Sample Question Paper 2

CHEMISTRY (Unsolved)

(A Highly Simulated Practice Question Paper for CBSE Class XII Examination)

Instructions

1. There are 33 questions in this question paper. All questions are compulsory.
2. **Section A :** Q. no. 1-2 are case-based questions having four MCQs or Assertion-Reason type based on given passage each carrying 1 mark and Question 3 to 16 are MCQs and Assertion-Reason type questions carrying 1 mark each.
3. **Section B :** Q. no. 17 to 25 are short answer type I questions and carry 2 marks each.
4. **Section C :** Q. no. 26 to 30 are short answer type II questions and carry 3 marks each.
5. **Section D :** Q. no. 31 to 33 are long answer questions carrying 5 marks each.
6. There is no overall choice. However, an internal choices have been provided.
7. Use of calculators and log tables is not permitted.

Time : 3 hours ***Max. Marks : 70***

SECTION A : *Objective Questions* *(1 Mark)*

Passage Based Questions

1. *Read the passage given below and answer the following questions :* (1 × 4 = 4 Mark)

The phenomenon of the flow of solvent through a semipermeable membrane from pure solvent to the solution is known as osmosis. Semipermeable membranes can be of animal or vegetable origin and these occur naturally such as pig's bladder or parchment or can be synthetic such as cellophane.

If the osmosis takes place between the solutions of different concentration, then solvent molecules will move from the solution of low solute concentration to that of higher solute concentration. The flow will continue till the equilibrium is attained.

The osmotic pressure of a solution is the excess pressure that must be applied to a solution to prevent osmosis, i.e. to stop the passage of solvent molecules through a semipermeable membrane into the solution. It is a colligative property as it depends on the number of solute molecules and not on their nature.

Osmotic pressure is proportional to the molarity (C) of the solution at a given temperature T.

Thus, $\Pi \propto C, \pi = CRT$

The osmotic pressure π depends on the molar concentration of the solution ($\pi = CRT$). If two solutions are of equal solute concentration and, hence, have the same osmotic pressure.

They are said to be **isotonic**. If two solutions are of unequal osmotic pressures, the more concentrated solutions is said to be **hypertonic** and the more diluted solution is described as **hypotonic**.

The following questions (i-iv) are multiple choice questions. Choose the most appropriate answer :

(i) At a given temperature, osmotic pressure of the concentrated solution of a substance
(a) is higher than that of the dilute solution
(b) is lower than that of the dilute solution
(c) is same as that of the dilute solution
(d) cannot be compared with osmotic pressure of dilute solution

(ii) 0.1 M NaCl and 0.005 M $BaCl_2$ solutions are separated by a semipermeable membrane in a container. For this system, choose the correct answer.
(a) There is no movement of any solution across the membrane
(b) Water flows from $BaCl_2$ solution to NaCl solution
(c) Water flows from NaCl solution to $BaCl_2$ solution
(d) Osmotic pressure of 0.1 M NaCl is lower than that of $BaCl_2$ (assume complete dissociation)

(iii) The osmotic pressure of 0.2 molar solution of urea at 27°C ($R = 0.082$ L atm mol^{-1} K^{-1}) is
(a) 4.92 atm (b) 1 atm
(c) 0.2 atm (d) 27 atm

(iv) A 6% solution of urea is isotonic with
(a) 0.05 M solution of glucose
(b) 6% solution of glucose
(c) 25% solution of glucose
(d) 1 M solution of glucose

Or Solutions *A*, *B*, *C* and *D* are respectively 0.1 M glucose, 0.05 M NaCl, 0.05 M $BaCl_2$ and 0.1 M $AlCl_3$. Which one of the following pairs is isotonic?
(a) *A* and *B* (b) *B* and C
(c) *A* and *D* (d) *A* and *C*

2. *Read the passage given below and answer the following questions :* (1×4=4 Mark)

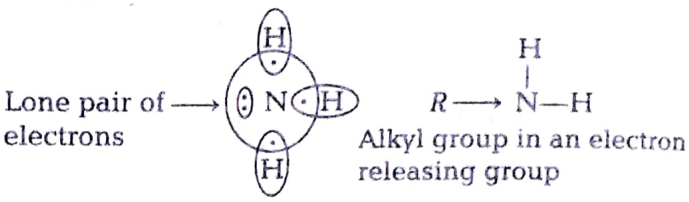
Amines are basic because they possess a pair of unshared electrons, which they can share with other atoms. These unshared electrons create an electron density around the nitrogen atom.

