



CHEMISTRY

SECTION-A

1. The work to be done on 2 moles of a perfect gas at 27°C , if it is compressed reversibly and isothermally from a pressure of $1.01 \times 10^5 \text{ Nm}^{-2}$ to $5.05 \times 10^6 \text{ Nm}^{-2}$ is :

- (1) $2.03 \times 10^4 \text{ J}$ (2) $1.95 \times 10^2 \text{ J}$
(3) $1.95 \times 10^4 \text{ J}$ (4) $1.95 \times 10^8 \text{ J}$

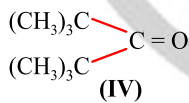
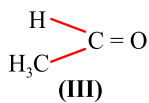
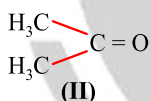
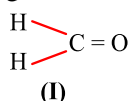
2. The ratio of radii of first orbits of H, He^+ and Li^{2+} is :

- (1) 1 : 2 : 3 (2) 6 : 3 : 2
(3) 1 : 4 : 9 (4) 9 : 4 : 1

3. The one of the product obtained on reaction of ethyl magnesium bromide with methanol is :

- (1) Ethane (2) Methane
(3) Propane (4) Methoxyethane

4. The correct order of reactivity for the addition reaction of the following carbonyl compounds with ethyl magnesium iodide is :



- (1) I > III > II > IV (2) IV > III > II > I
(3) I > II > IV > III (4) III > II > I > IV

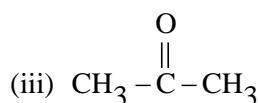
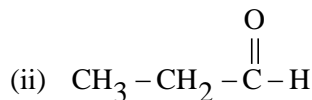
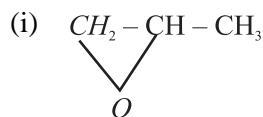
5. Solids are attracted by magnetic field due to the presence of atoms, ions or molecules with unpaired electrons, called paramagnetic. Which among the following is paramagnetic ?

- (1) Cl_2O_7 (2) Cl_2O
(3) ClO_2 (4) Cl_2O_5

6. The coordination entity formed when excess of KCN is added to an aqueous solution of CuSO_4 is :

- (1) $[\text{Cu}(\text{CN})_2]^+$ (2) $[\text{Cu}(\text{CN})_6]^{4-}$
(3) $[\text{Cu}(\text{CN})_4]^{2-}$ (4) $[\text{Cu}(\text{CN})_4]^{3+}$

7. Which of the following is (are) an isomer of compound (i) ?



- (1) (ii) (2) (iv)
(3) (ii) and (iii) (4) All of these

8. The major product of the following reaction is :



- (1) Propan-2-ol
(2) Propanal
(3) Acetaldehyde
(4) Propan-1-ol

9. Which of the following will undergo Cannizzaro reaction ?

- (1) Benzaldehyde (2) Acetaldehyde
(3) Acetone (4) Pentanone

10. **Assertion(A):** Each d-block series contains ten elements.

Reason (R): The maximum capacity of d-orbitals is of ten electrons as in each series d-orbitals are gradually filled up.

- (1) Both **Assertion (A)** and **Reason (R)** are true and **Reason (R)** is a correct explanation of **Assertion (A)**.
(2) Both **Assertion (A)** and **Reason (R)** are true but **Reason (R)** is not a correct explanation of **Assertion (A)**.
(3) **Assertion (A)** is true and **Reason (R)** is false.
(4) **Assertion (A)** is false and **Reason (R)** is true.



11. When CH_3Cl and AlCl_3 are used in Friedel-Crafts reaction, the electrophile is :

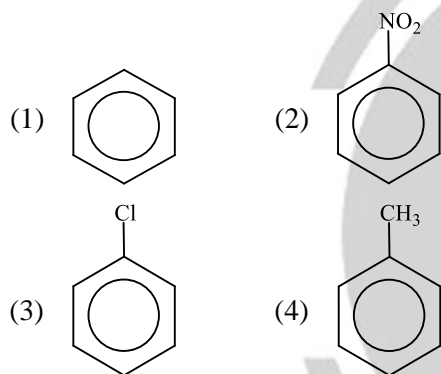
- (1) Cl^+
- (2) AlCl_4^-
- (3) CH_3^+
- (4) AlCl_2^+

12. $\text{Ph}-\text{C}\equiv\text{CH} \xrightarrow[\text{H}_2\text{O}]{\text{HgSO}_4/\text{H}_2\text{SO}_4} (\text{P})$

