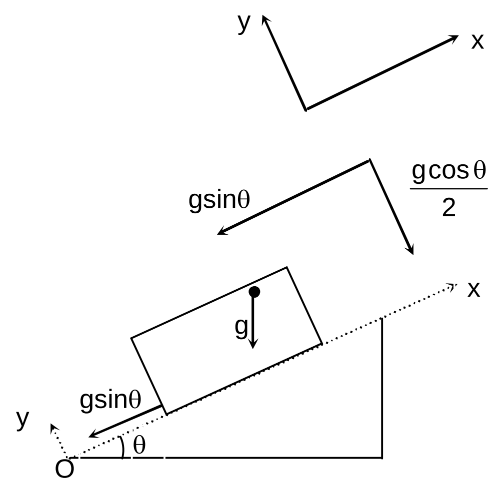
16. $\vec{a}_{Bg} = -g\sin\theta\,\hat{i} - \dfrac{g\cos\theta}{2}\hat{j} \Rightarrow$ Acceleration of box with respect to ground

$\vec{a}_{Pg} = -g\sin\theta\,\hat{i} - g\cos\theta\,\hat{j} \Rightarrow$ Acceleration of particle with respect to ground

$\vec{a}_{PB} = -\dfrac{g\cos\theta}{2}\hat{j} \Rightarrow$ Acceleration of particle with respect to Box

$\vec{u}_{PB} = u\cos 45^\circ\,\hat{i} + u\sin 45^\circ\,\hat{j} \Rightarrow$ Initial velocity of particle with respect to Box

Time of flight = $\dfrac{2u\sin 45^\circ}{\dfrac{g\cos\theta}{2}} = \dfrac{2\sqrt{2}u}{g\cos\theta}$



17. $A'P = \sqrt{2^2+1} = \sqrt{5}.$

$\Rightarrow \Delta h = \left(\sqrt{5}-1\right)$

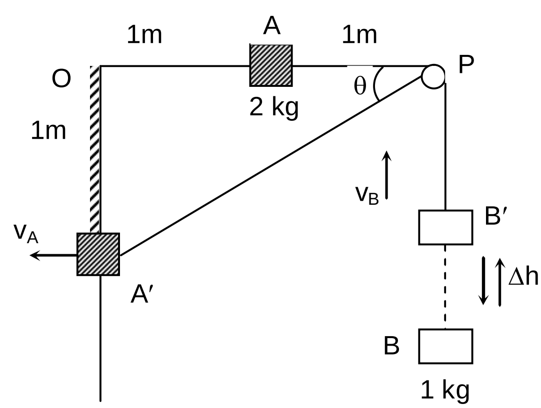
From work energy theorem :

$+2g\times 1 - 1\times g\Delta h = \dfrac{1}{2}2v_A^2 + \dfrac{1}{2}\times 1\times v_B^2$

Where $v_B = v_A\cos\theta;\ \cos\theta = \dfrac{2}{\sqrt{5}}$

On solving :

$7.5 = \dfrac{7}{5}v_A^2 \Rightarrow v_A = 2.3\text{ m/sec}.$



18. Bird has to fly away from wind direction as shown so as to reach P.

$\because V_{Bird} > V_{wind}$

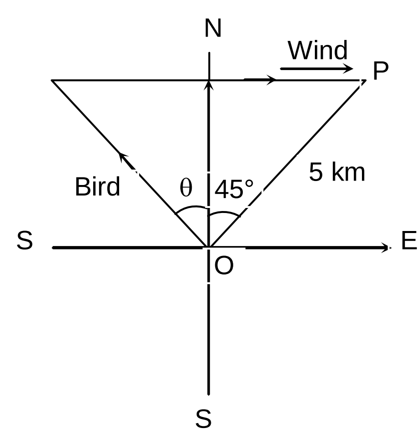
If t is time taken;

$\dfrac{5}{\sqrt{2}} \times \dfrac{1}{15\cos\theta} = t$ ...(i)

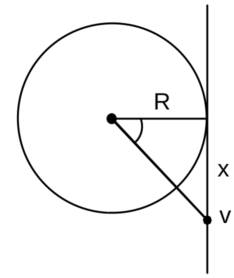
$\left(5 - 15\sin\theta\right)t = \dfrac{5}{\sqrt{2}}$ ...(ii)

Solving for t we get

$8t^2 + \sqrt{2}t - 1 = 0 \Rightarrow t = \left(\dfrac{\sqrt{34}-\sqrt{2}}{16}\right)$hrs.



