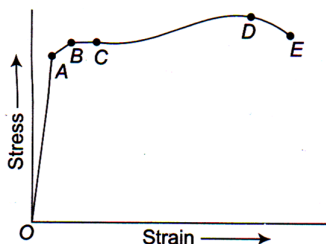


WEEKLY TEST MEDICAL PLUS -01 TEST - 18 R
 SOLUTION Date 15-09-2019

[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 $150 \times 10^6 \text{ N m}^{-2}$ the strain is 0.002.

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

$$Y = \frac{150 \times 10^6}{0.002} \text{ Nm}^{-2} = 7.5 \times 10^{10} \text{ Nm}^{-2}$$

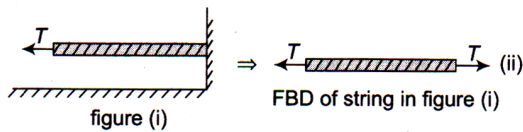
7. Initial length (circumference) of the ring = $2\pi r$
 Final length (circumference) of the ring = $2\pi R$
 Change in length = $2\pi R - 2\pi r$.

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

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

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

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



9. $Y = \frac{FL}{\pi r^2 l}$
 $\therefore l = \frac{FL}{\pi r^2 Y} \Rightarrow l \propto \frac{L}{r^2}$
 $\therefore \frac{L}{r^2}$ 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 $S_1 = 8 \times 10^8 \text{ N/m}^2$, 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 $\Delta V = V\alpha\Delta\theta \Rightarrow \frac{\Delta V}{V} = \alpha\Delta\theta$

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

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

$$\begin{aligned}\Delta p &= B \left(-\frac{\Delta V}{V} \right) \\ &= (2100 \text{ MPa}) \left(\frac{0.008 \text{ L}}{200 \text{ L}} \right) \\ &= 0.084 \text{ MPa} = 84 \text{ kPa}\end{aligned}$$

14. If side of the cube is L then $V = L^3 \Rightarrow \frac{dV}{V} = 3 \frac{dL}{L}$
 \therefore % change in volume = $3 \times$ (% 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. $K = \frac{\Delta p}{\Delta V/V} = \frac{(1.165 - 1.01) \times 10^5}{10/100} = \frac{0.155 \times 10^5}{1/10}$
 $= 1.55 \times 10^5 \text{ pa}$

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

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

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 = $\frac{1}{2} Kl_2^2$

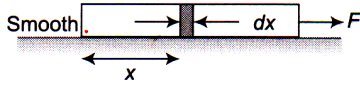
Work done in increasing its extension from l_1 to l_2

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

19. $U = \frac{1}{2} \times Y \times (\text{Strain})^2 = \frac{1}{2} \times 9 \times 10^{11} \times \left(\frac{1}{100} \right)^2$
 $= 4.5 \times 10^7 \text{ J}$



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



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.

$$\begin{aligned} W &= \frac{1}{2} \text{ stretching force} \times \text{extension} \\ &= \frac{1}{2} \times 3 \times 9.8 \times 0.61 \times 10^{-3} \\ &= 8.967 \times 10^{-3} \text{ J} \end{aligned}$$

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

$$\begin{aligned} W_2 &= \frac{1}{2} \times 5 \times 9.8 \times 1.02 \times 10^{-3} \\ &= 24.99 \times 10^{-3} \text{ J} \end{aligned}$$

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

$$\begin{aligned} \Delta W &= W_2 - W_1 = (24.99 - 8.961) \times 10^{-3} \\ &= 16 \times 10^{-3} \text{ J} \end{aligned}$$

22. The elastic potential energy per unit volume

$$\begin{aligned} &= \frac{1}{2} \text{ stress} \times \text{strain} = \frac{1}{2} Y \text{ strain} \times \text{strain} \\ &= \frac{1}{2} Y (\text{strain})^2 = \frac{1}{2} Y \sigma^2 \end{aligned}$$

23. The energy stored per unit volume is

$$\begin{aligned}
 U &= \frac{1}{2} \text{stress} \times \text{strain} \\
 &= \frac{1}{2} \text{stress} \times \frac{\text{strain}}{Y} \\
 U &= \frac{(\text{stress})^2}{2Y} = \frac{P^2}{Y}
 \end{aligned}$$

So the correct choice is (b).

24. As the weight of wire acts at centre of gravity.
 \therefore Only half the length of wire gets extended.

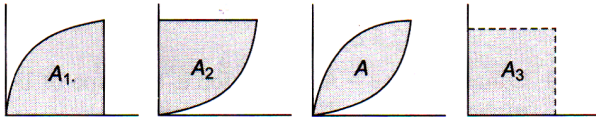
$$\text{Now } Y = \frac{F}{A} \cdot \frac{(L/2)}{\Delta l} = \frac{Mg(L/2)}{A\Delta l}$$

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

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

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

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

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

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

$$\begin{aligned} \Delta U &= U_h - U_e \\ &= \frac{GMm}{R} \left\{ 1 - \frac{1}{(n+1)} \right\} \\ &= \left(\frac{n}{n+1} \right) \frac{GMm}{R} \\ &= \left(\frac{n}{n+1} \right) mgR \quad (\because GM = gR^2) \end{aligned}$$

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

where r is the radius of orbit.

