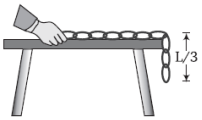
Medicine Paper - 4

1. A uniform chain of length L and mass M is lying on a smooth table and one third of its length is hanging vertically down over the edge of the table. If g is acceleration due to gravity, the work required to pull the hanging part on to the table is

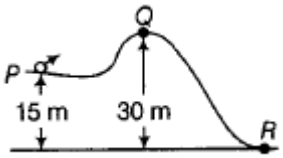
(a) MgL
(b) MgL/3
(c) MgL/9
(d) MgL/18

Answer: d
Solution



$W = \frac{MgL}{2n^2} = \frac{MgL}{2(3)^2} = \frac{MgL}{18}$ $[n = 3 \text{ Given}]$

2. In the figure shown, a ball of mass 1 kg is rolled with a kinetic energy of 330 J. It reaches R through the P path PQR. Find the speed of the ball at R, if its potential energy at P is zero



(a) 52 m/s
(b) 45 m/s
(c) 40 m/s
(d) 31 m/s

Answer: d
Solution

Given,

$m = 1kg$

$KE = 330J$

From conservation of energy

$KE_{at\,P} + PE_{at\,P} = KE_{at\,R} + PE_{at\,R}$

$\Rightarrow \frac{1}{2}mv_1^2 + mgh = \frac{1}{2}mv_2^2 + 0$

$\Rightarrow 330 + 1 \times 10 \times 15 = \frac{1}{2} \times 1 \times v^2$

$\Rightarrow v^2 = 2(330 + 150)$

$v = 31ms^{-1}$

3. A body of mass M is moving with a uniform speed of 10 m/s on frictionless surface under the influence of two forces F_1 and F_2. The

net power of the system is

(a) $10F_1F_2M$

(b) $10(F_1 + F_2)M$

(c) $(F_1 + F_2)M$

(d) Zero

Answer: d
Solution

$\because$ Speed is constant

$\therefore$ Work done by forces = 0

$\therefore$ Power $= \frac{\text{Work}}{\text{Time}} = 0.$

4. Select the false statement velocities are perpendicular

(a) In elastic collision, KE is not conserved during the collision
(b) The coefficient of restitution for a collision between two steel balls lies between 0 and 1
(c) The momentum of a ball colliding elastically with the floor is conserved
(d) In an oblique elastic collision between two identical bodies with one of them at rest initially, the final

Answer: c
Solution

Momentum will be conserved.

5. A hail is allowed to fall from a height of 10 m. If there is 40% loss of energy due to impact, then after one impact ball will go up to

(a) 10 m
(b) 8 m
(c) 4 m
(d) 6 m

Answer: d
Solution

mgh = Initial potential energy

mgh' = Final potential energy after rebound

As 40% energy lost during impact

$\therefore$ mgh' = 60% of mgh

$\Rightarrow$ $h' = \frac{60}{100} \times h = \frac{60}{100} \times 10 = 6$ m

6. A vertical spring with force constant K is fixed on a table. A ball of mass m at a height h above the free upper end of the spring falls vertically on the spring so that the spring is compressed by a distance d. The net work done in the process is

(a) $mg(h-d) + \frac{1}{2}Kd^2$
(b) $mg(h+d) + \frac{1}{2}Kd^2$
(c) $mg(h+d) - \frac{1}{2}Kd^2$
(d) $mg(h-d) - \frac{1}{2}Kd^2$

Answer: c
Solution

$W = W_g + W_{spring}$

$= mg(h + d) - \frac{1}{2}Kd^2$

7. A ball of mass 2 kg and another of mass 4 kg are dropped together from a 60 feet tall building. After a fall of 30 feet each towards earth, their respective kinetic energies will be in the ratio of

(a) $\sqrt{2} : 1$
(b) 1 : 4
(c) 1 : 2
(d) $1 : \sqrt{2}$

Answer: c
Solution

$\frac{v_1}{v_2} = \frac{\sqrt{2gh}}{\sqrt{2gh}} \Rightarrow v_1 = v_2$

$\frac{K.E_1}{K.E_2} = \frac{\frac{1}{2}m_1v_1^2}{\frac{1}{2}m_2v_2^2} = \frac{2}{4} = \frac{1}{2}$