19. $\frac{x}{R} = \tan\theta$



$x = R\tan\theta$

$\Rightarrow \frac{dx}{dt} = R\sec^2\theta\frac{d\theta}{dt} = R\omega\sec^2\theta$

$\Rightarrow v = R\omega\sec^2\theta$

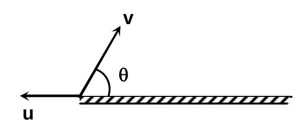
$\Rightarrow \frac{dv}{dt} = R\omega\left[2\sec\theta.\sec\theta\tan\theta\frac{d\theta}{dt}\right].$

$\Rightarrow a = 2R\omega^2\sec^2\theta\tan\theta$

$v = R(2)\sec^2 60^\circ = 2R(4) = 8R$

$a = 2(R)(4)(4)(\sqrt{3}) = 32\sqrt{3}R$

20. Let frog takes off at θ angle with v speed from ground frame



$v_P = \frac{mv\cos\theta}{3m} = \frac{v\cos\theta}{3}$

$\Rightarrow (\vec{v}_{f/P})_x = \vec{v}_f - \vec{v}_P = v\cos\theta + \frac{v\cos\theta}{3} = \frac{4}{3}v\cos\theta$

$(\vec{v}_{f/p})_y = v\sin\theta \Rightarrow R_{f/P} = \frac{2\left(\frac{4}{3}\right)v\cos\theta v\sin\theta}{g} = \ell$

$\Rightarrow v^2\sin 2\theta = \frac{3}{4}g\ell \quad \Rightarrow \quad v_{min} = \sqrt{\frac{3}{4}g\ell}$

21. $\hat{v}_i = \frac{2\hat{i} - 3\hat{j} + 4\hat{k}}{\sqrt{29}}$

$\hat{p} = \frac{3\hat{i} - 6\hat{j} + 2\hat{k}}{7}$

$\hat{v}_f = \vec{v}_i - 2(\hat{v}_i.\hat{p})\hat{p}$

$= \frac{2\hat{i} - 3\hat{j} + 4\hat{k}}{\sqrt{4+9+16}} - \frac{2(6+18+8)(3\hat{i} - 6\hat{j} + 2\hat{k})}{\sqrt{29}\times 49}$

$= \frac{-94\hat{i} + 237\hat{j} + 68\hat{k}}{49\sqrt{29}}$

22. Time of flight = $\frac{2\times 10}{10} = 2s$;

Range = 2 × 15 = 30 m

23. Area = $\frac{1}{2}\times 0.10\times 120 = 6$ Ns

Change in momentum = 6 – $400\times 10^{-3}\times 10\times 0.10$ (Due to Gravitation) = 6 – 0.4 = 5.6 Ns

mv = 5.6 $\Rightarrow$ v = 14 m/s

$H = \frac{v^2}{2g} = 9.8$ m

24. $\omega_r = v_0R$, and $\omega_z = \dfrac{v_0}{O'O}$

$OO' = R\cot\alpha$

$\vec{\omega} = \left[\omega_Z\hat{k} + \omega_r(-\hat{i})\right]$

$\therefore\ \vec{v}_A = \vec{\omega}\times\vec{r}_A = \vec{\omega}\times\left[R\cot\alpha(\hat{i}) + R(\hat{k})\right]$

$= \left[\dfrac{v_0}{R\cot\alpha}\hat{k} - \dfrac{v_0}{R}\hat{i}\right]\times\left[R\cot\alpha\,\hat{i} + R\hat{k}\right]$

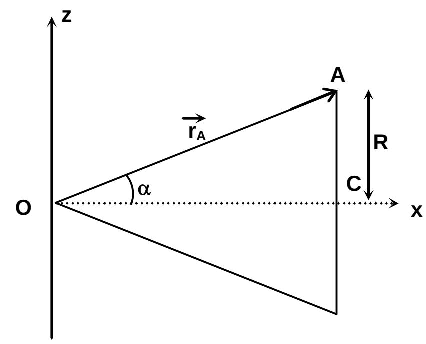
$\Rightarrow \vec{v}_A = (v_0 + v_0)\hat{i} = 2v_0\hat{i} \Rightarrow v_A = 2v_0$

