

CUET (UG) Exam Paper 2024

National Testing Agency

CHEMISTRY

(Solved)

[This includes Questions pertaining to Domain Specific Subject only]

Time Allowed: 45 Mins.

Maximum Marks: 200

General Instructions :

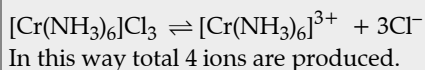
- (i) This paper consists of 50 MCQs, attempt any 40 out of 50 .
- (ii) Correct answer or the most appropriate answer: Five marks (+5) .
- (iii) Any incorrect option marked will be given minus One mark (-1) .
- (iv) Unanswered/Marked for Review will be given No mark (0) .
- (v) If more than one option is found to be correct then Five marks (+5) will be awarded to only those who have marked any of the correct options .
- (vi) If all options are found to be correct then Five marks (+5) will be awarded to all those who have attempted the question .
- (vii) If none of the options is found correct or a Question is found to be wrong or a Question is dropped then all candidates who have appeared will be given five marks (+5).
- (viii) Calculator / any electronic gadgets are not permitted .

1. The total number of ions produced from the complex $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$ in aqueous solution will be

- (1) 2 (2) 3
(3) 4 (4) 5

Ans. Option (3) is correct.

Explanation: In aqueous solution $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$ are ionised as follow:



2. Arrange the following in decreasing order of number of molecules contained in :

- (A) 16 g of O_2 (B) 16 g of CO_2
(C) 16 g of CO (D) 16 g of H_2

Choose the correct order from the options given below :

- (1) (A), (B), (C), (D) (2) (D), (C), (A), (B)
(3) (B), (A), (D), (C) (4) (C), (B), (D), (A)

Ans. Option (2) is correct.

Explanation: 1 mole of a substance contains 6.022×10^{23} molecules.

• For O_2

Molecular mass of $\text{O}_2 = 32 \text{ g}$

32 g contains 6.022×10^{23} molecules of O_2

$$16 \text{ g contains} = 6.022 \times 10^{23} \times \frac{16}{32}$$

$$= 3.01 \times 10^{23}$$

• For CO_2

Molecular mass of $\text{CO}_2 = 44 \text{ g}$

44 g of CO_2 contains 6.022×10^{23} molecules of CO_2

$$16 \text{ g contains} = 6.022 \times 10^{23} \times \frac{16}{44}$$

$$= 2.19 \times 10^{23}$$

• For CO

Molecular mass of CO = 28 g

28 g of CO contains 6.022×10^{23} molecules of CO

$$16 \text{ g contains} = 6.022 \times 10^{23} \times \frac{16}{28}$$

$$= 3.44 \times 10^{23}$$

• For H_2

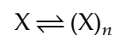
Molecular mass of $\text{H}_2 = 2 \text{ g}$

2 g contains 6.022×10^{23} molecules of H_2

$$16 \text{ g contains} = 6.022 \times 10^{23} \times \frac{16}{2}$$

$$= 48.18 \times 10^{23}$$

3. A molecule X associates in a given solvent as per the following equation :



For a given concentration of X, the van't Hoff factor was found to be 0.80 and the fraction of associated molecules was 0.3. The correct value of 'n' is :

- (1) 2 (2) 3
(3) 1 (4) 5

Ans. Option (2) is correct.

Explanation: Vant Hoff's factor can be given by:

$$i = 1 + \alpha \left(\frac{1}{n} - 1 \right)$$

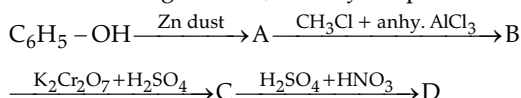
Ans. Option (4) is correct.

Explanation: The correct order of increasing boiling points of the given compound is:

n -butane < ethoxyethane < pentanal < pentan-1-ol

The n -butane has lowest boiling point as it does not have any functional group as addition of functional group increases the boiling point. Hydrogen bonding increases intermolecular forces and so increase the boiling points. The compounds including ethoxyethane pentanal and pentan-1-ol have intermolecular hydrogen bonding but the order of extent of hydrogen bonding is in order of < ethoxyethane < pentanal < pentan-1-ol and so the same is the order of boiling points.

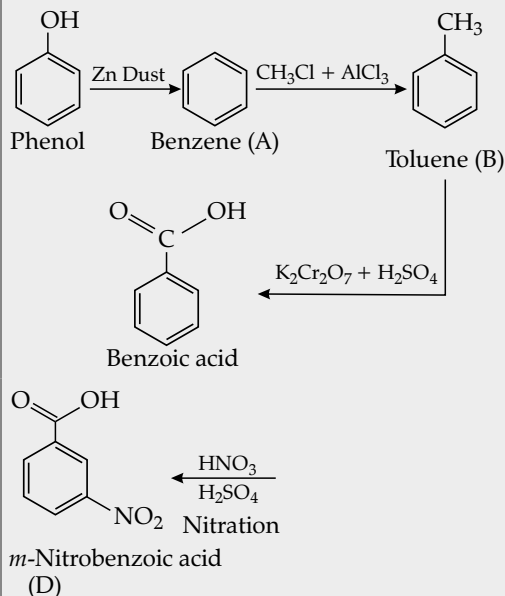
11. In the following reaction, identify the product D.



