

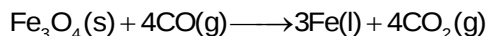
CHEMISTRY

SECTION - A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

1. Production of iron in blast furnace follows the following equation



when 4.640 kg of Fe_3O_4 and 2.520 kg of CO are allowed to react then the amount of iron (in g) produced is:

[Given : Molar Atomic mass (g mol^{-1}) : Fe = 56

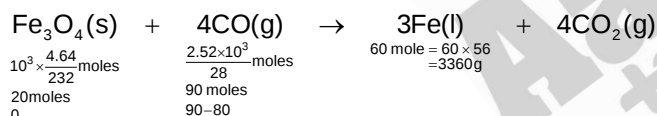
Molar Atomic mass (g mol^{-1}) : O = 16

Molar Atomic mass (g mol^{-1}) : C = 12]

- (A) 1400
(B) 2200
(C) 3360
(D) 4200

Answer (C)

Sol.



2. Which of the following statements are **correct**?
- (A) The electronic configuration of Cr is $[\text{Ar}] 3d^5 4s^1$.
- (B) The magnetic quantum number may have a negative value.
- (C) In the ground state of an atom, the orbitals are filled in order of their increasing energies.
- (D) The total number of nodes are given by $n - 2$.
- Choose the **most appropriate** answer from the options given below :
- (A) (A), (C) and (D) only
(B) (A) and (B) only
(C) (A) and (C) only
(D) (A), (B) and (C) only

Answer (D)

Sol. $\text{Cr} = (\text{Ar}) 3d^5 4s^1$

$M = +1$ to -1

As per Aufbau principle, orbitals are filled in increasing order of energy.

Total number of nodes = $(n - 1)$

3. Arrange the following in the decreasing order of their covalent character :

- (A) LiCl
(B) NaCl
(C) KCl
(D) CsCl

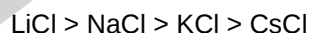
Choose the **most appropriate** answer from the options given below :

- (A) $(A) > (C) > (B) > (D)$
(B) $(B) > (A) > (C) > (D)$
(C) $(A) > (B) > (C) > (D)$
(D) $(A) > (B) > (D) > (C)$

Answer (C)

Sol. Covalent character $\propto$ polarising power of cation

Correct decreasing order of covalent character



4. The solubility of AgCl will be maximum in which of the following?
- (A) 0.01 M KCl
(B) 0.01 M HCl
(C) 0.01 M AgNO_3
(D) Deionised water

Answer (D)

Sol. Solubility decreases with increasing the concentration of common ion. Therefore, the maximum solubility of AgCl will be in deionized water.

5. Which of the following is a **correct** statement?
- (A) Brownian motion destabilises sols.
(B) Any amount of dispersed phase can be added to emulsion without destabilising it.

(C) Mixing two oppositely charged sols in equal amount neutralises charges and stabilises colloids.

(D) Presence of equal and similar charges on colloidal particles provides stability to the colloidal solution.

Answer (D)

Sol. Presence of equal and similar charges on colloidal particle provides stability to the colloidal solution.

6. The electronic configuration of Pt(atomic number 78) is:

(A) [Xe] $4f^{14} 5d^9 6s^1$

(B) [Kr] $4f^{14} 5d^{10}$

(C) [Xe] $4f^{14} 5d^{10}$

(D) [Xe] $4f^{14} 5d^8 6s^2$

Answer (A)

Sol. Pt = [Xe] $4f^{14} 5d^9 6s^1$

7. In isolation of which one of the following metals from their ores, the use of cyanide salt is not commonly involved?

(A) Zinc

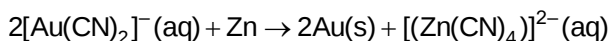
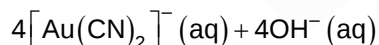
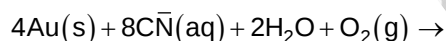
(B) Gold

(C) Silver

(D) Copper

Answer (D)

Sol. In the extraction of Silver and Gold, NaCN is used to leach the metal.