8. A body of mass m accelerates uniformly from rest v_1 in time t_1. As a function of time t, the instantaneous power delivered to the body is

(a) $\frac{mv_1t}{t_1}$

(b) $\frac{mv_1^2t}{t_1}$

(c) $\frac{mv_1t^2}{t_1}$

(d) $\frac{mv_1^2t}{t_1^2}$

Answer: d
Solution

$P = \vec{F}\cdot\vec{v} = ma \times at = ma^2t$ [as $u = 0$]

$= m\left(\frac{v_1}{t_1}\right)^2 t = \frac{mv_1^2t}{t_1^2}$ [as $a = v_1/t_1$]

9. A bullet of mass m moving with velocity v strikes a suspended wooden block of mass M. If the block rises to height h, the initial velocity of the bullet will be

(a) $\sqrt{2gh}$

(b) $\frac{M+m}{m}\sqrt{2gh}$

(c) $\frac{m}{M+m}\sqrt{2gh}$

(d) $\frac{M+m}{M}\sqrt{2gh}$

Answer: b
Solution

$P_i = P_f$

$mv + 0 = mv^1 + Mv^1$

$mv = (m + M)v^1$

$v^1 = \frac{mv}{m+M} = \sqrt{2gh}$

$v = \frac{(m+M)\sqrt{2gh}}{m}$

10. An open knife edge of mass \'m\' is dropped from a height `h\' on a wooden floor. If the blade penetrates upto the depth \'d\' into the wood, the average resistance offered by the wood to the knife edge is

(a) mg

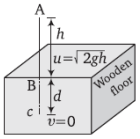
(b) $mg\left(1-\frac{h}{d}\right)$

(c) $mg\left(1+\frac{h}{d}\right)$

(d) $mg\left(1+\frac{h}{d}\right)^2$

Answer: c
Solution

Let the blade stops at depth of into the wood.



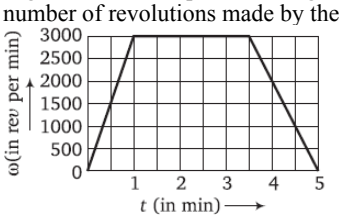
$v^2 = u^2 + 2aS$

$\Rightarrow \quad 0 = (\sqrt{2gh})^2 + 2(g-a)d$

by solving $a = \left(1+\frac{h}{d}\right)g$

So the resistance offered by the wood = $mg\left(1+\frac{h}{d}\right)$

11. As a part of a maintenance inspection the compressor of a jet engine is made to spin according to the graph as shown. The number of revolutions made by the compressor during the test is



(a) 9000
(b) 16570
(c) 12750
(d) 11250

Answer: d
Solution

No of revolution = Area of trapezium

$= \frac{1}{2}\times(2.5+5)\times 3000 = 11250$ rev

12. Three point masses m_1, m_2, m_3 are located at the vertices of an equilateral triangle of length \'a\'. The moment of inertia of the system about an axis along the altitude of the triangle passing through m_1, is

(a) $(m_2+m_3)\frac{a^2}{4}$

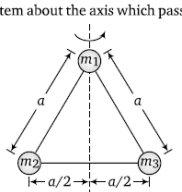
(b) $(m_1+m_2+m_3)a^2$

(c) $(m_1+m_2)\frac{a^2}{4}$

(d) $(m_2+m_3)a^2$

Answer: a
Solution

M.I. of system about the axis which passing through m_1.



$I_{system} = m_1(0)^2 + m_2\left(\frac{a}{2}\right)^2 + m_3\left(\frac{a}{2}\right)^2$

$I_{system} = (m_2+m_3)\frac{a^2}{4}$

13. A thin circular ring of mass m and radius R is rotating about its axis with a constant angular velocity ω. Two objects each of mass M are attached gently to the opposite ends of a diameter of the ring. The opposite ends of a diameter of the ring. The ring now rotates with an angular velocity ω is equal to

(a) $\frac{\omega\,(m+2M)}{m}$

(b) $\frac{\omega\,(m-2M)}{(m+2M)}$

(c) $\frac{\omega m}{(m+M)}$

(d) $\frac{\omega m}{(m+2M)}$

Answer: d
Solution
By conservation of angular momentum

$I_1\omega_1 = I_2\omega_2$

$\Rightarrow mR^2\omega = (mR^2 + 2MR^2)\omega^1$

$\Rightarrow \omega^1 = \left(\frac{m}{m+2M}\right)\omega$

14. A ring of mass M and radius r is melted and then molded in to a sphere then the moment of inertia of the sphere will be.....

