AVIRAL
JEE | NEET | FOUNDATIONS

WEEKLY TEST MEDICAL PLUS -01 TEST - 17 R SOLUTION Date 08-09-2019

[PHYSICS]

1. Kepler's second law is a consequence of conservation of angular momentum

2. According to Kepler's first law, every planet moves in an elliptical orbit with the sun situated at one of the foci of the ellipse.

   In options (a) and (b) sun is not at a focus while in (c) the planet is not in orbit around the sun. Only (d) represents the possible orbit for a planet.

3. Kepler's law $T^2 \propto R^3$

4. During path *DAB* planet is nearer to sun as comparison with path *BCD*. So time taken in travelling *DAB* is less than that for *BCD* because velocity of planet will be more in region *DAB*.

5. Time period of a revolution of a planet,

$$T = \frac{2\pi r}{v} = \frac{2\pi r}{\sqrt{\frac{GM_S}{r}}} = \frac{2\pi r^{3/2}}{\sqrt{GM_S}}$$

6. Gravitational force is independent of the medium. Thus, gravitational force will be same i.e., *F*.

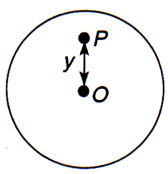
7. In arrangement 1, both forces act in the same direction. In arrangement 3, both the forces act in opposite direction. This alone decides in favour of option (a),

8. If a point mass is placed inside a uniform spherical shell, the gravitational force on the point mass is zero. Hence, the gravitational force exerted by the shell on the point mass is zero.

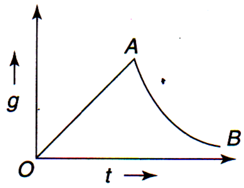
9. $g_d = g\left(1 - \frac{d}{g}\right)$

   or $g_d = g\frac{R-d}{R}$

   or $g_d = \frac{gy}{R}$ or $g_d \propto y$



So, within the Earth, the acceleration due to gravity varies linearly, with the distance from the centre of the Earth. This explains the linear portion OA of the graphs.



10. The value of g at the height h from the surface of earth

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

The value of g at depth x below the surface of earth

$$g' = g\left(1 - \frac{x}{R}\right)$$

These two are given equal, hence $\left(1 - \frac{2h}{R}\right) = \left(1 - \frac{x}{R}\right)$

On solving, we get $x = 2h$

11. Acceleration due to gravity $g = \frac{4}{3}\pi\rho GR \quad \therefore\ g \propto \rho R$

or $\frac{g_m}{g_e} = \frac{\rho_m}{\rho_e} \cdot \frac{R_m}{R_e}$

$$\left[\text{As } \frac{g_m}{g_e} = \frac{1}{6} \text{ and } \frac{\rho_e}{\rho_m} = \frac{5}{3} \text{(given)}\right]$$

$$\therefore \quad \frac{R_m}{R_e} = \left(\frac{g_m}{g_e}\right)\left(\frac{\rho_e}{\rho_m}\right) = \frac{1}{6} \times \frac{5}{3} \therefore R_m = \frac{5}{18} R_e$$

12. Acceleration due to gravity $g = \frac{GM}{R^2}$

$$\therefore \quad \frac{g_{\text{moon}}}{g_{\text{earth}}} = \frac{M_{\text{moon}}}{M_{\text{earth}}} \cdot \frac{R_{\text{earth}}^2}{R_{\text{moon}}^2} = \left(\frac{1}{80}\right)\left(\frac{4}{1}\right)^2$$

$$g_{\text{moon}} = g_{\text{earth}} \times \frac{16}{80} = \frac{g}{5}$$

13. Acceleration due to gravity $g = \frac{4}{3}\pi\rho GR$

$$\therefore \quad g_1 : g_2 = R_1\rho_1 : R_2\rho_2$$

14. $g' = g\left(1 - \frac{d}{R}\right) \Rightarrow \frac{g}{4} = g\left(1 - \frac{d}{R}\right) \Rightarrow d = \frac{3R}{4}$

15. We know $g = \frac{GM}{R^2} = \frac{GM}{(D/2)^2} = \frac{4GM}{D^2}$

If mass of the planet $= M_0$ and diameter of the planet $= D_0$. Then $g = \frac{4GM_0}{D_0^2}$.