Similarly, $\vec{v}_B = \vec{\omega}\times\vec{r}_B$

Where, $\vec{r}_B = R\cot\alpha\,\hat{i} - R\hat{j}$

$\Rightarrow\ \vec{v}_B = -v_0\hat{k} + \dfrac{v_0}{\cot\alpha}\hat{i} + v_0\hat{j}$

$\Rightarrow\ v_B = \sqrt{v_0^2 + \dfrac{v_0^2}{\cot^2\alpha} + v_0^2} = v_0\sqrt{2 + \tan^2\alpha}$



25. $a_1 = \dfrac{F_0}{m}\sin\omega t = \left(\dfrac{F_0}{m\omega^2}\right)\omega^2\sin\omega t = \omega^2R\sin\omega t$

$a_2 = \dfrac{F_0}{m}\cos\omega t = \left(\dfrac{F_0}{m\omega^2}\right)\omega^2\cos\omega t = \omega^2R\cos\omega t$

Here $R = \dfrac{F_0}{m\omega^2}$

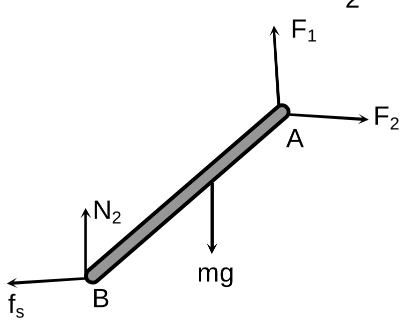
$v_1 = \dfrac{F_0}{m\omega}(1-\cos\omega t)$ & $v_2 = \dfrac{F_0}{m\omega}\sin\omega t \Rightarrow x_1 = R(\omega t - \sin\omega t)$ & $y_2 = R(1-\cos\omega t)$

$\langle v_1\rangle = \dfrac{F_0}{m\omega}$, and $\langle v_2\rangle = 0$

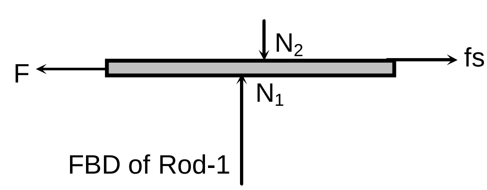
26. No external force is acting along horizontal direction

27. E = U + K, for a given E, k will be maximum where U will be minimum.

28. Taking torque about A $mg\dfrac{\ell}{2}\cos\alpha = f_s\ell\sin\alpha + N_2\ell\cos\alpha$



FBD of Rod-2



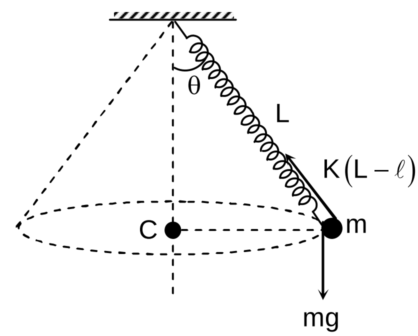
FBD of Rod-1

$\Rightarrow N_2 = \dfrac{mg}{2(1+\mu\tan\alpha)}$

$$F \ge f_s \Rightarrow F_{min} = f_{smax} = \mu N_2 \Rightarrow F_{min} = F_2 = \frac{\mu mg}{2(1+\mu \tan\alpha)} = \frac{0.5\times 3\times 10}{2(1+0.5\times 1)} = 5\,N$$

29.

$$mg = K(2\ell - \ell) = K\ell$$
$$K(L-\ell)\cos\theta = mg$$
$$\frac{mg}{\ell}(L-\ell)\frac{\sqrt{L^2-r^2}}{L} = mg$$
$$\Rightarrow \sqrt{L^2-r^2} = \frac{L\ell}{L-\ell}$$
$$\Rightarrow L^2 - \left(\frac{L\ell}{L-\ell}\right)^2 = r^2$$
$$\Rightarrow L^2\left(1-\frac{\ell^2}{(L-\ell)^2}\right) = r^2$$
$$\Rightarrow r^2 = L^2\left(\frac{L^2-2L\ell}{(L-\ell)^2}\right)$$
$$\Rightarrow r = \frac{L}{\sqrt{L-\ell}}\sqrt{L(L-2\ell)}$$



30.