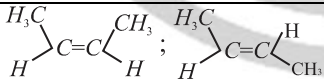
Major product (P) is :

- (1) $\text{Ph}-\text{CH}_2-\text{CH}_2-\text{OH}$
- (2) $\text{Ph}-\text{CH}_2-\text{CHO}$
- (3) $\text{Ph}-\text{CO}-\text{CH}_3$
- (4) $\text{Ph}-\text{CH}_2-\text{O}-\text{CH}_3$

13. Which of the following compound is most reactive towards electrophilic substitution ?



14. Match **List-I** with **List-II** to find out the correct option.

List-I		List-II	
(A)	A pair of functional isomers	(I)	
(B)	A pair of geometrical isomers	(II)	$\text{C}_2\text{H}_5\text{CHO}$; CH_3COCH_3
(C)	A pair of metamers	(III)	$\text{CH}_3\text{OC}_3\text{H}_7$; $\text{C}_2\text{H}_5\text{OC}_2\text{H}_5$
(D)	A pair of tautomers	(IV)	$\text{H}_2\text{C}=\text{CHOH}$; CH_3CHO

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

15. Match **List-I** with **List-II** to find out the correct option.

List-I (Molecule)		List-II (Number of lone pairs on central atom)	
(A)	NH_3	(I)	Two
(B)	H_2O	(II)	Three
(C)	XeF_2	(III)	Zero
(D)	CH_4	(IV)	Four
		(V)	One

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

16. Oxidation states of N in HCN , HN_3 and NO respectively are :

- (1) +1, +3 and –2
- (2) –3, +3 and +2
- (3) –3, $-\frac{1}{3}$ and +2
- (4) +2, $-\frac{1}{3}$ and +2

17. **Statement-I:** Photoelectric effect is easily pronounced by caesium metal.

Statement-II: Photoelectric effect is easily pronounced by the metals having high ionization energy.

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

18. 20 g of an impure sample of calcium carbonate decomposes on heating to give 8.4 g of calcium oxide. What is the percentage purity of calcium carbonate sample ?

[Atomic weight of Ca is 40 u]

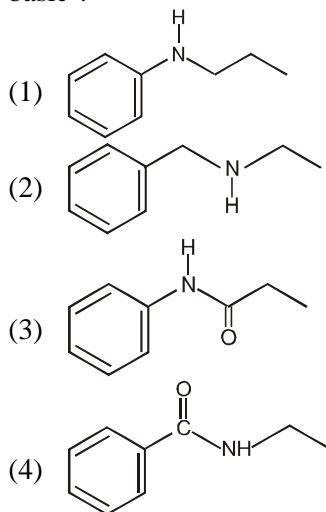
- (1) 85 %
- (2) 50 %
- (3) 95 %
- (4) 75 %

19. In laboratory, the presence of nitrate ion in a solution is confirmed by the formation of a coloured ring. What is the colour of the ring formed ?

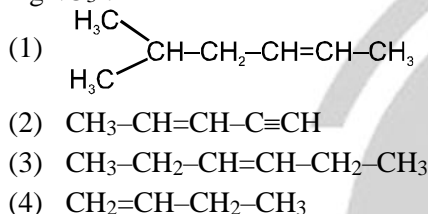
- (1) Blue
- (2) Red
- (3) Orange
- (4) Brown



20. Which one of the following compound is most basic ?



21. Which will undergo reaction with ammoniacal AgNO_3 ?

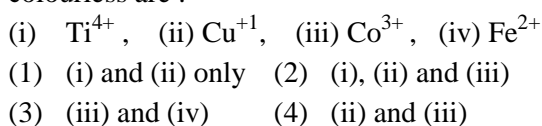


22. **Statement-I** : In octahedral complexes, the three orbitals (d_{xy} , d_{yz} , d_{zx}) are stable and of low energy while the two orbitals ($d_{x^2-y^2}$, d_z^2) are unstable and have high energy.

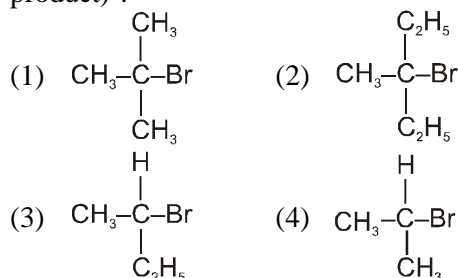
Statement-II : In octahedral complexes, the three d-orbitals (d_{xy} , d_{yz} , d_{zx}) experience less repulsion from the ligands while two d-orbitals ($d_{x^2-y^2}$, d_z^2) experience more repulsion from the ligands due to their shapes.