16. $\frac{g'}{g} = \left(\frac{R}{R+h}\right)^2 = \left(\frac{R}{R+2R}\right)^2 = \frac{1}{9} \quad \therefore g' = \frac{g}{9}$.

17. Acceleration due to gravity on earth is

$$g = \frac{GM_E}{R_E^2} \quad \text{(i)}$$

As $\rho = \frac{M_E}{\frac{4}{3}\pi R_E^3} \Rightarrow M_E = \rho\frac{4}{3}\pi R_E^3$

Substituting this value in Eq. (i), we get

$$g = \frac{G\left(\rho\frac{4}{3}\pi R_E^3\right)}{R_E^2} = \frac{4}{3}\pi\rho G R_E \text{ or } \rho = \frac{3g}{4\pi G R_E}$$

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

$$\frac{\Delta g}{g} \times 100 = 2\frac{\Delta R}{R} \times 100 = 2 \times 1\% = 2\%$$

19. Gravitational P.E. = $m \times$ gravitational potential

$U = mV$

So the graph of U will be same as that of V for a spherical shell.

20. $$\Delta U = U_2 - U_1 = \frac{mgh}{1+\frac{h}{R_e}} = \frac{mgR_e}{1+\frac{R_e}{R_e}} = \frac{mgR_e}{2}$$

$$\Rightarrow \quad U_2 - (-mgR_e) = \frac{mgR_e}{2} \Rightarrow U_2 = -\frac{1}{2}mgR_e$$

21. $\Delta K.E. = \Delta U$

$$\frac{1}{2}MV^2 = GM_eM\left(\frac{1}{R} - \frac{1}{R+h}\right) \quad \text{(i)}$$

Also $g = \frac{GM_e}{R^2}$ (ii)

On solving (i) and (ii) $h = \frac{R}{\left(\frac{2gR}{V^2} - 1\right)}$

22. Potential energy $U = \frac{-GMm}{r} = -\frac{GMm}{R+h}$

$$U_{\text{initial}} = -\frac{GMm}{3R} \text{ and } U_{\text{final}} = -\frac{-GMm}{2R}$$

Loss in PE = gain in $KE = \frac{GMm}{2R} - \frac{GMm}{3R} = \frac{GMm}{6R}$

23. $v = -\frac{GMM}{R} = -\frac{GM^2}{R}$

24. Before collision, $PE = mV = -\frac{GMm}{r}$

After collision, velocity will be zero. The wreckage will come to rest. The energy will be only potential energy.

$$PE = -\frac{GMm}{r} = -\frac{2GMm}{r} \text{ Ratio} = 1/2$$

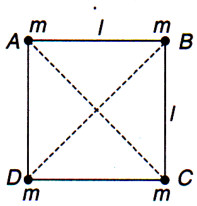
25. $\Delta u = -\left(\frac{GMm}{R+h}\right) - \left(-\frac{GMm}{R}\right)$

$H = 3R$

$\Delta u = -\frac{GMm}{4R} + \frac{GMm}{R} = \frac{3GMm}{4R^2} \times R$

$\Delta u = \frac{3}{4} mgR$

26.



From figure

$AB = BC = CD = AD = l$

27. $U = \frac{-GMm}{r}, K = \frac{GMm}{2r}$ and $E = \frac{-GMm}{2r}$

For a satellite U, K and E vary with r and also U and E remain negative whereas K remains always positive.

28. $v = \sqrt{\frac{GM}{r}}$ if $r_1 > r_2$ then $v_1 < v_2$

Orbital speed of satellite does not depend upon the mass of the satellite.

29. $v = \sqrt{\frac{GM}{R+h}}$

For first satellite $h = 0,\ v_1 = \sqrt{\frac{GM}{R}}$

For second satellite $h = \frac{R}{2}, v_2 = \sqrt{\frac{2GM}{3R}}$

$$v_2 = \sqrt{\frac{2}{3}} v_1 = \sqrt{\frac{2}{3}} v$$

30. Since the planet is at the centre, the focus and centre of the elliptical path coincide and the elliptical path becomes circular and the major axis is nothing but the diameter. For a circular path:

$$\frac{mv^2}{r} = \sqrt{\frac{GM}{r^2}}m$$

Also $T = \frac{2\pi r}{v} = \frac{2\pi r^{3/2}}{\sqrt{GM}} \Rightarrow T^2 = \frac{4\pi^2 r^3}{GM}$

