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. **Assertion:** Boron is unable to form BF_6^{3-}.

   Reason: Boron is very small in size.

   (1) Both Assertion and Reason are correct and Reason is correct explanation of Assertion

   (2) Both Assertion and Reason are correct but Reason is not correct explanation of Assertion

   (3) Assertion is correct and Reason is incorrect

   (4) Assertion is incorrect and Reason is correct

Answer (2)

Sol. The outermost shell of boron is 2 and its maximum covalency is 4. Therefore, boron cannot form BF_6^{3-}. Hence, Assertion is true.

Boron is the first element of Group-13 of modern periodic table. It is very small in size. But it does not provide correct explanation of assertion.

2. $KMnO_4$ reacts in alkaline medium with $S_2O_3^{-2}$ to form which of the following ionic species:

   (1) SO_4^{-2} (2) SO_3^{-2}

   (3) $S_2O_7^{-2}$ (4) $S_2O_8^{-2}$

Answer (1)

Sol. $H_2O + 8MnO_4^{\ominus} + 3S_2O_3^{-2} \rightarrow 8MnO_2 + 6SO_4^{-2} + 2OH^{\ominus}$

3.

Polymer	Monomer
(A) Neoprene	(1) Acrylonitrile
(B) Natural rubber	(2) Chloroprene
(C) Teflon	(3) Isoprene
(D) Orlon	(4) Tetrafluoroethene

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

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

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

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

Answer (1)

Sol. Neoprene is the polymer of chloroprene. Natural rubber is the polymer of isoprene. Teflon is the polymer of tetrafluoroethene. Orlon is the polymer of acrylonitrile.

4. Consider the following orbitals (A to D) containing electron with following set of quantum numbers (n, l, m, s).

   A. $3, 2, 1, \frac{1}{2}$ B. $3, 1, 1, \frac{1}{2}$

   C. $4, 0, 0, \frac{-1}{2}$ D. $3, 0, 0, \frac{1}{2}$

   The highest energy orbital among the above set of orbitals for a multielectron atom will be

   (1) A (2) B

   (3) C (4) D

Answer (1)

Sol. A has highest energy as (n + l) value for this orbital has the maximum value.

n + l for A = 5

n + l for B = 4

n + l for C = 4

n + l for D = 3

5.

Column-I	Column-II
I. $\Psi_{AB} = \Psi_A + \Psi_B$	(P) Bonding Molecular orbital (LCAO)
II. $\mu = q \times d$	(Q) Antibonding Molecular orbital (LCAO)
III. $\Psi^*_{AB} = \Psi_A - \Psi_B$	(R) dipole moment
IV. $\frac{1}{2}$ (Number of bonding e^- – number of anti bonding e^-)	(S)Bond order

   (1) I-(P); II-(R); III-Q; IV-S

   (2) I-(P); II-(Q); III-R; IV-S

   (3) I-(Q); II-(P); III-R; IV-S

   (4) I-(R); II-(P); III-Q; IV-S

Answer (1)

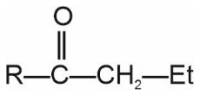
Sol. $\Psi_{AB} = \Psi_A + \Psi_B$ — Bonding molecular orbital

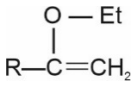
$\Psi^*_{AB} = \Psi_A - \Psi_B$ — Antibonding molecular orbital

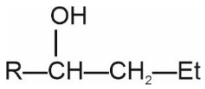
$\mu = q \times d$ — dipole moment

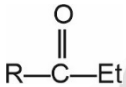
$\frac{n_b - n_a}{2}$ — Bond order, where n_b represents number of bonding electrons and n_a represents number of antibonding electrons

6. $R-COCH_3 \xrightarrow[EtBr]{NaOH}$ Final product (P) . The final product P is

(1) 

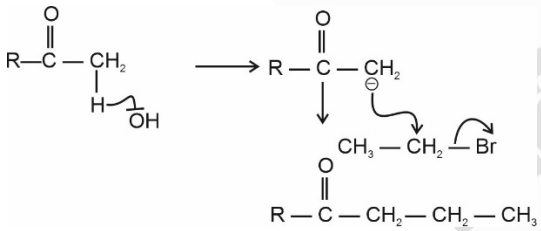
(2) 

(3) 

(4) 

Answer (1)

Sol.



