Studentpad

MHT-CET-XII CHEMISTRY 2022-23

Time : 150 Min	Chem : Full Portion Paper	Marks : 50

Hints and Solutions

01) Ans: **D)** equal number of cation and anion vacancies.
Sol: The schottky defect is because of missing of equal number of cations and anions.

02) Ans: **B)** high B.P.
Sol: Since, Na^+ as well as K^+ controls blood pressure and heart beat, thus excess of Na^+ ion increases B.P.

03) Ans: **B)** Cu_2O
Sol:

$$CH_3CHO + \underbrace{2Cu^{+2} + 5OH^-}_{\text{Fehling solution}} \longrightarrow$$

$$CH_3COO^- + \underset{\text{Red ppt.}}{Cu_2O} + 3H_2O$$

04) Ans: **B)** adsorption.

05) Ans: **C)** SP^2
Sol: Number of hybrid orbitals

$$= \frac{1}{2}(V + H - C + A) = \frac{1}{2}(6 + 0) = 3 \text{ hybrid orbitals}$$

$\therefore sp^2$ hybridization

06) Ans: **A)** Iodine powder

$$\text{Sol: } RX + Mg \xrightarrow[I_2 \text{ powder}]{\text{Dry ether}} R - Mg - X$$

07) Ans: **D)**

$$(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > NH_3$$

Sol: As alkyl groups are electron releasing, electron density on the nitrogen atom is increased and alkylamines are more basic than ammonia.
As a result, the basic character should decrease in the order, 3^o amine $> 2^o$ amine $> 1^o$ amine. But because of the combined effect i.e., inductive effect (+ I), steric factors and solvation of ions the basicity decreases in the order, 2^o amine $> 1^o$ amine $> 3^o$ amine $> NH_3$ for lower aliphatic amines.

08) Ans: **C)** 14
Sol: There are 14 Bravais lattices i.e. space lattices.

09) Ans: **D)**

$$C=20\%, O=26.67\%, N=46.67\%, H=6.67\%$$

Sol: Molecular formula of urea is $CO(NH_2)_2$
Hence, its molar mass is

$$12 + 16 + (14 + 2) \times 2 = 60 \text{ gmol}^{-1}$$

Percent of carbon $= 12/60 \times 100 = 20\%$
Percent of oxygen = $16/60 \times 100 = 26.67\%$
Percent of nitrogen = $28/60 \times 100 = 46.67\%$
ercent of hydrogen $= 4/60 \times 100 = 6.67\%$
Therefore the mass percentage of urea are, 20% carbon, 26.67%, oxygen,46.67% nitrogen and 6.67% hydrogen.

10) Ans: **A)** 5,6,3,3
Sol: $IO_3^- + aI^- + bH^+ \rightarrow cH_2O + dI_2$
Step 1 : $I^- \rightarrow I_2$ (oxidation)

$IO_3^- \rightarrow I_2$ (reduction)

Step 2 : $2IO_3^- + 12H^+ \rightarrow I_2 + 6H_2O$

Step 3 : $2IO_3^- + 12H^+ + 10e^- \rightarrow I_2 + 6H_2O$

$2I^- \rightarrow I_2 + 2e^-$

Step 4 : $2IO_3^- + 12H^+ + 10e^- \rightarrow I_2 + 6H_2O$

$\left[2I^- \rightarrow I_2 + 2e^-\right] \times 5$

Step 5 : $2IO_3^- + 10I^- + 12H^+ \rightarrow 6I_2 + 6H_2O$

$IO_3^- + 5I^- + 6H^+ \rightarrow 3I_2 + 3H_2O$

By comparing, a=5, b =6, c=3, d=3.