- (1) o -Nitrobenzoic acid
(2) p -Nitrobenzoic acid
(3) o, p -Dinitrobenzoic acid
(4) m -Nitrobenzoic acid

Ans. Option (4) is correct.

Explanation: In the given reaction phenol first converted into benzene by reduction and then into toluene by addition of methyl group. Further, on oxidation benzoic acid is formed. As the carboxylic group is at ortho position, it directs the nitrate group to meta position and m -nitrobenzoic acid will form.



12. The gold number range of some of the lyophilic colloids is given below :

A : 0.005 – 0.01, B : 0.15 – 0.25, C : 0.04 – 1.0 and D : 15 – 25.

Which among these can be used as a better protective colloid ?

- (1) A (2) B
(3) C (4) D

Ans. Option (1) is correct.

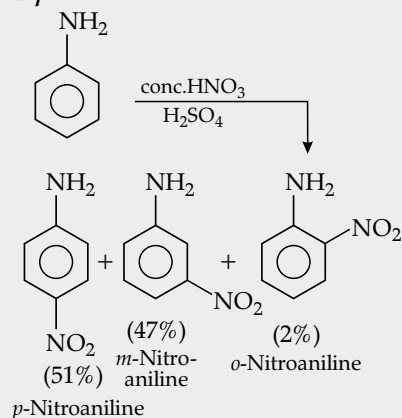
Explanation: The gold number is the minimum amount of a protective colloid required to coagulate the 10 ml of standard gold sol. The lower the gold number the better the protective colloid, as it has better protective action. For the given examples the A has lowest gold number range.

13. Reaction of aniline with conc. HNO_3 and conc. H_2SO_4 at 298 K will produce 47% of:

- (1) p -Nitroaniline (2) o -Nitroaniline
(3) m -Nitroaniline (4) 2, 4-Dinitroaniline

Ans. Option (3) is correct.

Explanation:



14. What will be increasing order of basic strength of the following compounds ?

$\text{C}_2\text{H}_5\text{NH}_2$, $(\text{C}_2\text{H}_5)_2\text{NH}$, $(\text{C}_2\text{H}_5)_3\text{N}$, $\text{C}_6\text{H}_5\text{NH}_2$

- (1) $\text{C}_2\text{H}_5\text{NH}_2 < (\text{C}_2\text{H}_5)_2\text{NH} < (\text{C}_2\text{H}_5)_3\text{N} < (\text{C}_2\text{H}_5)_2\text{NH}$
(2) $\text{C}_6\text{H}_5\text{NH}_2 < \text{C}_2\text{H}_5\text{NH}_2 < (\text{C}_2\text{H}_5)_3\text{N} < (\text{C}_2\text{H}_5)_2\text{NH}$
(3) $(\text{C}_2\text{H}_5)_3\text{N} < (\text{C}_2\text{H}_5)_2\text{NH} < \text{C}_6\text{H}_5\text{NH}_2 < \text{C}_2\text{H}_5\text{NH}_2$
(4) $(\text{C}_2\text{H}_5)_2\text{NH} < (\text{C}_2\text{H}_5)_3\text{N} < \text{C}_2\text{H}_5\text{NH}_2 < \text{C}_6\text{H}_5\text{NH}_2$

Ans. Option (2) is correct.

Explanation: The increasing order of basicity of the given compound is:

$\text{C}_6\text{H}_5\text{NH}_2 < \text{C}_2\text{H}_5\text{NH}_2 < (\text{C}_2\text{H}_5)_3\text{N} < (\text{C}_2\text{H}_5)_2\text{NH}$

With the increasing number of alkyl group the +I effect increases and so basicity too. However, due to presence of 3 alkyl group in $(\text{C}_2\text{H}_5)_3\text{N}$ its basicity decreases, and it has lesser basicity than $(\text{C}_2\text{H}_5)_2\text{NH}$. In case of $\text{C}_6\text{H}_5\text{NH}_2$, due to resonance effect the electron density over nitrogen is less. So its basicity is lower than $\text{C}_2\text{H}_5\text{NH}_2$.

15. Which of the following compounds will give Hell-Volhard-Zelinsky reaction ?

- (1) $\text{R}-\text{CH}_2-\text{COOH}$ (2) $\text{R}_3\text{C}-\text{CHO}$
(3) R_2CO (4) $\text{H}-\text{COOH}$

Ans. Option (1) is correct.

