SAFE HANDS & IIT-ian's PACE

EDT-04 (NEET) SOLUTIONS

1. (d)
Sol. Angular acceleration (α) = rate of change of angular speed

$$= \frac{2\pi(n_2 - n_1)}{t} = \frac{2\pi\left(\frac{4500 - 1200}{60}\right)}{10}$$

$$= \frac{2\pi\frac{3300}{60}}{10} \times \frac{360}{2\pi}\frac{degree}{sec^2} = 1980\ degree/sec^2.$$

2. (d)
Sol. Angular acceleration

$$\alpha = \frac{d^2\theta}{dt^2} = \frac{d^2}{dt^2}(at + bt^2 + ct^3) = 2b + 6ct$$

3. (a)
Sol. Distance covered by wheel in 1 rotation = $2\pi r = \pi D$

(Where D= 2r = diameter of wheel)

$\therefore$ Distance covered in 2000 rotation

= 2000 πD = $9.5 \times 10^3 m$ (given)

$\therefore D = 1.5\ meter$

4. (d)
Sol. Angular acceleration

$$\alpha = \frac{\omega_2 - \omega_1}{t} = \frac{60 - 0}{5} = 12 rad/sec^2$$

Now from $\theta = \omega_1 t + \frac{1}{2}\alpha t^2 = 0 + \frac{1}{2}(12)(5)^2 = 150\ rad.$

5. (c)
Sol. Angular displacement in first one second

$\theta_1 = \frac{1}{2}\alpha(1)^2 = \frac{\alpha}{2}$ ......(i) [From $\theta = \omega_1 t + \frac{1}{2}\alpha t^2$]

Now again we will consider motion from the rest and angular displacement in total two seconds

$\theta_1 + \theta_2 = \frac{1}{2}\alpha(2)^2 = 2\alpha$ ......(ii)

Solving (i) and (ii) we get $\theta_1 = \frac{\alpha}{2}$ and $\theta_2 = \frac{3\alpha}{2}$

$\therefore \quad \dfrac{\theta_2}{\theta_1} = 3$.

6. (b)

Sol. Moment of inertia of disc about a diameter $= \frac{1}{4}MR^2 = I$ (given) $\therefore \; MR^2 = 4I$

Now moment of inertia of disc about an axis perpendicular to its plane and passing through a point on its rim

$= \frac{3}{2}MR^2 = \frac{3}{2}(4I) = 6I$.

7. (b)

Sol. $\vec{F} = (2\hat{i} - 4\hat{j} + 2\hat{k})N$ and $\vec{r} = (3i + 2 - 4\hat{k})$ meter

Torque $\vec{\tau} = \vec{r} \times \vec{F} \; = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & 2 & -4 \\ 2 & -4 & 2 \end{vmatrix}$

$\Rightarrow \vec{\tau} = -12\hat{i} - 14\hat{j} - 16\hat{k}$

and $|\vec{\tau}| = \sqrt{(-12)^2 + (-14)^2 + (-16)^2}$ = 24.4 N-m

8. (a)

Sol. $\vec{L} = \vec{r} \times \vec{p} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 2 & -1 \\ 3 & 4 & -2 \end{vmatrix} = 0\hat{i} - \hat{j} - 2\hat{k} = -\hat{j} - 2\hat{k}$

and the X- axis is given by $i + 0\hat{j} + 0\hat{k}$

Dot product of these two vectors is zero i.e. angular momentum is perpendicular to X-axis.

9. (c)

Sol. Initial angular momentum of bullet + initial angular momentum of cylinder

= Final angular momentum of (bullet + cylinder) system

$\Rightarrow \; mvr + I_1\omega = (I_1 + I_2)\omega'$

$\Rightarrow mvr + I_1\omega \; = \left(\frac{1}{2}Mr^2 + mr^2\right)\omega'$

$\Rightarrow 0.5 \times 5 \times 0.2 + 0.12 = \left(\frac{1}{2}2(0.2)^2 + (0.5)(0.2)^2\right)\omega'$

$\therefore \quad \omega' = 10.3$ rad/sec.