In case of ore containing ZnS and PbS, the depressant used is NaCN.

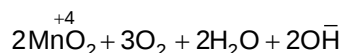
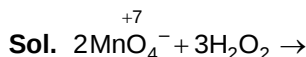
8. Which one of following reactions indicates the reducing ability of hydrogen peroxide in basic medium?

(A) $\text{HOCl} + \text{H}_2\text{O}_2 \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^- + \text{O}_2$

(B) $\text{PbS} + 4\text{H}_2\text{O}_2 \rightarrow \text{PbSO}_4 + 4\text{H}_2\text{O}$

(C) $2\text{MnO}_4^- + 3\text{H}_2\text{O}_2 \rightarrow 2\text{MnO}_2 + 3\text{O}_2 + 2\text{H}_2\text{O} + 2\text{OH}^-$

(D) $\text{Mn}^{2+} + \text{H}_2\text{O}_2 \rightarrow \text{Mn}^{4+} + 2\text{OH}^-$

Answer (C)

In basic medium MnO_4^- is reduced to MnO_2 , whereas in acidic medium it is reduced to Mn^{2+} .

9. Match **List-I** with **List-II**.

List-I

(Metal)

List-II

(Emitted light wavelength (nm))

(A) Li

(I) 670.8

(B) Na

(II) 589.2

(C) Rb

(III) 780.0

(D) Cs

(IV) 455.5

Choose the **most appropriate** answer from the options given below:

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

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

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

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

Answer (A)

Sol.

Metal	Li	Na	K	Rb	Cs
Colour	Crimson-red	Yellow	Violet	Red violet	Blue
λ/nm	670.8	589.2	766.5	780.0	455.5

10. Match **List-I** with **List-II**.

List-I

(Metal)

List-II

(Application)

(A) Cs

(I) High temperature thermometer

(B) Ga

(II) Water repellent sprays

(C) B

(III) Photoelectric cells

(D) Si

(IV) Bullet proof vest

Choose the **most appropriate** answer from the options given below:

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

Answer (A)

Sol. Metal

Application

Cs	Photoelectric cells
Ga	High temperature thermometer
B	Bullet proof vest
Si	Water repellent sprays

11. The oxoacid of phosphorus that is easily obtained from a reaction of alkali and white phosphorus and has two P-H bonds, is:

- (A) Phosphonic acid (B) Phosphinic acid
 (C) Pyrophosphorus acid (D) Hypophosphoric acid

Answer (B)

Sol. White phosphorus + alkali $\rightarrow$ H_3PO_2

H_3PO_2 = phosphinic acid

12. The acid that is believed to be mainly responsible for the damage of Taj Mahal is

- (A) sulfuric acid (B) hydrofluoric acid
 (C) phosphoric acid (D) hydrochloric acid

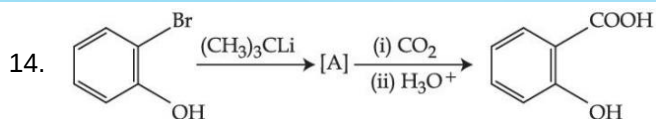
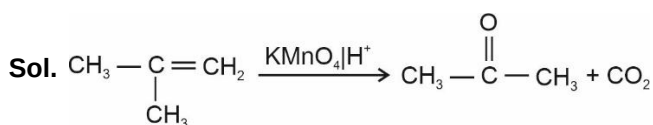
Answer (A)

Sol. $\text{CaCO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{CaSO}_4 + \text{H}_2\text{O} + \text{CO}_2$

13. Two isomers 'A' and 'B' with molecular formula C_4H_8 give different products on oxidation with KMnO_4/H^+ results in effervescence of a gas and gives ketone. The compound 'A' is

- (A) But-1-ene
 (B) cis-But-2-ene
 (C) trans-But-2-ene
 (D) 2-methyl propene

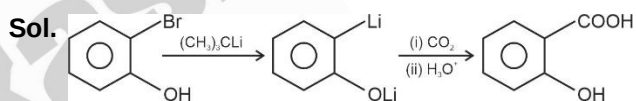
Answer (D)



In the given conversion the compound A is:

- (A)
 (B)
 (C)
 (D)

Answer (B)



15. Given below are two statements:

Statement I: The esterification of carboxylic acid with an alcohol is a nucleophilic acyl substitution.