(a) more than that of the ring
(b) Less than that of the ring
(c) Equal to that of the ring
(d) None of these

Answer: b
Solution
$I_{ring} = MR_1^2$ As Volume and Mass remain same

$I_{solid} = \frac{2}{5}MR_2^2 \quad R_2 \ll R_1$

15. A rectangular block has a square base measuring a × a, and its height is h. It moves on a horizontal surface in a direction perpendicular to one of its edges. The coeffiient of friction is μ. It will topple if

(a) $\mu > \frac{h}{a}$

(b) $\mu > \frac{a}{h}$

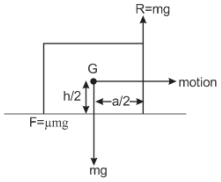
(c) $\mu > \frac{2a}{h}$

(d) $\mu > \frac{a}{2h}$

Answer: b
Solution
Normal reaction R = mg. Frictional force F = μ
= μ R mg.

To topple, clockwise moment must be more than the anticlockwise moment

$i.e., \mu mg \times \frac{h}{2} > mg \times \frac{a}{2}$ or $\mu > \frac{a}{h}$



16. What is moment of inertia in terms of angular momentum (L) and kinetic energy (K)?

(a) $\frac{L^2}{K}$

(b) $\frac{L^2}{2K}$

(c) $\frac{L}{2K^2}$

(d) $\frac{L}{2K}$

Answer: b
Solution
Kinetic energy is given by

$kE = \frac{1}{2}I\omega^2 = \frac{1}{2I}(I\omega)^2 = \frac{L^2}{2I} \quad [\because L = I\omega]$

$\Rightarrow I = \frac{L^2}{2k}$

17. From a uniform circular disc of radius R, a circular disc of radius R/6 and having centre at a distance + R/2 from the centre of the disc is removed. Determine the centre of mass of remaining portion of the disc.

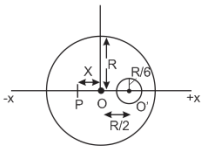
(a) $-\frac{R}{70}$

(b) $+\frac{R}{70}$

(c) $-\frac{R}{7}$

(d) $+\frac{R}{7}$

Answer: a
Solution



Let mass per unit area of disc = m

Mass of disc = $M = \pi R^2.m$

Mass of removed disc = $M' = \pi\left(\frac{R}{6}\right)^2.m = \frac{\pi R^2 m}{36}$

from figrue $OO' = \frac{R}{2}$

$M \times 0 = M' \times \frac{R}{2} + (M - M')x$

$M'x = M'\frac{R}{2} + Mx$

$x = \left(\frac{M'}{M - M'}.\frac{R}{2}\right)$

18. Two discs of same thickness but of different radii are made of two different materials such that their masses are same. The densities of the materials are in the ratio 1 : 3. The moments of inertia of these discs about the respective axes passing through their centres and perpendicular to their planes will be in the ratio

(a) 1 : 3
(b) 3 : 1
(c) 1 : 9
(d) 9 : 1

Answer: b
Solution

$$\text{M.I of disc} = \frac{1}{2}MR^2 = \frac{1}{2}M\frac{M}{\pi t\rho} = \frac{1}{2}\frac{M^2}{\pi t\rho}$$

$$\left(\text{As } \rho = \frac{M}{\pi R^2 t}, \text{ There fore } R^2 = \frac{M}{\pi t\rho}\right)$$

If mass and thickness are same then, $I \propto \frac{1}{\rho}$.

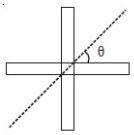
$$\therefore \quad \frac{I_1}{I_2} = \frac{\rho_2}{\rho_1} = \frac{3}{1}$$

19. Two rods of equal lengths(l) and equal mass M are kept along x and y axis respectively such that their centre of mass lie at origin. The moment of inertia about an line y = x, is

(a) $\frac{ml^2}{3}$
(b) $\frac{ml^2}{4}$
(c) $\frac{ml^2}{12}$
(d) $\frac{ml^2}{6}$

