

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 :

31. In which of the following reactions the hydrogen peroxide acts as a reducing agent?

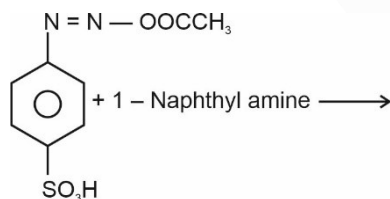
- (1) $\text{HOCl} + \text{H}_2\text{O}_2 \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^- + \text{O}_2$
 (2) $\text{PbS} + 4\text{H}_2\text{O}_2 \rightarrow \text{PbSO}_4 + 4\text{H}_2\text{O}$
 (3) $2\text{Fe}^{2+} + \text{H}_2\text{O}_2 \rightarrow 2\text{Fe}^{3+} + 2\text{OH}^-$
 (4) $\text{Mn}^{2+} + \text{H}_2\text{O}_2 \rightarrow \text{Mn}^{4+} + 2\text{OH}^-$

Answer (1)

Sol. $\text{HOCl} + \text{H}_2\text{O}_2 \longrightarrow \text{H}_3\text{O}^{\oplus} + \text{Cl}^{\ominus} + \text{O}_2$

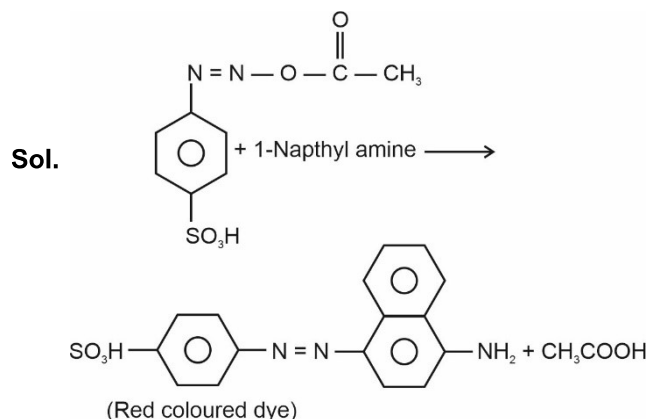
In this reaction H_2O_2 is acting as a reducing agent as Cl is undergoing a change in oxidation state from +1 to -1.

32. Choose the correct colour of the product for the following reaction.



- (1) Blue (2) Red
 (3) Yellow (4) White

Answer (2)



33. Which one amongst the following are good oxidizing agents?

- A. Sm^{2+}
 B. Ce^{2+}
 C. Ce^{4+}
 D. Tb^{4+}

Choose the most appropriate answer from the options given below.

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

Answer (4)

Sol. Ce^{+4} and Tb^{+4} are strong oxidising agents as the common oxidation state of Lanthanides is (+3).

34. Given below are two statements:

Statement-I : Pure Aniline and other arylamines are usually colourless.

Statement-II : Arylamines get coloured on storage due to atmospheric reduction.

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

- (1) Statement-I is correct but Statement-II is incorrect
 (2) Both Statement-I and Statement-II are incorrect
 (3) Statement-I is incorrect but Statement-II is correct
 (4) Both Statement-I and Statement-II are correct

Answer (1)

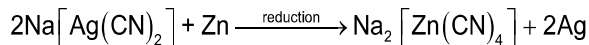
Sol. Both Statement-I and Statement-II is incorrect as arylamines get coloured due to atmospheric oxidation.

35. The metal which is extracted by oxidation and subsequent reduction from its ore is

- (1) Al (2) Cu
 (3) Fe (4) Ag

Answer (4)

Sol. Ag is first extracted by oxidation and then subsequent reduction is carried out to obtain



36. Given below are two statements, one is labelled as **Assertion A** and the other is labelled as **Reason R**.

Assertion A : Benzene is more stable than hypothetical cyclohexatriene.

Reason R : The delocalized π electron cloud is attracted more strongly by nuclei of carbon atoms.

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

- (1) Both A and R are correct but R is NOT the correct explanation of A
- (2) Both A and R are correct and R is the correct explanation of A
- (3) A is true but R is false
- (4) A is false but R is true

Answer (2)

Sol. Benzene is more stable than hypothetical cyclohexatriene due to resonance.

So, 1st statement is correct.

As the delocalised π -electron cloud is attracted more strongly by the nuclei of carbon atoms, therefore benzene is resonance stabilized. It is also aromatic in character.

Hence, the correct answer is (2)

37. Given below are two statements, one is labelled as **Assertion A** and the other is labelled as **Reason R**.

Assertion A : Beryllium has less negative value of reduction potential compared to the other alkaline earth metals.