$\Rightarrow \quad r = \left(\frac{GMT^2}{4\pi^2}\right)^{1/3} = \text{Radius}$

$\Rightarrow \quad \text{Diameter (major axis)} = 2\left(\frac{GMT^2}{4\pi^2}\right)^{1/3}$

31. Orbital velocity of the satellite is

$v = \sqrt{\frac{GM_E}{r}}$ where M_E is the mass of the earth

Kinetic energy, $K = \frac{1}{2}mv^2 = \frac{GM_E m}{2r}$

where m is the mass of the satellite.

$$K \propto \frac{1}{r}$$

Hence, option (b) in incorrect.

Linear momentum, $p = mv = m\sqrt{\frac{GM_E}{r}}$

$$p \propto \frac{1}{\sqrt{r}}$$

Hence, option (c) is incorrect.

Frequency of revolution, $\nu = \frac{1}{T} = \frac{1}{2\pi}\sqrt{\frac{GM_E}{r^3}}$

$$\nu \propto \frac{1}{r^{3/2}}$$

Hence, option (d) is correct.

32. Time period, $T = \frac{2\pi R}{\sqrt{\frac{GM_m}{R}}} = \frac{2\pi R^{3/2}}{\sqrt{GMm}}$

where the symbols have their meanings as given. Squaring both sides, we get

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

33. Total energy of the orbiting satellite of mass m having orbital radius r is

$E = -\frac{GMm}{2r}$ where M is the mass of the planet.

Additional kinetic energy required to transfer the satellite from a circular orbit of radius R_1 to another radius R_2 is

$$= E_2 - E_1$$

$$= -\frac{GMm}{2R_E} - \left(-\frac{GMm}{2R_1}\right) = -\frac{GMm}{2R_2} + \frac{GMm}{2R_1}$$

$$= \frac{GMm}{2}\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

34. Total energy of orbiting satellite at a height h is

$$E = -\frac{GM_E m}{2(R_E + h)}$$

The total energy of the satellite at infinity is zero.

∴ Energy expended to rocket the satellite out of the earth's gravitational field is

$$\Delta E = E_\infty - E$$

$$= 0 - \left(-\frac{GM_E m}{2(R_E + h)}\right) = \frac{GM_E m}{2(R_E + h)}$$

35. Let m_1 is mass of core and m_2 is of outer portion

$$m_1 = \frac{4}{3}\pi R^3 \rho_1, \quad m_2 = \frac{4}{3}\pi[(2R)^3 - R^3]\rho_2$$

Given that: $\frac{Gm_1}{R^2} = \frac{G(m_1 + m_2)}{(2R)^2} \Rightarrow \frac{\rho_1}{\rho_2} = \frac{7}{3}$

36. $v_1 r_1 = v_2 r_2$

$$\frac{KE_1}{KE_2} = \frac{\frac{1}{2}mv_1^2}{\frac{1}{2}mv_2^2} = \left(\frac{v_1}{v_2}\right)^2 = \left(\frac{r_2}{r_1}\right)^2$$

37 For two points on same orbit $L = mv_A r_A = mvr_B$

$$v_A = \frac{vr_B}{r_A} \qquad \text{(i)}$$

For two points on different orbits.

$$v = \sqrt{\frac{GM}{r}} \quad \frac{v_0}{v_A} = \left(\frac{r_A}{1.2r_A}\right)^{1/2}$$

$$v_0 = v_A\left(\frac{r_A}{1.2r_A}\right)^{1/2} = \frac{vr_B}{r_A}\left(\frac{r_A}{1.2r_A}\right)^{1/2} = \frac{vr_B}{r_A\sqrt{1.2}}$$

38. $\frac{1}{2}mv_{\min}^2 = \left[-\frac{GMm}{r} - \frac{GMm}{r}\right]$

$$-\left[-\frac{GMm}{(2r-a)} - \frac{GMm}{a}\right]$$

$$= \frac{2GMm(a^2 - 2ar + r^2)}{ar(2r-a)}$$

or $\quad v_{\min} = \sqrt{\frac{GM}{a}} \times \frac{2(r-a)}{[r(2r-a)]^{1/2}}$

So, $\quad K = \frac{2(r-a)}{[r(2r-a)]^{1/2}}$

39. $m_1 r_1 = m_2 r_2 \; r_1 = \frac{m_2 r}{m_1 + m_2}$ (i)

$$m_1 r_1 \omega^2 = \frac{Gm_1 m_2}{r^2} \; \omega^2 = \frac{G(m_1 + m_2)}{r^3}$$