11) Ans: **B)** 8 times of that in Y
Sol: $P = \frac{1}{2}\frac{mnu^2}{V}$

$$\frac{P_X}{P_Y} = \frac{n_X u_X V_Y}{n_Y u_Y V_X} = \frac{\left(\frac{N_0}{1000}\right)}{\left(\frac{N_0}{2000}\right)} \times 2 \times \frac{2}{1} = 8$$

12) Ans: **C)** p-3, q-1, r-5, s-2
Sol: Compounds (I) and (II) both contain complex cation and anion, so they show coordination isomerism.
Compounds (III) and (IV) are obtained by the interchange of group outside the coordination sphere and the ligands within the coordination sphere. They give different ions in the solution. Therefore, they show ionization isomerism.
Compounds (V) and (VI) are linkage isomers, because the ambident ligand, SCN has two donor atoms, i.e., it has two possibilities of attachment (-SCN and -NCS) with the central metal.
Hence, they show linkage isomerism.
Compounds (VII)and (VIII) are obtained by the replacement of a coordinated group such as Cl^- by water of hydration.
Therefore, they show hydrate isomerism.

13) Ans: **B)** 9

Sol: $S = \sqrt{K_{sp}} = \sqrt{1\times10^{-10}} = 1\times10^{-5}\,M$

$\left[OH^-\right] = \left[MOH\right] = 1\times10^{-5}$

$\Rightarrow \left[H_3O^+\right] = \dfrac{1\times10^{-14}}{1\times10^{-5}} = 1\times10^{-9}$

$\Rightarrow pH = -\log\left[H_3O^+\right] = -\log 10^{-9} = 9.$

14) Ans: **D)** $-\dfrac{E_a}{2.303\,R}$

Sol: $-\dfrac{E_a}{2.303\,R}$

15) Ans: **C)** I

16) Ans: **B)** $0.34-(-0.76) = 1.10\ V$

Sol: $E^o = E_{cathode} - E_{anode}$

$E^o = 0.34-(-0.76) = 1.10$ volt

17) Ans: **C)** $N_2(g)\ 1atm \rightarrow N_2(g)\ 8\ atm$

Sol: Processes (1) and (2) take place with the increase of number of moles of gaseous species and so the disorder or entropy increases. (3) on increasing pressure, disorder or randomness decreases and so also the entropy (4) is endothermic process and ΔS is positive.

18) Ans: **A)** $rate = k[A]^2$

Sol: Suppose the rate of reaction depends on x^{th} power of [A].

Then, $r_1 = k[A]^x$ and $r_2 = k[2A]^x$

$\therefore \dfrac{r_1}{r_2} = \dfrac{[A]^x}{[2A]^x} = \dfrac{1}{4} = \left(\dfrac{1}{2}\right)^2 \quad (\because r_2 = 4r_1) \quad \Rightarrow x = 2.$

As the reaction rate is independent of the concentration of B. Thus, the correct rate law will be $rate = K[A]^2[B]^o$ or rate $= K[A]^2$.

19) Ans: **B)** osmosis

20) Ans: **B)** neither has electron pair available for donation nor can accomodate electron since all shells of nitrogen are fully occupied

Sol: $(CH_3)_4\overset{+}{N}$ has no electron pair available for donation to act as nucleophile.

Valence shell of nitrogen to act as nucleophile.

Valence shell of nitrogen is completely filled and has no scope for acceptance of extra electrons to act as electrophile.

21) Ans: **C)** -0.177 V

Sol:

$H^+ + e^- \rightarrow 1/2\,H_2$

$E = E^\circ - \dfrac{0.059}{n}\log\dfrac{1}{\left[H^+\right]} = 0 - \dfrac{0.059}{1}pH$

$= -0.059\times3 = -0.177\ V$

22) Ans: **C)** oxidation followed by reduction.

Sol: Firstly, carbon which is added along which crushed hematite ore is oxidized to CO (and CO_2) and second the produced CO behaves as chief reducing agent for the reduction of hematite to steel.

23) Ans: **C)** 39

Sol: Number of protons=18+1=p=19

Number of neutrons=n=20

Mass number p+n=19+20=39

24) Ans: **C)** NOCl

Sol: $3HCl + HNO_3 \rightarrow NOCl + 2H_2O + Cl_2$

25) Ans: **B)** aprotic.

Sol: The solvent which neither accept proton nor donates is known as aprotic.