Explanation: The Hell Volhard Zelinsky reaction is a method of addition of a group at alpha position in a carboxylic acid. The alpha addition can be done in ketones and aldehyde through some other method as carbonyl group gets tautomerised easily. It is a specific reaction of carboxylic acids for alpha addition as it is difficult to do this with any other method. Formic acid does not show this reaction as it has only one carbon and does not have alpha hydrogen.

16. Arrange the following acids in increasing order of their acidic strengths :

HCOOH, FCH₂COOH, NO₂CH₂COOH, ClCH₂COOH

- (1) HCOOH < FCH₂COOH < NO₂CH₂COOH < ClCH₂COOH
 (2) HCOOH < NO₂CH₂COOH < ClCH₂COOH < FCH₂COOH
 (3) NO₂CH₂COOH < HCOOH < ClCH₂COOH < FCH₂COOH
 (4) HCOOH < ClCH₂COOH < FCH₂COOH < NO₂CH₂COOH

Ans. Option (4) is correct.

Explanation: The increasing order of acid strength of given compounds is:

HCOOH < ClCH₂COOH < FCH₂COOH < NO₂CH₂COOH

Higher the stability of conjugate base higher will be the acidic strength. The stability order for conjugate base is HCOOH < ClCH₂COOH < FCH₂COOH < NO₂CH₂COOH. So, the option (4) is correct.

17. Arrange the following compounds in an increasing order of reactivity in nucleophilic addition reactions.

Benzaldehyde, *p*-Tolualdehyde, *p*-Nitrobenzaldehyde, Acetophenone

- (1) Benzaldehyde < *p*-Tolualdehyde < *p*-Nitrobenzaldehyde < Acetophenone
 (2) Acetophenone < Benzaldehyde < *p*-Tolualdehyde < *p*-Nitrobenzaldehyde
 (3) Acetophenone < *p*-Tolualdehyde < Benzaldehyde < *p*-Nitrobenzaldehyde
 (4) Benzaldehyde < Acetophenone < *p*-Tolualdehyde < *p*-Nitrobenzaldehyde

Ans. Option (3) is correct.

Explanation: Nucleophilic reaction is a reaction in which nucleophile attacks the electron deficient centre. Higher the +I effect more will be electron density and lesser will be the chance to be attacked by nucleophile. In aldehyde the +I effect is lesser than ketone. Hence, acetophenone is the least reactive towards nucleophilic addition reactions. However, among aldehydes, the order of +I effect is:

p-tolualdehyde > Benzaldehyde > *p*-nitrobenzaldehyde
 Hence, the increasing order of the reactivities of the given compounds is:
 Acetophenone < *p*-tolualdehyde < Benzaldehyde < *p*-Nitrobenzaldehyde

18. The Gattermann-Koch reaction is used in the industrial preparation of benzaldehyde. The electrophile involved in this reaction is :

- (1) CO⁺
 (2) HCl + CO₂ + anhydrous AlCl₃
 (3) HCO⁺
 (4) CO + anhydrous AlCl₃

Ans. Option (3) is correct.

Explanation: HCO⁺ formed by the reaction of HCl and CO while AlCl₃ acts as an electrophile which reacts with benzene to give benzaldehyde in Gattermann-Koch reaction.

19. Formaldehyde undergoes Cannizzaro reaction because :

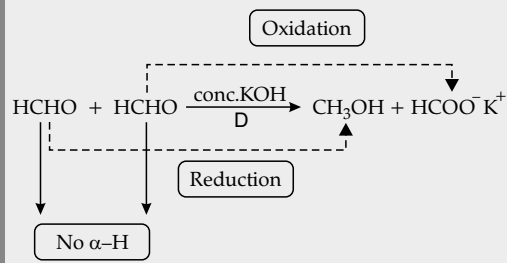
- (A) It has alpha-hydrogen atom.
 (B) It does not have alpha-hydrogen atom.
 (C) It does not undergo self-oxidation and reduction on heating with concentrated alkali.
 (D) It undergoes self-oxidation and reduction on heating with concentrated alkali.

Choose the correct answer from the options given below :

- (1) (B) and (D) only (2) (A) and (C) only
 (3) (B) and (C) only (4) (A) and (D) only

Ans. Option (1) is correct.

Explanation: Formaldehyde gives cannizzaro reaction because it does not have alpha hydrogen. When it heated with alkali it undergoes self oxidation and reduction to give methanol and potassium formate.



20. In the reaction, (CH₃)₃C - O - CH₃ + HI → Products

CH₃OH and (CH₃)₃CI are the main products and CH₃I and not (CH₃)₃C - OH. It is because,

- (A) in step 2 of the reaction the departure of leaving group (HO - CH₃) creates less stable carbocation.
 (B) in step 2 of the reaction the departure of leaving group (HO - CH₃) creates more stable carbocation.
 (C) the reaction follows S_N1 mechanism.
 (D) the reaction follows S_N2 mechanism.