[From (i)] or $r = \left[\frac{G(m_1 + m_2)}{\omega^2}\right]^{1/3}$

$$(m_1 + m_2)^{1/3} = 2m_1 + m_2 = 8$$

and $\quad m_2 - m_1 = 6 \qquad$ (given)

which gives $m_1 = 1$ and $m_2 = 7$ units

$$\frac{m_1}{m_2} = \frac{1}{7}$$

40. Interstellar velocity $v' = \sqrt{\frac{GM}{r}} = R\sqrt{\frac{g}{(R+h)}}$

$$= \sqrt{v^2 - v_e^2}$$

where v = projection velocity

$$\frac{R^2 g}{(r+h)} = v^2 - 2gR \text{ Solving } v^2 = \frac{23gR}{11}$$

41. For observer, $T' = \frac{2\pi}{\omega_S - \omega_E} = \frac{T_S T_E}{T_E - T_S}$

$= T_E$ (given) or, $T_E^2 = 2T_S T_E \;\; T_S = T_E/2$

42. Time period is minimum for the satellites with minimum radius of the orbit i.e. equal to the radius of the planet. Therefore.

$$\frac{GMm}{R^2} = \frac{mv^2}{R} \Rightarrow V = \sqrt{\frac{GM}{R}}$$

$$T_{\min} = \frac{2\pi R}{\sqrt{\frac{GM}{R}}} = \frac{2\pi R\sqrt{R}}{\sqrt{GM}}$$

using $M = \frac{4}{3}pR^3 \cdot \rho$ $T_{\min} = \sqrt{\frac{3\pi}{G\rho}}$

Using values $T_{\min} = 3000$ s

43. Conserving angular momentum

$m \cdot (V_1 \cos 60°) \cdot 4R = m \cdot V_2 \cdot R;\ \frac{V_2}{V_1} = 2$ Conserving energy of the system

$$-\frac{GMm}{4R} + \frac{1}{2}mV_1^2 = -\frac{GMm}{R} + \frac{1}{2}mV_2^2$$

$$\frac{1}{2}V_2^2 - \frac{1}{2}V_1^2 = \frac{3}{4}\frac{GM}{R}$$

or $$V_1^2 = \frac{1}{2}\frac{GM}{R}$$

$$V_1 = \frac{1}{\sqrt{2}}\sqrt{64 \times 10^6} = \frac{8000}{\sqrt{2}} \text{m/s}$$

44. The time period of satellite, $T \propto r^{3/2}$

or $T \propto (R_e + h)^{3/2}$

For a satellite revolving close to surface of earth's $h = 0$

$\therefore\ T \propto R_e^{3/2}$. It is evident that the period of revolution of a satellite depends upon its height above the earth's surface. Greater is the height of a satellite above the earth's surface greater is its period of revolution.

45. Geostationary satellites orbit around the earth in the equatorial plane with time period of 24 hours. Since the earth rotates with the same period, the satellite would appear fixed from any point on earth.

[CHEMISTRY]

46. Adding of any material in the equilibrium mixture or any change in equilibrium ultimately result the same final equilibrium composition, independent from the final at which the change is made. Even, any change at equilibrium may be made at initial condition. The final result will be same.

47.

48.

49.

Loss of H^+ from $[Al(H_2O)_3(OH)_3]$ gives $[Al(H_2O)_2(OH)_4]^-$ as conjugate base.

50.

	$NH_2COONH_4(s) \rightleftharpoons$	$2NH_3(g)$ +	$CO_2(g)$
Equ. par. pressure of gases		$2P$ atm	P atm
Pas. pressure just on adding NH_3		$(2P + a)$ atm	P atm
New equ. par. pressure of gases		$(2P + a - x)$ atm	$(P - x)$ atm
		$= 3P$ atm	$= P'$ atm

(from equation)

Now, $K_p = P_{NH_3}^2 . P_{CO_2}$

or, $(2P)^2 \times P = (3P)^2 \times P'$

or, $P' = \frac{4}{9} P$ atm

Now, $\frac{\text{first total pressure}}{\text{initial total pressure}} = \frac{3P + P'}{2P + P} = \frac{3P + \frac{4}{9}P}{3P} = \mathbf{\frac{31}{27}}$

51.