10. (d)

Sol. Rotational kinetic energy $\frac{1}{2}I\omega^2 = \frac{1}{2}\left(\frac{1}{2}MR^2\right)\omega^2$

$= \frac{1}{2}\left(\frac{1}{2}\times 10\times (0.5)^2\right)(20)^2 = 250\ J$

11. (c)

Sol. $P = \tau\omega \Rightarrow \tau = \frac{100\times 10^3}{2\pi\frac{1800}{60}} = 531\ N\text{-}m$

12. (a)

Sol. $v = \sqrt{\frac{2gh}{1+\frac{k^2}{R^2}}} = \sqrt{\frac{2\times 9.8\times l\sin\theta}{1+\frac{2}{5}}}$

[As $\frac{k^2}{R^2} = \frac{2}{5}$, $l = \frac{h}{\sin\theta}$ and $\sin\theta = \frac{1}{10}$ given]

$\Rightarrow v = \sqrt{\frac{2\times 9.8\times 1.4\times\frac{1}{10}}{7/5}} = 1.4\ m/s.$

13. (a)

Sol. $\tau = \frac{dL}{dt} = \frac{4A_0 - A_0}{4} = \frac{3A_0}{4}$

14. (b)

Sol. $\tau = \frac{P}{\omega} = \frac{200\times 746}{600\times\frac{2\pi}{60}} = 237\text{N}-\text{m}$.

15. (b)

Sol. $I = MR^2 + 50\ m\ \frac{l^2}{3}$

$= 1(0.4)^2 + \frac{50(5\times 10^{-3})}{3}\left(\frac{0.4}{3}\right)^2$

$= 0.16\left[1+\frac{0.25}{3}\right] = 0.174\text{Kgm}^2$

16. (c)

Sol. Moment of inertial of the disc about the axis of rotation is

$$I = \frac{mR^2}{4} + mR^2 = \frac{5}{4}mR^2$$

$\therefore$ Kinetic energy of the disc = $\frac{1}{2}I\omega^2 = \frac{1}{2}\frac{5}{4}mR^2\omega^2 = \frac{5}{8}\times 2\times(0.1)^2\times(10)^2 = 1.25$ J

(C) is correct.

17. (d)

Sol. K.E. = $\frac{1}{2}I\omega^2 \Rightarrow$ K.E. $\propto \omega^2$ % increase K.E.

$$= \frac{KE_f - KE_i}{KE_i} \times 100$$

$$= \frac{5^2 - 4^2}{4^2} \times 100$$

$$= \frac{9}{16} \times 100 = 56\%$$

18. (c)

Sol. $\frac{KE_{Rot.}}{KE_{Total}}$

$$\frac{\frac{1}{2}mv^2\frac{K^2}{R^2}}{\frac{1}{2}mv^2\left(1+\frac{K^2}{R^2}\right)}$$

$$\frac{K^2/R^2}{1+\frac{K^2}{R^2}}$$

$$= \frac{2/5}{1+2/5}$$

19. (c)

Sol. Let M and R be the mass and radius respectively. Moment of inertia of a ring about any of its diameter is. $I_{ring} = \frac{1}{2}MR^2$

Moment of inertia of a disc about any of its diameter is

$$I_{disc} = \frac{1}{4}MR^2$$

Moment of inertia of a hollow sphere about any of its diameter is.

$I_{hollow\,sphere} = \frac{2}{3}MR^2$

Moment of inertia of a solid sphere about any of its diameter is.

$I_{solidsphere} = \frac{2}{5}MR^2$

Thus, $I_{\text{hollow sphere}}$ is largest.

20. (b)

Sol. From above solution

$\alpha = 25\,\text{rad}\,s^{-2}$

Linearacceleration,

$a = \alpha R = (25\,\text{rad}\,s^{-2})(40\times10^{-2}\,m)$

$= 10\,m\,s^{-2}$

21. (b)

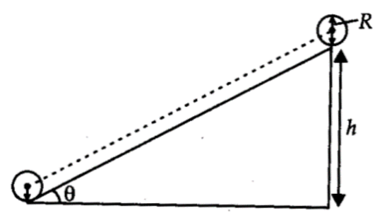
Sol. $K_R = \frac{L^2}{2I}$

22. (a)

Sol. According to law of conservation of angular momentum, if the net torque action on the body is zero, then the total angular momentum of the body is zero.

23. (c)

Sol.



