

WEEKLY TEST TYM TEST - 26 Balliwala
SOLUTION Date 10 -11-2019

[PHYSICS]

1. $l = \frac{FL}{AY} \therefore l \propto \frac{1}{r^2}$ (F, L and Y are constant)

$$\frac{l_1}{l_2} = \left(\frac{r_2}{r_1}\right)^2 = (2)^2 = 4$$

2. According to Hooke's law

Within the elastic limit, stress is directly proportional to the strain i.e., Stress \propto Strain

or Stress = k strain

$$\frac{\text{Stress}}{\text{Strain}} = k$$

when k is the proportionality constant and is known as modulus of elasticity.

3. Here, $r = 10 \text{ mm} = 10 \times 10^{-3} = 10^{-2} \text{ m}$

$$L = 1 \text{ m}, F = 100 \text{ kN} = 100 \times 10^3 \text{ N} = 10^5 \text{ N}$$

Stress produced in the rod is

$$\begin{aligned} \text{Strain} &= \frac{F}{A} = \frac{F}{\pi r^2} = \frac{100 \times 10^3 \text{ N}}{3.14 \times (10^{-2} \text{ m})^2} \\ &= 3.18 \times 10^8 \text{ Nm}^{-2} \end{aligned}$$

4. Young's modulus depends upon the nature of material and not the radii of the wires.

5. $Y = \frac{Fl}{A\Delta l}$ or $F = \frac{YA\Delta l}{l}$

$$\text{or } F = \frac{2.2 \times 10^{11} \times 2 \times 10^{-6} \times 0.5 \times 10^{-3}}{2} = 1.1 \times 10^2 \text{ N}$$

6. $B = -\frac{\Delta P}{\Delta V/V} = -\frac{V\Delta P}{\Delta V}$

$$= -\frac{1.5 \times 140 \times 10^3}{-0.2 \times 10^{-3}} = 1.05 \times 10^9 \text{ Pa}$$

$$7. \quad U = \frac{1}{2} \left(\frac{YA}{L} \right) l^2 \therefore U \propto l^2$$

$$\frac{U_2}{U_1} = \left(\frac{l_2}{l_1} \right)^2 = \left(\frac{10}{2} \right)^2 = 25 \Rightarrow U_2 = 25U_1$$

i.e., potential energy of the spring will be 25 V

$$8. \quad W = \frac{1}{2} Fl \therefore W \propto l \quad (F \text{ is constant})$$

$$\therefore \frac{W_1}{W_2} = \frac{l_1}{l_2} = \frac{l}{2l} = \frac{1}{2}$$

$$9. \quad U = \frac{1}{2} \times \frac{YA l^2}{L} = \frac{1}{2} \times \frac{2 \times 10^{11} \times 3 \times 10^{-6} \times (1 \times 10^{-3})^2}{4} \\ = 0.075 \text{ J}$$

$$10. \quad \text{The elastic pot. Energy} = \frac{1}{2} \text{ stress} \times \text{strain.}$$

$$= \frac{1}{2} Y (\text{strain})^2 = \frac{1}{2} Y \left(\frac{\Delta l}{L} \right)^2$$

$$\therefore \frac{U_2}{U_1} \propto \left(\frac{\Delta l_2}{\Delta l_1} \right)^2 = \left(\frac{10}{2} \right)^2$$

$$\frac{U_2}{U_1} = 25$$

$$\Rightarrow U_2 = 25U_1$$

So the correct choice is (b).

11. Viscosity of a liquid decreases with increase in temperature whereas viscosity of gases increases with increase in temperature.

$$12. \quad F = \frac{\eta A v}{y} = \frac{12 \times 2 \times 0.5}{1 \times 10^{-3}} \text{ N} = 12000 \text{ N}$$

$$13. \quad v_0 \propto r^2$$

since r becomes one-half therefore v_0 becomes one-fourth.

$$14. \quad \text{Viscous force} = 6\pi\eta r v = 6\pi \times 18 \times 10^{-5} \times 0.03 \times 100 \\ = 101.73 \times 10^{-4} \text{ dyne}$$