Lower the pK_b, stronger is the base.

52.

Lower the pK_a, stronger is the acid.

53.

Solution

	$N_2O_4(g) \rightleftharpoons$	$2NO_2(g)$
Equ. par. pressure	2 atm	1 atm
Par. pressure just on doubling the volume	1 atm	0.5 atm
New Equ. par. pressure	$(1 - x)$ atm	$(0.5 + 2x)$ atm

Now, $K_p = \frac{P_{NO_2}^2}{P_{N_2O_4}}$

or, $\frac{(1)^2}{2} = \frac{(0.5 + 2x)^2}{1 - x}$

or, $x = 0.088$

$\therefore$ New equ. par. pressure of $N_2O_4 = 1 - x = \mathbf{0.912\ atm}$

and new equ. par. pressure of $NO_2 = 0.5 + 2x = \mathbf{0.676\ atm}$

54.. The equilibrium constant of second reaction is very large and hence the equilibrium concentrations may be determined by adding the reactions. On adding,

	A	+	B	$\rightleftharpoons$	D	+	E	$K = K_1 \times K_2 = 1$
Initial moles	2		5		0		0	
Moles at equ.	$2 - x$		$5 - x$		x		x	
Equ. conc.	$\frac{2-x}{2}$M		$\frac{5-x}{2}$M		$\frac{x}{2}$M		$\frac{x}{2}$M	

Now, $K = \frac{[D][E]}{[A][B]} = \frac{\left(\frac{x}{2}\right)\cdot\left(\frac{x}{3}\right)}{\left(\frac{2-x}{2}\right)\cdot\left(\frac{5-x}{2}\right)}$

or, $1 = \frac{x^2}{(2-x)(5-x)}$

or $x = 1.428$

Now, for first reaction, $K_1 = \frac{[C][D]}{[A]}$

or, $5 \times 10^{-6} = \frac{[C]\left(\frac{x}{2}\right)}{\left(\frac{2-x}{2}\right)}$

$\therefore$ $[C] = \mathbf{2 \times 10^{-6}\ M}$

55. *Some solid* NH_4HS *is introduced in a vessel containing* NH_3 *gas at* 0.5 atm. *Calculate the equilibrium partial pressures of gases. For the reaction:*

$NH_4HS(s) \rightleftharpoons NH_3(g) + H_2S(g)$, $K_p = 0.12\ atm^2$.

Solution

	$NH_4HS(g)$	$\rightleftharpoons$	$NH_3(g)$	+	$H_2S\ (g)$
Initial partial pressure			0.5 atm		0
Equ. par. pressure of gases			$(0.5 + x)$ atm		x atm

Now, $K_p = P_{NH_3} \cdot P_{H_2S}$

or, $0.12 = (0.5 + x) \times x$

or, $x = 0.177$

Hence, equilibrium pressure of $NH_3 = 0.5 + x =$ **0.677 atm**

$H_2S = x =$ **0.177 atm**

56.. Dissociation constant of a substance is the equilibrium constant for its dissociation.

For PCl_5 : $K_p = \frac{\alpha^2 P}{1 - \alpha^2}$

For N_2O_4 : $K_p = \frac{4\alpha^2 P}{1 - \alpha^2}$

From question, K_p values are same and ratio of pressure is required at which α also becomes

Hence, $\frac{\alpha^2 P_1}{1 - \alpha^2} = \frac{4\alpha^2 P_2}{1 - \alpha^2}$

or, $\frac{P_1}{P_2} = \mathbf{\frac{1}{4}}$

57.

$$\frac{\text{strength of acid } A}{\text{strength of acid } B} = \sqrt{\frac{(K_a)A}{(K_a)B}}$$

pK_a of $A = 4 \Rightarrow K_a = 10^{-4}$

pK_a of $B = 5 \Rightarrow K_a = 10^{-5}$

$$\frac{\text{strength of acid } A}{\text{strength of acid } B} = \sqrt{\frac{10^{-4}}{10^{-5}}} = \sqrt{10} = \mathbf{3.2}$$

58..