Choose the correct answer from the options given below :

- (1) (B) and (D) only (2) (B) and (C) only
(3) (A) and (D) only (4) (A) and (C) only

Ans. Option (2) is correct.

Explanation: Usually iodide being a strong nucleophile attacks the group with less steric hinderance to follow S_N2 mechanism. However, for this reaction the departure of methanol group generates a more stable tertiary carbocation and follow the S_N1 mechanism.

21. Aniline does not undergo Friedel-Crafts reaction because :

- (A) It forms salt with the Lewis acid catalyst, $AlCl_3$.
(B) Nitrogen of aniline acquires negative charge.
(C) Nitrogen of aniline acquires positive charge.
(D) Nitrogen acts as a strong deactivating group in the further reaction.

Choose the correct answer from the options given below :

- (1) (A), (B) and (D) only
(2) (A), (B) and (C) only
(3) (A), (C) and (D) only
(4) (B), (C) and (D) only

Ans. Option (3) is correct.

Explanation: Aniline does not undergo Friedel Craft reaction because it reacts with Lewis acid catalyst of the reaction i.e., $AlCl_3$, and forms salt. Due to this nitrogen of aniline acquires positive charge and acts as a strong deactivating group for further reaction.

22. Although chlorine is an electron withdrawing group, yet it is ortho- and para-directing in electrophilic aromatic substitution reaction because:

- (A) Chlorine withdraws electrons through inductive effect.
(B) Chlorine destabilises the intermediate carbocation formed during electrophilic substitution.
(C) Chlorine accepts electrons through resonance.
(D) Chlorine releases electrons through resonance.

Choose the correct answer from the options given below :

- (1) (A), (B) and (D) only
(2) (A), (B) and (C) only
(3) (A), (C) and (D) only
(4) (B), (C) and (D) only

Ans. Option (1) is correct.

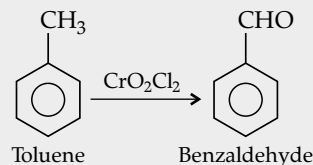
Explanation: Although chlorine is an electron withdrawing group, yet it is *ortho-para* directing in electrophilic aromatic substitution reactions because it withdraw electrons through inductive effect and release them through resonance. It destabilise the carbocation formed during electrophilic substitution. Usually halides stabilise the carbocation but in case of chlorine the inductive effect dominate the resonance effect and destabilise the carbocation.

23. In Etard reaction, the final product is :

- (1) Aromatic aldehyde (2) Aromatic chloride
(3) Aromatic amine (4) Aromatic alcohol

Ans. Option (1) is correct.

Explanation: In Etard reaction the aromatic or heterocyclic methyl group is oxidised using chromyl chloride to produce aldehyde.



24. Match List-I with List-II.

List-I		List-II	
A.	Amino acids linked in a specific sequence	I.	Primary structure of proteins
B.	Regular folding of a specific sequence of amino due to H-bonding	II.	Secondary structure of proteins
C.	Fibrous proteins	III.	Quaternary structure of proteins
D.	Spatial arrangement of two or more polypeptide chains	IV.	Tertiary structure of proteins

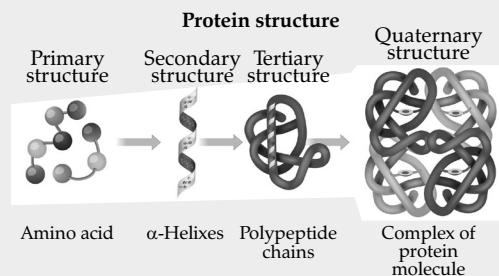
Choose the correct answer from the options given below :

- (1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
(2) (A) - (I), (B) - (III), (C) - (II), (D) - (IV)
(3) (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
(4) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

Ans. Option (3) is correct.

Explanation: Linear sequence of amino acids that are linked together by peptide bonds represent the primary structure of a protein. The regular folding patterns of a specific sequence of amino acids due to hydrogen bonds represents the secondary of protein.

The quaternary structure is referred to the spatial arrangement of two or more polypeptide chains. The final or tertiary structure of protein is observed in fibrous proteins.



25. Match List-I with List-II.

List-I		List-II	
A.	Tollen's reagent	I.	Rochelle salt
B.	Jones reagent	II.	Conc. HCl and ZnCl ₂
C.	Lucas reagent	III.	Ammoniacal silver nitrate
D.	Fehling solution	IV.	Chromium trioxide-sulphuric acid

Choose the correct answer from the options given below :

- (1) (A) - (III), (B) - (IV), (C) - (II), (D) - (I)
 (2) (A) - (IV), (B) - (III), (C) - (I), (D) - (II)
 (3) (A) - (I), (B) - (IV), (C) - (II), (D) - (III)
 (4) (A) - (III), (B) - (I), (C) - (IV), (D) - (II)

Ans. Option (1) is correct.