7. Lathering property of soap is due to which of the following?

(1) Sodium stearate (2) Sodium carbonate

(3) Sodium rosinate (4) Glycerol

Answer (3)

Sol. Due to formation of sodium rosinate soap lathers well

8. Consider the following statements :

Statement I : on dilution, molar conductivity for KI (aqueous) increase steeply

Statement II : On dilution, molar conductivity for carbonic acid (aqueous) slowly increases till infinite dilution.

(1) Statement I is correct & statement II is incorrect

(2) Both statement (I) and (II) are correct

(3) Statement (I) is incorrect and statement (II) is correct

(4) Both statement (I) and (II) are incorrect

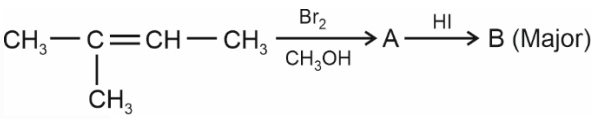
Answer (4)

Sol. On dilution, molar conductivity for strong electrolyte increases gradually till infinite dilution.

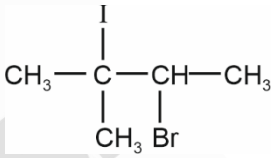
As KI is a strong electrolyte, molar conductivity increases gradually.

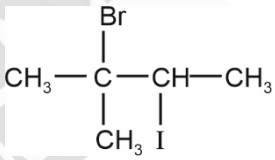
Carbonic acid is a weak electrolyte. So, molar conductivity increases steeply on excess dilution.

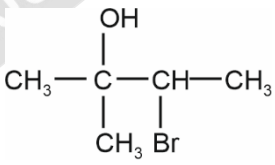
$\therefore$, statement (I) and statement (II) are incorrect.

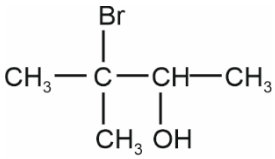
9. 

The product B is

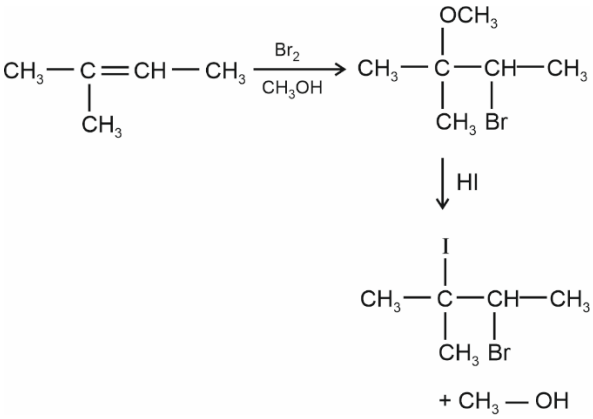
(1) 

(2) 

(3) 

(4) 

Answer (1)

Sol. 

10. Match column-I with column-II.

Colum-I	Column-II
(A) Impure Aniline + water	(P) Crystallisation
(B) Aniline + Chloroform	(Q) Steam distillation followed by use of separating funnel
(C) Benzoic acid + naphthalene	(R) Sublimation
(D) Naphthalene + nonvolatile salts	(S) Distillation

(1) A(Q), B(S), C(P), D(R)

(2) A(P), B(Q), C(R), D(S)

(3) A(S), B(R), C(Q), D(P)

(4) A(Q), B(P), C(R), D(S)

Answer (1)

