WEEKLY TEST MEDICAL PLUS -01 TEST - 18 B
SOLUTION Date 15-09-2019

[PHYSICS]

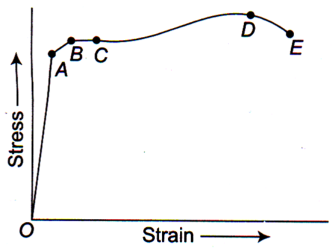
1. As stress is shown on x-axis and strain on y-axis

So we can say that $Y = \cot\theta = \frac{1}{\tan\theta} = \frac{1}{\text{slope}}$

So elasticity of wire P is minimum and of wire R is maximum.

2. In the region OA, the graph is linear showing that stress is proportional to the strain. Is proportional to the strain. Thus, in this region Hooke's law is obeyed.

The point D on the graph is known as ultimate tensile strength.



The point E on the graph is known as fracture point.

3. In ductile materials, yield point exist while in Brittle material, failure would occur without yielding.

4. $Y = \tan\theta$. According to figure $\theta_A > \theta_B > \theta_C$

i.e., $\tan\theta_A > \tan\theta_B > \tan\theta_C$

or $Y_A > Y_B > Y_C$

$\therefore$ A, B, and C graph are for steel, brass and rubber respectively.

5. For a perfectly rigid body, both Young's modulus and bulk modulus is infinite.

6. From the given graph for a stress of 150×10^6 N m^{-2} the strain is 0.002.

$\therefore$ Young's modulus $Y = \frac{\text{Stress}}{\text{Strain}}$

$$Y = \frac{150\times10^6}{0.002}\,\text{N m}^{-2} = 7.5\times10^{10}\,\text{N m}^{-2}$$

7. Initial length (circumference) of the ring = $2\pi r$
Final length (circumference) of the ring = $2\pi R$
Change in length = $2\pi R - 2\pi r$.

$$\text{Strain} = \frac{\text{change in length}}{\text{original length}} = \frac{2\pi(R-r)}{2\pi r} = \frac{R-r}{r}$$

Now Young's modulus $E = \frac{F/A}{l/L} = \frac{F/A}{(R-r)/r}$

$$\therefore \quad F = AE\left(\frac{R-r}{r}\right)$$

8. Tension in both string shall be same which can be observed by making FBD of string in figure (1)

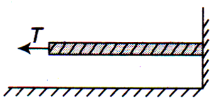
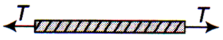


figure (i)

$\Rightarrow$



FBD of string in figure (i)

9. $Y = \frac{FL}{\pi r^2 l}$

$$\therefore \quad l = \frac{FL}{\pi r^2 Y} \Rightarrow l \propto \frac{L}{r^2}$$

$\therefore \frac{L}{r^2}$ is greatest for option A.

10. Let load put on the hanger is F, then stress in lower wire

$$S_1 = \frac{m_1 g + F}{0.003 \times 10^{-4}}$$

Let $S_1 = 8 \times 108$ N/m^2, then

$$8 \times 10^8 = \frac{10 \times 10 + F}{3 \times 10^{-7}} \Rightarrow F = 140 \text{ N}$$

Let stress developed in upper wire is S_2, then

$$S_2 = \frac{(m_1 + m_2)g + F}{0.006 \times 10^{-4}}$$

11. Shearing strain $= \frac{\Delta x}{L}$

12. If coefficient of volume expansion is α and rise in temperature is $\Delta\theta$ then $\Delta V = V\alpha\Delta\theta \Rightarrow \frac{\Delta V}{V} = \alpha\Delta\theta$

Volume elasticity $\beta = \frac{P}{\Delta V/V} = \frac{P}{\alpha\Delta\theta} \Rightarrow \Delta\theta = \frac{P}{\alpha\beta}$

13. $\Delta V = 0.00004(200\text{ L}) = 0.008\text{ L}$

$$\Delta p = B\left(-\frac{\Delta V}{V}\right)$$

$$= (2100\text{ MPa})\left(\frac{0.008L}{200L}\right)$$

$$= 0.084\text{ MPa} = 84\text{ kPa}$$

14. If side of the cube is L then $V = L^3 \Rightarrow \frac{dV}{V} = 3\frac{dL}{L}$

$\therefore$ % change in volume = 3 × (% change in length)

$$= 3 \times 1\% = 3\% \therefore \text{Bulk strain } \frac{\Delta V}{V} = 0.03$$