Answer: b
Solution

$$I_{\text{Total}} = 2\left(\frac{ml^2}{12}\sin^2 45°\right)$$



$$\frac{2ml^2}{12}\cdot\frac{1}{2} = \frac{ml^2}{12}$$

20. A solid sphere rolls down without slipping on an inclined plane at angle 60° over a distance of 10 m. The acceleration (in ms $^{-2}$) is

(a) 4
(b) 5
(c) 6
(d) 7

Answer: c
Solution

$\theta = 60°, l = 10\text{m}, a = ?$

Acceleration of the body,

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

We know that, Solid sphere, $k^2 = \frac{2}{5}R^2$

$$a = \frac{9.8\sin 60°}{1 + \frac{2}{5}}$$

$$a = 6\ \text{ms}^{-2}$$

21. The enthalpies of formation of N_2O and NO are 82 and 90 kJ/ mole respectively.The enthalpy of the reaction $2N_2O(g) + O_2(g) \rightarrow 4NO(g)$ is equal to

(a) 8 kJ
(b) 88 kJ
(c) -16 kJ
(d) 196 kJ

Answer: d
Solution

$$\Delta H = 4\Delta H_f^o(NO) - [2 \times \Delta H_f^o(N_2O) + \Delta H_f^o(O_2)]$$
$$= 4 \times 90 - [2 \times 82] = 196\ \text{kJ}$$

22. Heat of neutralisation of NaOH and HCl is – 57.3 kJ mol^{-1}. The heat of ionization of water will be

(a) – 57.3 kJ mol^{-1}
(b) – 114.6 kJ mol^{-1}
(c) +57.3 kJ mol^{-1}
(d) +114.6 kJ mol^{-1}

Answer: c
Solution

$NaOH + HCl \rightarrow NaCl + H_2O$ means

$H^+ + OH^- \rightarrow H_2O, \Delta H = -57.3\ \text{kJ}$

Hence $H_2O \rightarrow H^+ + OH^-, \Delta H = +57.3\ \text{kJ}$

23. For the reactions A → B; ΔH = + 24 kJ / mol and B → C ; ΔH = -18 kJ / mol, the decreasing order of enthalpy of A, B, C follows the order

(a) A ,B ,C
(b) B ,C , A
(c) C, B, A
(d) C, A ,B

Answer: b
Solution

Given,

$A \rightarrow B, \Delta H_1 = +24\ \text{KJ mol}^{-1}$

$B \rightarrow C, \Delta H_2 = -18\ \text{KJ mol}^{-1}$

Since, $\Delta H_1 = H_B - H_A = +24\ \text{KJ mol}^{-1}$

and $\Delta H_2 = H_C - H_B \Rightarrow \Delta H_2 = H_B - H_C = +18\ \text{KJ mol}^{-1}$

$\therefore\ \Delta H_1 + \Delta H_2 = H_B - H_A + H_C - H_B$

$\Rightarrow\ \Delta H_1 + \Delta H_2 = H_C - H_A$

$\Rightarrow 24 - 18 = H_C - H_A$

$\Rightarrow 6 = H_C - H_A$

$\Rightarrow H_C - H_A = +6\ \text{KJ mol}^{-1}$

$\therefore$ Hence the order is

$H_B > H_C > H_A$

$B > C > A.$

24. Two moles of helium gas expanded isothermally and irreversible at 27°C form volume 1 dm^3 to 1 m^3 at constant pressure of 100 k Pa. Calculate the work done.

(a) 99900 kJ
(b) 99900 J
(c) 35464.65 kJ
(d) 34465.65 J

Answer: b
Solution

$$\text{work done(w)} = P\Delta V$$
$$= P(V_2 - V_1)$$
$$= 10^5(1 - 10^{-3})$$
$$\text{work done(w)} = 99900\ \text{J}$$

25. A swimmer coming out from a pool is covered with a film of water weighing about 18 g. Calculate the internal energy of vaporisation at 100°C.