Reason R: Beryllium has large hydration energy due to small size of Be^{2+} but relatively large value of atomization enthalpy.

In the light of the above statements, choose the most appropriate answer from the options given below.

- (1) Both A and R are correct but R is NOT the correct explanation of A
- (2) A is correct but R is not correct
- (3) Both A and R are correct and R is the correct explanation of A
- (4) A is not correct but R is correct

Answer (3)

Sol. 1st statement is correct as Be has least negative value of reduction potential among alkaline earth metals.

2nd statement is also correct.

The reducing nature is indeed less due to high atomisation enthalpy and ionisation enthalpy while having large hydration enthalpy of Be^{+2} . Correct answer is (3)

38. Which of the following cannot be explained by crystal field theory?

- (1) Stability of metal complexes
- (2) The order of spectrochemical series
- (3) Magnetic properties of transition metal complexes
- (4) Colour of metal complexes

Answer (2)

Sol. CFT does not explain the order of spectrochemical series because as per CFT, anionic ligands should exert greatest splitting effect. However, they lie on lower end of the spectrochemical series.

39. What is the number of unpaired electron(s) in the highest occupied molecular orbital of the following species: N_2 ; N_2^+ ; O_2 ; O_2^+ ?

- | | |
|----------------|----------------|
| (1) 0, 1, 0, 1 | (2) 0, 1, 2, 1 |
| (3) 2, 1, 2, 1 | (4) 2, 1, 0, 1 |

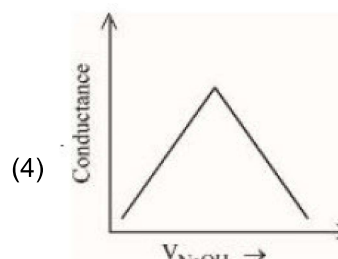
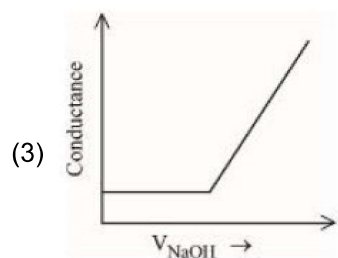
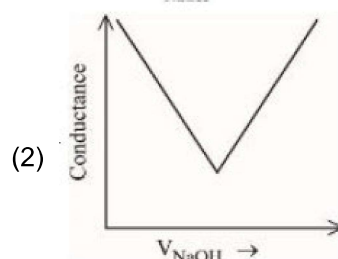
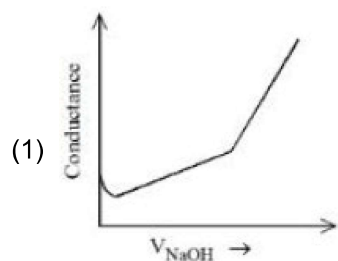
Answer (2)

Sol.

Molecule	No. of unpaired electron in highest occupied molecular orbital
N ₂	0
N ₂ [⊕]	1
O ₂	2
O ₂ [⊕]	1

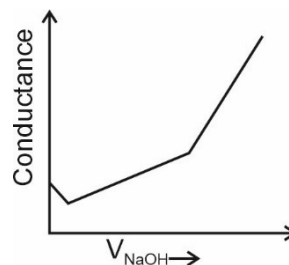
Correct answer is (2)

40. Choose the correct representation of conductometric titration of benzoic acid vs sodium hydroxide.

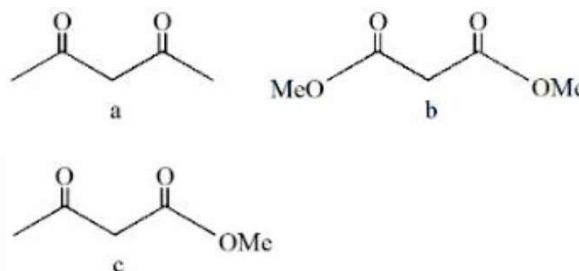


Answer (1)

Sol. Correct graph is: →



41. Which will undergo deprotonation most readily in basic medium



- (1) c only (2) a only
 (3) Both a and c (4) b only

Answer (2)

Sol. (a) Since most readily is asked, deprotonation will be easily possible for (a).

∴ The correct answer is (2)

In (b) and (c), tendency for deprotonation is less due to cross conjugation.