	$PCl_5(g)$	$\rightleftharpoons$	$PCl_3(g)$	+	$Cl_2(g)$
Initial moles	1 (say)		0		0
Moles at equ.	$1-\alpha$		α		α
Total moles at equ.	$= (1-\alpha) + \alpha + \alpha = 1 + \alpha$				
Equ. par pressure	$\frac{1-\alpha}{1+\alpha} \cdot P$		$\frac{\alpha}{1+\alpha} \cdot P$		$\frac{\alpha}{1+\alpha} \cdot P$

Now, $K_p = \frac{P_{PCl_3} \cdot P_{Cl_2}}{P_{PCl_5}} = \frac{\left(\frac{\alpha}{1+\alpha} \cdot P\right)\left(\frac{\alpha}{1+\alpha} \cdot P\right)}{\left(\frac{1-\alpha}{1+\alpha} \cdot P\right)} = \frac{\alpha^2 P}{1-\alpha^2}$

or, $0.2 = \frac{\alpha^2 \times 4}{1-\alpha^2}$

$\therefore \quad \alpha = \mathbf{0.218}$

59..-

60..-

61.

62.

In $PCl_5 \rightleftharpoons PCl_3 + Cl_2$, number of moles are increasing, it will be favoured by low pressure.

63.

$K_1 = \frac{[NO]^2}{[N_2][O_2]}$; $K_2 = \frac{[NO_2]^2}{[NO]^2[O_2]^2}$

$K = \frac{[N_2]^{1/2}[O_2]}{[NO_2]}$

$K_1 K_2 = \frac{[NO_2]^2}{[N_2][O_2]^2} \Rightarrow \sqrt{K_1 K_2} = \frac{[NO_2]}{[N_2]^{1/2}[O_2]} = \frac{1}{K}$

$K = \left[\frac{1}{K_1 K_2}\right]^{1/2}$

64.

The reaction is facing the decrease in number of moles and release of heat. According to Le-Chatelier's principle, forward reaction will be favoured by increase in pressure and decrease in temperature.

65.

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

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

66.

$$C\alpha^2 = K_a$$

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

$$pH = -\log\frac{K_a}{\alpha}$$

$$= -\log K_a + \log\alpha$$

$$= -\log 10^{-9} + \log\left(\frac{0.01}{100}\right)$$

$$= +9 - 4 = \mathbf{5}$$

67. **Solution** The equilibrium constant of second reaction is not very large, *i.e.*, second reaction will not tend towards completion and hence, reactions should not be added for the determination of amounts at equilibrium.

	PCl_5	$\rightleftharpoons$	PCl_3	+	Cl_2;	$K_1 = 0.8$
Initial moles	1		0		0	
Moles at equ.	$1-x$		x		$x-y$	
Equ. conc.	$\frac{1-x}{10}$M		$\frac{x}{10}$M		$\frac{x-y}{10}$M	

	CO	+	Cl_2	$\rightleftharpoons$	$COCl_2$;	$K_2 = \frac{1}{1.25} = 0.8$
Initial moles	1		x		0	
Moles at equ.	$1-y$		$x-y$		y	
Equ. conc.	$\frac{1-y}{10}$M		$\frac{x-y}{10}$M		$\frac{y}{10}$M	

Now, $$K_1 = \frac{[PCl_3][Cl_2]}{[PCl_5]}$$

or, $$0.8 = \frac{\left(\frac{x}{10}\right)\cdot\left(\frac{x-y}{10}\right)}{\left(\frac{1-x}{10}\right)}$$

or, $$8 = \frac{x(x-y)}{(1-x)} \quad \text{... (i)}$$

and $$K_2 = \frac{[COCl_2]}{[CO][Cl_2]}$$

or, $$0.8 = \frac{\frac{y}{10}}{\left(\frac{1-y}{10}\right)\cdot\left(\frac{x-y}{10}\right)}$$

or, $$0.08 = \frac{y}{(1-y)(x-y)} \quad \text{... (ii)}$$

From (i) and (ii), $x = 0.903$

$y = 0.064$

Hence, equilibrium conc. of $Cl_2 = \left(\frac{x-y}{10}\right)$M = **0.0839**

68.

