WEEKLY TEST RANKER'S BATCH-01 TEST - 02 Balliwala
SOLUTION Date 15-09-2019

[PHYSICS]

1. From the law of conservation of angular momentum

$$mr_1v_1 = mr_2v_2$$
$$r_1v_1 = r_2v_2$$
$$\frac{v_1}{v_2} = \frac{r_2}{r_1}$$

2. We have

$$P = \mathbf{F}\cdot\mathbf{v} = Fv\cos\theta$$

So just before hitting θ is zero and both F and v are maximum.

3.
$$\frac{9h}{25} = \frac{g}{2}(2t-1)$$
$$\frac{1}{2}gt^2 = h$$
$$h = 122.5\text{ m}$$

4. The acceleration due to gravity at depth d below the earth's surface is given by $g_d = g\left(1-\frac{d}{R}\right)$

5. The potential energy on the surface of earth would be equal to mgR.
So, the change in potential energy would be equal to

$$\Delta PE = \frac{mgh}{1+\frac{h}{R}} = \frac{mgR}{1+\frac{R}{R}} = \frac{mgR}{2}$$

6. Option (c) shows the graph of variation of acceleration due to gravity g with depth h from the surface of the earth.

7. Given, $g' = \frac{g}{4}$

We know that is acceleration due to gravity at height h from the surface of the earth

$$g' = g\left[\frac{R}{R+h}\right]^2$$

Hence
$$\frac{g}{4} = g\left[\frac{R}{R+h}\right]^2 \qquad \left(\because g' = \frac{g}{4}\right)$$
$$\frac{R}{R+h} = \frac{1}{2}$$
$$R + h = 2R$$
$$h = R$$

8. The escape speed of a body from the surface of earth (radius of earth = R_E) is $\sqrt{2gR_E}$.

9. Escape velocity, $v_e = \sqrt{\frac{2GM}{R}}$

$$= \sqrt{\frac{2G \times 2M}{R/2}} = 2\sqrt{\frac{2GM}{I}}$$

$$= 2 \times 11.2 \text{ kms}^{-1}$$

$$= 22.4 \text{ km s}^{-1}$$

10. Time period $T = \frac{2\pi r}{v_o}$

$$T = \frac{2\pi R}{\sqrt{\frac{GM_m}{R}}} \qquad \left(\because v_o = \sqrt{\frac{GM}{R}}\right)$$

$$T^2 = \frac{4\pi^2 R^3}{GM_m}$$

11. When a satellite revolves around planet in its orbit, it possesses both potential energy and kinetic energy.

Potential energy, $U = -\frac{GMm}{r}$

and kinetic energy, $K = \frac{GMm}{2r}$

12. Time period does not depends on mass.

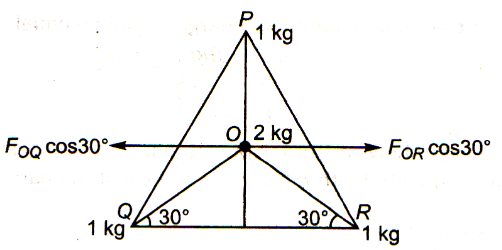
13. Force, $F = G\frac{M_E m}{R_E^2}$

$$mg = G\frac{M_E m}{R_E^2}$$

$$g = \frac{GM_E}{R_E^2}$$

or $M_E = \frac{gR_E^2}{G}$

14. Given, $OP = OQ = OR = \sqrt{2}$ m



The gravitational force on mass 2 kg due to mass 1 kg at P.