26) Ans: **A)** Polystyrene

27) Ans: **C)** Staggered > gauche > eclipsed

Sol: The eclipsed conformation is least stable due to the hydrogens and bonding pairs of electrons on adjacent carbon atoms are as close to one another as possible. It causes maximum repulsion and least stability. Staggered conformation is most stable because of minimum repulsion.

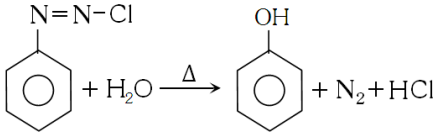
Gauche conformation lies between these two.

Therefore order of stability is,

staggered > gauche > eclipsed

28) Ans: **A)** Phenol

Sol:



29) Ans: **B)** ionization energy.

Sol: When the number of shells increases, size increases and the effective nuclear charge on the outermost electron decreases. As a result, I.E. decreases.

30) Ans: **A)** soluble in all solvents.

Sol: Lower alcohols are soluble in all solvents.

31) Ans: **A)** Blood

32) Ans: **A)** reduces the ammoniacal silver nitrate.

33) Ans: **B)** Polymethylmethacrylate

Sol: Also called as PMMA. It is a transparent, excellent light transmitter and its optical clarity is better than glass, therefore it is used in the preparation of lenses for eyes.

34) Ans: **B)** energy

Sol: Green chemistry reduces the use of the energy. The less consumption of energy also reduces the cost of production. Thus, the product will be

available at low costs.

35) Ans: **A)** ΔH is + ve; ΔS is - ve.
Sol: Both +ve ΔH and –ve ΔS oppose the reaction.

36) Ans: **A)** Reducing the hazard inherent in a chemical product or process

37) Ans: **C)** Hydrogen
Sol: $M + 2HCl \rightarrow MCl_2 + H_2$

38) Ans: **A)** glucose and fructose.
Sol: Tollen's reagent oxidizes the compound with aldehyde group such as glucose and also oxidizes α-hydroxy ketones having $-COCH_2OH$ group as in fructose.

39) Ans: **A)** Thiol
Sol: Thiol functional group takes part in disulphide in proteins.

40) Ans: **B)** 0.50
Sol: 0.5 moles of $CaCl_2$ are present in 1000mL of solution
500mL of solution contains
$\frac{0.5}{1000} \times 500$ moles of $CaCl_2 = 0.25$ moles of $CaCl_2$

$\underset{1\text{ mole}}{CaCl_2} \; f \; Ca^{2+} + \underset{2\text{ moles}}{2Cl^-}$

500 mL of solution contains
$2 \times 0.25 = 0.50$ moles of Cl^- ions

41) Ans: **D)** potassium tris oxalato aluminate (III).
Sol: According to IUPAC rule.

42) Ans: **B)** 0.63 g
Sol: Here, $k = \frac{0.693}{24} hr^{-1} = \frac{2.303}{96} \log \frac{10}{a-x}$

$\log \frac{10}{a-x} = 1.2036 \Rightarrow 1 - \log (a - x) = 1.2036$

$\log(a-x) = -0.2036 = 1.7964$

$(a-x) = \text{antilog } 1.7964 = 0.6258 \text{ gm}$

43) Ans: **B)** $\Delta H = \Delta U - P\,\Delta V$
Sol: $\Delta H = \Delta U - P\Delta V$

44) Ans: **D)** All of these

45) Ans: **B)** Secondary alcohol

46) Ans: **C)** oxidation of Cu.
Sol: In this, Cu is oxidized which turns the solution blue.

47) Ans: **D)** CN^-
Sol: CN^- ligand has strong field ligand due to higher value of Δ.

48) Ans: **C)** 8.00
Sol: We know, $pH = pKa + \log \frac{[Salt]}{[Acid]}$

$pH = pKa$

$Ka = 0.1 \times (10^{-3.5})^2 = 0.1 \times 10^{-7} = 10^{-8} \qquad \therefore pH = 8$

49) Ans: **B)** ethyl bromide and HBr
Sol: $C_2H_6 + Br_2 \rightarrow C_2H_5Br + HBr$

50) Ans: **B)** isopropyl benzene.
Sol: