



General Instructions

- (i) **Duration:** The total duration of the examination is 1 hours (60 minutes).
- (ii) **Total Marks:** The complete Chemistry paper carries a maximum of 100 marks.
- (iii) **Structure:** The paper consists of two sections:
 - **Section A:** 20 Multiple Choice Questions (MCQs).
 - **Section B:** 5 Numerical Value Type Questions.
- (iv) **Compulsory Questions:** All 25 questions are compulsory.
- (v) Each question has four options. Only **one** option is correct.
- (vi) **Correct Answer:** +4 marks.
- (vii) **Incorrect Answer:** –1 mark (Negative marking).
- (viii) **Unanswered/Marked for Review:** 0 marks.

Chemistry Section - A

1. The mass of iron converted into Fe_3O_4 by the action of 18 g of steam is :

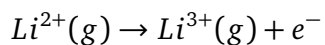
(Given : Molar mass of H, O and Fe are 1, 16 and 56 $g\ mol^{-1}$ respectively)

Assume iron is present in excess :

- (A) 2.1 g
- (B) 4.2 g
- (C) 21 g

(D) 42 g

2. What is the energy (in J atom⁻¹) required for the following process ?



(Take the ionization energy for the H atom in the ground state as 2.18×10^{-18} J atom⁻¹)

(A) 8.72×10^{-18}

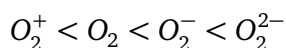
(B) 1.962×10^{-18}

(C) 1.962×10^{-17}

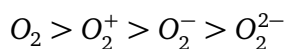
(D) 6.54×10^{-17}

3. Given below are two statements :

Statement (I) : The correct sequence of bond lengths in the following species is :



Statement (II) : The correct sequence of number of unpaired electrons in the following species is :



In the light of the above statements, choose the correct answer from the options given below :

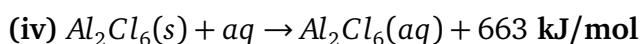
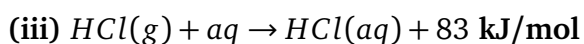
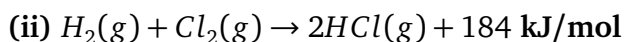
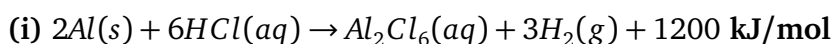
(A) Both Statement I and Statement II are true

(B) Both Statement I and Statement II are false

(C) Statement I is true but Statement II is false

(D) Statement I is false but Statement II is true

4. Consider the following data.



The enthalpy of formation of anhydrous solid Al_2Cl_6 is :

(A) -648 kJ mol^{-1}

(B) $-1350 \text{ kJ mol}^{-1}$

(C) $-2002 \text{ kJ mol}^{-1}$

(D) $-1527 \text{ kJ mol}^{-1}$

5. 19.5 g of fluoroacetic acid (molar mass = 78 g mol^{-1}) is dissolved in 500 g of water at 298 K. The depression in the freezing point of water was 1°C . What is K_a of fluoroacetic acid ? (For water, $K_f = 1.86 \text{ K kg mol}^{-1}$). Assume molarity and molality to have same values.

(A) 10^{-6}

(B) 4×10^{-4}

(C) 3×10^{-5}

(D) 3×10^{-3}

6. The solubility product constants of Ag_2CrO_4 and AgBr are $32x$ and $4y$ respectively at 298 K. The value of $\left[\frac{\text{molarity of } \text{Ag}_2\text{CrO}_4}{\text{molarity of } \text{AgBr}} \right]$ can be expressed as :

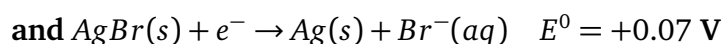
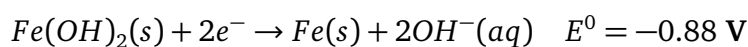
(A) $\frac{2\sqrt[3]{x}}{y}$

(B) $2\sqrt{\frac{x}{y}}$

(C) $\frac{\sqrt{x}}{\sqrt{y}}$

(D) $\frac{\sqrt[3]{x}}{\sqrt{y}}$

7. An electrochemical cell is constructed using half cells in the direction of spontaneous change:



Which of the following options is correct ?

(A) Overall reaction $\text{Fe}(\text{s}) + 2\text{OH}^-(\text{aq}) + 2\text{AgBr}(\text{s}) \rightleftharpoons \text{Fe}(\text{OH})_2(\text{s}) + 2\text{Ag}(\text{s}) + 2\text{Br}^-(\text{aq})$

(B) $E_{\text{cell}}^0 = -0.95 \text{ V}$

(C) Fe is reduced in the electrochemical cell

(D) E_{cell}^0 is an extensive property

8. $t_{100\%}$ is the time required for the 100% completion of the reaction while $t_{1/2}$ is the time

required for 50% of the reaction to be completed. Which of the following correctly represents the relation between $t_{100\%}$ and $t_{1/2}$ for zero and first order reactions respectively ?