$$F_{OP} = G\frac{2 \times 1}{(\sqrt{2})^2}$$

$$= G \text{ along } OP$$

Similarly,

$$F_{OQ} = G\frac{2\times 1}{(\sqrt{2})^2} = G \text{ along } OQ$$

and $$F_{OR} = G\frac{2\times 1}{(\sqrt{2})^2} = G \text{ along } OR$$

$F_{OQ}\cos 30°$ and $F_{OR}\cos 30°$ are equal and acting in opposite directions, then cancel out each other. Then the resultant force on the mass 2 kg at O

$$F = F_{OP} - (F_{OQ}\sin 30° + F_{OR}\sin 30°)$$

$$F = G - \left(\frac{G}{2} + \frac{G}{2}\right)$$

$$F = 0 \text{ (zero)}$$

15. Acceleration due to gravity at the surface of the earth

$$g = \frac{GM}{R^2} = \frac{4}{3}\pi\rho GR \quad \text{...(i)}$$

Acceleration due to gravity at depth d from the surface of earth

$$g' = \frac{4}{3}\pi\rho G(R-d) \quad \text{...(ii)}$$

From Eqs. (i) and (ii)

$$g' = g\left[1 - \frac{d}{R}\right]$$

16. The acceleration due to gravity varies with height as

$$g' = \frac{g}{\left(1+\frac{h}{R}\right)^2}$$

$$\Rightarrow \quad \frac{g}{100} = \frac{g}{\left(1+\frac{h}{R}\right)^2}$$

$$\Rightarrow \quad \left(1+\frac{h}{R}\right)^2 = 100$$

$$\Rightarrow \quad h = 9R$$

17. Gravitational pull depends upon acceleration due to gravity on that planet.

$$M_m = \frac{1}{81}M_e,\ g_m = \frac{1}{6}g_e$$

$$g = \frac{GM}{R^2}$$

$$\Rightarrow \quad \frac{R_e}{R_m} = \left[\frac{M_e}{M_m}\times\frac{g_m}{g_e}\right]^{1/2} = \left[81\times\frac{1}{6}\right]^{1/2}$$

$$\therefore \quad R_e = \frac{9}{\sqrt{6}}R_m$$

18. Acceleration due to gravity at earth's surface is given by

$$g = \frac{GM}{R^2} \quad \ldots(i)$$

Since, earth is assumed to be spherical in shape, its mass is

$$M = \text{volume} \times \text{density} = \frac{4}{3}\pi R^3 \rho$$

Given, $\rho_e = \rho_p = \rho,\ G_p = 2G_e$

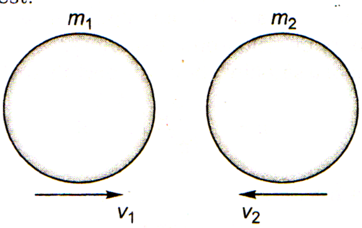
$$\therefore \quad \frac{g_e}{g_p} = \frac{G_e\left(\frac{4}{3}\pi R_e^3\right)\rho \times R_p^2}{R_e^2 \times G_p\left(\frac{4}{3}\pi R_p^3\right)\rho}$$

$$1 = \frac{G_e R_e^3 \times R_p^2}{R_e^2 \times R_p^3 \times 2G_e} \quad (\because G_p = 2G_e)$$

$$1 = \frac{R_e}{2R_p}$$

$$\Rightarrow \quad \frac{R_p}{R_e} = \frac{1}{2}$$

19. According to Newton's law of universal gravitation, every point mass attracts every other point mass by a force directed along the line connecting the two. The gravitational force is an internal force. Since, the two particles are initially at rest their centre of mass is also initially at rest under the effect of internal forces, so the centre of mass remains in the state of rest.



20. Ratio of acceleration due to gravity

$$\frac{g'}{g} = \frac{978}{980} = 1 - \frac{d}{R}$$

or $$\frac{d}{R} = 1 - \frac{978}{980} = \frac{2}{980} \text{ or } d = \frac{2R}{980}$$

$$= \frac{2 \times 6300}{980}$$

$$= 12.86 \text{ km}$$

21. Escape velocity from earth's surface,

$$v_e = \sqrt{2gR}$$

where g = acceleration due to gravity

and R = radius of earth.