According to conservation of mechanical energy,

$mgh = \frac{1}{2}mv^2\left(1+\frac{K^2}{R^2}\right)$

or $v^2 = \left(\frac{2gh}{1+\frac{k^2}{R^2}}\right)$

Note: It is independent of the mass of the rolling body for a ring, $k^2 = R^2$

$v_{ring} = \sqrt{\frac{2gh}{1+1}} = \sqrt{gh}$

For a solid cylinder, $k^2 = \frac{R^2}{2}$

$$v_{cylinder} = \sqrt{\frac{2gh}{1+\frac{1}{2}}} = \sqrt{\frac{4gh}{3}}$$

For a solid sphere, $k^2 = \frac{2}{5}R^2$

$$v_{sphere} = \sqrt{\frac{2gh}{1+\frac{2}{5}}} = \sqrt{\frac{10gh}{7}}$$

Among the given three bodies the solid sphere has the greatest and the ring has the least velocity at the bottom of the inclined plane.

24. (d)

Sol. Rotational kinetic energy is,

$$K_R = \frac{1}{2}I\omega^2 = \frac{1}{2}Mk^2\left(\frac{v}{R}\right)^2 \quad (\because I = Mk^2 \text{ and } v = R\omega) = \frac{1}{2}Mv^2\left(\frac{k^2}{R^2}\right)$$

Translational kinetic energy is,

$$K_T = \frac{1}{2}Mv^2$$

As per question, $K_R = 40\% k_T$

$$\therefore \frac{1}{2}Mv^2\left(\frac{k^2}{R^2}\right) = 40\% \frac{1}{2}Mv^2 \quad \text{or} \quad \frac{k^2}{R^2} = \frac{40}{100} = \frac{2}{5} \text{For solid sphere, } \frac{K^2}{R^2} = \frac{2}{5}$$

Hence, the body is solid ball.

25. (b)

Sol. Force of friction, $f = Mg\sin\theta - Ma$

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

26. (c)

Sol. Angular momentum will be conserved if $\tau = 0$

i.e. $\vec{r} \times \vec{F} = 0$

$$\frac{a}{2} = \frac{3}{-6} = \frac{6}{-12}$$

$\therefore a = -1$

27. (a)

Sol. Let the force producing impulse J is F then

$$F \times h = \frac{2}{5} mR^2 \times \alpha$$

and F = ma (where a = Rα)

$$\therefore \; mah = \frac{2}{5} mRa \;\; \Rightarrow h = \frac{2}{5} R$$

Also impulse = change in momentum

or J = Mv

28. (d)

Sol. $a_t = \alpha_A r_A = \alpha_C r_C$

$$\alpha_C = \alpha_A \left(\frac{r_A}{r_C}\right) = 1.6 \times \frac{10}{25} = 0.64 \text{ rad/s}^2$$

$$t = \frac{\omega_C}{\alpha_C} = \frac{\frac{100 \times 2\pi}{60}}{0.64} = 16.35 \text{ sec.}$$

29. (c)

Sol. When body slides, $v = \sqrt{2gh}$ ....(1)

When ring rolls, $v' = \sqrt{\frac{2gh}{1 + k^2/r^2}} = \sqrt{\frac{2gh}{2}} = \frac{v}{\sqrt{2}}$

30. (b)

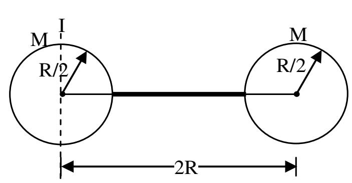
Sol. $I_1\omega_1 = I_2\omega_2$

$$\frac{ML^2}{12}\omega_0 = \left[\frac{ML^2}{12} + m\left(\frac{L}{2}\right)^2 + m\left(\frac{L}{2}\right)^2\right]\omega'$$

$$\Rightarrow \omega' = \frac{M}{M + 6m}\omega_0$$

31. (a)

Sol.

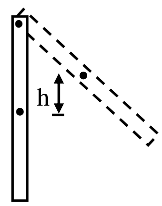


$I_1 = \frac{2}{5} M (R/2)^2$

$I_2 = I_0 + Md^2 = \frac{2}{5} M(R/2)^2 + M(2R)^2$

$\therefore\ I = I_1 + I_2 = \frac{21}{5} MR^2$

32. (d)
Sol.

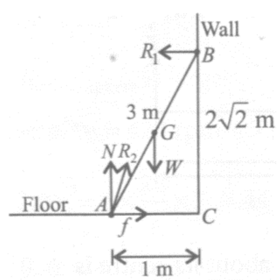


$\because\ mgh_{CM}$
$= \frac{1}{2} I\omega^2$

$\therefore\ mgh_{CM} = \frac{1}{2} . \frac{m\ell^2}{3} . \omega^2$

$\Rightarrow\ h_{CM} = \frac{w^2\ell^2}{6g}$

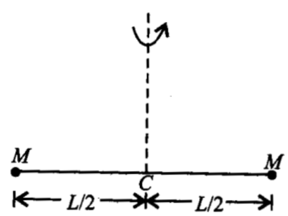
33. (a)
Sol.