Explanation: Tollen's reagent is ammoniacal silver nitrate used to distinguish between aldehydes and ketones.

Lucas's reagent is solution of conc. HCl and ZnCl₂ used to differentiate primary, secondary and tertiary alcohols.

The Jones reagent is a solution of chromium trioxide in diluted sulfuric acid used to oxidise primary alcohol to carboxylic acids and secondary alcohols to ketone.

Fehling solution B is Rochelle salt, prepared by dissolving potassium tartrate in an aqueous solution of sodium hydroxide. It acts as a chelating agent. It is used to differentiate between reducing sugar and non-reducing sugar.

26. Match List-I with List-II.

List-I		List-II	
A.	Swarts reaction	I.	$C_6H_5NH_2 + NaNO_2 + HX + Cu_2X_2 \rightarrow C_6H_5X + N_2$
B.	Finkelstein reaction	II.	$2RX + 2Na \rightarrow R-R + 2NaX$
C.	Sandmeyer's reaction	III.	$RX + AgF \rightarrow R-F + 2NaX$
D.	Wurtz reaction	IV.	$RX + NaI \rightarrow R-I + NaX$

Choose the correct answer from the options given below :

- (1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
 (2) (A) - (I), (B) - (III), (C) - (II), (D) - (IV)
 (3) (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
 (4) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

Ans. Option (4) is correct.

Explanation: Swarts reaction: $RX + AgF \rightarrow R-F + AgX$

- Finkelstein reaction: $RX + NaI \rightarrow R-I + NaX$
- Sandmeyer's reaction: $C_6H_5NH_2 + NaNO_2 + HX + Cu_2X_2 \rightarrow C_6H_5X + N_2$
- Wurtz reaction: $2RX + 2Na \rightarrow R-R + 2NaX$

27. Match List-I with List-II.

List-I (Biomolecule)		List-II (Function/Diseases)	
A.	Vitamin A	I.	Menstrual cycle
B.	Thiamine	II.	Xerophthalmia
C.	Glucocorticoids	III.	Beri-Beri
D.	Estradiol	IV.	Addison's disease

Choose the correct answer from the options given below :

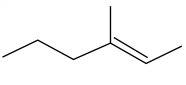
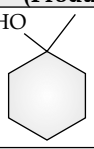
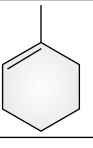
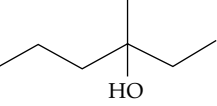
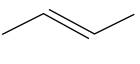
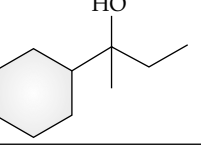
- (1) (A) - (III), (B) - (II), (C) - (I), (D) - (IV)
 (2) (A) - (II), (B) - (III), (C) - (I), (D) - (IV)
 (3) (A) - (III), (B) - (II), (C) - (IV), (D) - (I)
 (4) (A) - (II), (B) - (III), (C) - (IV), (D) - (I)

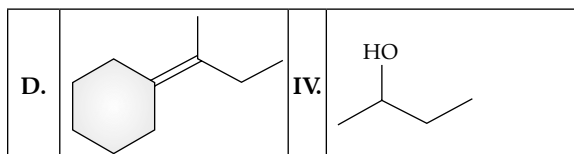
Ans. Option (4) is correct.

Explanation:

- Vitamin A, also known as retinol essential for vision, immune function, and cell growth. Its deficiency may lead to xerophthalmia.
- Thiamine also known as vitamin B₁, plays an important role in energy metabolism, particularly for carbohydrate. Its deficiency may lead to beriberi, a disease caused weakness, fatigue, nerve damage, heart problems, and edema.
- Glucocorticoids are steroid hormones produced by the adrenal glands. Its deficiency leads to fatigue, weight loss, low blood pressure, dehydration, salt craving, hyperpigmentation of the skin, and gastrointestinal symptoms.
- Estradiol is the primary sex hormone in females. It plays a crucial role in the development and maintenance of female reproductive tissues and secondary sexual characteristics. Changes in estradiol levels also affects the ovulation, cervical mucus production, and other aspects of the menstrual cycle.

28. In the following table, match the reactants given in List-I with the correct product in List-II as per the reaction of hydration of alkene under acidic condition.

List-I (Reactants)		List-II (Products)	
A.		I.	
B.		II.	
C.		III.	



Choose the correct answer from the options given below :

- (1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
 (2) (A) - (I), (B) - (III), (C) - (II), (D) - (IV)
 (3) (A) - (II), (B) - (I), (C) - (IV), (D) - (III)
 (4) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

Ans. Option (3) is correct.