The greater the electron density, the more basic is the molecule. Groups that donate or supply electrons will increase the basicity of amines, while groups that decrease the electron density around the nitrogen decrease the basicity of the molecule.

Due to this property of the alkyl group attached to the nitrogen of the amine, the electron density around the nitrogen atom increases due to which its electron releasing ability increases.

Due to the greater and easier release of electrons in the alkyl amine, the molecule becomes more basic than ammonia.

Whereas in ammonia, no such releasing group is attached. So, obviously the basicity of ammonia is much less than that of an alkyl amine.



The basicity of amine in the gaseous phase and aqueous solutions varies.

(a) In the gaseous phase, the order of basic strength is given below :

$$NH_3 < CH_3NH_2 < (CH_3)_2NH < (CH_3)_3$$
(Increase in basicity)

(b) In aqueous solutions, the order of basicity

$$NH_3 < \text{Primary amine} - \text{Tertiary amine} < \text{Secondary amine}$$
(Increase in basicity)

The differences in the basicity order in the gas phase and aqueous solutions are the result of solvation effects.

In these questions (i-iv) a statement of Assertion followed by a statement of Reason is given. Choose the correct answer out of the following choices :

(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and Reason both are correct statements but Reason is not correct explanation for Assertion.
(c) Assertion is correct statement but Reason is incorrect statement.
(d) Assertion is incorrect statement but Reason is correct statement.

(i) **Assertion** Order of basicity of amines in gaseous phase is NH_3 > primary amine > secondary amine > tertiary amine.

Reason In gaseous phase, the basic nature of aliphatic amine increases with the increase in number of alkyl groups.

(ii) **Assertion** Aliphatic amines are weaker bases than ammonia and aromatic amines are stronger bases than ammonia.

Reason +*I*-effect of alkyl groups in aliphatic amines increases the electron density on nitrogen atom. Aromatic amines are weaker due to electron withdrawing nature of the aryl group.

(iii) **Assertion** $MeNH_2$ is the weaker base than MeOH.

Reason N is less electronegative than O, lone pair of electrons on N is more easily available for the donation in $MeNH_2$.

(iv) **Assertion** Aniline is a weaker base than cyclohexyl amine.

Reason Aniline undergoes halogenation even in absence of a catalyst.

Or

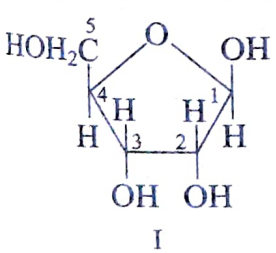
Assertion Ammonia is less basic than water.

Reason Nitrogen is less electronegative than oxygen.

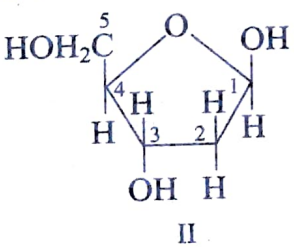
Multiple Choice Questions

Following questions (No. 3-11) are multiple choice questions carrying 1 mark each :

3. Consider the following structures



I



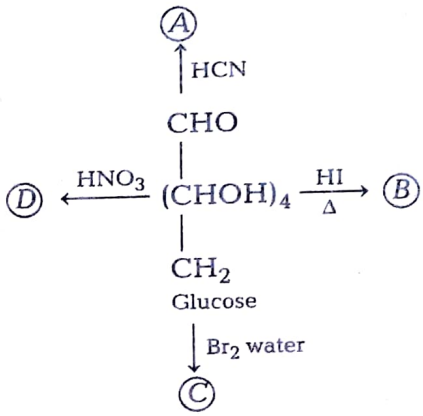
II

Identify structure I and II and choose the correct option.

	I	II
(a)	β-D-ribose	β-D-2-deoxyribose
(b)	α-D-ribose	β-D-3-deoxyribose
(c)	β-D-deoxyribose	β-D-ribose
(d)	β-D-deoxyribose	α-D-ribose

Or

Consider the following reaction,



Here, *A*, *B*, *C* and *D* respectively are

(a) *n*-hexane, gluconic acid, glucose cyanohydrin, saccharic acid

(b) glucose cyanohydrin, *n*-hexane, gluconic acid, saccharic acid.

(c) saccharic acid, glucose cyanohydrin, *n*-hexane, gluconic acid.