15. Initially the terminal velocity V of sphere of radius a is

$$W_{\text{eff}} = 6\pi\eta a V \quad (1) \quad (W_{\text{eff}} = \text{weight} - \text{Buoyant force})$$

As the radius is doubled, mass is increased to 8 times and new terminal velocity will be

$$8W_{\text{eff}} = 6\pi\eta 2a V' \quad (2)$$

from (1) and (2) $V' = 4V$

16. Effective length = $2\pi r + 2\pi R$

17. $2l\sigma = 1 \times 980$ or $l = \frac{980}{2 \times 70} \text{ cm} = 7 \text{ cm}$

18. As volume remains constant therefore $R = n^{1/3} r$

$$\frac{\text{surface energy of one big drop}}{\text{surface energy of } n \text{ drop}} = \frac{4\pi R^2 T}{n \times 4\pi r^2 T}$$

$$\frac{R^2}{nr^2} = \frac{n^{2/3} r^2}{nr^2} = \frac{1}{n^{1/3}} = \frac{1}{(1000)^{1/3}} = \frac{1}{10}$$

19. Energy needed = Increment in surface energy

$$= (\text{surface energy of } n \text{ small drops}) - (\text{surface energy of one big drop})$$

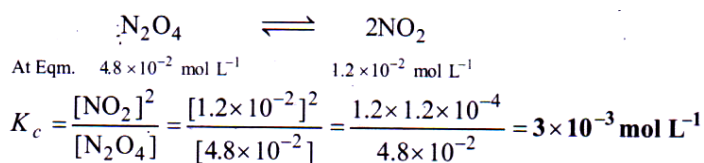
$$= n4\pi r^2 T - 4\pi R^2 T = 4\pi T(nr^2 - R^2)$$

20. $W = 8\pi T(r_2^2 - r_1^2) = 8\pi T \left[\left(\frac{2}{\sqrt{\pi}} \right)^2 - \left(\frac{1}{\sqrt{\pi}} \right)^2 \right]$

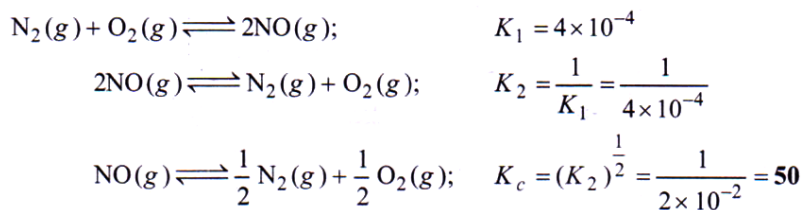
$$\therefore W = 8 \times \pi \times 30 \times \frac{3}{\pi} = 720 \text{ erg}$$

[CHEMISTRY]

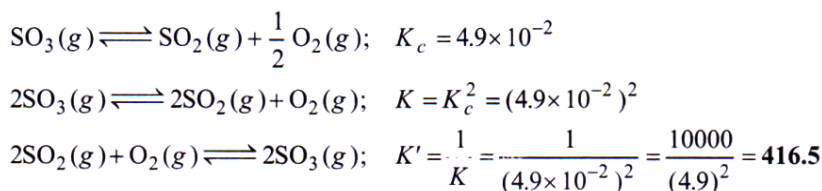
21.



22.

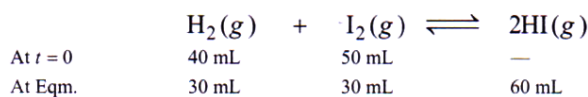


23.



The closest choice is (d).

24.

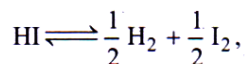
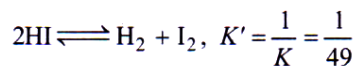
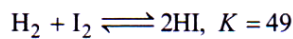


	consumed		produced
Ratio of volumes	(40 - 30)	:(50 - 30)	: 60
Ratio of moles	1	: 2	: 6

(Avogadro's law)

$$K_c = \frac{C_{\text{HI}}^2}{C_{\text{H}_2} \times C_{\text{I}_2}} = \frac{6 \times 6}{1 \times 2} = 18$$

25.



$$K'' = (K')^{1/2} = \frac{1}{\sqrt{49}} = \frac{1}{7} = 0.143$$

26.