15. $B = \frac{\Delta p}{\Delta V/V} = \frac{h\rho g}{0.1/100} = \frac{200 \times 10^3 \times 9.8}{1/1000}$

$= 19.6 \times 10^8\ \text{N/m}^2$

16. $K = \frac{\Delta p}{\Delta V/V} = \frac{(1.165 - 1.01) \times 10^5}{10/100} = \frac{0.155 \times 10^5}{1/10}$

$= 1.55 \times 10^5$ pa

17. Work done in stretching a wire .

$$W = \frac{1}{2}Fl = \frac{1}{2} \times 10 \times 0.5 \times 10^{-3} = 2.5 \times 10^{-3}\text{ J}$$

Work done to displace it through 1.5 mm

$$\text{W} = \text{F} \times \text{l} = 5 \times 10^{-3}\text{ J}$$

The ratio of above two work = 1 : 2

18. At extension l_1, the stored energy $= \frac{1}{2}Kl_1^2$

At extension l_2, the stored energy $= \frac{1}{2}Kl_2^2$

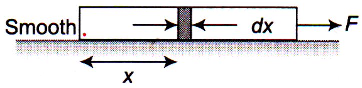
Work done in increasing its extension from l_1 to l_2

$$= \frac{1}{2}K(l_2^2 - l_1^2)$$

19. $U = \frac{1}{2} \times Y \times (\text{Strain})^2 = \frac{1}{2} \times 9 \times 10^{11} \times \left(\frac{1}{100}\right)^2$

$= 4.5 \times 10^7$ J

20. Tension, $T = \frac{F}{L_0} \cdot x\,x$



Stress, $\sigma = \frac{T}{A} = \frac{F}{AL_0} x$

$$dU = \frac{1}{2} \cdot \frac{\sigma^2}{Y} A dx = \frac{1}{2} \frac{F^2}{A^2 L_0^2} \cdot x^2 \frac{A}{Y} dx$$

or $$dU = \frac{F^2}{2A^2 L_0^2 Y} \cdot x^2 dx$$

$\Rightarrow$ $$U = \frac{F^2}{2AY L_0^2} \int_0^{L_0} x^2 dx$$

$$U = \frac{F^2}{2AY L_0^2} \cdot \frac{L_0^3}{3} = \frac{F^2 L_0}{6AY}$$

21. Work done in stretching the wire through 0.61 mm under the load of 3 kg wt.

$$W = \frac{1}{2} \text{ stretching force} \times \text{extension}$$

$$= \frac{1}{2} \times 3 \times 9.8 \times 0.61 \times 10^{-3}$$

$$= 8.967 \times 10^{-3} \text{ J}$$

Work done in stretching the wire through 1.02 mm under the load of 5 kg wt.

$$W_2 = \frac{1}{2} \times 3 \times 9.8 \times 1.02 \times 10^{-3}$$

$$= 34.99 \times 10^{-3} \text{ J}$$

Hence the work done in stretching the wire from 0.61 mm to 1.02 mm.

$$\Delta W = W_2 - W_1 = (24.99 - 8.961) \times 10^{-3}$$

$$= 16 \times 10^{-3} \text{ J}$$

22. The elastic potential energy per unit volume

$$= \frac{1}{2} \text{stress} \times \text{strain} = \frac{1}{2} Y \text{ strain} \times \text{strain}$$

$$= \frac{1}{2} Y (\text{strain})^2 = \frac{1}{2} Y \sigma^2$$

23. The energy stored per unit volume is

$$U = \frac{1}{2}\text{stress} \times \text{strain}$$

$$= \frac{1}{2}\text{stress} \times \frac{\text{strain}}{Y}$$

$$U = \frac{(\text{stress})^2}{2Y} = \frac{P^2}{Y}$$

So the correct choice is (b).

24. As the weight of wire acts at centre of gravity.

∴ Only half the length of wire gets extended.