22. Energy required = Total energy (final) − Total energy (initial)

$$= -\frac{GMm}{2(3R)}\left(-\frac{GMm}{2(2R)}\right)$$

$$= \frac{GMm}{4R} - \frac{GMm}{6R}$$

$$= \frac{GMm}{12R}$$

23. Escape velocity is given by

$$v_e = \sqrt{\frac{2GM}{R}}$$

$$= \sqrt{\frac{2G}{R} \times \frac{4}{3}\pi R^3 \rho}$$

$$\Rightarrow \quad v_e = R\sqrt{\frac{8}{3}\pi G\rho}$$

$$\therefore \quad \frac{v_A}{v_B} = \frac{R_A}{R_B} = 2$$

24. Using law of conservation of energy

$$\frac{1}{2}mv^2 = \frac{1}{2}m[(20)^2 - v_e^2]$$

Here escape velocity $v_e = 8\sqrt{2}$ kmh^{-1}

$$\therefore \quad v^2 = (20)^2 - (8\sqrt{2})^2$$

$$= 400 - 128$$

$$= 272$$

So, $v = 16.5$ kmh^{-1}

25. . Escape velocity of a body from the surface of earth is given by

$$v_e = \sqrt{\frac{2GM_e}{R_e}}$$

So, from the question,

$$M_p = \frac{M_e}{2}, \ R_p = \frac{R_e}{4}$$

We have $v'_e = \sqrt{\dfrac{2G \times M_e \times 4}{2R_e}} = \sqrt{2}v_e$

26. Gravitational potential energy of mass m at earth's surface

$$U_e = -\frac{GMm}{R}$$

Gravitational potential energy of same mass at a height nR from the earth's surface

$$U_h = -\frac{GMm}{(R+nR)} = -\frac{GMm}{R(n+1)}$$

Thus, magnitude of the change in gravitational potential energy

$$\Delta U = U_h - U_e$$

$$= \frac{GMm}{R}\left\{1 - \frac{1}{(n+1)}\right\}$$

$$= \left(\frac{n}{n+1}\right)\frac{GMm}{R}$$

$$= \left(\frac{n}{n+1}\right) mgR \qquad (\because GM = gR^2)$$

27. Binding energy of satellite in the first case is $= \frac{GMm}{2r}$

where r is the radius of orbit.

In second case $BE = \frac{GMm}{2 \times \frac{3r}{2}}$

$$\therefore \qquad \Delta E = \frac{GMm}{r}\left(\frac{1}{2} - \frac{1}{3}\right) = \frac{GMm}{6r}$$

% increase in energy of a satellite

$$= \frac{\frac{GMm}{6r}}{\frac{GMm}{2r}} \times 100$$

$$= \frac{2}{6} \times 100 = 33.33\%$$

28. Acceleration due to gravity on the surface of the planet is

$$g_p = \frac{GM_p}{R_p^2}$$

Given, $M_p = \frac{M_e}{2}$ and $R_p = \frac{R_e}{2}$

$$\therefore \qquad g_p = \frac{G(M_e/2)}{(R_e/2)^2} = \frac{2\,GM_e}{R_e} = 2g_e$$

29. On earth, $mg = 10$ or $1 \times g = 10 \Rightarrow g = 10\ \text{ms}^{-2}$

Now, $g' = g\frac{R^2}{r^2} = 10 \times \frac{R^2}{(3R/2)^2} = \frac{40}{9}$

Pull on satellite $= m'g'$

$$= 200 \times \frac{40}{9} = 889\ \text{N}$$

30. The ratio

$$\frac{g'}{g} = \frac{R^2}{(R+h)^2} = \frac{1}{2}$$

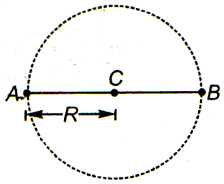
or $R + h = \sqrt{2}R$

or $h = (\sqrt{2} - 1)\,R$

or $h = (0.414) \times 6400$

$\Rightarrow$ $h = 2650$ km

31. Two particles A and B each of mass m move in a circular path of radius R.
Then gravitational force between them provides the necessary centripetal force,