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

Since, Δn is $[2 + 1 - 2] = 1$, $K_p > K_c$

27.

Δn (gaseous substances) for this equation is zero.

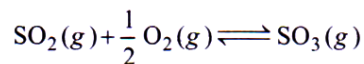
Hence, $K_p = K_c (RT)^{\Delta n} = K_c$.

28.

$$\Delta n = (c + d) - (a + b)$$

$$K_p = K_c (RT)^{\Delta n} = K_c (RT)^{(c+d) - (a+b)}$$

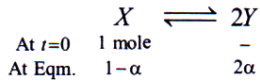
29.



$$K_p = K_c (RT)^{\Delta n_g}$$

$$\text{Here, } \Delta n_g = x = 1 - \left(1 + \frac{1}{2}\right) = -\frac{1}{2}$$

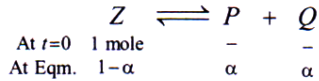
30.



$$\text{Total moles} = 1 - \alpha + 2\alpha = 1 + \alpha$$

$$\text{Total pressure} = P_1$$

$$K_{p_1} = \frac{P_Y^2}{P_X} = \frac{\left(\frac{2\alpha}{1+\alpha} P_1\right)^2}{\left(\frac{1-\alpha}{1+\alpha} P_1\right)} = \frac{4\alpha^2 P_1^2 (1+\alpha)}{P_1 (1+\alpha)(1+\alpha)(1-\alpha)} = \frac{4\alpha^2 P_1}{1-\alpha^2} \quad \dots(i)$$



$$\text{Total moles} = 1 - \alpha + \alpha + \alpha = 1 + \alpha$$

$$\text{Total pressure} = P_2$$

$$K_{p_2} = \frac{P_P P_Q}{P_Z} = \frac{\left(\frac{\alpha}{1+\alpha} P_2\right) \cdot \left(\frac{\alpha}{1+\alpha} P_2\right)}{\left(\frac{1-\alpha}{1+\alpha} P_2\right)} = \frac{\alpha^2 P_2^2}{(1+\alpha)^2 P_2} = \frac{\alpha^2 P_2}{1-\alpha^2} \quad \dots(ii)$$

From eqns. (i) and (ii)

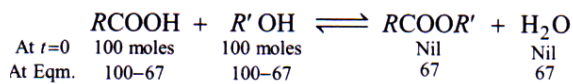
$$\frac{K_{p_1}}{K_{p_2}} = \frac{4\alpha^2 P_1}{1-\alpha^2} \times \frac{1-\alpha^2}{\alpha^2 P_2} = \frac{4P_1}{P_2} \quad \dots(iii)$$

$$\text{Given, } \frac{K_{p_1}}{K_{p_2}} = \frac{1}{9} \quad \dots(iv)$$

From eqns. (iii) and (iv)

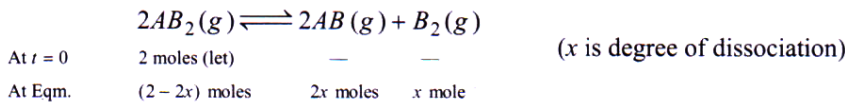
$$\text{So, } \frac{4P_1}{P_2} = \frac{1}{9} \Rightarrow \frac{P_1}{P_2} = \frac{1}{36}$$

31.



$$K = \frac{67 \times 67}{33 \times 33} = 4.12$$

32.



$$\text{Total} = 2 - 2x + 2x + x = (2+x) \text{ moles};$$

$$\text{Total pressure} = P$$

$$K_p = \frac{P_{AB}^2 \cdot P_{B_2}}{P_{AB_2}^2} = \frac{\left(\frac{2x}{2+x} P\right)^2 \left(\frac{x}{2+x} P\right)}{\left(\frac{2-2x}{2+x} P\right)^2} = \frac{x^3}{2} P$$

$$\Rightarrow x = \left[\frac{2K_p}{P} \right]^{1/3} \quad (\text{given is } x \ll 1)$$

