Solution H2 MCQ Prelim 2008

1) Solution: B

Amount of H₃PO₃ used in the experiment = $\frac{30}{1000} \times 0.05 = 1.50 \times 10^{-3}$ mol Amount of NaOH neutralised = $\frac{15}{1000} \times 0.2 = 3 \times 10^{-3}$ mol H₃PO₃ = 2 NaOH

2 mol of NaOH neutralizes 2 mol of H⁺

- \Rightarrow 1 mol of H⁺ is left (since H₃PO₃ = 3H⁺)
- \Rightarrow Salt formed will contain 1 mol of H⁺

2) Solution: C

Large jump in 2nd Ionisation energy, 2nd electron removed is found in inner shell.

G has 1 valence electron; G is a Group I element.

Thus, the oxide of G has the formula: $\underline{G_2O}$

3) Solution: A

Using pV = nRT,

At constant T, pV = constant, so graph should be a straight line at all density

4) Solution: B



5) Solution: C

To show an energy profile diagram with two activation energies and the first activational energy is greater than the 2nd one as the 1st step is the slow step.

$$K_c = \frac{[HI]^2}{[H_2][I_2]}$$
 no units

Initial pH of 13 indicated that a strong base was used as it dissociates fully to give OH^{-} . The final pH of 2.5 indicates a weak acid buffer region due to presence of CH_3COOH with $CH_3COO^{-}Na^{+}$. The end point is basic due to hydrolysis of the salt $CH_3COO^{-}Na^{+}$.

 $CH_3COO^-Na^+(s) \rightarrow CH_3COO^-(aq) + Na^+(aq)$

 CH_3COO^- (aq) + $H_2O(I) = CH_3COOH$ (aq) + OH^- (aq)

8) Solution: B

Let $[Ba^{2+}]$ be w mol dm⁻³, $[L^-]$ will be 2w mol dm⁻³

q = (w) (2w)²
q= 4w³ w =
$$\left(\frac{q}{4}\right)^{\frac{1}{3}}$$
 [L⁻] = $2\left(\frac{q}{4}\right)^{\frac{1}{3}}$

9) Solution: D

There are 5 C^{*} and number of optical isomers = $2^5 = 32$

10) Solution: C

KMnO₄ will cleave the 2 double bonds present as well as oxidised the secondary alcohol to ketone



2 "OD" will be added across the 2 C=C in Linalo-ol



12) Solution: A

CH₃OCH₂CH₂Br → CH₃OCH₂CH₂NH₂ (nucleophilic substitution by ammonia) CH₃OCH₂CN → CH₃OCH₂CH₂NH₂ (reduction of nitriles)

13) Solution: B

Only ethanol undergoes oxidation with $K_2Cr_2O_7$ in dilute H_2SO_4 whereas phenol does not. Orange $K_2Cr_2O_7$ will turn green.

Both ethanol and phenol will react with alkaline aqueous iodine and decolourised the brown iodine. Ethanol undergoes iodoform test with alkaline aqueous iodine. Phenol undergoes easy electrophilic substitution with alkaline aqueous iodine.



$C_6H_5CH_2CN$ undergoes acidic hydrolysis to give $C_6H_5CH_2COOH$ $C_6H_5CH_2CH_2OH$ undergoes oxidation to give $C_6H_5CH_2COOH$



17) Solution: C



 C_3H_7Br undergoes nucleophilic substitution with OH⁻ to form X, CH₃CH₂CH₂OH is a primary alcohol.

 $CH_3CH_2CH_2OH$ undergoes mild oxidation with $K_2Cr_2O_7$ to form Y, $CH3CH_2CHO$ which is an aldehyde.

CH $_3$ CH $_2$ CHO, an aldehyde undergoes oxidation with Tollen's reagent to form Z and silver mirror. Z is CH $_3$ CH $_2$ COOH

18) Solution: B

Propanone gives positive iodoform test as it contain the group $-C^{\parallel} - CH_3$

19) Solution: B



2 compounds can be formed; amide bonds are formed between the following functional groups: 1 and 2 as well as 1 and 3.



20) Solution: B

$$\Delta H_{at}^{\theta}(AI) = \Delta H_{rxn}^{\theta}(AI^{3+}) - 1^{st} IE(AI) - 2^{nd} IE(AI) - 3^{rd} IE(AI)$$

= 5467 - 577 - 1820 - 2740
= +330 kJ mol⁻¹
Total amount of energy required to form AI³⁺ and O²⁻ ions
= 2 (5467) + 3 (897)
= 13625 kJ mol⁻¹

Lattice energy of aluminium oxide is definitely more exothermic than -13625 kJ mol⁻¹ as the question has already stated that aluminium oxide is a stable compound.