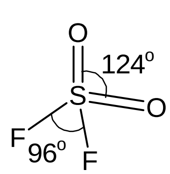
$$\frac{mv^2}{R} = mg\cos\theta \qquad \ldots(1)$$
$$\frac{1}{2}(M+m)v^2 = mg(1-\cos\theta)R + \frac{\pi R}{4}Mg \qquad \ldots(2)$$
$$\frac{1}{2}(M+m)g\cos\theta = mg(1-\cos\theta) + \frac{\pi Mg}{4}$$
$$\Rightarrow (M+m)\cos\theta = 2m(1-\cos\theta) + \frac{\pi}{2}M$$

Chemistry

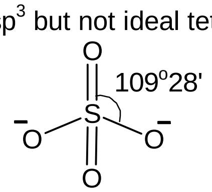
PART – II

SECTION – A

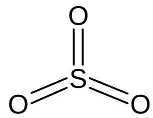
31.



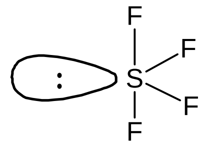
sp^3 but not ideal tetrahedral.



Ideal tetrahedral

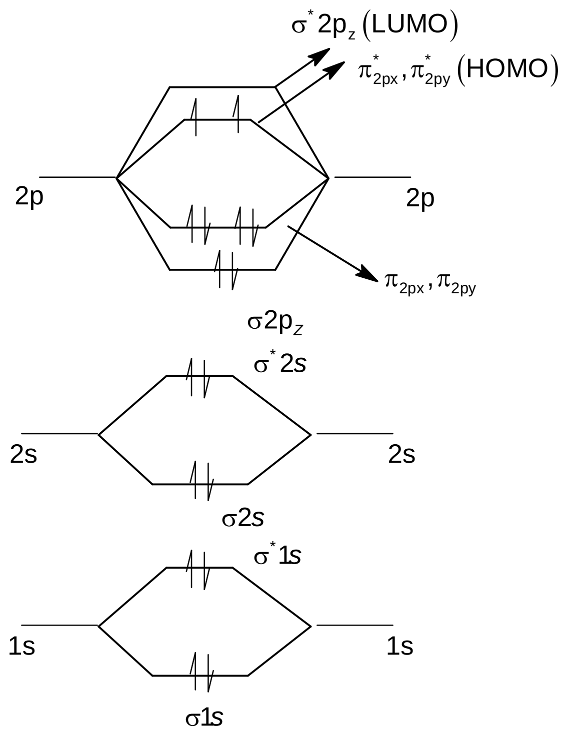


Trigonal planer



See-saw

33.



35.

$$S_8(g) \rightleftharpoons 4S_2(g)$$

$$C \qquad 0$$

$$C - C\alpha \qquad 4C\alpha$$

$$\frac{V.D_{initial}}{V.D_{eqm}} = \frac{(moles)_{eqm}}{(moles)_{initial}}$$

$$\frac{(32\times 8)/2}{96} = \frac{C - C\alpha + 4C\alpha}{C}$$

$$\Rightarrow \frac{4}{3} = 1 + 3\alpha$$

$$\Rightarrow \alpha = \frac{1}{9}$$

% decomposition $\frac{1}{9} \times 100 = 11.11\%$

36. 'Hf' form interstitial hydride, e.g. $HfH_{1.98}$
$\rightarrow$ KH is an ionic hydride
$\rightarrow$ SiH_4 is a covalent hydride
$\rightarrow$ 'Co' don't form hydride (hydride gap)

37. Actual boiling point order
$H_2S < H_2Se < H_2Te < H_2O$

38. On heating

$Na_2O_2 \xrightarrow{\Delta} Na_2O + \frac{1}{2}O_2$

$\Rightarrow Na_2O_2 \Rightarrow O_2^{2-} \Rightarrow$ it is diamagnetic in nature.

