+2 PCM TEST – 4 JEE-MAINS (13.1.2018) Chemistry Answer Key

1. B

Sol. $Mg(NO_3)_2 \longrightarrow Mg^{2+} + 2NO_3^-$

$\alpha = \frac{i-1}{n-1} = \frac{2.74-1}{3-1} = \frac{1.74}{2} = 0.87$

Degree of dissociation = 0.87 × 100 = 87%

2. A

Sol. Oxidation takes place at magnesium electrode and reduction at hydrogen electrode.

3. B

4. B

Sol. (i) $2MnO_4^- + 16H^+ + 10I^- \rightarrow 2Mn^{2+} + 8H_2O + 5I_2$

(ii) $2MnO_4^- + H_2O + I^- \rightarrow 2MnO_2 + 2OH^- + IO_3^-$

5. **B**

Sol. $La(OH)_3$ is most basic. Hence, (I) is wrong. (II) is correct due to lanthanoid contraction. (III) is correct because Ce^{4+} tends to change to stable Cr^{3+}.

6. B

Sol. Due to weak intermolecular forces of attraction, H_2 and He gases show the value of Z > 1.

7. A

Sol.

Species	**Conjugated acid**	**Conjugate base**
HCO_3^-	H_2CO_3	CO_3^{2-}
HSO_4^-	H_2SO_4	SO_4^{2-}
NH_3	NH_4^+	NH_2^-
H_2O	H_3O^+	OH^-

8. D

Sol. The unit of rate of reaction is mol L^{-1} s^{-1}. It does change with order.

9. B

Sol. $k = \frac{2.303}{(t_2 - t_1)} \log \frac{[A_1]}{[A_2]}$

$k = \frac{2.303}{(1600-800)} \log \frac{2}{0.4} = \frac{2.303}{800} \times 0.6990$

$= 20.15 \times 10^{-4}\ s^{-1}$

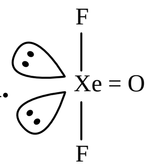
10. A

11. B

Sol. Calamine – $ZnCO_3$; Bartyes – $BaSO_4$

Cinnabar – HgS ; Limestone – $CaCO_3$

12. A

Sol. 

has sp^3d hybridisation and T-shape geometry

13. A

Sol. (A) $4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$

(B) $2Na_2CrO_4 + H_2SO_4 \rightarrow Na_2Cr_2O_7 + Na_2SO_4 + H_2O$

(C) $Na_2Cr_2O_7 + 2KCl \rightarrow K_2Cr_2O_7 + 2NaCl$

14. A

Sol. $\underset{(P)}{CaCO_3} \xrightarrow{\Delta} \underset{(Q)}{CaO} + CO_2 \xrightarrow{H_2O} \underset{(R)}{Ca(OH)_2}$

$\underset{(R)}{Ca(OH)_2} \xrightarrow{NH_4Cl} \underset{(S)}{NH_3}$

$\underset{(U)}{NH_4HCO_3} \xleftarrow{CO_2} \underset{(T)}{NH_4OH} \xleftarrow{H_2O} \underset{(S)}{NH_3}$

$\underset{(U)}{NH_4HCO_3} \xrightarrow{NaCl} \underset{(V)}{NaHCO_3}$

$\underset{(V)}{NaHCO_3} \xrightarrow{heat} Na_2CO_3 + CO_2 + H_2O$

15. A

Sol. $\underset{(X)}{2Al} + 2NaOH + 2H_2O \longrightarrow \underset{(Y)}{2NaAlO_2} + 3H_2$

$\underset{(Y)}{2NaAlO_2} + CO_2 + 3H_2O \rightarrow \underset{(Z)}{2Al(OH)_3} + Na_2CO_3$

$\underset{(Z)}{2Al(OH)_3} \rightarrow Al_2O_3 + 3H_2O$

16. B

Sol. The most strongly adsorbed component is present in the band near the top while the weakly adsorbed constituent is found near the bottom.

17. A

Sol. For cubic, a = b = c, $\alpha = \beta = \gamma = 90°$

Tetragonal, a = b ≠ c, $\alpha = \beta = \gamma = 90°$

Orthorhombic, a ≠ b ≠ c, $\alpha = \beta = \gamma = 90°$

Hexagonal, a = b ≠ c, $\alpha = \beta = 90°$, $\gamma = 120°$

18. A

Sol. Depending on the charges on the cation and anion produced on dissociation of the electrolyte in the solution, the type of electrolytes are known as 1 – 1, 2 – 1 & 2 – 2 electrolytes respectively.