42. Identify the correct statements about alkali metals.

- A. The order of standard reduction potential (M⁺ | M) for alkali metal ions is Na > Rb > Li.
 B. CsI is highly soluble in water.
 C. Lithium carbonate is highly stable to heat.
 D. Potassium dissolved in concentrated liquid ammonia is blue in colour and paramagnetic.
 E. All the alkali metal hydrides are ionic solids.

Choose the correct answer from the options given below.

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

Answer (4)

Sol. A. The order given is correct

B. CsI is less soluble in water due to less hydration enthalpy.

C. $\text{Li}_2\text{CO}_3 \xrightarrow{\Delta} \text{Li}_2\text{O} + \text{CO}_2$

D. In concentrated liquid ammonia, solution becomes diamagnetic

E. Alkali metal hydrides are ionic solids.

The correct answer is (A and E) only.

43. The hybridization and magnetic behaviour of cobalt ion in $[\text{Co}(\text{NH}_3)_6]^{3+}$ complex, respectively is

(1) d^2sp^3 and paramagnetic

(2) sp^3d^2 and diamagnetic

(3) sp^3d^2 and paramagnetic

(4) d^2sp^3 and diamagnetic

Answer (4)

Sol. $[\text{Co}(\text{NH}_3)_6]^{3+}$ is diamagnetic with d^2sp^3 hybridisation of Co^{+3} .

This is because NH_3 is a strong field ligand and forces electrons to pair up in a d^6 configuration.

44. Correct statement is:

(1) An average human being consumes nearly 15 times more air than food

(2) An average human being consumes more food than air

(3) An average human being consumes 100 times more air than food

(4) An average human being consumes equal amount of food and air

Answer (1)

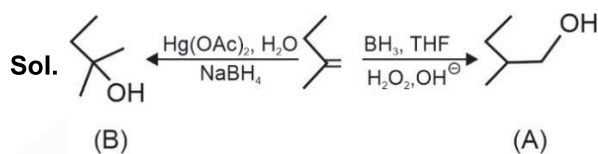
Sol. An average human being consumes 15 times more air than food.

The correct answer is (1).

45. Find out the major products from the following reactions.



Answer (2)



The correct answer is (2).

46. Match List I with List II.

	LIST I Type		LIST II Name
A.	Antifertility drug	I.	Norethindrone
B.	Tranquilizer	II.	Meprobomate
C.	Antihistamine	III.	Seldane
D.	Antibiotic	IV	Ampicillin

Choose the correct answer from the options given below:

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

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

Answer (2)

Sol. Correct match is

A. Antifertility drug (I) Norethindrone

B. Tranquilizer (II) Meprobomate

C. Antihistamine (III) Seldane

D. Antibiotic (IV) Ampicillin

47. $\text{K}_2\text{Cr}_2\text{O}_7$ paper acidified with dilute H_2SO_4 turns green when exposed to

(1) Hydrogen sulphide (2) Carbon dioxide

(3) Sulphur dioxide (4) Sulphur trioxide

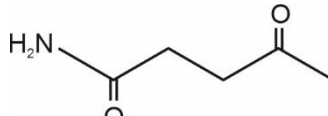
Answer (3)

Sol. SO_2 gets oxidised in presence of $\text{K}_2\text{Cr}_2\text{O}_7$ and it converts to Cr^{+3} in presence of dil. H_2SO_4 .

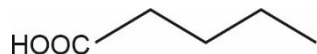
Similarly, H_2S can also get oxidized to sulphur.

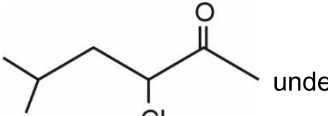
However, most appropriate is (3).

48. Given below are two statements:

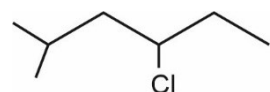
Statement I:  under

Clemmensen reduction conditions will give



Statement II:  under Wolff-

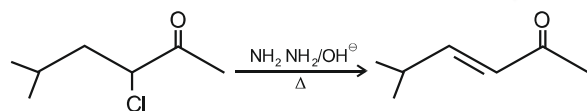
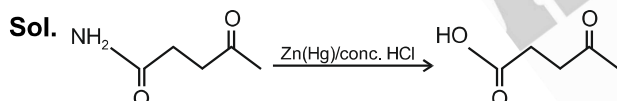
Kishner reduction condition will give



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

- (1) Statement I is true but Statement II is false
- (2) Both Statement I and Statement II are false
- (3) Both Statement I and Statement II are true
- (4) Statement I is false but Statement II is true

Answer (1)



\therefore Statement I is true but statement II is false.