$\Rightarrow Na_2O_2 + CO_2 \longrightarrow Na_2CO_3$ (Suitable for use in air purification)

$\Rightarrow Na_2O_2$ is good oxidizing agent.

41. $\overset{+4}{S} \longrightarrow \overset{+6}{S} + 2e^-$ (Oxidation half reaction)

$Cr^{+6} + 3e^- \longrightarrow Cr^{+3}$ (Reduction half reaction)

$\therefore Na_2CrO_4$ is oxidizing agent

$\therefore$ Eq. wt. of Na_2CrO_4 (oxidizing agent) = M/3

42. $2CH_4(g) + 4H_2O(g) \rightleftharpoons 2CO_2(g) + 8H_2(g)$ … (i)

$CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g)$ … (ii)

Equation (i) – 2 × Equation (ii)

$2CH_4(g) + 2H_2O(g) \rightleftharpoons 2CO(g) + 6H_2(g)$ … (iii)

Equilibrium constant for Equation (iii) $= \frac{K_1}{K_2^2}$

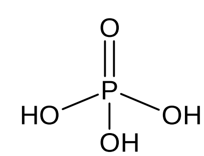
By multiplying Eq. (iii) by $\frac{1}{2}$ we get

$CH_4(g) + 4H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$

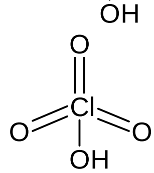
$\therefore$ Equilibrium constant $= \left(\frac{K_1}{K_2^2}\right)^{1/2} = \frac{\sqrt{K_1}}{K_2}$

43. Possible value of quantum number of 3d orbital.
$n = 3$, $\ell = 2$, $m = -2, -1, 0, +1, +2$
$s = +1/2, -1/2$

44.

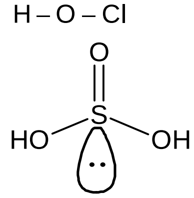


$n = 1$ $\quad pK_a \simeq 9 - 7 \times 1 = 2$



$n = 3$ $\quad pK_a \simeq 9 - 7 \times 3 = -12$

$H-O-Cl$ $\quad n = 0$ $\quad pK_a \simeq 9 - 7 \times 0 = 9$



$n = 1$ $\quad pK_a \simeq 9 - 7 \times 1 = 2$

45.

	n	P
D	1	1
O^{18}	10	8
H	0	1
x = 11		y = 10

x – y = 1

46. $\overset{+7}{Mn}O_4^- + \overset{+2}{M}^{2+} \longrightarrow \overset{+5}{M}O_3^- + \overset{+2}{Mn}^{2+}$

n-Factor of Mn = 5

n-Factor of M = 3

Number of equivalent of MnO_4^- = Number of M^{2+}

5 × mole of MnO_4^- = 3 × 2

$\therefore$ Mole of $MnO_4^- = \frac{6}{5} = 1.2$

47.

CH_3COONa	+ HCl	$\longrightarrow$ CH_3COOH	+ $NaCl$
400×0.05	100×0.2		
20 meq.	20 meq.	0	0
0	0	20 meq.	20 meq.

$$\therefore [CH_3COOH] = \frac{20}{500} = 0.04 \text{ M}$$

$$pH = \frac{1}{2}(pK_a - \log C) = \frac{1}{2}(4.75 - \log(0.04))$$

$$= \frac{1}{2}\left(4.75 - \log\left(\frac{1}{25}\right)\right)$$

$$= \frac{1}{2}(4.75 + \log(25))$$

$$= \frac{1}{2}(4.75 + 1.4) = 3.075$$

48. Uncertainty in velocity

$$\Delta v = \frac{0.2 \times 200}{100} = 0.4 \text{ ms}^{-1}$$

$$\Delta x.\Delta p \ge \frac{h}{4\pi}$$

$$\Delta x \ge \frac{h}{4 \times m \times \pi \times \Delta v}$$

$$= \frac{6.4 \times 10^{-34}}{4 \times 50 \times 10^{-3} \times 0.4 \times 3.2}$$

$$= \frac{10^{-34}}{40 \times 10^{-3}} = 2.5 \times 10^{-33}$$

49. $$k = \frac{2.303}{t}\log\left(\frac{A_0}{A_t}\right)$$

$$\log\left(\frac{A_0}{A_t}\right) = \frac{k.t}{2.303} = \frac{4.606 \times 10^{-5} \times 4 \times 3600}{2.303}$$