Let AB be ladder
$\therefore$AB = 3m
Its foot A is a distance 1m from the wall.
$\therefore$AC = 1m
And $BC = \sqrt{(AB)^2 - (AC)^2} = \sqrt{(3)^2 - (1)^2} = 2\sqrt{2}m$
The various force acting on the ladder are
(i) Weight W acting at its center of gravity G.
(ii) Reactions force R_1 of the wall acting Perpendicular to the wall ($\because$the wall is frictionless).

(iii) Reactions force R_2 of the floor. This force can be resolved into two components, the normal reactions N and the force of frictions f.
For translator equilibrium in the horizontal directions,
$f - R_1 = 0$ or $f = R_1$ .....(i)
For translator equilibrium in the vertical directions,
$N - W = 20g = 20 \times 10 = 200$ N ..... (ii)
For rotational equilibrium, taking moment of the forces about A, we get
$$R_1(2\sqrt{2}) - W\left(\frac{1}{2}\right) = 0$$
$$R_1 = \frac{W}{4\sqrt{2}} = \frac{200}{4\sqrt{2}} = 25\sqrt{2}N \quad \text{..... (iii)}$$
From (ii), $f = R_1 = 25\sqrt{2}N$
$$R_2 = \sqrt{N^2 + f^2} = \sqrt{(200N)^2 + (25\sqrt{2}N)^2} = 203N$$

34. (b)
Sol.



The moment of inertia of the system about the given axis is.
$$I = M\left(\frac{L}{2}\right)^2 + M\left(\frac{L}{2}\right)^2 = \frac{ML^2}{4} + \frac{ML^2}{4} = \frac{ML^2}{2}$$

35. (a)
Sol. Here, $\upsilon_0 = 420\,\text{rpm} = 7\,\text{rps}$
$$\omega_0 = 2\pi\upsilon_0 = 2\times\frac{22}{7}\times 7 = 44 \text{ rad s}^{-1}$$
$$\omega = 0,\ \alpha = -2\,\text{rad s}^{-2}$$
$$\therefore t = \frac{\omega - \omega_0}{\alpha} = \frac{-44}{-2} = 22s$$

36. (a)
Sol. $\omega = \omega_0 + \alpha t$ or $\omega = 0 + \alpha t$
$$\text{or } \alpha = \frac{\omega}{t} = \frac{15}{0.270}\text{rad s}^{-2}$$
$$\therefore \alpha = r\alpha = 0.81\times\frac{15}{0.270} = 45 \text{ m s}^{-2}$$

37. (c)

Sol. Here, M = 3 kg

R = 40 cm = 40 × 10^{-2} m

Force applied, F = 30 N

Torque,

$\tau = FR = (30N)(40\times10^{-2} m) = 12 Nm$

Moment of inertia of hollow cylinder about its axis

Is

$I = MR^2 = (3kg)(40\times10^{-2} m)^2 = 0.48 kg\ m^2$

Let α is the angular acceleratin produced.

As: $\tau = I\alpha$

$\therefore \alpha = \frac{\tau}{I} = \frac{12\,N\,m}{0.48\,kg\,m^2} = 25 rad\ s^{-2}$

38. (a)

Sol. Here, $\omega = 100$ rad $s^{-1}, \tau = 100$ N m

As, P = $\tau\omega$

$\therefore P = (100 N\ m)(100\ rad\ s^{-1}) = 10\times10^3 W = 10 kW$

39. (a)

Sol. Given: $\theta(t) = 2t^3 - 6t^2$

$\therefore \frac{d\theta}{dt} = 6t^2 - 12t$

$\frac{d^2\theta}{dt^2} = 12t - 12$

Angular acceleration,

$\alpha = \frac{d^2\theta}{dt^2} = 12t - 12$

When angular acceleration (α) is zero, then the torque on the wheel becomes zero ($\because \tau = \alpha$)

$\Rightarrow 12t - 12 = 0$ or $t = 1$ s

40. (a)

Sol. Here, M = 20 kg

R = 20 cm = 20 × 10^{-2} m, $\omega = 100$ rad s^{-1}

Moment of inertia of the solid cylinder about its axis is

$I = \frac{MR^2}{2} = \frac{(20 kg)(20\times10^{-2} m)^2}{2} = 0.4 kg\, m^2$

Angular momentum of the cylinder about its axis is $L = I\omega = (0.4\, kg\ m^2)(100\, rad\ s^{-1}) = 40$ J s