[$\Delta_{vap} H^{\ominus}$ for water at 373 K = 40.66 kJ mol $^{-1}$]

The correct option is

(a) 35.67 kJ mol $^{-1}$
(b) 37.56 kJ mol $^{-1}$
(c) 36.57 kJ mol $^{-1}$
(d) 38.75 kJ mol $^{-1}$

Answer: b
Solution

$$\underset{m=18g}{H_2O\,(l)} \xrightarrow{\text{vaporization}} \underset{m=18g}{H_2O(g)}$$

$$\text{Number of moles} = \frac{18\text{ g}}{18\text{ g mol}^{-1}} = 1\text{ mole}$$

$$\Delta_{vap} U = \Delta_{vap}H^{\ominus} - p\Delta V$$

$$= \Delta_{vap}H^{\ominus} - \Delta ngRT$$

$$= 40.66 - 1 \times 8.314 \times 10^{-3} \times 373$$

$$= 40.66 - 3.10$$

$$\Delta_{vap} U = 37.56\text{ KJ mol}^{-1}$$

26. When 1 mole of H_2O_2 is decomposed by platinum black, the heat evolved is 96.6 kJ. The heat of formation of 1 mole of H_2O_2 is

(a) 96.6 kJ
(b) 193.2 kJ
(c) 386.4 kJ
(d) 48.3 kJ

Answer: a
Solution

$$H_2O_2 \rightarrow H_2 + O_2, \Delta H = -96.6\text{ kJ}$$

$$H_2 + O_2 \rightarrow H_2O_2, \Delta H_f^{\circ} = +96.6\text{ kJ}$$

27. Standard cell potential of electro chemical cell is 1.20 volt for given reaction. Calculate change in free energy in KJ associated with it

$$2Ag^{+} + Cd \leftrightarrows 2Ag + Cd^{+2}$$

(a) 115.8
(b) –115.8
(c) –231.6
(d) 231.6

Answer: c
Solution

$$\Delta G^{o} = -nFE^{o}_{cell} = -2 \times 96500 \times 1.20J$$

$$= -231.6\,KJ$$

28. In the reaction CS_2 (l) + $3O_2$ (g) → CO_2 (g) + $2SO_2$ (g) ΔH = –265 kcal The enthalpies of formation of CO_2 and SO_2 are both negative and are in the ratio 4 : 3. The enthalpy of formation of CS_2 is + 26 kcal/mol. Calculate the enthalpy of formation of SO_2.

(a) – 90 kcal/mol
(b) – 52 kcal/mol
(c) – 78 kcal/mol
(d) – 71.7 kcal/mol

Answer: d
Solution

$Cs_2(l) + 3O_2(g) \rightarrow Co_2 + 2SO_2 + 2SO_2\Delta H = -256\,Kcal$

Let $\Delta H_f(CO_2, g) = 4x\ and\ \Delta H_f\ (SO_2, g) = 3x$

$\Delta H_{reaction} = \Delta H_f\ (CO_2, g) = 2\Delta H_f(SO_2, g) - \Delta H_f(CS_2(l))$

$-265 = 4x + 6x - 26$

$x = -23.9$

$\therefore \Delta H_f(SO_2, g) = 3x = -71.7\,Kcal/mol$

29. An ideal gas expands in volume from 1×10^{-3} m^3 to 1×10^{-2} m^3 at 300 K against a constant pressure of 1×105 Nm^{-2} . The work is :

(a) – 900 J
(b) – 900 kJ
(c) 270 kJ
(d) + 900 kJ

Answer: a
Solution

$$w = -P\Delta V$$

$$= -1 \times 10^5 (1 \times 10^{-2} - 1 \times 10^{-3})$$

$$= -1 \times 10^5 \times 9 \times 10^{-3} = -900J$$

30. Given the following thermo chemical equations
Zn + 1/2O_2 → ZnO + 84,000 cals
Hg + 1/2O_2 → HgO + 21,700 cals
Then the heat of reaction for the following reaction Zn + HgO → ZnO + Hg Heat is

(a) 105,700 cals
(b) 61,000 cals
(c) 105,000 cals
(d) 60,000 cals
(e) 62,300 cals

Answer: e
Solution

$$\Delta H_{reaction} = [\Delta H_f^{\circ}(ZnO) + \Delta H_f^{\circ}(Hg)] - [\Delta H_f^{\circ}(Zn) + \Delta H_f^{\circ}(HgO)]$$

$$= (84000 + 0) - (0 + 21{,}700)$$

$$= 62{,}300\text{ cals}$$

31. In the reversible reaction A + B ⇌ C + D , the concentration of each C and D at equilibrium was 0.8 mol litre, then the equilibrium constant K_C will be.