$= 2 \times 4 \times 3600 \times 10^{-5}$
$= 0.288$
$\left(\frac{A_0}{A_t}\right)$ = Anti log (2.88)
$= 1.94$
Fraction remain $= \frac{A_t}{A_0} = \frac{1}{1.94}$
Fraction decomposed $= 1 - \frac{1}{1.94}$
$0.4845 \simeq .48$

50.

$$NH_4SH(s) \rightleftharpoons NH_3(g) + H_2S(g)$$

At eqm P P
$P_{total} =$ 2P
$K_P = P^2$
When H_2S is added
$$NH_4SH(s) \rightleftharpoons NH_3(g) + H_2S(g)$$
$$\left(P'_{NH_3}\right) \quad \left(P'_{H_2S}\right)$$
According to question
$P'_{H_2S} = \frac{3}{2} \times P_{total} = \frac{3}{2} \times 2P = 3P$
$K_P = P'_{H_2S}.P'_{NH_3}$
$P^2 = P'_{NH_3}.3P$
$\therefore P'_{NH_3} = \frac{P}{3}$
$\therefore \frac{P'_{NH_3}}{P_{NH_3}} = \frac{\frac{P}{3}}{P} = 1:3$

51.

	Na_2CO_3	+ HCl $\longrightarrow$	$NaHCO_3$	$+ NaCl$
m.eq. initial	$\frac{2.12}{106} \times 1000$	20×0.5	0	0
	20 m.eq.	10 m.eq.		
m.eq. after mixing	10 m.eq.	0	10 m.eq.	10 m.eq.

Now,
Mixture contains Na_2CO_3 and $NaHCO_3$ so it will acts as buffer.
$\therefore pH = pK_a + \log\frac{[Na_2CO_3]}{[NaHCO_3]}$
$= 10.25 + \log 10/10 = 10.25$

52. Moles of $CaSO_4$ in 200 ml solution $= \frac{0.34}{136} = 0.25 \times 10^{-2}$

$\therefore$ Molarity $= \frac{0.25 \times 10^{-2}}{200} \times 1000$
$= 1.25 \times 10^{-2}$ mol/lit.

$K_{sp} = \left[Ca^{2+}\right]\left[SO_4^{2-}\right]$
$= \left(1.25 \times 10^{-2}\right)^2$
$= 1.5625 \times 10^{-4}$

53. $t_{2/3}rd - t_{1/3}rd = \frac{2.303}{K}\log\left(\frac{A_0}{1/3A_0}\right) - \frac{2.303}{K}\log\frac{A_0}{\frac{2}{3}A_0}$
$= \frac{2.303}{K}\log 2$
$\Rightarrow 100 \text{ min} = \frac{0.693}{K} \Rightarrow$ half life
$\therefore$ Time taken for completion of 75% $\left(2t_{1/2}\right) = 2 \times 100 = 200$ min

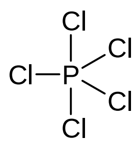
54. Cr^{+x} $\mu = 3.87$
$\sqrt{n(n+2)} = 3.87$
$\Rightarrow \therefore n = 3$ (unpaired e^-)
$\therefore Cr^{+3} \Rightarrow x = 3$ $\therefore y = 4\left(Mn^{+4}\right)$
$\sqrt{n(n+2)} = 3.87$
$\Rightarrow \therefore n = 3$ (unpaired e^-)
$\therefore Mn^{+4}$
$\therefore x = 3 \quad y = 4$
$x - y = -1$

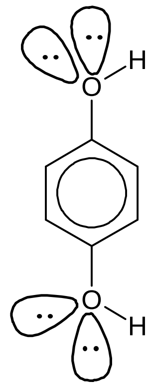
55. Rate of disappearance of ‘A’ $= -\frac{\Delta[A]}{\Delta t} = \frac{4 \times 10^{-2}}{40} = 10^{-3}$ mol L^{-1} s^{-1}