41. (d)

Sol. Acceleration produced in the centre of mass due to friction

$$a=\frac{f}{M}=\frac{\mu_k Mg}{M}\mu_k g$$

Where M is the mass of the ring, …(i)

Angular retardation produced by the torque due to friction

$$\alpha=\frac{\tau}{I}=\frac{fR}{I}=\frac{\mu_k MgR}{I} \quad \ldots(ii)$$

As v = u + at

$\therefore v=0+\mu_k gt(\therefore u=0)$ (Using (i))

As $\omega=\omega_0+\alpha t$

$\therefore \omega-\omega_0-\frac{\mu_k MgR}{I}t$ (Using (ii))

For rolling without slipping

V = Rω

$$\therefore \frac{v}{R}-\omega_0-\frac{\mu_k MgR}{I}t$$

$$\frac{\mu_k gt}{R}=\omega_0-\frac{\mu_k MgR}{I}t\Rightarrow\frac{\mu_k gt}{R}\left[1+\frac{MR^2}{I}\right]=\omega_0$$

$$\frac{\mu_k gt}{R}=\frac{\omega_0}{1+\frac{MR^2}{I}}\Rightarrow t=\frac{R\omega_0}{\mu_k g\left(1+\frac{MR^2}{I}\right)}$$

For ring, $I=MR^2$

$$\therefore t=\frac{R\omega_0}{\mu_k g\left(1+\frac{MR^2}{MR^2}\right)}=\frac{R\omega_0}{2\mu_k g}$$

42. (c)

Sol. Acceleration of the solid sphere when it rolls without slipping down an inclined plane is.

$$a=\frac{g\sin\omega}{1+\frac{I}{MR^2}}$$

For a solid sphere, $I=\frac{2}{5}MR^2$

$$\therefore a=\frac{g\sin\theta}{1+\frac{2}{5}}=\frac{5}{7}g\sin\theta \quad \ldots(i)$$

Acceleration ofj the same sphere when it slides when it slides without friction down an same inclined plane is , $a'=g\sin\theta$ …(ii)

Divide (ii) by (i), we get,

$\frac{a'}{a}=\frac{7}{5}$ or $a'=\frac{7}{5}a$

43. (c)

Sol. As, $K_{R_1}=K_{R_2}$

$\therefore \frac{1}{2}I_1\omega_1^2=\frac{1}{2}I_2\omega_2^2$

or $\frac{\omega_1}{\omega_2}=\sqrt{\frac{I_2}{I_1}}$ ...(i)

$\frac{L_1}{L_2}=\frac{I_1\omega_1}{I_2\omega_2}=\frac{I_1}{I_2}\sqrt{\frac{I_2}{I_1}}=\sqrt{\frac{I_1}{I_2}}$ (Using (i))

$\frac{L_1}{L_2}=\sqrt{\frac{1}{2}}=\frac{1}{\sqrt{2}}$

44. (b)

Sol. Acceleration of a rolling body down an inclined plane is,

$$a=\frac{g\sin\theta}{1+\frac{k^2}{R^2}}$$

For solid cylinder, $k^2=\frac{R^2}{2}$

$$\therefore a=\frac{\sin\theta}{1+\frac{1}{2}}=\frac{2}{3}g\sin\theta$$

45. (c)

Sol. Total kinetic energy,

= K.E. of translation + K.E. of rotation

$=\frac{1}{2}Mv^2+\frac{1}{2}I\omega^2$

$=\frac{1}{2}Mv^2+\frac{1}{2}Mk^2\frac{v^2}{R^2}$ ($\because I=Mk^2$ and $v=\omega R$)

$=\frac{1}{2}Mv^2\left(1+\frac{k^2}{R^2}\right)$

$$\frac{K.E\ of\ rotation}{Total\ K.E.}=\frac{\frac{1}{2}Mk^2\frac{v^2}{R^2}}{\frac{1}{2}Mv^2\left(1+\frac{k^2}{R^2}\right)}$$

$$= \frac{\frac{k^2}{R^2}}{1+\frac{k^2}{R^2}} = \frac{k^2}{k^2+R^2}$$

46. (a)

Sol. Here, angular momentum is conserved.
Initial angular momentum = final angular
Momentum
$I \times 20 = I' \times 10$]
Where I' is new moment of inertia, $I' = 2I$