49. The number of s-electrons present in an ion with 55 protons in its unipositive state is

- (1) 10
- (2) 8
- (3) 9
- (4) 12

Answer (1)

Sol. 55 protons are present in Cs^{\oplus}

\therefore Number of s-electrons = 10

50. A student has studied the decomposition of a gas AB_3 at 25°C . He obtained the following data.

p (mm Hg)	50	100	200	400
relative $t_{1/2}$ (s)	4	2	1	0.5

The order of the reaction is

- (1) 1
- (2) 0 (Zero)
- (3) 2
- (4) 0.5

Answer (3)

Sol. $\text{AB}_3(\text{g}) \longrightarrow \text{A}(\text{g}) + 3\text{B}(\text{g})$ or $\frac{3}{2}\text{B}_2(\text{g})$

As decomposition reaction of $\text{AB}_3(\text{g})$ is not given, we assume that p(mm Hg) is for $\text{AB}_3(\text{g})$ only.

$$\therefore t_{1/2} \propto (p)^{1-n}$$

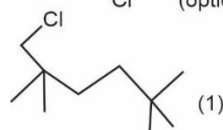
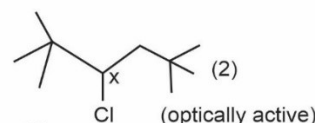
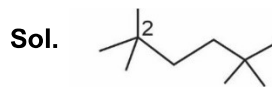
$$\therefore \text{Order of reaction is 2 as } t_{1/2} \propto \frac{1}{p}$$

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 andw the on-screen virtual numeric keypad in the place designated to enter the answer.

51. Maximum number of isomeric monochloro derivatives which can be obtained from 2,2,5,5-tetramethylhexane by chlorination is _____

Answer (3)



Total isomers = 3

(considering stereoisomers)

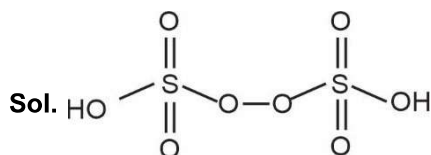
52. Total number of tripeptides possible by mixing of valine and proline is _____

Answer (8)

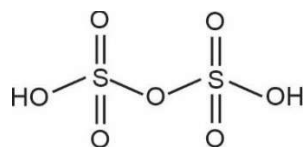
Sol. Considering only linear tripeptides, total number of tripeptides are 8 or 2^3 .

53. Sum of π - bonds present in peroxodisulphuric acid and pyrosulphuric acid is _____

Answer (8)



($H_2S_2O_8$) (peroxodi sulphuric acid)



($H_2S_2O_7$) (pyro sulphuric acid)

Number of π -bonds = 8

54. The total pressure observed by mixing two liquids A and B is 350 mm Hg when their mole fractions are 0.7 and 0.3 respectively.

The total pressure becomes 410 mm Hg if the mole fractions are changed to 0.2 and 0.8 respectively for A and B. The vapour pressure of pure A is _____ mm Hg. (Nearest integer). Consider the liquids and solutions behave ideally.

Answer (314)

Sol. $350 = P_A^\circ(0.7) + P_B^\circ(0.3)$

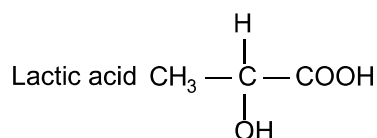
$410 = P_A^\circ(0.2) + P_B^\circ(0.8)$

$-21700 = -P_B^\circ(50)$

$P_B^\circ = 434 \text{ mm Hg}$

$P_A^\circ = 314 \text{ mm Hg}$

55. If the pK_a of lactic acid is 5, then the pH of 0.005 M calcium lactate solution at 25°C is _____ $\times 10^{-1}$ (Nearest integer)



Answer (85)

Sol. $\text{pH} = 7 + \frac{1}{2}(\text{p}K_a + \log c)$

$= 7 + \frac{1}{2}(5 - 2)$

$= 7 + 1.5$

$= 8.5$

56. The number of statement/s which are the characteristics of physisorption is _____

- A. It is highly specific in nature
- B. Enthalpy of adsorption is high
- C. It decreases with increases in temperature
- D. It results into unimolecular layer
- E. No activation energy in needed

Answer (2)