$NaCl \rightarrow Na^+ + Cl^-$ (1 – 1)

$MgCl_2 \rightarrow Mg^{2+} + 2Cl^-$ (2 – 1)

$CaSO_4 \rightarrow Ca^{2+} + SO_4^{2-}$ (2 – 2)

19. A

Sol. At anode: $2Br^-(M) \rightarrow Br_{2(\ell)} + 2e^-$

At cathode: $2H^+ (M) + 2e^- \rightarrow H_2$ (1 bar)

Net reaction: $2H^+ (M) + 2Br^- (M) \rightarrow Br_{2(\ell)} + H_2$

Nernst equation for the given cell,

$E_{cell} = E^\circ_{cell} - \frac{0.0591}{2} \log \frac{[Br_{2(\ell)}]P_{H_2}}{[H^+]^2[Br^-]^2}$

20. A

Sol. Rate = $k[X][Y]^0$

Rate is independent of the conc. of Y and it depends only on the conc. of X and it is the first order reaction.

From exp. (1), $2 \times 10^{-2} = k(0.1)$ …(i)

From exp. (2), $4 \times 10^{-2} = k(A)$ …(ii)
Dividing (ii) and (i),

$$\frac{4\times10^{-2}}{2\times10^{-2}} = \frac{k(A)}{k(0.1)} = \frac{A}{0.1}$$

$\Rightarrow\ 2 \times 0.1 = A$
$\Rightarrow\ A = 0.2 \text{ mol L}^{-1}$
From exp. (3), $B = k(0.4)$ …(iii)
Dividing (iii) and (i), $\frac{B}{2\times10^{-2}} = \frac{k(0.4)}{k(0.1)} = 4$
$\Rightarrow B = 4 \times 2 \times 10^{-2} = 8 \times 10^{-2}\ \text{mol L}^{-1}\ \text{s}^{-1}$
From exp. (4), $2 \times 10^{-2} = k\,(C)$ …(iv)
Dividing (iv) and (i), $\frac{2\times10^{-2}}{2\times10^{-2}} = \frac{k(C)}{k(0.1)} = \frac{C}{0.1}$
$\Rightarrow\ C = 0.1 \text{ mol L}^{-1}$

21. C
Sol. The CFSE of the ligands is in the order:
$H_2O < NH_3 < CN^-$
Hence, excitation energies is in the order:
$[Co(H_2O)_6]^{3+} < [Co(NH_3)_6]^{3+} < [Co(CN)_6]^{3-}$
From the relation $E = \frac{hc}{\lambda} \Rightarrow E \propto \frac{1}{\lambda}$
The order of absorption of wavelength of light in the visible region:
$[Co(H_2O)_6]^{3+} > [Co(NH_3)_6]^{3+} > [Co(CN)_6]^{3-}$

22. C
23. B
Sol. NaCN acts as a depressant, it selectively prevents ZnS from coming to froth by forming a complex $Na_2[Zn(CN)_4]$ but allows PbS to come with the froth.

24. A
Sol. Greater the reduction potential of a substance, stronger is the oxidizing agent.
$\therefore MnO_4^-$ is the strongest oxidizing agent.

25. B
Sol. $E = -2.178\times10^{-18} Z^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

$$E = -2.178\times10^{-18}\left[\frac{1}{(2)^2} - \frac{1}{(1)^2}\right]$$

$$E = +2.178\times10^{-18} \times \frac{3}{4} = 1.6335\times10^{-18}\,J$$

$$E = \frac{hc}{\lambda}$$

$$\Rightarrow\ \lambda = \frac{hc}{E} = \frac{6.62\times10^{-34}\,Js \times 3\times10^{8}\,m}{1.6335\times10^{-18}\,J}$$

$\lambda = 12.14 \times 10^{-8}$ m or $\lambda = 1.214 \times 10^{-7}$m

26. C
Sol. Mole fraction of solute $= \frac{n}{N+n}$
n = number of moles of solute
N = number of moles of solvent
Here solute is methyl alcohol, solvent is water.
Given n = 5.2, $N = \frac{1000}{18}$

$$\therefore\ \text{Mole fraction} = \frac{5.2}{5.2+\frac{1000}{18}} = \frac{5.2}{60.7} = 0.086$$

27. A
Sol. Thermal stability decreases gradually from NH_3 to BiH_3. So the stability also decrease.

	NH_3	PH_3	AsH_3	SbH_3	BiH_3
Decomposition temperature	1300^0C	4400^0C	280^0C	150^0C	room temp.

The size of the central atom increases from N to Bi therefore, the tendency to form a stable covalent bond with small atom like hydrogen decreases and therefore, stability decreases.

28. B
Sol. As it absorbs heat,
$\therefore\ q = + 208$ J

$$W_{rev} = -\,2.303nRT \log_{10}\left(\frac{V_2}{V_1}\right)$$

$$W_{rev} = -2.303\times(0.04)\times8.314\log_{10}\left(\frac{375}{50}\right)$$

$\therefore\ W_{rev} = -\,207.76 = -\,208$ J

29. A
30. A
Sol. Initial concentration of aq. HCl solution with pH $1 = 10^{-1}$ M
Final concentration of this solution after dilution = 10^{-2}M
$MV = M_1(V_1+V_2)$
$10^{-1} \times 1 = 10^{-2}(1+V)$
$\frac{0.1}{0.01} = 1 + V$
$10 = 1 + V \Rightarrow V = 9L$