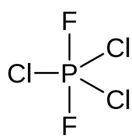
We know
$-\frac{1}{2}\frac{\Delta[A]}{\Delta t} = \frac{1}{2}\frac{\Delta[B]}{\Delta t} = \frac{1}{4}\frac{\Delta[C]}{\Delta t}$
$\therefore$ Rate of appearance of ‘C’
$\Rightarrow \frac{\Delta[C]}{\Delta t} = -2\frac{\Delta[A]}{\Delta t}$
$= 2 \times 10^{-3}$ mol L^{-1} s^{-1}

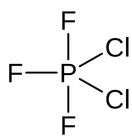
56. Here $\Delta n = -ve$
$\therefore$ By adding inert gas backward reaction favoured
$\Rightarrow$ By adding D(g) backward reaction takes place.

57.


$\mu = 0$


$\mu \neq 0$


$\mu = 0$

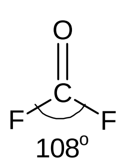

$\mu \neq 0$

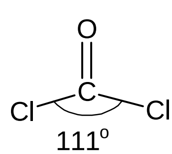
58. Mass of ${}^{2}_{1}H$ = Mass of ${}^{1}_{1}H$ + mass of neutron
= 1.0086 + 1.0078
= 2.0164 amu
Actual mass = 2.0064 amu
$\therefore$ mass defect = 2.0164 – 2.0064
= 0.01 amu.
$\therefore$ Bond Energy = 0.01 × 931.5 Mev
= 9.315 Mev.

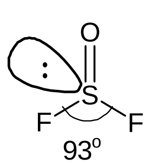
59.

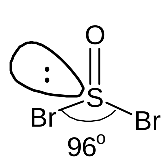
	Diamond	Graphite
Resistivity	10^{11}	1.375×10^{-5}
Standard molar entropy	2.377	5.740
Density	3.513	2.260

60.









Mathematics PART – III

SECTION – A

61. If $\lim_{x\to a} f(x) = \ell$ and $\lim_{x\to a} g(x) = m \Rightarrow \lim_{x\to a} f(x)\cdot g(x) = \ell m$

62. Volume = $\pi\cdot 3^2\cdot 2\cdot 3 = 54\pi$

63. $(p \wedge q) \Leftrightarrow (r \wedge q)$ is equivalent to $[\sim(p \wedge q) \vee (r \wedge q)] \wedge [\sim(r \wedge q) \vee (p \wedge q)]$

64. $y = x \Rightarrow f(x + x^2) + 1 + 2x = f(x) + f(x^2) + 2x\, f(x)$
$y = -x \Rightarrow f(x + x^2) + 1 + 2x = f(x) + f(x^2) + 2x\, f(-x)$
$\Rightarrow f(x) = f(-x)$

65. $$\int \frac{x^{18} - 1\,dx}{x^7\left(x^{12} + 3 + 2x^{-6}\right)^{1/6}} = \frac{1}{12}\int \frac{12x^{11} - 12x^{-7}dx}{\left(x^{12} + 3 + 2x^{-6}\right)^{1/6}}$$
$$= \frac{1}{12}\cdot\frac{\left(x^{12} + 3 + 2x^{-6}\right)^{5/6}}{5/6} + c = \frac{\left(x^{18} + 3x^6 + 2\right)^{5/6}}{10x^5} + c$$
$\Rightarrow P(x) = x^{18} + 3x^6 + 2$

66. $$f'(x) = \lim_{h\to 0} \frac{f(x)e^h + f(h)e^x + 2xhe^xe^h - f(x)}{h}$$
$\Rightarrow f'(x) = f(x) + 2xe^x \Rightarrow f(x) = x^2e^x$

67. One of them has to be maxima and other minima

68. There are only 2 points where f(x) has local minima

69. Area = $\int_0^{x_1} \tan x - x^{1000}dx + \int_{x_1}^{x_2} x^{1000} - \tan x\, dx$

70. Circle is circumcircle of the triangle

71. $a_{n+1} = a_n + a_{n-1}$
$$\Rightarrow \lim_{n\to\infty}\frac{a_{n+1}}{a_n} = 1 + \lim_{n\to\infty}\frac{a_{n-1}}{a_n}$$
Let $\lim_{n\to\infty}\frac{a_{n+1}}{a_n} = \ell$
$\Rightarrow \ell^2 - \ell - 1 = 0$
$$\Rightarrow \ell = \frac{1+\sqrt{5}}{2}$$