Sol. A. It is non-specific

B. It is low

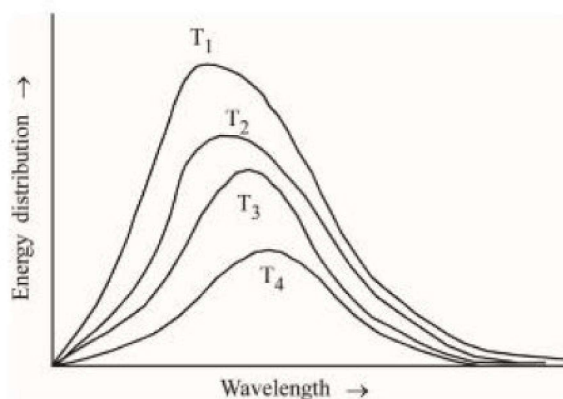
C. Extent of adsorption decreases with increase of temperature

D. It results in multimolecular layer

E. No activation energy is needed

No. of correct statements = 2

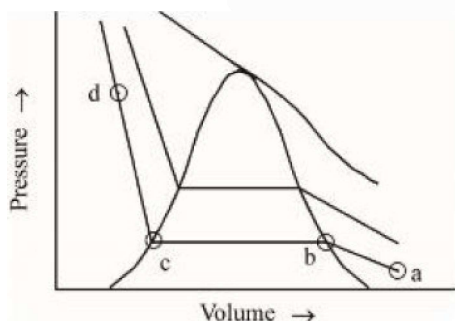
57. Following figure shows spectrum of an ideal black body at four different temperatures. The number of **correct** statement/s from the following is _____



- A. $T_4 > T_3 > T_2 > T_1$
- B. The black body consists of particles performing simple harmonic motion.
- C. The peak of the spectrum shifts to shorter wavelength as temperature increases.
- D. $\frac{T_1}{v_1} = \frac{T_2}{v_2} = \frac{T_3}{v_3} \neq \text{constant}$
- E. The given spectrum could be explained using quantisation of energy.

Answer (2)

- Sol.** A. $T_1 > T_2 > T_3 > T_4$
- B. It is incorrect as particles do not undergo simple harmonic motion.
 - C. It is correct
 - D. It is incorrect
 - E. It is correct
58. The number of statement/s, which are correct with respect to the compression of carbon dioxide from point (a) in the Andrews isotherm from the following is _____

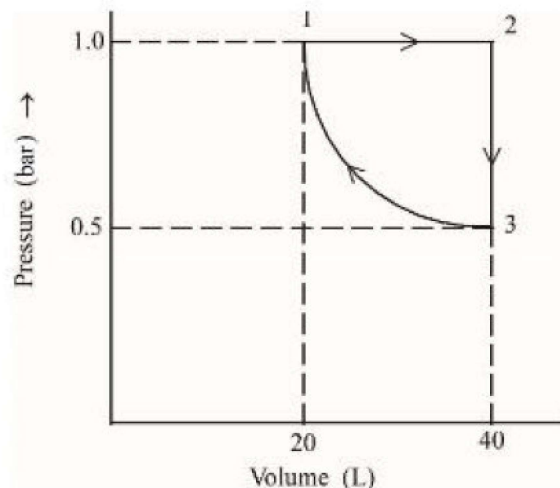


- A. Carbon dioxide remains as a gas upto point (b)
- B. Liquid carbon dioxide appears at point (c)
- C. Liquid and gaseous carbon dioxide coexist between points (b) and (c)
- D. As the volume decreases from (b) to (c), the amount of liquid decreases

Answer (2)

- Sol.** A. It is correct
- B. It is incorrect as it appears at point (b)
 - C. It is also correct
 - D. It is incorrect.
- Number of correct statements = 2

59. One mole of an ideal monoatomic gas is subjected to changes as shown in the graph. The magnitude of the work done (by the system or on the system) is _____ J (nearest integer)



Given: $\log 2 = 0.3$

$\ln 10 = 2.3$

Answer (620)

Sol. $W_{3 \rightarrow 1} = - \left(20 \log \frac{20}{40} \right) \times 2.3$
 $= +20 \times 0.3 \times 100 \times 2.3 \text{ J}$
 $= 1.38 \text{ kJ}$
 $W_{2 \rightarrow 3} = 0$

$W_{1 \rightarrow 2} = -1 \times 20 \times 100 = -2 \text{ kJ}$

$W_{1 \rightarrow 2} + W_{2 \rightarrow 3} + W_{3 \rightarrow 1} = 1.38 - 2 = -0.62 \text{ kJ}$

$|W| = 620 \text{ J}$

60. The number of units, which are used to express concentration of solutions from the following is _____
- Mass percent, Mole, Mole fraction, Molarity, ppm, Molality

Answer (5)

Sol. Mass percent, mole fraction, molarity, ppm & molality are used to express concentration. So, number of units = 5