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

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

% increase in energy of a satellite

$$\begin{aligned} &\frac{\frac{GMm}{6r}}{\frac{GMm}{2r}} \times 100 \\ &= \frac{2}{6} \times 100 = 33.33\% \end{aligned}$$

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

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

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

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

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

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

$$\begin{aligned} \text{Pull on satellite} &= m' g' \\ &= 200 \times \frac{40}{9} = 889 \text{ N} \end{aligned}$$

- 30.

The ratio

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

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

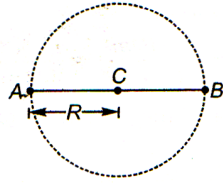
$$\text{or } h = (\sqrt{2} - 1)R$$

$$\text{or } h = (0.414) \times 6400$$

$$\Rightarrow h = 2650 \text{ km}$$



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,



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

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

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

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

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

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

33. On moon, $g_m = \frac{4}{3} \pi G \left(\frac{R}{4}\right) \left(\frac{2\rho}{3}\right)$
- $$= \frac{1}{6} \left(\frac{4}{3} \pi GR\rho\right) = \frac{1}{6} g$$

$$\text{Work done in jumping} = m \times g_m \times 0.5$$

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

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

34. A satellite which revolves 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

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

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

$$R = \text{radius of earth} = 6400 \text{ km}$$

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

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

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

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



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

$$\begin{aligned} \frac{T'}{T} &= \left(\frac{4R}{R}\right)^{3/2} \\ &= (4)^{3/2} = (2^2)^{3/2} \\ &= 2^3 = 8 \end{aligned}$$

$$\begin{aligned} \therefore T' &= 8T = 8 \times 90 \\ &= 720 \text{ min} \end{aligned}$$

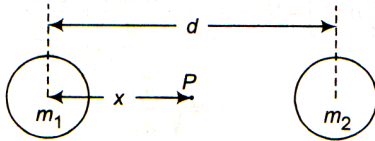
36.

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

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

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

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



$$\begin{aligned} x &= \frac{\sqrt{m_1}}{\sqrt{m_1} + \sqrt{m_2}} d \\ &= \frac{\sqrt{81M}}{\sqrt{81M} + \sqrt{M}} D = \frac{9}{10} D \end{aligned}$$

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 $h \ll R$, increase in potential energy is mgh

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

41.

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

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

42. Decrease in kinetic energy = increase in PE

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

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

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

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.

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

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

$$\text{or } v \propto r^0$$

44. Actually gravitational force provides the centripetal force.

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

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

[CHEMISTRY]

46.

The corresponding acids are HI, HCl, HNO₂ and HCN. Their acid strength follows the order HI > HCl > HNO₂ > HCN. Hence, their conjugate base follows the reverse order.

47.

pH of a weak acid is given by

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

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

$$\therefore \quad 4\text{pH} = pK_a - \log C'$$

$$2\text{pH} = pK_a = \log C$$

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

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

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

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

$$\text{Thus, dilution } \frac{1}{C'} = \frac{5.55 \times 10^5}{0.1} = 5.55 \times 10^6 \text{ times}$$

48.

The conjugate acid-base pairs are (HCl, Cl⁻) and (CH₃COOH₂⁺, CH₃COOH).

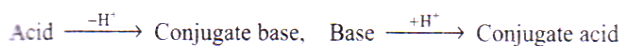
49.

The conjugate acids are H₂O, NH₃, HC ≡ CH and CH₃CH₃. Their order of acid strength is CH₃CH₃ < NH₃ < HC ≡ CH < H₂O. Their conjugate base follows the reverse order.

50.

NH₃ donates pair of electrons while BF₃, Cu²⁺ and AlCl₃ accept lone pair of electrons.

51.



52.

H₃O⁺ (acid), H₂O (conjugate base) and not OH⁻.

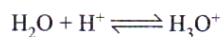
53.

54.

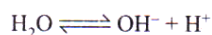
For each weak polyprotic acid $K_{a_1} > K_{a_2} > K_{a_3}$

55.

H₂O is the weaker base, hence, its conjugate acid is the stronger acid,



H₂O is the weakest acid, hence, its conjugate base is the strongest base.