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

23. The ions from among the following which are colourless are :



24. Which one of the following compounds will give (d)- and (l)- form in $\text{S}_{\text{N}}1$ reaction (as major product) ?



25. **Statement-I**: Elevation in boiling point will be high if the molal elevation constant of solvent is high.

Statement-II: Elevation in boiling point is a colligative property.

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

26. If excess of AgNO_3 solution is added to 100 mL of a 0.024 M solution of dichlorobis(ethylenediamine)cobalt (III) chloride, how many moles of AgCl be precipitated ?

- (1) 0.0012 (2) 0.0016
(3) 0.0024 (4) 0.0048

27. Which of the following pairs is (are) correctly matched ?

- (1) $\alpha\text{-D-(+)-glucose}$ and $\beta\text{-D-(+)-glucose} \rightarrow$ C-2 epimers
(2) Glucose and fructose \rightarrow C-3 epimers
(3) Glucose \rightarrow Furanose ring
(4) Sucrose \rightarrow Glucose + fructose

28. When ethyne is passed through a red hot iron tube, then formation of benzene takes place.

$$\Delta H_f^\circ(\text{C}_2\text{H}_2)(\text{g}) = 230 \text{ kJ mol}^{-1}$$

$$\Delta H_f^\circ(\text{C}_6\text{H}_6)(\text{g}) = 85 \text{ kJ mol}^{-1}$$

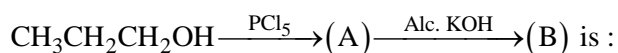
Calculate the standard heat of trimerisation of ethyne to benzene.



- (1) 205 kJ mol^{-1} (2) 605 kJ mol^{-1}
(3) -605 kJ mol^{-1} (4) -205 kJ mol^{-1}



29. The compound (B) formed in the following sequence of reactions,



- (1) propene (2) propyne
(3) propane (4) propanal
30. Which of the following has maximum weight ?
(1) 40 g iron
(2) 1.2 g atom of N
(3) 1×10^{23} atoms of C
(4) 1.12 liter of O_2 at STP
31. The half-life of second order reaction is :
(1) Inversely proportional to the square of the initial concentration of the reactants.
(2) Inversely proportional to the initial concentration of reactants.
(3) Proportional to the initial concentration of reactants.
(4) Independent of the initial concentration of reactants.
32. **Assertion (A):** Reduction of fructose with sodium borohydride forms two products differing in configuration.
Reason (R): A chiral carbon is formed due to reduction of keto group at C_2 .
(1) **Assertion (A)** is correct, **Reason (R)** is correct and **Reason (R)** is a correct explanation for **Assertion (A)**.
(2) **Assertion (A)** is correct, **Reason (R)** is correct but **Reason (R)** is not a correct explanation for **Assertion (A)**.
(3) **Assertion (A)** is correct but **Reason (R)** is incorrect.
(4) **Assertion (A)** is incorrect but **Reason (R)** is correct.
33. Ge (II) compounds are powerful reducing agents whereas Pb (IV) compounds are strong oxidants. It can be due to :
(1) Pb is more electronegative than Ge.
(2) Ionization potential of lead is less than that of Ge.
(3) Ionic radii of Pb^{2+} and Pb^{4+} are larger than those of Ge^{2+} and Ge^{4+} .
(4) More pronounced inert pair effect in lead than in Ge.

34. The specific conductivity of N/10 KCl solution at 20°C is $0.0212 \text{ ohm}^{-1} \text{ cm}^{-1}$ and the resistance of the cell containing this solution at 20°C is 55 ohm. The cell constant is :

- (1) 4.616 cm^{-1} (2) 1.166 cm^{-1}
(3) 2.173 cm^{-1} (4) 3.324 cm^{-1}

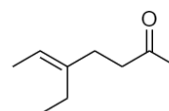
35. For which of the following sparingly soluble salt, the solubility (S) and solubility product (K_{sp}) are related by the expression :