47. (d)

Sol. From third equation, $\omega^2 = \omega_0^2 - 2\alpha\theta$]

$\Rightarrow (\omega_0/2)^2 = \omega_0^2 - 2\alpha(2n\pi)$

$\Rightarrow 4\pi n\alpha = 3/4\ \omega_0^2$ ……(1)

Let no. of rotations before coming to rest = n′

$\Rightarrow 0 = \left(\frac{\omega_0}{2}\right)^2 - 2\alpha\,(2\pi n') \Rightarrow 4\pi n'\,\alpha = \frac{\omega_0^2}{4}$ ….(2)

from (1)/(2) $n/n' = 3 \Rightarrow n' = n/3$

48. (a)

Sol. For Ring, $I = MR^2\ (\lambda \times 2\pi R)\ R^2$

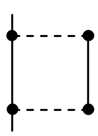
$\Rightarrow I = 2\pi\lambda R^3$ (where, λ = linear density)

$\therefore\ \frac{I_1}{I_2} = \left(\frac{R_1}{R_2}\right)^3 \Rightarrow \frac{1}{8} = \left(\frac{R}{nR}\right)^3 \Rightarrow n = 2$

49. (c)

Sol. $\frac{KE_{Rot.}}{\text{Total KE}} = \frac{K^2/R^2}{(1+K^2/R^2)} = \frac{2/5}{1+2/5} = \frac{2}{7}$

50. (b)

Sol.  $I = \left[\frac{2}{5}Ma^2\right] \times 2 + \left[\frac{2}{5}Ma^2 + Mb^2\right] \times 2$

CHEMISTRY

51. (a)

Sol. $K.E_{O2} = \dfrac{\frac{3}{2}\times\frac{N}{32}\times R\times 150}{\frac{3}{2}\times\frac{N}{32}\times R\times 300} = \dfrac{x}{2x}$

$K.E_{O2} = \dfrac{N\times 1}{N\times 2} = \dfrac{1}{2}$

52. (c)

Sol. Ease of liquification $\propto$ a

53. (a)

Sol. $V_t = V_0 + \dfrac{V_0}{273}\times t = 100 + \dfrac{1}{273}\times 10 = 100 + 0.0366 = 100.0366 ml$

54. (b)

Sol. The tube will burst when the final pressure exceeds 3 *atm.* at constant volume,

$\dfrac{P_1}{T_1} = \dfrac{P_2}{T_2}$ *i.e.* $\dfrac{760}{300\ K} = \dfrac{3\times 760}{T_2}$

$T_2 = 900\ K = 627^o C$

55. (c)

Sol. K.E. $= \dfrac{3}{2}RT\ mol^{-1}$

or K.E. $= \dfrac{3}{2}nRT = \dfrac{3}{2}\times\dfrac{14}{28}\times 8.31\times 400\ J = 2493\ J$

56. (c)

Sol. $u = \sqrt{\dfrac{3RT}{M}}$; $\therefore \dfrac{u(H_2)}{u(N_2)} = \sqrt{\dfrac{T(H_2)}{M(H_2)}\times\dfrac{M(N_2)}{T(N_2)}}$ or

$\sqrt{7} = \sqrt{\dfrac{T(H_2)}{T(N_2)}\times\dfrac{28}{2}}$ or $7 = \dfrac{T(H_2)}{T(N_2)}\times 14$ or $\dfrac{T(H_2)}{T(N_2)} = \dfrac{1}{2}$

or $T(N_2) = 2\times T(H_2)$ *i.e.*, $T(N_2) > T(H_2)$

57. (a)

Sol. $r_{SO_2} = \sqrt{\dfrac{3RT}{64}}$; $r_{He} = \sqrt{\dfrac{3R\times 300}{4}}$

$\therefore \sqrt{\dfrac{3R\times 300}{4}} = \mathbf{2}\sqrt{\dfrac{3RT}{64}}$

or $\dfrac{3R\times 300}{4} = \mathbf{4}\times\dfrac{3RT}{64}$

or $T = \frac{64}{16} \times 300 = 1200$ K

58. (b)

Sol. For ideal gas $\frac{P\overline{V}_{id}}{RT} = 1$

$\therefore \ \overline{V}_{id} = \frac{RT}{P}$

For real gas, $P\overline{V} = RT$

$\frac{P\overline{V}}{RT} = Z$

$\frac{\overline{V}}{\overline{V}_{id}} = Z$

59. (c)