(d) *n*-hexane, gluconic acid, saccharic acid and glucose cyanohydrin.

4. Some reactions alongwith the units of their rate constants are given below :

S.No	Reaction	Unit of rate constant
1.	$SO_2Cl_2 \longrightarrow SO_2 + Cl_2$	s^{-1}
2.	$NO + O_3 \longrightarrow NO_2 + O_2$	$L\,mol^{-1}s^{-1}$
3.	$2NO + Cl_2 \longrightarrow 2NOCl$	$L^2\,mol^{-2}s^{-1}$

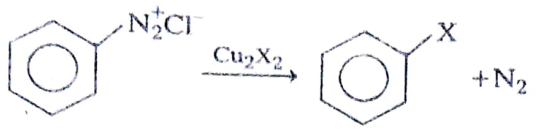
Which of the following represents a third order reaction ?

(a) $SO_2Cl_2 \longrightarrow SO_2 + Cl_2$

(b) $NO + O_3 \longrightarrow NO_2 + O_2$

(c) $2NO + Cl_2 \longrightarrow 2NOCl$

(d) None of the above

5. 

Which of the following do/does not match the equation

(a) X = Cl (b) X = Br
(c) X = I (d) Both (a) and (b)

6. Which of the following is correct?

(a) Bond order $\propto \frac{1}{\text{bond length}}$
$\propto \frac{1}{\text{bond enthalpy}} \propto$ stability

(b) Stability $\propto \frac{1}{\text{bond order}} \propto \frac{1}{\text{bond length}}$
$\propto \frac{1}{\text{bond enthalpy}}$

(c) Stability $\propto$ bond order $\propto$ bond length
$\propto$ bond enthalpy

(d) Stability $\propto$ bond order $\propto$ bond enthalpy
$\propto \frac{1}{\text{bond length}}$

Or The amount of energy required to break one mole of bonds of a particular type between two atoms in a gaseous state is called

(a) bond enthalpy
(b) bond angle
(c) bond order
(d) None of the above

7. 'Spin-only' formula to calculate magnetic moment is expressed as,

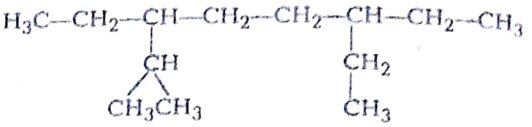
(a) $\mu = n(n+2)$ (b) $\mu = \frac{\sqrt{n+2}}{n}$

(c) $\mu = \sqrt{n(n+2)}$ (d) $\mu = \frac{n+2}{\sqrt{n}}$

8. Which amine acid has phenolic —OH group as its backbone?

(a) Glycine
(b) Leucine
(c) Serine
(d) Tyrosine

Or The correct IUPAC name of the following alkane is



(a) 3, 6-diethyl-2-methyloctane
(b) 5-isopropyl-3-ethyloctane
(c) 3-ethyl-5-isopropyloctane
(d) 3-isopropyl-6-ethyloctane

9. Acid catalysed hydration of alkenes except ethene leads to the formation of

(a) primary alcohol
(b) secondary or tertiary alcohol
(c) mixture of primary and secondary alcohols.
(d) mixture of secondary and tertiary alcohols.

10. Which among the following will be named as dibromido*bis* (ethylenediammine) chromium (III) bromide ?

(a) $[Cr(en)_3]Br_3$ (b) $[Cr(en)_2Br_2]Br$
(c) $[Cr(en)Br_4]^-$ (d) $[Cr(en)Br_2]Br$

Or A magnetic moment of 1.73 BM will be shown by one among the following.

(a) $[Cu(NH_3)_4]^{2+}$ (b) $[Ni(CN)_4]^{2-}$
(c) $TiCl_4$ (d) $[CoCl_6]^{4-}$

11. Among the following which hydrocarbon is not produced by Wurtz reaction?

(a) methane
(b) ethane
(c) propane
(d) All given options can be prepared

Assertion-Reason

In the following questions (Q.No. 12-16) a statement of Assertion followed by a statement of Reason is given. Choose the correct answer out of the following choices.

(a) Assertion and Reason both are correct statements and Reason is correct explanation for Assertion.
(b) Assertion and Reason both are correct statements but Reason is not correct explanation for Assertion.

(c) Assertion is correct statement but Reason is incorrect statement.

(d) Assertion is incorrect statement but Reason is correct statement.