Solution

	A	+	B	$\rightleftharpoons$	C
Equ. conc.	2 M		3 M		4 M
conc. first on adding B	2 M		3 + 1 = 4 M		4 M
New equ. conc.	$(2 - x)$ M		$(4 - x)$ M		$(4 + x)$ M

Now, $K_c = \dfrac{[C]}{[A][B]}$

or, $\dfrac{4}{2 \times 3} = \dfrac{(4 + x)}{(2 - x)(4 - x)}$

or $x = 0.28$

Hence, new equ. conc. of $B = (4 - x)$ M = **3.72 M**

69.

	$2AB_2(g)$	$\rightleftharpoons$	$2AB(g)$	+	$B_2(g)$
Initial moles	1 (say)		0		0
Moles at equ.	$1 - x$		x		$\frac{x}{2}$
Total moles at equ.	$= (1 - x) + x + \frac{x}{2} = 1 + \frac{x}{2}$				
Equ. par. pressure	$\dfrac{1-x}{1+\frac{x}{2}} \cdot P$		$\dfrac{x}{1+\frac{x}{2}} \cdot P$		$\dfrac{x/2}{1+\frac{x}{2}} \cdot P$

Now, $K_p = \dfrac{P_{AB}^2 \cdot P_{B_2}}{P_{AB_2}^2} = \dfrac{\left(\dfrac{x}{1+\frac{x}{2}} \cdot P\right)^2 \cdot \left(\dfrac{x/2}{1+\frac{x}{2}} \cdot P\right)}{\left(\dfrac{1-x}{1+\frac{x}{2}} \cdot P\right)^2} = \dfrac{x^3 \cdot P}{2\left(1 + \frac{x}{2}\right)(1 - x)^2}$

But from question, $x << 1$

$\therefore$ $(1 - x) \approx 1$

and $\left(1 + \frac{x}{2}\right) \approx 1$

Hence, $K_p \approx \dfrac{x^3 . P}{2.1.1}$

or, $x = \left(\dfrac{2 \cdot K_p}{P}\right)^{1/3}$

74.

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

For $K_p < K_c$, Δn is –ve, *i.e.*, product side has lesser number of moles of gaseous substances. Hence, **increase in pressure** will favour the forward reaction.

75

The reaction is exothermic. So, increase in temperature will not favour forward reaction. Removal of Cl_2, a reactant, will favour backward reaction. Increase in volume, *i.e.*, decrease in pressure, will also favour the backward reaction.

76.

The number of moles of gaseous substances are decreasing as a result of reaction (4 to 2). Increase in pressure will favour the forward reaction.

77.

Catalyst does not affect the equilibrium constant.

78.

Catalyst speeds up forward and backward reactions both equally.

79.

The reaction is exothermic, so it will be favoured in forward direction by lowering of temperature. Since, the number of moles of gaseous substances are decreasing as a result of reaction, high pressure will favour the forward reaction.

80.

Number of moles of gaseous substances is more on the product side (2) than on the reactant side (1).
Increase in volume of container will decrease the pressure and thereby favour the forward reaction.
Addition of reactant at constant volume will also favour the formation of products.
Addition of inert gas will favour the formation of more number of molecules which is on the product side.

82.

Since, the number of moles of gaseous substances on product side is less, increase in pressure will increase the yield. Equilibrium constant will not change because it depends only on temperature (for a specific reaction).

83.

Because the equilibrium constant is increasing with increase in temperature, the forward reaction is **endothermic.**

85. (b) If $\Delta G^o = 0$

$\Delta G^o = -2.303\ RT\ \log K_p$

$\log K_p = 0$ $(\because \log 1 = 0)$

$K_p = 1$.

86. (a) Both assertion and reason are true and reason is the correct explanation of assertion.

$CO(H_2O)_6^{2+}$ (Pink) while $CoCl_4^{2-}$ (blue). So, on

Cooling because of Le-chatelier's principle the reaction tries to over come the effect of temperature.

87. (c) The value of K depends on the stoichiometry of reactants and products at the point of equilibrium. For *e.g.*, if the reaction is multiplied by 2, the equilibrium constant is squared.

88. (d) Catalyst does not affect the final state of the equilibrium. It enables the system to attain equilibrium state earlier by providing an alternative path which involve lower energy of activation.

89. (c) According to Le-Chatelier's principle endothermic reaction favours increase in temperature. However exothermic reaction favours decrease in temperature.

90. (d) $K_p = K_c(RT)^{\Delta n}$; where $\Delta n = (l+m)-(x+y)$