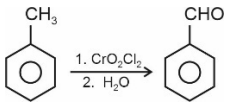
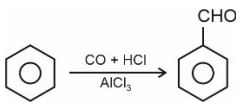
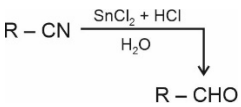
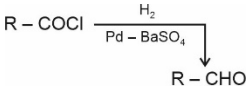
Sol. Chloroform (B.P. = 334 K) and Aniline (B.P. = 457) – Distillation

Imp Aniline and water – Steam distillation to purify water and aniline are separated by using separating funnel

Benzoic acid and Naphthalene – Crystallisation

Naphthalene and non volatile impurities – sublimation since naphthalene sublime while impure is non volatile

11. Match the reactions given in Column-I with their corresponding names in Column-II.

Column-I	Column-II
(A) 	(P) Etard's Reaction
(B) 	(Q) Gattermann Koch reaction
(C) 	(R) Stephen's reduction
(D) 	(S) Rosenmund reduction

The correct match is :

(1) A(P); B(Q); C(R); D(S)

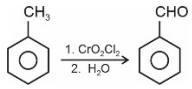
(2) A(Q); B(P); C(R); D(S)

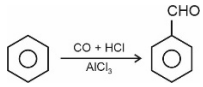
(3) A(Q); B(R); C(P); D(S)

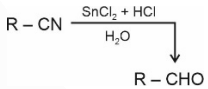
(4) A(R); B(Q); C(P); D(S)

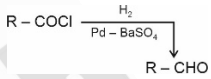
Answer (1)

Sol. The correct match is :

(A)  → (P) Etard's Reaction

(B)  → (Q) Gattermann Koch reaction

(C)  → (R) Stephen's reduction

(D)  → (S) Rosenmund reduction

12. Consider the following Reaction :

$Fe^{+3} + A \longrightarrow$ Prussian blue

Which of the following represents A?

(1) A is $[Fe(CN)_6]^{-4}$

(2) A is $[Fe(CN)_6]^{-3}$

(3) A is $[FeCl_4]^{\ominus}$

(4) A is $FeSO_4$

Answer (1)

Sol. $4Fe^{+3} + 3\left[Fe(CN)_6\right]^{-4} \longrightarrow \underset{\text{Prussian Blue}}{Fe_4\left[Fe(CN)_6\right]_3}$

Hence A is $\left[Fe(CN)_6\right]^{-4}$

13. Correct order of first ionisation energy for the elements with given electronic configuration.

(i) $3s^2$

(ii) $3s^2\ 3p^1$

(iii) $3s^2\ 3p^3$

(iv) $3s^2\ 3p^4$

(1) (iii) > (iv) > (i) > (ii)

(2) (iv) > (iii) > (ii) > (i)

(3) (i) > (ii) > (iii) > (iv)

(4) (ii) > (iii) > (i) > (iv)

Answer (1)

Sol. Orbitals with fully filled and half filled are stable, and require more energy for ionisation.

Elements with greater electronegativity require more energy for ionisation.

Hence, the correct order is (iii) > (iv) > (i) > (ii).

14. Group-1 element (A) with maximum hydration enthalpy, shows similarity with group-2 element (B). A and B respectively are

(1) Li, Mg

(2) Be, Mg

(3) Na, Ca

(4) K, Be

Answer (1)

Sol. Among group-1 elements lithium has maximum hydration enthalpy and shows diagonal relationship with Mg.

15. Statement I : Parchment paper can be used to separate true solution from colloid.

Statement II : When we use parchment paper the particles of true solution cannot pass but colloids can pass.

(1) Both statement I and II are correct

(2) Statement I is correct but statement II is incorrect

(3) Statement I is incorrect, Statement II is correct

(4) Neither statement I, nor statement II is correct

Answer (2)

Sol. Colloidal particles cannot pass through parchment paper but they can pass through ordinary filter paper.

Particles of true solution can pass through ordinary filter paper as well as parchment paper. Hence, parchment paper can be used for separation.

Statement I is correct and statement II is incorrect.