i.e., $\frac{mv^2}{R} = \frac{GMm}{(2R)^2}$

$\Rightarrow$ $v = \frac{1}{2}\sqrt{\left(\frac{GM}{R}\right)}$

32. On earth $v_e = \sqrt{\frac{2GM}{R}} = 11$ km/s

On moon $v_m = \sqrt{\frac{2GM \times 4}{81 \times R}}$

$$= \frac{2}{9}\sqrt{\frac{2GM}{R}}$$

$$= \frac{2}{9} \times 11.2 = 2.5 \text{ kms}^{-1}$$

33. On moon, $g_m = \frac{4}{3}\pi G\left(\frac{R}{4}\right)\left(\frac{2\rho}{3}\right)$

$$= \frac{1}{6}\left(\frac{4}{3}\pi GR\rho\right) = \frac{1}{6}g$$

Work done in jumping $= m \times g_m \times 0.5$

$$= m \times \left(\frac{g}{6}\right) h_1$$

$$h_1 = 0.5 \times 6 = 3.0 \text{ m}$$

34. . A satellite which revalues around the earth in its equatorial plane with the same angular speed and in the same direction as the earth rotates about its own axis is called a geostationary or synchronous satellite.
The height of a satellite above the earth's surface is given by

$$h = \left(\frac{T^2 R^2 g}{4\pi^2}\right)^{1/3} - R$$

But $T = 24$ h $= 86400$ s

R = radius of earth = 6400 km

$g = 9.8\ \text{ms}^{-2} = 0.0098\ \text{kms}^{-2}$

$$\therefore \quad h = \left(\frac{(86400)^2 \times (6400)^2 \times 0.0098}{4 \times 9.87}\right)^{1/3}$$

$d = 42330 - 6400 = 35930$ km

≈ 36000 km

35. From Kepler's law

$$T^2 \propto R^3$$

or $$T \propto R^{3/2}$$

$$\frac{T'}{T} = \left(\frac{R'}{R}\right)^{3/2}$$

or $$\frac{T'}{T} = \left(\frac{4R}{R}\right)^{3/2}$$

$$= (4)^{3/2} = (2^2)^{3/2}$$

$$= 2^3 = 8$$

$\therefore$ $$T' = 8T = 8 \times 90$$

$$= 720 \text{ min}$$

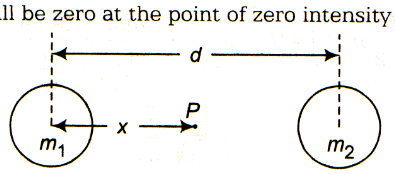
36.

$$g = \frac{GM}{R^2} = \frac{G\left(\frac{4}{3}\pi R^3\right)\rho}{R^2}$$

$$\therefore \quad \rho = \frac{g}{G \cdot 4\pi \frac{R}{3}} = \frac{3g}{4\pi GR}$$

37. Total mechanical energy is conserved, not the kinetic energy..

38. Force will be zero at the point of zero intensity



$$x = \frac{\sqrt{m_1}}{\sqrt{m_1} + \sqrt{m_2}} d$$

$$= \frac{\sqrt{81M}}{\sqrt{81M} + \sqrt{M}} D = \frac{9}{10} D$$

39. At equator $g' = g - R\omega^2 = 0$

$\therefore$ $$\omega = \sqrt{\frac{g}{R}}$$

$$\frac{2\pi}{T} = \sqrt{\frac{g}{R}}$$

$\therefore$ $$T = 2\pi\sqrt{\frac{R}{g}}$$

40. On surface of earth $U = -\frac{GMm}{R}$

At height $h (<< R)$, increase in potential energy is mgh

$\therefore$ $$U_h = -\frac{GMm}{R} + mgh$$

41. $$T = 2\pi\sqrt{\frac{l}{g}} \propto \frac{1}{\sqrt{g}}$$

$\therefore$ $$\frac{T_2}{T_1} = \sqrt{\frac{g_1}{g_2}} = \sqrt{\frac{g}{\dfrac{g}{\left(1+\dfrac{h}{R}\right)^2}}} = 2 \quad (\text{at } h = R)$$