(a) 6.4
(b) 0.64
(c) 0.16
(d) 16

Answer: d
Solution

$$A + B \rightleftharpoons C + D$$

initial 1 1 0 0
conc.
Ateqm (1 − 0.8) 0.8 0.8
conc. (1 − 0.8)

$$= 0.2 = 0.2$$

$$Kc = \frac{[C][D]}{[A][B]} = \frac{0.8 \times 0.8}{0.2 \times 0.2} = 16.0$$

32. For the reaction SO_2 (g) + 1/2 O_2 (g) ⇌ SO_3 (g)

if, $K_p = K_c\,(RT)^x$
where, the symbols have usual meaning, then the value of *x* is (assuming ideality)

(a) -1
(b) - (1/2)
(c) 2018/01/02
(d) 1

Answer: b
Solution

Relationship between K_p and K_c,

$K_p = K_C(RT)^{\Delta n}$ (1)

Given, $K_p = K_C(RT)^x$ (2)

Hence from equation (1) & (2) , we get

$\Delta n = x$

Where, $\Delta n = n_{products} - n_{reactants}$

∴ Given equation,

$SO_{2(g)} + 1/2\ O_{2(g)} \rightleftharpoons SO_{3(g)}$

Then $\Delta n = 1 - \left(1 - \frac{1}{2}\right) = 1 - \frac{3}{2} = \frac{2-3}{2} = \frac{-1}{2}$

If $\Delta n = x$. Then the value of $x = \frac{-1}{2}$

33. At 550 K, the value of K_C for the following reaction is 10^4 mol^{-1} L

X (g) + Y (g) ⇌ Z (g)

At equilibrium, it was observed that

[X] = 1/2 [Y] = 1/2 [Z]

What is the value (in mol L^{-1}) of [Z] at equilibrium ?

(a) 2×10^{-4}
(b) 10^{-4}
(c) 2×10^{4}
(d) 10^{4}

Answer: a

Solution

$\text{Given}, K_C = 10^4 \text{ mol}^{-1} \text{ L}, T = 550 \text{ K}$

Consider the given reaction

$X(g) + Y(g) \rightleftharpoons Z(g)$

Equilibrium constant K_C is given as

$$K_C = \frac{[Z]}{[X][Y]}$$

$$10^4 = \frac{[Z]}{[X][Y]}$$

$$[Z] = 10^4 \times [X] \times [Y] \quad \ldots . (1)$$

Given that at equilibrium ,

$$[X] = \frac{1}{2}[Y] = \frac{1}{2}[Z]$$

∴ Now equation (1) becomes,

$$[Z] = 10^4 \times \frac{1}{2}[Z][Z]$$

$$1 = 10^4 \times \frac{1}{2}[Z]$$

$$2 \times 10^{-4} = [Z]$$

or $[Z] = 2 \times 10^{-4} \text{ mol L}^{-1}$

34. Equimolar solution of the following were prepared in water separately. Which one of the solutions will record the highest P^H ?

(a) $SrCl_2$
(b) $BaCl_2$
(c) $MgCl_2$
(d) $CaCl_2$

Answer: b

Solution

All alkaline earth metal chlorides (MCl_2)on hydrolysis will produce acidic solution

$MCl_2 + H_2O \rightleftharpoons M(OH)_2 + 2HCl$

because $M(OH)_2$ is a weak base and HCl is a strong acid. But as we go down the group, basic character of hydroxides increases. Hence acidic character decreases. So $BaCl_2$ will have the highest p^H.

35. A vessel contains CO_2 at 1000k temperature with a pressure 0.5 atm.some of CO_2 is converted in to CO on addition of graphite. If total pressure at equilibrium is 0.8 atm the value of KP is:

(a) 3 atm
(b) 0.3 atm
(c) 0.18 atm
(d) 1.8 atm

Answer: b

Solution

$$CO_{2(g)} + C_{(g)} \rightleftharpoons 2CO_{(g)}$$

Initial pressure 0.5 atm 0

Final pressure $(0.5 - x)$ 2x

Total pressure $= 0.5 - x + 2x = 0.5 + x = 0.8$ atm

$\therefore x = 0.3$ atm

$$K_P = \frac{(P_{CO})^2}{(P_{CO_2})} = \frac{(0.6)^2}{0.2} = 1.8 \text{ atm.}$$

36. The equilibrium constants Kp_1 and Kp_2 for the reactions, $X \rightleftharpoons 2Y$ and $Z \rightleftharpoons P + Q$ respectively are in the ratio of 1 : 9. If the degree of dissociation of x and z are equal then the ratio of total pressure at these equilibria is .