Sol. K.E. $= \frac{3}{2}RT$

$E_1 = \frac{3}{2}$ R 293 and $E_2 = \frac{3}{2}$ R 313 Þ E_2

$= \frac{313}{293} \times E_1$

60. (d)

Sol. Cl_2 6.579 L^2 bar mol^{-2} 0.05622 L mol^{-1}

C_2H_5 5.562 L^2 bar mol^{-2} 0.06380 L mol^{-1}

61. (a)

Sol. $\left(P + \frac{a}{V^2}\right)(V) = RT$

$PV + \frac{a}{V} = RT$

$\frac{PV}{RT} = 1 - \frac{a}{VRT}$

62. (d)
Sol. (i) (ii) and (iii)

63. (c)
Sol. Units in which P, V, and T are measured

64. (b)

Sol. At low temperature and high pressure, the volume of the particles is not negligible as compare to the volume of the gas. Also, the intermolecular forces start acting upon the molecules. Hence, they deviate from ideal behavior.

65. (a)

Sol. According to van der Waals equation for 1 mole of a real gas, $\left(P+\frac{a}{V^2}\right)(v-b)=RT$

If a and b are small, a/v^2 and b can be neglected as compared to p and V and the equation reduces to PV = RT. Hence, a real gas will resemble an ideal gas when constants a and b are small

66. (c)

Sol. $Po_2 = Xo_2 \times P_{total}$

Given : $P_{total} = 1atm, xo_2 = \frac{4}{5}$

$Po_2 = \frac{4}{5} \times 1 = 0.8atm$

$(\because 1atm = 1.0135 \times 10^5 \text{ Pa or N m}^{-2})$

$= 0.8 \times 10^5 \text{ N m}^{-2} = 8 \times 10^4 \text{ N m}^{-2}$

67. (c)

Sol. $a = \frac{PV^2}{n^2}$ unit : atm $L^2 mol^{-2}$

68. (a)

Sol. Let initial number of moles of air at 27^0C (300k) =n

At temperature T K, the no. of moles left $= n - \frac{n}{3} = \frac{2n}{3}$

At constant pressure and volume, $n_1T_1 = n_2T_2$

$n \times 300 = \frac{2n}{3} \times T \Rightarrow T = 450k \text{ or } 177^0C$

69. (d)

Sol. From ideal gas equation.

$d = \frac{PM}{RT} = \frac{2.5 \times 44}{0.0821 \times 300} = 4.46 \text{ g L}^{-1}$

70. (c)

Sol. Mole fraction of

$$O_2 = \frac{\frac{w}{32}}{\frac{w}{32} + \frac{w}{4}} = \frac{w}{32} \times \frac{32}{9w} = \frac{1}{9}$$

Partial pressure of oxygen

$$= P \times xo_2 = P_{total} \times \frac{1}{9} \text{ or } \frac{1}{9} P_{toal}$$

71. (b)

Sol. Due to weak intermolecular forces of attraction, H_2 and He gases show the value of $Z > 1$.

72. (d)

Sol. The graph between V and T at constant pressure is called isobar.

73. (a)

Sol. $P = \frac{n}{v} RT$

n for $CH_4 = \frac{3.2}{16} = 0.2$; n for $CO_2 = \frac{4.4}{44} = 0.1$

$n_{total} = 0.2 + 0.1 = 0.3$

$$P = \frac{0.3 \times 0.0821 \times 300}{9} = 0.82 \text{ atm}$$

74. (b)

Sol. PV = nRT, Keeping other conditions same, if n becomes half, the pressure will become half.

75. (c)

Sol. Higher the critical temperature, Faster is the liquefaction of the gas.

76. (c)

Sol. PV = constant at given temperature

$\therefore P_1V_1 = P_2V_2 = P_3V_3 = P_4V_4$

Now, $V_1 > V_2 > V_3 > V_4$ (From the figures)

Hence, $P_1 < P_2 < P_3 < P_4$ $\left(\because P \propto \frac{1}{V}\right)$

77. (a)
Sol. For ideal gas PV = constant at all pressures

78. (d)
Sol. Sponge will be completely soaked by water, so it is absorption.

79. (c)
Sol. Catalyst provides new path to the chemical reaction which has lower value of activation energy. Reactant and product with not be affected, so there will not be any change in state parameter like enthalpy and internal energy.

80. (a)
Sol. Lower the gold number, higher the producting powe of lyophillic colloid.