- (A) $t_{100\%} = (t_{1/2})^2$ and $t_{100\%} = (t_{1/2})^{-\infty}$
 - (B) $t_{100\%} = 2t_{1/2}$ and $t_{100\%} = (t_{1/2})^{\infty}$
 - (C) $t_{100\%} = 2t_{1/2}$ and $t_{100\%} = (2t_{1/2})^2$
 - (D) $t_{100\%} = (t_{1/2})^{\infty}$ and $t_{100\%} = 2t_{1/2}$
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9. Given below are two statements :

Statement (I) : The first ionisation enthalpy of the elements Na, Mg, Cl and Ar follows the order $\text{Na} > \text{Mg} > \text{Cl} > \text{Ar}$.

Statement (II) : Among Ca, Al, Fe and B, the third ionisation enthalpy is very high for Ca.

In the light of the above statements, choose the correct answer from the options given below :

- (A) Both Statement I and Statement II are true
 - (B) Both Statement I and Statement II are false
 - (C) Statement I is true but Statement II is false
 - (D) Statement I is false but Statement II is true
-

10. Given below are two statements :

Statement (I) : Oxidising power of halogens decreases in the order $F_2 > Cl_2 > Br_2 > I_2$, which is the basis of "Layer test".

Statement (II) : "Layer test" to identify Br_2 and I_2 in aqueous solution involves the oxidation of bromide or iodide into Br_2 or I_2 respectively with Cl_2 , which is a type of displacement redox reaction.

In the light of the above statements, choose the correct answer from the options given below :

- (A) Both Statement I and Statement II are true
 - (B) Both Statement I and Statement II are false
 - (C) Statement I is true but Statement II is false
 - (D) Statement I is false but Statement II is true
-

11. Which of the following sets includes all the species that will change the orange colour of

$K_2Cr_2O_7$ in acidic medium ?

- (A) $Fe^{2+}, Sn^{2+}, I^-, S^{2-}$
(B) $S^{2-}, Fe^{3+}, I^-, C_2O_4^{2-}$
(C) $Fe^{2+}, NO_2^-, SO_2, Sn^{4+}$
(D) $Fe^{3+}, SO_4^{2-}, S^{2-}, Sn^{4+}$
-

12. Match List - I with List - II.

List - I		List - II	
Chromium (III) Complexes (en = ethylene diamine)		$\Delta_0(\text{cm}^{-1})$	
A.	$[Cr(CN)_6]^{3-}$	I.	15,060
B.	$[CrF_6]^{3-}$	II.	17,400
C.	$[Cr(H_2O)_6]^{3+}$	III.	22,300
D.	$[Cr(en)_3]^{3+}$	IV.	26,600

Choose the correct answer from the options given below :

- (A) A-I, B-II, C-III, D-IV
(B) A-II, B-III, C-IV, D-I
(C) A-III, B-IV, C-I, D-II
(D) A-IV, B-I, C-II, D-III
-

13. Given below are two statements :

Statement (I) : 1,2,3-Trihydroxypropane can be separated from water by simple distillation.

Statement (II) : An azeotropic mixture cannot be separated by fractional distillation.

In the light of the above statements, choose the correct answer from the options given below :

- (A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true
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14. Given below are two statements :

Statement (I) : Benzyl chloride reacts faster in S_N1 mechanism than ethyl chloride.

Statement (II) : Ethyl carbocation intermediate is less stabilized by hyperconjugation than benzyl carbocation by resonance.

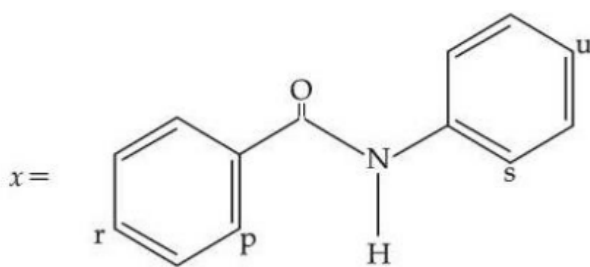
In the light of the above statements, choose the correct answer from the options given below :

- (A) Both Statement I and Statement II are true
 - (B) Both Statement I and Statement II are false
 - (C) Statement I is true but Statement II is false
 - (D) Statement I is false but Statement II is true
-

15. In IUPAC nomenclature, the correct order of decreasing priority of functional group is :

- (A) $-CONH_2$, $>C=O$, $-CHO$, $-NH_2$, $-C \equiv C-$
 - (B) $-CONH_2$, $-COOCH_3$, $-CHO$, $-NH_2$, $-OH$
 - (C) $-CONH_2$, $-CHO$, $>C=O$, $-NH_2$, $-C \equiv C-$
 - (D) $-CONH_2$, $-CHO$, $-CN$, $-NH_2$, $-C \equiv C-$
-