Explanation: Alkenes converted to corresponding alcohol on hydration under acidic condition.

That's why the products formed are corresponding alcohols of given products.

List-I (Reactants)	List-II (Products)

29. Which among the following is not an Analgesic ?

- (1) Morphine (2) Heroin
 (3) Codeine (4) Ranitidine

Ans. Option (4) is correct.

Explanation: An analgesic is a drug used to relieve from pain. Morphine and codeine are medicinal drugs of analgesic groups used under different circumstances to relieve from pain. Heroin is an analgesic but not a medicinal drug. However, Ranitidine is used to cure acidity and ulcer of stomach caused due to hyperacidity.

30. The increasing order of acidity of the following compounds based on pKa values is :

- (A) BrCH_2COOH (B) ClCH_2COOH
 (C) FCH_2COOH (D) HCOOH

Choose the correct answer from the options given below :

- (1) (D) < (A) < (B) < (C)
 (2) (A) < (D) < (C) < (B)
 (3) (B) < (A) < (D) < (C)
 (4) (C) > (B) < (D) < (A)

Ans. Option (1) is correct.

Explanation: Higher the electronegativity and -I effect of the substituent group higher will be acidity. The electronegativity and -I effect increasing order is $\text{H} < \text{Br} < \text{Cl} < \text{F}$ and the increasing order of acidity is: $\text{HCOOH} < \text{BrCH}_2\text{COOH} < \text{ClCH}_2\text{COOH} < \text{FCH}_2\text{COOH}$.

31. For $\text{S}_{\text{N}}2$ reaction, the increasing order of the reactivity of the following alkyl halides is :

- (A) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$ (B) $\text{CH}_3\text{CH}_2\text{CH}(\text{Br})\text{CH}_3$
 (C) $(\text{CH}_3)_3\text{CBr}$ (D) $(\text{CH}_3)_2\text{CHCH}_2\text{Br}$

Choose the correct answer from the options given below :

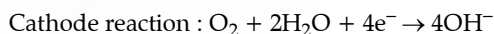
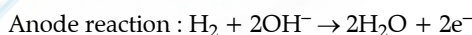
- (1) (A) < (B) < (C) < (D)
 (2) (A) < (C) < (B) < (D)
 (3) (B) < (A) < (D) < (C)
 (4) (C) < (B) < (D) < (A)

Ans. Option (4) is correct.

Explanation: The reactant with a weaker leaving group and primary carbon atom are more reactive than the reactant with strong leaving group and tertiary carbon atoms. So, based on that the option (4) is correct.

Read the following passage and answer the next five questions based on it.

Battery or cell converts chemical energy of the redox reaction to electrical energy. In fuel cell (a galvanic cell), the chemical energy of combustion of fuels like H_2 , ethanol, etc. are directly converted to electrical energy. In a fuel cell, H_2 and O_2 react to produce electricity, where H_2 gas is oxidised at anode and oxygen is reduced at cathode and the reactions involved are



67.2 L of H_2 at STP reacts in 15 minutes.

32. The number of moles of hydrogen oxidised is :

- (1) 0.33 moles (2) 33.3 moles
 (3) 3.0 moles (4) 1.33 moles

Ans. Option (3) is correct.

Explanation: $22.4 \text{ L at STP} = 1 \text{ mole of } \text{H}_2$

$$67.2 \text{ L at STP} = \frac{67.2}{22.4} = 3.0 \text{ moles}$$

33. The number of moles of electrons produced in the oxidation of 67.2 L of H_2 at STP is :

- (1) 2 moles (2) 4 moles
 (3) 1 moles (4) 6 moles

Ans. Option (4) is correct.

Explanation: $22.4 \text{ L of } \text{H}_2 \text{ produces} = 2 \text{ mole of electrons}$

$$67.2 \text{ L at STP will produce} = \frac{2 \times 67.2}{22.4}$$

= 6 moles of electrons

34. The quantity of electricity produced in the oxidation of 67.2 L of H_2 at STP is:

(1) 96500 C (2) 579000 C
(3) 193000 C (4) 48250 C

Ans. Option (2) is correct.

Explanation: Electric charge carried by 1 mole of electrons = $96500 \times C/mol$ (Faraday constant)

Total charge:

Electric charge carried by 6 moles of electrons = $6 \times 96500 = 579000C$

35. If the entire current produced is used for the electrodeposition of Silver (at. wt. 108 g mol^{-1}) from Silver (I) solution, the amount of silver deposited will be :

(1) 324 g (2) 648 g
(3) 108 g (4) 216 g

Ans. Option (2) is correct.