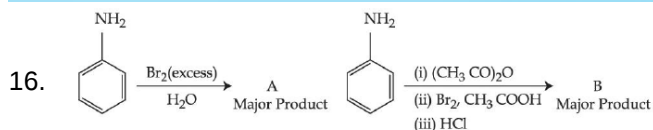
Statement II: Electron withdrawing groups in the carboxylic acid will increase the rate of esterification reaction.

Choose the **most appropriate** option :

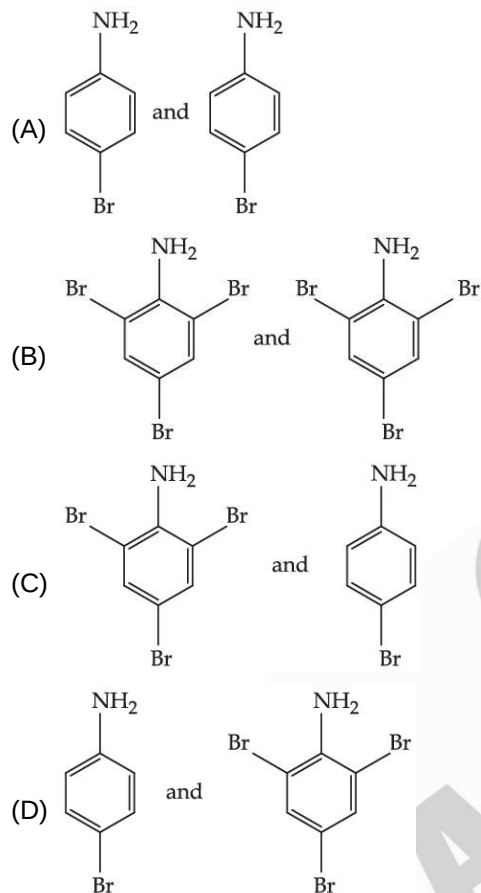
- (A) Both **Statement I** and **Statement II** are correct.
 (B) Both **Statement I** and **Statement II** are incorrect.
 (C) **Statement I** is correct but **Statement II** is incorrect.
 (D) **Statement I** is incorrect but **Statement II** is correct.

Answer (A)

Sol. Esterification of carboxylic acid with an alcohol is nucleophilic acyl substitution and presence of electron withdrawing group in the carboxylic acid increases the rate of esterification reaction.

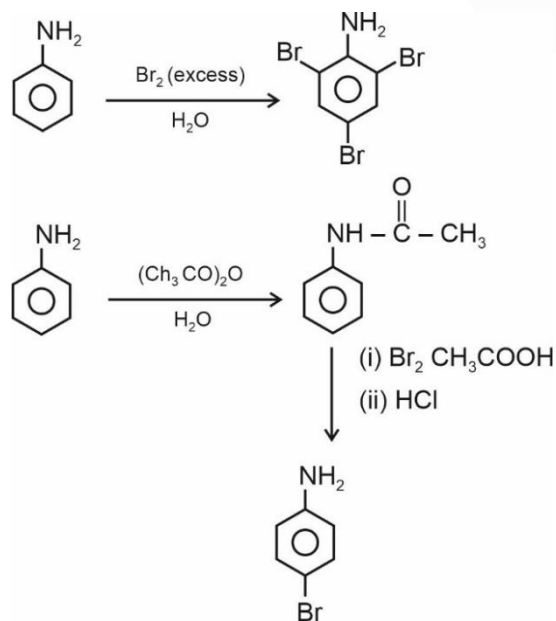


Consider the above reactions, the product A and product B respectively are



Answer (C)

Sol.