16. Match the following :

	Column-I (Reactions)		**Column-II (Product formed)**
A.	Glucose + Br_2 water	(1)	n-Hexane
B.	Glucose + conc. HNO_3	(2)	Gluconic acid
C.	Glucose + acetic anhydride	(3)	Saccharic acid
D.	Glucose + HI/red P_4	(4)	Glucose pentaacetate

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

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

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

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

Answer (2)

Sol. Glucose + Br_2 water $\rightarrow$ Gluconic acid

Glucose + conc. HNO_3 $\rightarrow$ Saccharic acid

Glucose + acetic anhydride $\rightarrow$ Glucose pentaacetate

Glucose + HI/red P_4 $\rightarrow$ n-hexane

Correct match is A(2); B(3); C(4); D(1).

17.

18.

19.

20.

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.

21. 100 ml of 0.1 M H_2SO_4 is reacted with 50 ml of 0.1 M NaOH. What is the normality of H_2SO_4 left in the solution?

Answer (00.10)

Sol.

	H_2SO_4	+ 2NaOH	$\rightarrow Na_2SO_4$	+ $2H_2O$
Initial $\rightarrow$	10 millimoles	5 millimoles	–	–
Final $\rightarrow$	7.5 millimoles	–	2.5 mm	–

$\therefore$ Normality of H_2SO_4 = $\frac{7.5}{150} \times 2 = \frac{7.5}{75}$ = 0.1 N

22. Consider a first order reaction

$A \rightarrow B$

The concentration of A after 70 minutes becomes half. If the rate constant of the reaction is 'x' × 10^{-6} seconds^{-1}, then find x. [Take ln2 = 0.693]

Answer (165.00)

Sol. $t_{1/2} = \frac{0.693}{k}$

$\therefore$ $k = \frac{0.693}{70 \times 60}$ = 0.000165 s^{-1}

= 165 × 10^{-6} s^{-1}

Hence, x = 165

23. How many among the following are primary ores of Fe (iron)?

Siderite, Malachite, Magnetite, Haematite, Cryolite, Cuprite, Limonite, Kaolinite, Sphalerite, Bauxite, Chalcopyrite

Answer (04)

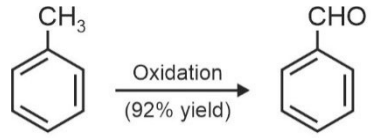
Sol. Primary ores of iron are,

Magnetite (Fe_3O_4), Haematite (Fe_2O_3), Siderite ($FeCO_3$) and Limonite ($FeO(OH)\cdot nH_2O$)

24. 5.0 gm of toluene is subjected to controlled oxidation to get benzaldehyde. The percentage yield of the product formed in the above reaction is 92%. Find the mass of benzaldehyde formed in gm.

Answer (5.30)

Sol. Mass of toluene (molar mass = 92) given = 5.0 gm



(Molar mass = 106)

Number of moles of benzaldehyde formed

= 0.92 × Number of moles of toluene

Mass of benzaldehyde formed

$= 0.92 \times \frac{5}{92} \times 106 = 5.30$ gm

25. How many of the following molecules species are non planar?

$BF_3, NO_3^-, SF_4, XeF_4, XeO_3, PH_4^+, PCl_3, Al(OH)_4^-$

and H_2O_2

Answer (6)

Sol. Among the given molecules/species, the following species are non planar.

SF_4	see-saw
XeO_3	Pyramidal
PH_4^+	Tetrahedral
PCl_3	Pyramidal
$Al(OH)_4^-$	Tetrahedral
H_2O_2	Open book

$\therefore$ No. of non planar species = 6.

26. When $MnO_4^{\ominus}$ reacts with H_2O_2 in alkaline medium, the oxidation state of Mn in the product containing Mn will be:

Answer (04.00)

Sol. $2MnO_4^{\ominus} + 3H_2O_2 \longrightarrow 2MnO_2 + 3O_2 + 2OH^{\ominus} + 2H_2O$

Oxidation state of Mn in MnO_2 is (+4)

27.

28.

29.

30.