Explanation: 1 mole in electron carried 96500 charges

96500 electric charge deposits = 1 mole or 108 g silver

So, 579000 C will deposits = $108 \times \frac{579000}{96500}$
= 648 g of silver

36. The source of electrical energy on the Apollo moon flight was :

(1) Lead storage battery
(2) A generator set
(3) Ni-Cd cells
(4) H_2-O_2 Fuel cell

Ans. Option (4) is correct.

Explanation: H_2-O_2 fuel cell was used as a source of electric energy on Apollo moon flight.

Read the following passage and answer the next five questions based on it.

Sc Ti V Cr Mn Fe Co Ni Cu Zn

Y Zr Nb Mo Tc Ru Rh Pd Ag Cd

La Hf Ta W Re Os Ir Pt Au Hg

In any transition series, as we move from left to right, the d -orbitals are progressively filled and their properties varies accordingly.

Ce	Th
Pr	Pa
Nd	U
Pm	Np
Sm	Pu
Eu	Am
Gd	Cm
Tb	Bk
Dy	Cf
Ho	Es

Er	Fm
Tm	Md
Ty	No
Lu	Lr

The above are the two series of f -block elements in which the chemical properties won't change much. The $5f$ -series elements are radioactive in nature and mostly are artificially synthesized in laboratories and thus much is not known about their chemical properties.

37. Identify the incorrect statement.

(1) Second ionisation enthalpy of Ag is greater than second ionisation enthalpy of Pd.
(2) Zr and Hf shares almost identical nuclear properties.
(3) Melting point of Mn is lower than that of Cr.
(4) Interstitial compounds are non-stoichiometric and neither ionic nor covalent in nature.

Ans. Option (1),(2),(3) & (4) are correct.

38. Which of the following is the correct order of second ionisation enthalpy ?

(1) $V > Cr > Mn$ (2) $V < Cr < Mn$
(3) $V < Cr > Mn$ (4) $V > Cr < Mn$

Ans. Option (3) is correct.

Explanation: The electronic configuration of the elements are:

$V = [Ar] 3d^3 4s^2$

$Cr = [Ar] 3d^5 4s^1$

$Mn = [Ar] 3d^5 4s^2$

After removal of first electrons the configuration becomes:

$V = [Ar] 3d^3 4s^1$

$Cr = [Ar] 3d^5 4s^0$

$Mn = [Ar] 3d^5 4s^1$

As per the electronic configuration Cr is in most stable oxidation state and will not lose the electron easily. So, will have maximum second ionization enthalpy. However, both Mn and V are in unstable state and will lose electrons easily to attain stable electronic configuration. So, they will have lesser second ionization enthalpy than Cr.

39. Which of the following pair of compounds exhibit same colour in aqueous solution ?

(1) $FeCl_2, CuCl_2$ (2) $VOCl_2, CuCl_2$
(3) $VOCl_2, FeCl_2$ (4) $VOCl_2, MnCl_2$

Ans. Option (2) is correct.

Explanation: The compounds have same number of unpaired electrons exhibit same colour in the solution and Cu and VO both have one unpaired electron so exhibit same colour $VOCl_2$ is vanadium oxydichloride.

40. Which metal has the highest oxidation state in the first row transition series ?

(1) Cr (2) Fe
(3) Mn (4) V

Ans. Option (3) is correct.

Explanation: Manganese has maximum number of unpaired electrons and show maximum number of oxidation states from + 2 to + 7.

41. Why do the actinoids exhibit higher number of oxidation states than lanthanoids ?

- (1) 4f orbitals are more diffused than the 5f orbitals.
- (2) Energy difference between 5f and 6d is less with respect to the energy difference between 4f and 5d.
- (3) Energy difference between 5f and 6d is more with respect to the energy difference between 4f and 5d.
- (4) Actinoids are more reactive in nature than the lanthanoids.

Ans. Option (2) is correct.

Explanation: Due to poor shielding effect the distance between 5f and 6d is lesser as compared to 4f and 5d. That is why actinides show more oxidation states as compared to lanthanides.

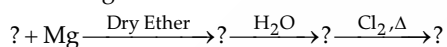
42. Camphor in nitrogen gas is which type of solution?

- (1) Gas – Gas
- (2) Solid – Gas
- (3) Liquid – Gas
- (4) Solid – Liquid

Ans. Option (2) is correct.

Explanation: Camphor is in solid state and nitrogen is a gas at room temperature. So, it is an example of solid in gas.

43. Identify the correct order of organic compounds in the following chemical reaction :



- (A) CH_3MgBr
- (B) CH_3Br
- (C) CH_3Cl
- (D) CH_4

Choose the correct answer from the options given below :

- (1) (B), (A), (D), (C)
- (2) (A), (C), (B), (D)
- (3) (B), (A), (C), (D)
- (4) (C), (B), (D), (A)

Ans. Option (1) is correct.