(a) 1 : 36
(b) 1 : 1
(c) 1 : 3
(d) 1 : 9

Answer: a

Solution

For a reaction $X \rightleftharpoons 2Y$

Initial mol 1 0

at equilibrium mol $1 - x$ 2x

Total moles $= 1 - x + 2x = 1 + x$

$$\therefore K_{P_1} = \frac{P_Y^2}{P_X} = \frac{\left(\frac{2x}{1+x}P_1\right)^2}{\left(\frac{1-x}{1+x}\right)P_1}$$

$$= \frac{4x^2 . p_1}{(1+x)(1-x)} - - - (1)$$

For a reaction $Z \rightleftharpoons P + Q$

Initial 1 0 0

at eqm $1 - x$ x x

Total moles $= 1 + x$

$$\therefore K_{P_2} = \frac{x \cdot P_2 \times x \cdot p_2}{(1+x)^2 \times \left(\frac{1-x}{1+x}\right)P_2}$$

$$= \frac{x^2}{(1-x)(1+x)} . p_2 - - - (2)$$

$$\therefore \frac{K_{P_1}}{K_{P_1}} = \frac{1}{9}$$

$$\therefore \frac{4P_1}{P_2} = \frac{1}{9}$$

$$\therefore \frac{P_1}{P_2} = \frac{1}{36}$$

$$\therefore P_1 : P_2 = 1 : 36$$

37. The pH of a 0.1 molar solution of the acid HQ is 3. The value of the ionisation constant, K_a of the acid is

(a) 3×10^{-1}
(b) 1×10^{-3}
(c) 1×10^{-5}
(d) 1×10^{-7}

Answer: c
Solution

Given , pH of HQ = 3

$[HQ] = 0.1M$

$K_a = ?$

Consider dissociation of HQ,

$HQ \rightarrow H^+ + Q^-$

Since, $pH = -\log[H^+]$

$\Rightarrow 3 = -\log[H^+]$

$\Rightarrow [H^+] = -\text{antilog } 3$

$\Rightarrow [H^+] = 10^{-3} M$

Now, by ostwald's dilution law

$[H^+] = \sqrt{K_a C}$

$10^{-3} = \sqrt{K_a \times C}$

Squaring on both sides,

$(10^{-3})^2 = \left(\sqrt{K_a \times C}\right)^2$

$10^{-6} = K_a \times C$

$\Rightarrow K_a = \frac{10^{-6}}{C}$

$\Rightarrow K_a = \frac{10^{-6}}{0.1}$

$\Rightarrow K_a = 10^{-5}$

or $K_a = 1 \times 10^{-5}$

38. The ionization constant of formic acid is 1.8×10^{-4} around what P^H will its mixture with sodium formate give buffer solution of highest capacity

(a) 3.74
(b) 7.48
(c) 4.37
(d) 3.96

Answer: a
Solution

Buffer Solution of highest capacity is formed at which

$P^H = pka = -\log(1.8 \times 10^{-4}) = 3.74$

39. The solubility product of AgCl is 4×10^{10} at 298 k. The solubility of AgCl in 0.04 M $CaCl_2$ will be

(a) 2×10^{-5} M
(b) 1×10^{-4} M
(c) 5×10^{-9} M
(d) 2.2×10^{-4} M

Answer: c
Solution

If x is the solubility of AgCl in 0.04 M $CaCl_2$

then $[Ag^+] = x$ mol L^{-1}

$[\bar{Cl}] = 2 \times 0.04 + x = 0.08 + x \cong 0.08$ M

K_{SP} of $AgCl = [Ag^+][\bar{Cl}]$

$4 \times 10^{-10}/0.08 = [Ag^+] = 5 \times 10^{-9}$M

40. What is the decreasing order of strength of the bases $OH^-NH_2^-, H-C\equiv C^- and\ CH_3-CH_2^-$?

(a) $CH_3-CH_2^- > NH_2^- > H-C\equiv C^- > OH^-$
(b) $H-C\equiv C^- > CH_3-CH_2^- > NH_2^- > OH^-$
(c) $OH^- > NH_2^- > H-C\equiv C^- > CH_3-CH_2^-$
(d) $NH_2^- > H-C\equiv C^- > OH^- > CH_3-CH_2^-$