$$S = \left[\frac{K_{\text{sp}}}{4} \right]^{1/3}$$

- (1) BaSO_4 (2) $\text{Ca}_3(\text{PO}_4)_2$
(3) Hg_2Cl_2 (4) Ag_3PO_4

SECTION-B

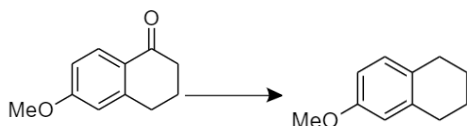
36. The element with atomic number 35 belongs to :
(1) d-block (2) f-block
(3) p-block (4) s-block
37. The correct order of ionic radii of Ce, La, Pm and Yb in +3 oxidation state is :
(1) $\text{La}^{3+} < \text{Pm}^{3+} < \text{Ce}^{3+} < \text{Yb}^{3+}$
(2) $\text{La}^{3+} < \text{Ce}^{3+} < \text{Pm}^{3+} < \text{Yb}^{3+}$
(3) $\text{Yb}^{3+} < \text{Ce}^{3+} < \text{Pm}^{3+} < \text{La}^{3+}$
(4) $\text{Yb}^{3+} < \text{Pm}^{3+} < \text{Ce}^{3+} < \text{La}^{3+}$
38. Using phenolphthalein as an indicator, which of the following titration is possible ?
(1) Acetic acid with pyridine.
(2) Oxalic acid and sodium hydroxide.
(3) Hydrochloric acid with aniline.
(4) Sulphuric acid with aqueous ammonia.
39. The IUPAC name for the compound given below is :



- (1) (E)-5-ethylhept-5-en-2-one
(2) (Z)-5-ethylhept-5-en-2-one
(3) (E)-3-ethylhept-2-en-6-one
(4) (Z)-3-ethylhept-2-en-6-one



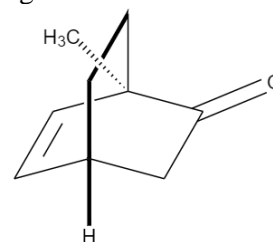
40. The most suitable reagent for the following transformation is :



- (1) NaBH_4 (2) B_2H_6
(3) Zn-Hg/HCl (4) $\text{NH}_2\text{NH}_2/\text{HCl}$
41. Acetophenone can be converted to phenol by reaction with :
(1) m-CPBA followed by base catalysed hydrolysis.
(2) Conc. nitric acid.
(3) Iodine and NaOH.
(4) Singlet oxygen followed by base catalysed hydrolysis.
42. Among dimethylcyclobutanes, which one exhibit optical activity ?
(1) cis-1,2-dimethylcyclobutane
(2) trans-1,2-dimethylcyclobutane
(3) cis-1,3-dimethylcyclobutane
(4) trans-1,3-dimethylcyclobutane
43. The decreasing order of stability of the free radicals A, B and C is :

(1) ABC (2) CAB
(3) BAC (4) ACB
44. Bond dissociation enthalpies of $\text{H}_2(\text{g})$ and $\text{N}_2(\text{g})$ are $436.0 \text{ kJ mol}^{-1}$ and $941.8 \text{ kJ mol}^{-1}$ respectively and enthalpy of formation of $\text{NH}_3(\text{g})$ is -46 kJ mol^{-1} . What is enthalpy of atomization of $\text{NH}_3(\text{g})$?
(1) $390.3 \text{ kJ mol}^{-1}$ (2) $1170.9 \text{ kJ mol}^{-1}$
(3) 590 kJ mol^{-1} (4) 720 kJ mol^{-1}

45. The configuration at the two stereocenters in the compound given below are :



- (1) 1R, 4R (2) 1R, 4S
(3) 1S, 4R (4) 1S, 4S
46. The molecule with highest number of lone pairs and has a linear shape based on the VSEPR theory is :
(1) Carbon dioxide
(2) Triiodide anion
(3) Nitrogen dioxide
(4) Nitrogen dioxide cation
47. Find out the value of K_c for the following equilibria from the value of K_p :
 $2\text{NOCl}(\text{g}) \rightleftharpoons 2\text{NO}(\text{g}) + \text{Cl}_2(\text{g}) ; K_p = 1.8 \times 10^{-2}$
atm at 500 K.
(1) 4.38×10^{-6} (2) 2.19×10^{-4}
(3) 4.38×10^{-4} (4) 2.19×10^{-6}
48. On monochlorination of 2-methylbutane, the total number of chiral compounds is :
(1) 2 (2) 4
(3) 6 (4) 8
49. $\text{RCOOH} + \text{N}_3\text{H} \xrightarrow{\text{H}_2\text{SO}_4(\text{conc.})} \text{RNH}_2 + \text{CO}_2 + \text{N}_2$
The above reaction is called :
(1) HVZ reaction
(2) Hunsdiecker reaction
(3) Schmidt reaction
(4) Decarboxylation reaction
50. Which has a maximum pK_a value ?
(1) H_2O (2) H_2S
(3) H_2Se (4) H_2Te