17. The polymer, which can be stretched and retains its original status on releasing the force is

- (A) Bakelite
(B) Nylon 6, 6
(C) Buna-N
(D) Terylene

Answer (C)

Sol. Buna – N is a synthetic rubber which can be stretched and retains its original status on releasing the force.

18. Sugar moiety in DNA and RNA molecules respectively are

- (A) β -D-2-deoxyribose, β -D-deoxyribose
(B) β -D-2-deoxyribose, β -D-ribose
(C) β -D-ribose, β -D-2-deoxyribose
(D) β -D-deoxyribose, β -D-2-deoxyribose

Answer (B)

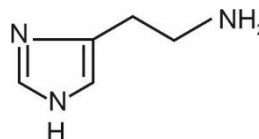
Sol. DNA consists of β -D-2-deoxyribose sugar whereas RNA consists of β -D-ribose.

19. Which of the following compound **does not** contain sulphur atom?

- (A) Cimetidine
(B) Ranitidine
(C) Histamine
(D) Saccharin

Answer (C)

Sol. Histamine – does not contain sulphur.



20. Given below are two statements.

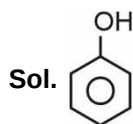
Statement I : Phenols are weakly acidic.

Statement II : Therefore they are freely soluble in NaOH solution and are weaker acids than alcohols and water.

Choose the **most appropriate** option.

- (A) Both **Statement I** and **Statement II** are correct.
 (B) Both **Statement I** and **Statement II** are correct.
 (C) **Statement I** is correct but **Statement II** is incorrect.
 (D) **Statement I** is incorrect but **Statement II** is correct.

Answer (C)



pKa = 10

Alcohol

pKa ≈ 16

H₂O

pKa ≈ 15

SECTION - B

Numerical Value Type Questions: This section contains 10 questions. In Section B, attempt any five questions out of 10. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the second decimal place; e.g. 06.25, 07.00, -00.33, -00.30, 30.27, -27.30) using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.

1. Geraniol, a volatile organic compound, is a component of rose oil. The density of the vapour is 0.46 gL⁻¹ at 257°C and 100 mm Hg. The molar mass of geraniol is ____ g mol⁻¹. (Nearest Integer)
 [Given: R = 0.082 L atm K⁻¹ mol⁻¹]

Answer (152)

Sol. $\frac{PM}{RT} = d \Rightarrow M = \frac{0.46 \times 0.082 \times 530 \times 760}{100}$
 $\approx 152 \text{ g mol}^{-1}$

2. 17.0 g of NH₃ completely vapourises at -33.42°C and 1 bar pressure and the enthalpy change in the process is 23.4 kJ mol⁻¹. The enthalpy change for the vapourisation of 85 g of NH₃ under the same conditions is ____ kJ.

Answer (117)

Sol. Number of moles of NH₃ = 5

So, required $\Delta H = 5 \times 23.4$

$$= 117 \text{ kJ}$$

3. 1.2 mL of acetic acid is dissolved in water to make 2.0 L of solution. The depression in freezing point observed for this strength of acid is 0.0198°C. The percentage of dissociation of the acid is ____ . (Nearest integer)

[Given: Density of acetic acid is 1.02 g mL⁻¹

Molar mass of acetic acid is 60 g mol⁻¹

K_f(H₂O) = 1.85 K kg mol⁻¹]

Answer (5)

Sol. $\Delta T_b = i \times K_b \times m$

$$\text{Moles of solute (acetic acid)} = \frac{1.2 \times 1.02}{60}$$

As moles of solute are very less.