Explanation:

- CH_3Br on reaction with Mg in presence of dry ether gives CH_3MgBr .
- CH_3MgBr on hydrolysis gives CH_4 and MgBrOH .
- CH_4 on reaction with Cl_2 gives CH_3Cl .

44. Consider the following statements regarding osmotic pressure :

- (A) Molar mass of protein can be determined using osmotic pressure method.
- (B) The osmotic pressure is proportional to the molarity.
- (C) Reverse osmosis occurs when a pressure larger than osmotic pressure is applied to the concentrated solution side.
- (D) Edema occurs due to retention of water in tissue cells as a result of osmosis.

Choose the correct statements with reference to osmotic pressure :

- (1) (A), (B) and (D) only
- (2) (A), (B) and (C) only
- (3) (A), (B), (C) and (D)
- (4) (B), (C) and (D) only

Ans. Option (3) is correct.

Explanation: All the statement related to osmotic pressure is correct. Osmotic pressure is directly proportional to molarity. So, by knowing osmotic pressure of any solution its molarity and the molar mass of solute can be determined. Reverse osmosis is a process opposite of osmosis and it can happen when pressure more than osmotic pressure is applied. Edema is a condition in which endosmosis causes swelling of tissue.

45. Vapour pressures of pure liquids 'A' and 'D' at 50°C are 500 mm Hg and 800 mm Hg respectively. The binary solution of 'A' and 'D' boils at 50°C and 700 mm Hg pressure. The mole percentage of 'D' in the solution is :

- (1) 33.33 mole percent
- (2) 66.67 mole percent
- (3) 25.75 mole percent
- (4) 75.25 mole percent

Ans. Option (2) is correct.

Explanation: By Raoult's law

$$P_t = P^\circ X_1 + P^\circ X_2$$

P_t is total pressure of the solution = 700 mmHg

Vapour pressure pure liquid A = $P^\circ X_1$ = 500 mmHg

Vapour pressure pure liquid D = $P^\circ X_2$ = 800 mmHg

Mole fraction of pure liquid A = X_1

= Mole fraction of pure liquid D = X_2

= Put the values in the equation

$$700 = 500 \times 1 + 800 \times 2$$

Let us consider $X_2 = 1 - X_1$

$$700 = 500 \times 1 + 800(1 - X_1)$$

$$700 = 500 \times 1 + 800 - 800 X_1$$

$$700 = 500 \times 1 - 800 \times 1 + 800$$

$$700 = -300 \times 1 + 800$$

$$300 X_1 = 800 - 700$$

$$300 X_1 = 100$$

$$X_1 = \frac{100}{300} = 0.3333$$

$$X_2 = 1 - 0.3333 = 0.6667$$

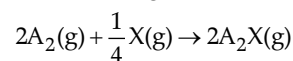
In percentage

$$A = X_1 = 33.33\% \text{ and } D = X_2 = 66.67\%$$

Each P atom forms 4s bonds

\therefore Total no. of s bonds = 16.

46. For the following reaction :



The volume is increased with decrease in pressure. If the reaction is first order with respect to X and second order with respect to A_2 , the rate of reaction will :

- (1) Decrease by eight times of its initial value.
- (2) Increase by eight times of its initial value.

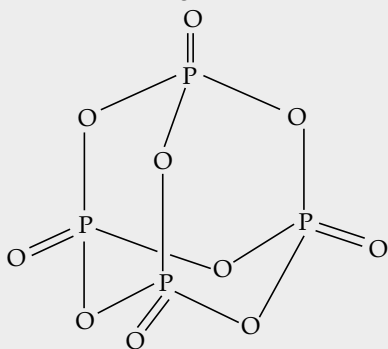
- Ans. Option (1) is correct.**

$$K = [A_2]^2/4 [X]/2 \text{ or } 1/8[A_2]^2[X]$$

- (1) 6
(3) 16
- (2) 7
(4) 17

Ans. Option (3) is correct.

4 double bonds so $4 \times 1 = 4$ sigma bonds
12 single bonds so $12 \times 1 = 12$ sigma bonds
So, total $12 + 4 = 16$ sigma bonds



- (1) lower the melting point of alumina.
- (2) dissolve the alumina in the molten cryolite.
- (3) remove the impurities of alumina.
- (4) increase the electrical conductivity.

Ans. Option (1) is correct.

(1) Zero order (2) First order
(3) Second order (4) Half order

Ans. Option (2) is correct.

- (1) Sum of stoichiometric coefficients in balanced chemical reaction.
- (2) The molecularity of overall reaction.
- (3) Order of fastest step of the reaction.
- (4) The molecularity of slowest step of reaction.

Ans. Option (4) is correct.

Explanation: Order of reaction for a complex reaction is equal to the molecularity of slowest step. This is because the rate of overall reaction depends upon a total number of molecules involved in the slowest step of the reaction.