Answer: a
Solution

Their conjugate acids are H – OH, NH_3, H – C ≡ C – H and $CH_3 – CH_3$. Their acidic character are H – OH > CH ≡ CH > NH_3 > CH_3 – CH_3 A strong acid has a week conjugate base. Hence the strengths of bases will be

$CH_3-CH_2^- > NH_2^- > H-C\equiv C^- > OH^-$

41. Bamboo, grass and mint stem elongate by the activity of -

(a) Primary meristem
(b) Secondary meristem
(c) Intercalary meristems
(d) Apical meristems

Answer: c

42. Histogens are components of -

(a) Apical meristem
(b) Intercalary meristem
(c) Lateral meristem
(d) Secondary meristem

Answer: a

43. Maximum growth in root occurs –

(a) At its tip
(b) Towards light
(c) Behind the apex
(d) Towards apex

Answer: c

44. In monocotyledon roots, the histogen present at the apex of the root tip is -

(a) Dermatogen
(b) Procambium
(c) Calyptrogen
(d) Plerome

Answer: c

45. Periclinal division in a cell takes place by -

(a) Vertical cleavage
(b) Transverse cleavage
(c) Perpendicular cleavage
(d) Tangential cleavage

Answer: b

46. Which of the following is a well differentiated plant tissue -

(a) Apical meristem
(b) Cambium
(c) Parenchyma
(d) All of the above

Answer: c

47. Which of the following is a primary meristem -

(a) Intra fascicular cambium
(b) Cork cambium
(c) Vascular cambium in roots
(d) None of the above

Answer: a

48. In plants, during embryonic condition –

(a) All cells of the embryo divide
(b) Meristematic activity is confined to single apical cell
(c) Meristematic activity is confined to a group of apical cells
(d) Apical & lateral cells only divide

Answer: a

49. Which of the following plants grow by a single "apical cell" -

(a) Monocots
(b) Dicots
(c) Gymnosperms
(d) Bryophyta

Answer: d

50. Plate meristem shows -

(a) Anticlinal divisions in two planes to right angle to each other
(b) Anticlinal divisions in one plane
(c) Both periclinal & anticlinal divisions in one plane
(d) Three dimensional divisions

Answer: a

51. Epithelial tissues lie on the basement membrane. It is made up of -

(a) Basal lamina composed of glycoproteins secreted by epithelial cells
(b) Fibrous lamina composed of collagen or reticular fibres suspended in mucopolysaccharide of underlying connective tissue
(c) Both 1 and 2
(d) Cellular layer

Answer: c

52. Simple epithelium is not effective in -

(a) Nutrition
(b) Excretion
(c) Secretion
(d) Protecting the underlying tissues

Answer: d

53. Which of the following epithelium forms the inner lining of lung alveoli, blood vessels and peritoneum of body cavity ?

(a) Cuboidal
(b) Squamous
(c) Columnar
(d) Ciliated columner

Answer: b

54. Which of the following mammalian tissues is associated with filteration and diffusion ?

(a) Simple columnar
(b) simple squamous
(c) Stratified squamous
(d) Stratified columnar

Answer: b

55. Germinal Epithelium is

(a) Modified cuboidal Epthelium produces gametes
(b) Modified squamous
(c) Modified Pigmented
(d) Sensory Epithelium

Answer: a

56. Olfactory Epithelium (Schneidarian membrane) is

(a) Neuro sensory Epithelium
(b) Simple sq. Epithelium
(c) Simple cuboidal
(d) Germinal Epithelium

Answer: a

57. Basement membrane is absent in

(a) Transitional Epithelium
(b) Sq. Epithelium
(c) Columnar Epithelium
(d) Simple cuboidal Epithelium

Answer: a

58. Mucus cells (Goblet cells)

(a) Unicellular gland
(b) Multicellular glands
(c) Endocrine glands
(d) Parietal cells of gastric glands

Answer: a

59. Active Mammary glands are

(a) Compound tubulo alveolar
(b) Compound tubular
(c) Compound Alveolar
(d) Simple alveolar

Answer: a

60. In structure Sweat glands are

(a) Simple Aveolar
(b) Simple tubular
(c) Simple coiled tubular
(d) Compound Alveolar

Answer: c