So, take molarity and molality same.

$$0.0198 = i \times 1.85 \times \frac{1.2 \times 1.02}{60 \times 2}$$

$$i = 1.05$$

$$\alpha = \frac{i-1}{n-1} = \frac{0.05}{1} = 0.05$$

4. A dilute solution of sulphuric acid is electrolysed using a current of 0.10 A for 2 hours to produce hydrogen and oxygen gas. The total volume of gases produced at STP is ____ cm³. (Nearest integer)

[Given : Faraday constant F = 96500 C mol⁻¹ at STP, molar volume of an ideal gas is 22.7 L mol⁻¹]

Answer (127 cm³)

Sol. 2 F produces = $\frac{3}{2}$ mole of gas

0.10 × 2 × 3600 coulomb produces

$$= \frac{\frac{3}{2} \times 0.1 \times 2 \times 3600}{2 \times 96500}$$

$$= 0.0056 \text{ moles of gas}$$

$$\begin{aligned}\text{Volume of gas produced} &= 0.0056 \times 22.7 \text{ L} \\ &\approx 0.127 \text{ L} \\ &= 127 \text{ mL}\end{aligned}$$

5. The activation energy of one of the reactions in a biochemical process is $532611 \text{ J mol}^{-1}$. When the temperature falls from 310 K to 300 K , the change in rate constant observed is $k_{300} = x \times 10^{-3} k_{310}$. The value of x is _____.

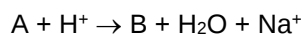
[Given: $\ln 10 = 2.3$, $R = 8.3 \text{ JK}^{-1} \text{ mol}^{-1}$]

Answer (1)

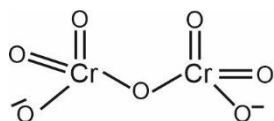
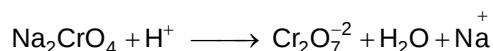
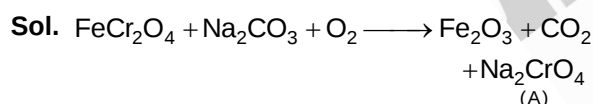
$$\text{Sol. } \log\left(\frac{k_{310}}{k_{300}}\right) = \frac{532611}{8.3} \left(\frac{1}{300} - \frac{1}{310}\right)$$

$$\frac{k_{310}}{k_{300}} = 10^3 \Rightarrow k_{300} = 1 \times 10^{-3} \times k_{310}$$

6. The number of terminal oxygen atoms present in the product B obtained from the following reaction is _____.

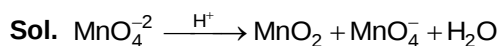


Answer (6)



7. An acidified manganate solution undergoes disproportionation reaction. The spin-only magnetic moment value of the product having manganese in higher oxidation state is _____ B.M. (Nearest integer)

Answer (00.00)



$$\text{Mn}^{+7} = d^0$$

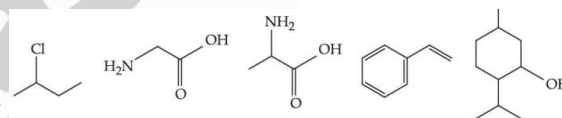
Hence, magnetic moment = zero

8. Kjeldahl's method was used for the estimation of nitrogen in an organic compound. The ammonia evolved from 0.55 g of the compound neutralised 12.5 mL of $1 \text{ M H}_2\text{SO}_4$ solution. The percentage of nitrogen in the compound is _____. (Nearest integer)

Answer (64)

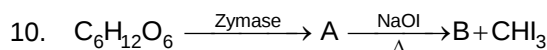
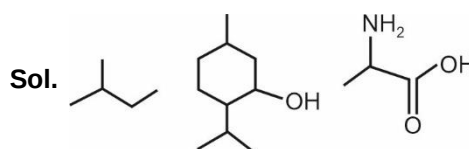
$$\begin{aligned}\text{Sol. } \% \text{ N} &= \frac{1.4 \times \text{N} \times \text{V}}{\text{Mass of organic compound}} \\ &= \frac{1.4 \times 2 \times 12.5}{0.55} = 63.63\% \approx 64\end{aligned}$$

9. Observe structures of the following compounds



The total number of structures/compounds which possess asymmetric carbon atoms is _____.

Answer (3)



The number of carbon atoms present in the product B is _____.

Answer (1)