42. Decrease in kinetic energy = increase in PE

$\therefore$ $$\frac{1}{2} m\left(\frac{v_e}{\sqrt{2}}\right)^2 = \frac{mgh}{1+\dfrac{h}{R}}$$

or $$\frac{v_e^2}{4} = \frac{gh}{1+\dfrac{h}{R}}$$

or $$\frac{2gR}{4} = \frac{gh}{1+\dfrac{h}{R}} \quad \text{or} \quad \frac{R}{2} = \frac{h}{1+\dfrac{h}{R}}$$

Solving this equation, we get $h = R$

Note Kinetic energy is half the value required to escape.

Therefore speed is $\frac{1}{\sqrt{2}}$ times the value required to escape.

43. $F = \frac{k}{r}$

$\therefore$ $$\frac{mv^2}{r} = \frac{k}{r}$$

or $$v \propto r^0$$

44. Actually gravitational force provides the centripetal force.

45. $g = \frac{GM}{R^2}$ or $\frac{G}{g} = \frac{R^2}{m}$

$\therefore$ $\frac{G}{g}$ will have the units $\frac{\text{m}^2}{\text{kg}}$

[CHEMISTRY]

46.

The corresponding acids are HI, HCl, HNO_2 and HCN. Their acid strength follows the order HI > HCl > HNO_2 > HCN. Hence, their conjugate base follows the reverse order.

47.

pH of a weak acid is given by

(I) $2pH = \frac{1}{2}[pK_a - \log C]$ at $C = 0.1M$

(ii) $pH = \frac{1}{2}[pK_a - \log C']$ at $C' = ?$

$\therefore$ $4pH = pK_a - \log C'$
$2pH = pK_a = \log C$

$2pH = \log C - \log C' = \log\frac{0.1}{C'}$

From I, $pH = \frac{1}{2}[4.74 - \log 0.1] = \frac{1}{2}[4.74 + 1.0] = 2.87$

$\therefore$ $2 \times 2.87 = \log\frac{0.1}{C'} \Rightarrow 5.74 = \log\frac{0.1}{C'}$

$\therefore$ $\frac{0.1}{C'} = 5.5 \times 10^5$

Thus, dilution $\frac{1}{C'} = \frac{5.55\times10^5}{0.1} = 5.55\times10^6$ times

48.

The conjugate acid-base pairs are (HCl, Cl^-) and ($CH_3COOH_2^+$, CH_3COOH).

49.

The conjugate acids are H_2O, NH_3, $HC\equiv CH$ and CH_3CH_3. Their order of acid strength is $CH_3CH_3 < NH_3 < HC\equiv CH < H_2O$. Their conjugate base follows the reverse order.

50.

NH_3 donates pair of electrons while BF_3, Cu^{2+} and $AlCl_3$ accept lone pair of electrons.

51.

Acid $\xrightarrow{-H^+}$ Conjugate base, Base $\xrightarrow{+H^+}$ Conjugate acid

52.

H_3O^+ (acid), H_2O (conjugate base) and not OH^-.

53.

54.

For each weak polyprotic acid $K_{a_1} > K_{a_2} > K_{a_3}$

55.

H_2O is the weaker base, hence, its conjugate acid is the stronger acid,

$H_2O + H^+ \rightleftharpoons H_3O^+$

H_2O is the weakest acid, hence, its conjugate base is the strongest base.