72. $f^{-1}(x) = g(x) \Rightarrow h(x) = x$

73. $$3x^4\frac{\left(2xydx - x^2dy\right)}{y^2} = 2y^2\frac{\left(xdy + ydx\right)}{xy} \Rightarrow 3\left(\frac{x^2}{y}\right)^2 d\left(\frac{x^2}{y}\right) = 2\frac{d(xy)}{xy}$$

74. Apply chain rule

75. f(x) is constant function

76. cot $\alpha > 0$

77. $\frac{dy}{dx} = \pm 1 \Rightarrow y + x = 0, y - x = 0$

78. $\frac{d^2y}{dx^2} = 4$

79. Substitute x = r sec θ. y = r tan θ

$$\Rightarrow \frac{rdr}{r^2 \sec\theta d\theta} = \frac{1}{2}\cos(\sin\theta)\cos^2\theta$$

$$\Rightarrow \ell n|r| = \frac{1}{2}\sin(\sin\theta) + \frac{\ell nc}{2}$$

$$\Rightarrow \ell n\left|x^2 - y^2\right| = \sin\left(\frac{y}{x}\right) + \ell nc$$

80. $$\lim_{m\to\infty}\sum_{n=1}^{m}\left(\int_{\pi/6}^{\pi/2} f^n(x) + \int_{(3/\pi)^n}^{(2/\pi)^n}\left(f^{-1}(x)\right)^{1/n} dx\right)$$

$$= \lim_{m\to\infty}\sum_{n=1}^{m}\left(\frac{\pi}{2}\cdot\left(\frac{2}{\pi}\right)^n - \frac{\pi}{6}\left(\frac{3}{\pi}\right)^n\right) = \frac{\frac{\pi}{2}\cdot\frac{2}{\pi}}{1-\frac{2}{\pi}} - \frac{\frac{\pi}{6}\cdot\frac{3}{\pi}}{1-\frac{3}{\pi}} = \frac{\pi}{\pi-2} - \frac{\pi}{2\pi-6}$$

81. h(x) is a constant function and is always periodic

82. $$\lim_{x\to 0}\left(\frac{a\frac{\sin 2x}{2x} - x^x\cdot\frac{x}{2x}}{\frac{\ell n(1+2x)}{2x}}\right)^{\frac{2}{x+1}} = \frac{9}{4}$$

$$\left(\frac{a-\frac{1}{2}}{1}\right)^2 = \frac{9}{4} \Rightarrow a = 2$$

83. $$\int e^{x^2+x}\left(4x^3 + 4x^2 + 5x + 1\right)dx = \int e^{x^2+x}\left((2x+1)\left(2x^2+x\right) + 4x + 1\right)dx = e^{x^2+x}\left(2x^2+x\right) + c$$

84. For $\lim_{x\to\infty} f(x)$ to exist, $\lim_{x\to\infty} f'(x)$ must be 0

85. $$\lim_{x\to\infty}\frac{\sum_{r=1}^{2018}\left(1+\frac{r}{x}\right)^{2019}}{\prod_{r=1}^{2019}\left(1+\frac{r}{x}\right)} = 2018$$

86. $x = 2020\pi$, 2π are points of non-differentiability

87. $x = \frac{1}{e}$ is point of global minima

$\Rightarrow 1 > \frac{1}{b} > \frac{1}{e} \Rightarrow b = 2$

88. Let $I = \int_0^\infty \frac{\tan^{-1} x}{(x+1)^2} dx$

Let $x = \frac{1}{t} \Rightarrow I = \int_0^\infty \frac{\cot^{-1} t}{(t+1)^2} dt$

$\Rightarrow I = \frac{1}{2}\frac{\pi}{2}\int_0^\infty \frac{1}{(x+1)^2} dx = \frac{\pi}{4}$

89. If f(x) is differentiable, then f′(x) should have a unique value at that point

90. If $n(P \cup M \cup C) = 100 \Rightarrow n(M' \cap C') \le 0 \Rightarrow n(M' \cap C') = 0$