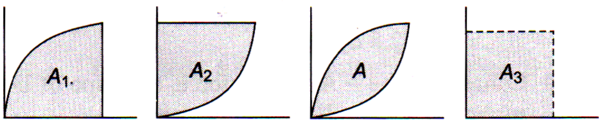
Now $Y = \frac{F}{A} \cdot \frac{(L/2)}{\Delta l} = \frac{Mg(L/2)}{A\Delta l}$

$\Rightarrow \quad \Delta l \frac{MgL}{2AY} \Rightarrow \Delta l \frac{AL\rho gL}{2AY}$

$\therefore \quad \Delta l = \frac{PL^2 g}{2Y}$

So the correct choice is (b)

25. Hysteresis loss corresponding to elasticity per unit volume of a substance is given by the area of hysteresis loop, i.e., stress-strain curve corresponding to one complete loading and deloading.



Area of an ellipse = $\pi \times$ semi-major axis $\times$ semi-minor axis

$A_1 = \frac{1}{4}(\pi \times 8 \times 4 \times 10^2)$ and $A_2 = \frac{1}{4}(\pi \times 8 \times 4 \times 10^2)$

Also, $A_3 = 8 \times 4 \times 10^2$

Area of hysteresis loop is $A = A_1 + A_2 - A_3$

$$A = 2\left[\frac{\pi}{4} \times 8 \times 4 \times 10^2\right] - [8 \times 4 \times 10^2]$$

= work done per cycle

= energy lost per cycle per unit volume

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

Pull on satellite $= m'g'$

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

30. The ratio

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

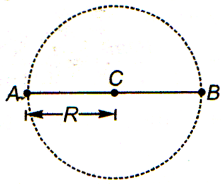
or $\quad R + h = \sqrt{2}R$

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

or $\quad h = (0.414) \times 6400$

$\Rightarrow \quad h = 2650$ 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 $v_e = \sqrt{\frac{2GM}{R}} = 11 \text{ km/s}$

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

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

But $T = 24 \text{ h} = 86400 \text{ s}$

R = radius of earth = 6400 km

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

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

$$d = 42330 - 6400 = 35930 \text{ km}$$

$$\approx 36000 \text{ km}$$

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

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

$$= 2^3 = 8$$

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

$$= 720 \text{ min}$$

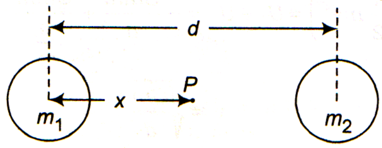
36.

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

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

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.

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

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

42. Decrease in kinetic energy = increase in PE

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

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

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

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.

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

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

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 $\frac{m^2}{kg}$

[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.

$$pH\ [HCl] = 2.0$$
$$\therefore \quad [H^+] = 10^{-2}\ M$$
$$[HCl] = 10^{-2}\ M$$
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.
$$N(OH^-) = \frac{N_2V_2 - N_1V_1}{V_1 + V_2} = \frac{3-2}{500} = 2\times10^{-3}\ M$$
$$pOH = -\log(2 \times 10^{-3}) = 2.7$$
$$\therefore \quad pH = 14 - pOH\ 14 - 2.7 = 11.3$$

57.

$$[H^+]\ \text{after mixing} = \frac{10^{-2}\times10 + 10^{-4}\times990}{1000} = \frac{0.1+0.0990}{1000}$$
$$= \frac{0.1990}{1000} = 1.99\times10^{-4}$$
$$pH = (\log 1.99 \times 10^{-4})$$
$$\therefore \quad pH = 4 - 0.3 = 3.7$$

58.

$$[H^+] = \frac{50\times10^{-1} + 50\times10^{-2}}{100} = 5.5\times10^{-2}\ M$$
$$pH = \log(1.99 \times 10^{-4})$$
$$\therefore \quad pH = 2 - 0.74 = 1.26$$

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. $= \frac{1}{10} \times 100 = 10$ — $\frac{1}{10} \times 100 = 10$

So solution is neutral

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

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

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

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

$[H^+] = 0.1$ 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,

$= 0.1 \times 100 = 10$ 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.