$H_2O \rightleftharpoons OH^- + H^+$

56.

pH [HCl] = 2.0

$\therefore$ $[H^+] = 10^{-2}$ M

$[HCl] = 10^{-2}$ M

Volume = 200 mL

pH [NaOH] = 12.0

pOH = 2.0

$[OH^-] = 10^{-2}$ M

$[NaOH] = 10^{-2}$ M

Volume = 300 mL

N_1V_1 (acid) = $200 \times 10^{-2} = 2$

N_1V_2 (base) = $300 \times 10^{-2} = 3$

$N_2V_2 > N_1V_1$

Thus, resultant mixture basic.

$$N(OH^-) = \frac{N_2V_2 - N_1V_1}{V_1 + V_2} = \frac{3-2}{500} = 2\times10^{-3}\ M$$

pOH = $-\log(2 \times 10^{-3}) = 2.7$

$\therefore$ pH = 14 – pOH 14 – 2.7 = 11.3

57.

$$[H^+] \text{ after mixing} = \frac{10^{-2}\times10 + 10^{-4}\times990}{1000} = \frac{0.1+0.0990}{1000}$$

$$= \frac{0.1990}{1000} = 1.99\times10^{-4}$$

pH = $(\log 1.99 \times 10^{-4})$

$\therefore$ pH = 4 – 0.3 = 3.7

58.

$$[H^+] = \frac{50\times10^{-1} + 50\times10^{-2}}{100} = 5.5\times10^{-2}\ M$$

pH = $\log(1.99 \times 10^{-4})$

$\therefore$ pH = 2 – 0.74 = 1.26

59.

On heating pure water the value of ionic product of water increases i.e., $K_w = 10^{-14}$ at 25°C and at 100°C, $K_w = 10^{-12}$. Thus pH and pOH both become 6 at 100°C (pH and pOH = 7 at 25°C).

60.

(a) At 25°C, $[H^+]$ in a solution of 10^{-8} M HCl > 10^{-7} M.

(b) $[H^+] = 10^{-8}$ M.

(c) $[OH^-] = 4 \times 10^{-6}$ M $\Rightarrow$ $[H^+] = 2.5 \times 10^{-9}$ M

(d) $[H^+] = 10^{-9}$ M

61.

K_w changes with temperature. As temperature increases, $[OH^-]$ and $[H^+]$ decrease.

62.

Meq. of HCl = $10 \times 10^{-1} = 1$

Meq. of NaOH = $10 \times 10^{-1} = 1$

Thus both are neutralised and 1 Meq. of NaCl (a salt of strong acid and strong base) which does not hydrolyse and thus pH = 7.

63.

The dissociation of H_3BO_3 is

$$H_3BO_3 + H_2O \rightarrow H_2BO_3^- + H_3O^+$$

$$K_1 = \frac{[H_2BO_3^-][H_3O^+]}{[H_3BO_3]} = \frac{(0.18).x}{(01.0)} = 7.3 \times 10^{-10}$$

or $x = [H_3O^+] = 4.1 \times 10^{-10}$

or $pH = -\log x = -\log(4.1 \times 10^{-10}) = 9.39$

64.

(a) HCl NaOH

No. of milli eq. $= \frac{1}{10} \times 100 = 10$ $\quad \frac{1}{10} \times 100 = 10$

So solution is neutral

(b) $\frac{1}{10} \times 55 = 5.5$ $\quad \frac{1}{10} \times 45 = 4.5$

$[H^+] = \frac{1}{100} = 10^{-2}$ M, pH = 2

(c) $\frac{1}{10} \times 10 = 1$ $\quad \frac{1}{10} \times 90 = 9$ Basic

(d) $\frac{1}{5} \times 75 = 15$ $\quad \frac{1}{5} \times 25 = 5$

$[H^+] = 0.1$ M, pH = 1

65.

Initial	Final
pH = 12	pH = 11
$[H^+] = 10^{-12}$ M	$[H^+] = 10^{-11}$ M
$[OH^-] = 10^{-2}$ M	$[OH^-] = 10^{-3}$ M

Initial no. of mole of $OH^- = 10^{-2}$

Final no. of mole of $OH^- = 10^{-3}$

So no. of mole of OH^- removed = [0.1 – 0.001] = 0.009

66.

$$pK_w = -\log K_w = -\log 1 \times 10^{-12} = 12.$$

$$K_w = [H^+][OH^-] = 10^{-12}$$

$$[H^+] = [OH^-]$$

$\Rightarrow$ $[H^+]^2 = 10^{-12}$; $[H^+] = 10^{-6}$; $pH = -\log[H^+] = -\log 10^{-6} = 6.$

H_2O is neutral because $[H^+] = [OH^-]$ at 373 K even when pH = 6.