12. **Assertion** Carbon oxygen bond length of phenol is slightly less than that of methanol.

Reason There exist a partial double bond character and sp^2-hybridisation of carbon to which oxygen is attached in phenol.

13. **Assertion** (A) Alcohols and phenols are soluble in water.

Reason (R) There occurs a dipole-dipole interaction of OH group of alcohol and phenol with water molecules which is responsible for their solubility in water.

14. **Assertion** Bond cleavage in haloarene is difficult than haloalkane.

Reason Phenyl carbocation is more stable than alkyl carbocation.

15. **Assertion** A bright silver mirror is produced during the warming of an aldehyde with freshly prepared ammoniacal silver nitrate solution.

Reason A bright silver mirror is produced due to the formation of silver metal.

16. **Assertion** Aromatic primary amines cannot be prepared by Gabriel phthalimide synthesis.

Reason Aryl halides do not undergo electrophilic substitution with anion formed by phthalimide.

Or **Assertion** *p*-fluoroanilinium ion is more acidic than anilinium ion.

Reason Electron density in the N—H bond of *p*-fluoroanilinium ion decreases and release of a proton from *p*-fluoroanilinium ion is much easier than from anilinium ion.

SECTION B : *Short Answer Type I Questions* *(2 Marks)*

17. Amylopectin and glycogen both have branched structures. How do they differ from one another?

18. The resistance of a conductivity cell containing 0.001 M KCl solution at 298 K is 1500 Ω. What is the cell constant if the conductivity of 0.001 M KCl solution at 298 K is 0.146×10^{-3} S cm^{-1} ?

19. Give reason for the following :

(i) Mn(II) shows maximum paramagnetic character amongst the divalent ions of the first transition series.

(ii) Most of the transition metals do not displace hydrogen from dilute acids.

Or First, second, third and fourth ionisation energies of Ni and Pt are given below :

Element	$(IE)_1 + (IE)_2$	$(IE)_3 + (IE)_4$
Ni	2.49 kJ mol^{-1}	8.80 kJ mol^{-1}
Pt	2.66 kJ mol^{-1}	6.70 kJ mol^{-1}

Compare the stability of Ni^{2+}, Pt^{2+} and Ni^{4+}, Pt^{4+} compounds.

20. What role do enzymes have in the functioning of our bodies ?

Or

Define :

(i) Carbylamine reaction.

(ii) Hofmann bromamide reaction.

21. A coordination compound $CoCl_3 \cdot 4H_2O$ precipitates silver chloride when treated with silver nitrate. This compound dissociates into two ions in solution. Write the structural formula of the compound and name it.

22. Account for the following :

(i) Draw the Fischer projection of L-glucose and D-Glucose and also give the product of D-Glucose on reaction with Tollen's reagent ?

(ii) Glucose or sucrose are soluble in water but cyclohexane or benzene (simple six membered ring compounds) are insoluble in water. Why?

23. (i) Write the structure of the major organic product in each of the following reactions :

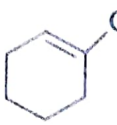
(a) $CH_3CH_2Br + KCN \xrightarrow{aq.\ ethanol}$

(b) $C_6H_5ONa + C_2H_5Cl \longrightarrow$

(ii) Arrange CH_3F, CH_3Br, CH_3I, CH_3Cl in increasing order of nucleophilic substitution reactions.

24. Suggest a mechanism of enzyme catalysed reaction.

25. Complete the following reactions :

(i)  + HI $\longrightarrow$

(ii) $CH_3CH=C(CH_3)_2 + HBr \longrightarrow$

Or

Account for the following :

(i)  reacts faster than  . why?

(ii) The treatment of an alkyl chloride with aqueous KOH leads to the formation of an alcohol whereas in the presence of alcoholic KOH, alkene is the major product.

SECTION C : *Short Answer Type II Questions* (3 Marks)

26. Degree of dissociation of pure water is 1.9×10^{-9}. Molar ionic conductances of H^+ ions and OH^- ions at infinite dilution are 200 S cm^2 mol^{-1} respectively. What is the molar conductance of water?

27. Two elements *A* and *B* form compounds having formula AB_2 and AB_4. When dissolved in 20 g of benzene (C_6H_6), 1 g of AB_2 lowers the freezing point by 2.3 K, whereas 1.0 g of AB_4 lowers it by 1.3 K. The molal depression constant for benzene is 5.1 K kg mol^{-1}.