56.

$$\begin{aligned} \text{pH [HCl]} &= 2.0 \\ \therefore [\text{H}^+] &= 10^{-2} \text{ M} \\ [\text{HCl}] &= 10^{-2} \text{ M} \\ \text{Volume} &= 200 \text{ mL} \\ \text{pH [NaOH]} &= 12.0 \\ \text{pOH} &= 2.0 \\ [\text{OH}^-] &= 10^{-2} \text{ M} \\ [\text{NaOH}] &= 10^{-2} \text{ M} \\ \text{Volume} &= 300 \text{ mL} \\ N_1 V_1 (\text{acid}) &= 200 \times 10^{-2} = 2 \\ N_1 V_2 (\text{base}) &= 300 \times 10^{-2} = 3 \\ N_2 V_2 &> N_1 V_1 \\ \text{Thus, resultant mixture basic.} \\ N(\text{OH}^-) &= \frac{N_2 V_2 - N_1 V_1}{V_1 + V_2} = \frac{3 - 2}{500} = 2 \times 10^{-3} \text{ M} \\ \text{pOH} &= -\log(2 \times 10^{-3}) = 2.7 \\ \therefore \text{pH} &= 14 - \text{pOH} = 14 - 2.7 = 11.3 \end{aligned}$$

57.

$$\begin{aligned} [\text{H}^+] \text{ after mixing} &= \frac{10^{-2} \times 10 + 10^{-4} \times 990}{1000} = \frac{0.1 + 0.0990}{1000} \\ &= \frac{0.1990}{1000} = 1.99 \times 10^{-4} \\ \text{pH} &= (\log 1.99 \times 10^{-4}) \\ \therefore \text{pH} &= 4 - 0.3 = 3.7 \end{aligned}$$

58.

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

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 , $[\text{H}^+]$ in a solution of $10^{-8} \text{ M HCl} > 10^{-7} \text{ M}$.
 (b) $[\text{H}^+] = 10^{-8} \text{ M}$.
 (c) $[\text{OH}^-] = 4 \times 10^{-6} \text{ M} \Rightarrow [\text{H}^+] = 2.5 \times 10^{-9} \text{ M}$
 (d) $[\text{H}^+] = 10^{-9} \text{ M}$

61.

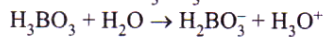
K_w changes with temperature. As temperature increases, $[\text{OH}^-]$ and $[\text{H}^+]$ decrease.

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

$$K_1 = \frac{[\text{H}_2\text{BO}_3^-][\text{H}_3\text{O}^+]}{[\text{H}_3\text{BO}_3]} = \frac{(0.18).x}{(01.0)} = 7.3 \times 10^{-10}$$

$$\text{or } x = [\text{H}_3\text{O}^+] = 4.1 \times 10^{-10}$$

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

64.

(a) HCl

NaOH

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

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

So solution is neutral

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

$$\frac{1}{10} \times 45 = 4.5$$

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

$$(c) \frac{1}{10} \times 10 = 1$$

$$\frac{1}{10} \times 90 = 9 \text{ Basic}$$

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

$$\frac{1}{5} \times 25 = 5$$

$$[\text{H}^+] = 0.1 \text{ M, pH} = 1$$

65.

Initial

Final

$$\text{pH} = 12$$

$$\text{pH} = 11$$

$$[\text{H}^+] = 10^{-12} \text{ M}$$

$$[\text{H}^+] = 10^{-11} \text{ M}$$

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

$$[\text{OH}^-] = 10^{-3} \text{ M}$$

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

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

$$\text{So no. of mole of OH}^- \text{ removed} = [0.1 - 0.001] = 0.099$$

66.

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

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

$$[\text{H}^+] = [\text{OH}^-]$$

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

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

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

67.

$$\text{Relative strength of weak acids} = \sqrt{\frac{K_{a_1} \times C_1}{K_{a_2} \times C_2}}$$

$$\therefore \text{Relative strength} = \sqrt{\frac{K_{a_1}}{K_{a_2}}} \quad (\because C_1 = C_2) = \sqrt{\frac{2 \times 10^{-4}}{2 \times 10^{-5}}}$$

$$\text{Relative strength for HCOOH to CH}_3\text{COOH} = \sqrt{10} : 1$$

68.

$$\text{pH} = 13$$

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

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

$$[\text{Ba}(\text{OH})_2] = 0.1 \text{ N,}$$

$$= 0.1 \times 100 = 10 \text{ milliequivalents}$$



69.

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

70.

71.

72.

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

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

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

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

$$PV = \Sigma nRT$$

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

From equations (i) and (ii),

$$K_P = \frac{n_C \times n_D}{n_A^2 \times n_B} \times \frac{V}{RT}$$

73.

Concentration of $[\text{NO}_2]$ will decrease with increase in concentration $[\text{N}_2\text{O}_4]$.

74.

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

75.

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

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

76.

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

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

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

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

77.

Required equilibrium is obtained if we operate.

Eq. (III) \times 4 - Eq. (I) \times 2 - Eq. (II) \times 2

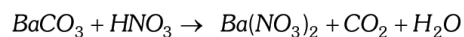
$$K_C = \frac{[\text{N}_2\text{O}_4]^2}{[\text{N}_2\text{O}]^2 [\text{O}_2]^3} = \frac{(4.1 \times 10^{-9})^4}{(2.7 \times 10^{-18})^2 (4.6 \times 10^{-3})^2} = 1.832 \times 10^6$$

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 because carbonate is a weak base and reacts with the H^+ ion of HNO_3 causing the barium salt to dissociate.



89. (a) The conjugate base of $CHCl_3$ is more stable than conjugate base of $CHF_3(CF_3)$. CCl_3 is 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 fluorine atoms. Here both assertion and reason are true and reason is correct explanation of assertion.