(d) is not correct at 373 K. Water cannot become acidic.

67.

Relative strength of weak acids $= \sqrt{\left(\frac{K_{a_1}}{K_{a_2}} \times \frac{C_1}{C_2}\right)}$

$\therefore$ Relative strength $= \sqrt{\left(\frac{K_{a_1}}{K_{a_2}}\right)}$ $(\because C_1 = C_2) = \sqrt{\left(\frac{2\times10^{-4}}{2\times10^{-5}}\right)}$

Relative strength for HCOOH to $CH_3COOH = \sqrt{10}:1$

68.

$$pH = 13$$

$\therefore$ $[H^+] = 10^{-13}$ M

$[OH^-] = 10^{-1}$ M = 0.1 mol L^{-1}

$[Ba(OH)_2] = 0.1$ N,

= 0.1 × 100 = 10 milliequivalents

69.

pH of amphiprotic salts and weak acid-weak base salt is independent of its concentration.

70.

71.

72.

Reaction: $2A + B \rightleftharpoons C + D$

$$K_P = \frac{n_C \times n_D}{n_A^2 \times n_B} \times \left(\frac{P}{\Sigma n}\right)^{\Delta n_g}$$

$$\Delta n_g = 2 - 3 = -1$$

$$K_P = \frac{n_C \times n_D}{n_A \times n_B} \times \left(\frac{\Sigma n}{P}\right)$$

$$PV = \Sigma nRT$$

$$\frac{V}{RT} = \frac{\Sigma n}{P}$$

From equations (i) and (ii),

$$K_p = \frac{n_C \times n_D}{n_A \times n_B} \times \frac{V}{RT}$$

73.

Concentration of $[NO_2]$ will decrease with increase in concentration $[N_2O_4]$.

74.

With passage of time conc. of reactants decreases and products increases.

75.

$$K = 2 = \sqrt{k_1}\ , K_2 = \frac{1}{K_4}\ , K_1 = \frac{1}{K_3}$$

$$\therefore \quad K_1K_3 = 1,\ \sqrt{K_1}\ K_4 = 1\ \sqrt{K_3}\ = 1$$

76.

$$\Delta n_g = 4 + 1 - (2 + 2) = 1$$

$$\therefore \quad K_P = k_c\,(RT)^{\Delta n_g}$$

$$0.03 = K_C\,(0.082 \times 700)^1$$

$$K_C = 5.23 \times 10^{-4}$$

77.

Required equilibrium is obtained if we operate.

Eq. (III) × 4 – Eq. (I) × 2 – Eq. (II) × 2

$$K_C = \frac{[N_2O_4]^2}{[N_2O]^2[O_2]^3} = \frac{(4.1\times10^{-9})^4}{(2.7\times10^{-18})^2\,(4.6\times10^{-3})^2} = 1.832\times10^6$$

78.

At equilibrium rates of backward and forward reactions become equal.

87. (c) HCl is a strong electrolyte since it will produce more H^+, comparison than that of CH_3COOH. Hence assertion is true but reason false.

88. (a) Barium carbonate is more soluble in HNO_3 than in water become carbonate is a weak base and reacts with the H^+ ion of HNO_3 causing the barium salt to dissociate.

$BaCO_3 + HNO_3 \rightarrow Ba(NO_3)_2 + CO_2 + H_2O$

89. (a) The conjugate base of $CHCl_3$ is more stable than conjugate base of $CHF_3(CF_3)$. CCl_3 stabilized by –I effect of chlorine atoms as well as by the electrons. But conjugate base of $CH_3(CH_3)$ is stabilized only by –I effect of flourine atoms. Here both assertion and reason are true and reason is correct explanation of assertion.