81. (b)
Sol. At high concentrations of soap in water, soap behave as associated colloid. Micelles are formed above a particular concentrations called critical micelle concentrations (CMC).

82. (b)
Sol. AgI/Ag^{+} is positive colloid, It will be coagulated easily by the anion with large negative charge i.e., PO_4^{3-}.

83. (b)
Sol. Transition metals due to their small size and variable valency act as efficient catalysts.

84. (a)
Sol. The poisonous gases present in coal mines are adsorbed on the activated charcoal.

85. (b)
Sol. Aqueous solution of $Al(OH)_3$ will show Tyndall effect since it is a colloidal solutions. All other solutions are true solutions.

SECTION-B

86. (b)
Sol. The water obtained from natural sources often contains suspended impurities. Alum is added to such water to coagulate the suspended impurities and make water fit for drinking purposes.

87. (c)
Sol. Peptizations involves conversions of freshly prepared precipitate into colloidal particle using a suitable electrolyte.

88. (c)
Sol. Gel has liquid dispersed in solid.

89. (c)
Sol. Sb_2S_3 is a negatively charged sol. The most effective coagulating agent will be electrolyte with highest positive charge on the cation. Viz,
$Al_2(SO_4)_3$. The order is
$Al^{3+} > Ca^{2+} > Na^+ > NH_4^+$

90. (a)
Sol. CMC is the concentrations below which no micellizations takes place.

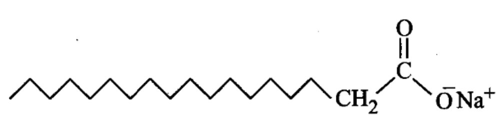
91. (d)
Sol. The separations of an emulsion into its constituents is called demulsification. Various methods of demulsifications are freezing, boiling, centrifugations or chemical methods.

92. (a)
Sol. Gelatin acts as an emulsifying agent which helps in stabilizing the ice-cream which is a mixture of liquids or emulsions.

93. (a)
Sol. In heterogeneous catalysis, the reactants and the catalyst are in different phases.

94. (a)
Sol. The colloidal particle are in a continuous zig-zag motion due to unbalanced bombardment of the particles by molecules of the dispersions medium.

95. (c)
Sol.



The $RCOO^-$ ion formed in the water contains tow parts, a long hydrocarbon chain R (non-polar or hydrophobic tail) and a polar COO^- (polar or hydrophilic head)

96. (a)
Sol. When an electric field is applied to purify an impure colloidal solutions, the process is known as electrodialysis. The ions present in the colloidal solutions migrate out to the oppositely charged electodes.

97. (a)
Sol. The bright cone of the light is known as Tyndall cone. The scattering of light is seen by the microscope.

98. (d)
Sol. (A) $\rightarrow$ (ii), (B) $\rightarrow$ (iii), (C) $\rightarrow$ (iv), (D) $\rightarrow$ (i)

99. (d)
Sol. More easily liquefible gases are adsorbed readily. Thus, H_2 gas having low critical temperature (33 K) is not easily liquefied and shows least adsorption.

100. (b)
Sol. (i) $\rightarrow$ (iii) $\rightarrow$ (ii) $\rightarrow$ (iv) $\rightarrow$ (v)

BOTANY									
Q.	ANS.	Q.	ANS.	Q.	ANS.	Q.	ANS.	Q.	ANS.
101	C	113	D	125	A	136	A	148	A
102	C	114	C	126	D	137	C	149	A
103	D	115	D	127	C	138	D	150	B
104	B	116	D	128	B	139	D		
105	C	117	C	129	C	140	D		
106	B	118	A	130	B	141	B		
107	A	119	A	131	C	142	A		
108	B	120	A	132	A	143	D		
109	D	121	D	133	D	144	B		
110	D	122	D	134	C	145	C		
111	A	123	B	135	B	146	D		
112	B	124	B			147	C		

ZOOLOGY									
Q.	ANS.	Q.	ANS.	Q.	ANS	Q.	ANS.	Q.	ANS
151	A	163	C	175	A	186	B	198	C
152	B	164	B	176	C	187	C	199	D
153	A	165	B	177	A	188	C	200	A
154	C	166	A	178	D	189	A		
155	C	167	B	179	C	190	C		
156	D	168	C	180	B	191	C		
157	B	169	A	181	C	192	A		
158	C	170	C	182	D	193	C		
159	B	171	D	183	B	194	C		
160	A	172	C	184	D	195	D		
161	C	173	C	185	A	196	A		
162	A	174	A			197	C		