21) Solution: B

$$\Delta G_{f}^{e}(O_{3}) = \Delta H_{f}^{e}(O_{3}) - T\Delta S^{e}(O_{3})$$

= 142.67 - 298(-68.7/1000)
= +163.14 kJ mol⁻¹

Q = I x t = 0.15 x 3 x 60 x 60 2e + Pb²⁺ → Pb 2 Faradays are required $n_{Pb} = \frac{0.15 \times 3 \times 60 \times 60}{96500 \times 2} \Rightarrow Mass of Pb = \frac{207 \times 0.15 \times 3 \times 60 \times 60}{96500 \times 2}$

23) Solution: D

Basic	Amphoteric	Acidic
Na ₂ O, MgO	Al ₂ O ₃	SiO₂ , P ₄ O ₁₀ , SO ₃

24) Solution: C

From Figure 1, since the greatest increase in IE occurs between the 1^{st} and 2^{nd} IE, U is in group I.

From Figure 2, A-B have low boiling points, hence they are molecular structure with weak intermolecular van der Waals' forces of attraction. C is the start of next period and hence is group I with has giant metallic structure and strong metallic bonds, hence high boiling point. Therefore, C corresponds to element U.

25) Solution: C

 $Ca(OH)_2$ is less soluble than $Ba(OH)_2$ due to its higher lattice energy.

26) Solution: D

2nd IE decreases down the group due to decreasing effective nuclear charge. The solubility of sulphates decreases down the group as decrease in hydration energy is more significant than the decrease in the lattice energy. The pH of oxides in solution increases down the group due to decreasing polarizing power of the cations due to larger ionic radius.

The graph shows the boiling point of the HX down the group. HF has the highest boiling point due to intermolecular hydrogen bonds present. For the rest of the HX, they are held by weak intermolecular Van der Waals' forces of attraction. Strength of Van der Waals' is proportional to the size of the molecule, hence boiling point increases down the group.

28) Solution: D

The top layer is the aqueous layer of sodium chloride and the iodine is found in the bottom layer. (Iodine is purple in organic solvent and brown in aqueous solution due to I_3^-)

29) Solution: A

Beryllium cannot form 6 coordinated complexes as there are no d orbitals present for dative bond to occur.

30) Solution: A

The mass of Copper is larger than calcium and copper has a smaller radius than Ca. Hence Cu has higher density than Ca.

31) Solution: D

The largest jump in IE is the 5th ionisation, hence its group number is (5 -1), Gp IV. It does not have similar chemical properties as AI as it is not from GP III. W is not from GP VI.

32) Solution: B

FIIIIIIH F Hydrogen bond Covalent bond

At low pH, equilibrium position shifts left to form $[Ga(H_2O)_6]^{3+}$ Increasing temperature will favour the forward endothermic reaction⁻ K_c remains unchanged when concentration of $[Ga(H_2O)_6]^{3+}$ is increased as K_c only changes with temperature.

34) Solution: B

When [Y] is doubled and the $[H^+]$ is doubled, the rate of the experiment increases by 8 times not 6 times.



36) Solution: C

Reaction with (1) will not have any observable reactions as there is no reaction between NaOH and hexane-1,6-diamine, which are both bases.



Magnesium ion has a higher charge density than that of calcium ion. Hence, all three processes will be more exothermic than that of calcium.

38) Solution: B

1 and 2 are correct $Pb^{2^+} + 2e$ Pb-0.13 V $E^{e_{red}}$ $Sn^{2^+} + 2e$ Sn-0.14 V $E^{e_{oxd}}$

 $E_{e_{cell}} = -0.13 - (-0.14) = + 0.01$

(reaction is feasible and reversible)

Reduction: $Pb^{2^+} + 2e \rightarrow Pb$ Pb is the cathode (+) Oxidation: $Sn \rightarrow Sn^{2^+} + 2e$ Sn is the anode (-) Electrons flow from anode to cathode i.e. from Sn to Pb electrode.

39) Solution: C

The products of the disproportionation reaction is Cl⁻ and ClO₃⁻ not ClO⁻. Mole ratio of 6KOH = $3Cl_2 = 5KCl$, so r mol of chlorine will react with 2r mol of KOH and $\frac{5}{3}$ r mol of KCl will be formed

40) Solution: A

The reduction potential increases from left to right indicating that +2 state is more stable than +3 state. Effective nuclear charge increases due to increasing nuclear charge. From the graph reduction of Mn^{3+}/Mn^{2+} has higher E^o value than Fe³⁺/Fe²⁺, hence Mn^{3+}/Mn^{2+} reduction is more favoured.