16. For the given molecule, "x", the preferred site for the attack of the electrophile is :



- (A) Predominantly at "r"
 - (B) "r" and "u"
 - (C) "p" and "s"
 - (D) Predominantly at "u"
-

17. Match List - I with List - II.

List - I**Mixture of Compounds**

- A. Diethyl amine + Ethyl amine
 B. Acetaldehyde + Acetone
 C. Ethanol + Phenol
 D. Benzoic acid + Cinnamic acid

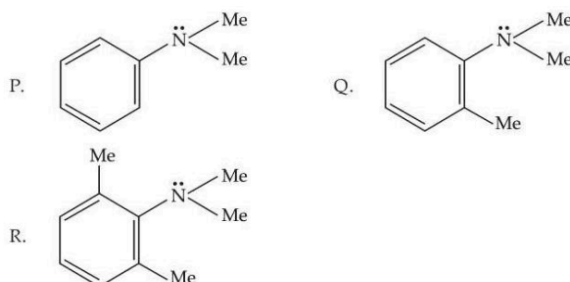
List - II**Reagent used to distinguish**

- I. Bromine water
 II. $\text{CHCl}_3 + \text{KOH}, \Delta$
 III. Neutral FeCl_3
 IV. Ammonical silver nitrate

Choose the correct answer from the options given below :

- (A) A-IV, B-II, C-I, D-III
 (B) A-IV, B-II, C-III, D-I
 (C) A-II, B-IV, C-I, D-III
 (D) A-II, B-IV, C-III, D-I

18. Consider the three aromatic molecules (P, Q and R) whose structures have been given below :



The correct order regarding the reactivity of these compounds with $\text{Ph}-\text{N} \equiv \text{N}^{(+)}\text{Cl}^{(-)}$ under optimum but slightly acidic medium is :

- (A) $P > Q > R$
 (B) $R > P > Q$
 (C) $R > Q > P$
 (D) $P > R > Q$

19. Match List - I with List - II.

List - I (Vitamin)	List - II (Name)
A. Vitamin B_1	I. Pyridoxine
B. Vitamin B_2	II. Ascorbic acid
C. Vitamin B_6	III. Thiamine
D. Vitamin C	IV. Riboflavin

Choose the correct answer from the options given below :

- (A) A-II, B-I, C-III, D-IV
 (B) A-IV, B-III, C-II, D-I
 (C) A-III, B-IV, C-I, D-II
 (D) A-I, B-III, C-II, D-IV

20. A salt with few drops of conc. HCl gives apple green colour in flame test. The group precipitate of the salt is dissolved in acetic acid and treated with K_2CrO_4 to give yellow precipitate. When the sodium carbonate extract of the salt solution is heated with conc. HNO_3 and ammonium molybdate, it resulted a canary yellow precipitate. The cation and anion present in the salt are respectively,

- (A) Ca^{2+} and SO_4^{2-}
 (B) Ba^{2+} and PO_4^{3-}
 (C) Mn^{2+} and PO_4^{3-}
 (D) Ba^{2+} and SO_4^{2-}

21. 5.33 g of $CrCl_3 \cdot 6H_2O$, which is a 1 : 3 electrolyte, is dissolved in water and is passed through a cation exchanger. The chloride ions in the eluted solution, on treatment with $AgNO_3$ results in 8.61 g of $AgCl$. The ratio of moles of complex reacted and moles of $AgCl$ formed is $\frac{\quad}{\quad} \times 10^{-2}$. (Nearest integer)
 Molar mass in $g\ mol^{-1}$ Cr : 52, Ag : 108, Cl : 35.5, H : 1, O : 16

22. Consider the isomers of hydrocarbon with molecular formula C_5H_{10} . These isomers do

not decolourise $KMnO_4$ solution. These isomers are subjected to chlorination with chlorine in presence of light to give monochloro compounds. The total number of monochloro compounds (structural isomers only) formed is ____.

23. One mole of an alkane (x) requires 8 mole oxygen for complete combustion. Sum of number of carbon and hydrogen atoms in the alkane (x) is ____.

24. For reaction $A \rightarrow P$, rate constant $k = 1.5 \times 10^3 \text{ s}^{-1}$ at 27°C . If activation energy for the above reaction is 60 kJ mol^{-1} , then the temperature (in $^\circ\text{C}$) at which rate constant, $k = 4.5 \times 10^3 \text{ s}^{-1}$ is _____. (Nearest integer)

Given : $\log 2 = 0.30, \log 3 = 0.48, R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}, \ln 10 = 2.3$

25. At the transition temperature T , $A \rightleftharpoons B$ and $\Delta G^0 = 105 - 35 \log T$ where A and B are two states of substance X. The transition temperature in $^\circ\text{C}$ when pressure is 1 atm is _____. (Nearest integer)