Calculate the atomic masses of *A* and *B*.

28. A solution of $[Ni(H_2O)_6]^{2+}$ is green but a solution of $[Ni(CN)_4]^{2-}$ is colourless. Explain.

Or $[Cr(NH_3)_6]^{3+}$ is paramagnetic, while $[Ni(CN)_4]^{2-}$ is diamagnetic. Explain, why?

29. How does Lucas reagent help in distinction of primary, secondary and tertiary alcohols?

30. Calculate the standard electrode potential of $Ni^{2+}|Ni$ electrode if emf of the cell.

$Ni(s)|Ni^{2+}(0.01M)||Cu^{2+}(0.1M)|Cu(s)$ is 0.059 V. [Given, $E^\circ_{Cu^{2+}/Cu} = +0.34V$]

Or

Explain the following

(i) Arrange HCl, HBr, HI and HF in order of decreasing reactivity towards alkene.

(ii) Arrange the alkenes 2-methyl but-1-ene (I), 2-methyl but-2-ene (II) and 3-methyl but-1-ene (III) in order of decreasing reactivity towards bromine.

(iii) Give a chemical test to distinguish between ethane and ethyne.

SECTION D : *Long Answer Type Questions* (5 Marks)

31. (i) In a first order reaction, the reactant concentration decreases from 0.8 M to 0.4 M in 15 min. What is the time taken for the concentration to change from 0.1 M to 0.025 M?

(ii) A first order reaction takes 100 min for completion of 60% of the reaction. Find the time when 90% of the reaction will be completed.

Or (i) For a reaction, $H_2 + Cl_2 \xrightarrow{h\nu} 2HCl$
Rate = k
(a) Write the order and molecularity of this reaction.
(b) Write the unit of k.

(ii) A reaction is of second order in A and first order in B.
(a) Write the differential rate equation.
(b) How is the rate affected on increasing the concentration of A three times?
(c) How is the rate affected when the concentration of both A and B is doubled?

32. (i) Explain, why mercury (I) ion exists as Hg_2^{2+} ions, while copper (I) exists as Cu^+ ion.

(ii) Describe the cause of the following :
(a) Transition metal compounds are paramagnetic.
(b) Interstitial compounds are well known for transition metals.
(c) In the series Sc to Zn, the enthalpy of atomisation of zinc is the lowest.

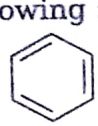
Or (i) What happens,
(a) when Cu^{2+} ion is treated with KI ?
(b) to the halides of transition metals when the oxidation state of transition metals is increased ?

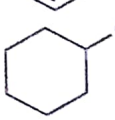
(ii) Explain the following :
(a) Mn^{3+} is a good oxidising agent.
(b) $E^{\circ}_{M^{2+}/M}$ values are not regular for first row transition metals (3*d*-series).
(c) Although, F is more electronegative than O, the highest Mn fluoride is MnF_4, whereas qthe highest oxide is Mn_2O_7.

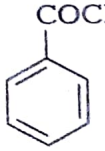
33. How will you convert ?
(i) Benzoic acid to *m*-fluoro benzoic acid.
(ii) Benzaldehyde to 3-phenylpropan-1-ol.
(iii) Benzene to benzaldehyde.
(iv) Acetone to 2-hydroxypropanoic acid.
(v) Benzene to phenyl acetic acid.

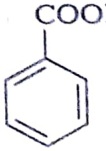
Or

Write the structure of A to E in the following :

(i)  $\xrightarrow[AlCl_3]{CH_3COCl} A$

(ii)  $\xrightarrow{Zn/Hg\text{-}HCl} B$

(iii)  $\xrightarrow[(ii)\ H_3O^+]{(i)\ I_2 / NaOH} C$

(iv)  $\xrightarrow{(i)\ Br_2 / FeBr_3} D$

Answers

1. (i) (a), (ii) (b), (iii) (a), (iv) (d) or (a) **2.** (i) (d), (ii) (d), (iii) (d), (iv) (b) or (d)
3. (a) or (b) **4.** (c) **5.** (c) **6.** (d) or (a) **7.** (c) **8.** (d) or (a) **9.** (b) **10.** (b) or (a) **11.** (a)
12. (a) **13.** (c) **14.** (c) **15.** (a) **16.** (c) **18.** 0.219 cm^{-1} **26.** 1.045×10^{-6} S cm^2 mol^{-1}
27. Step I $M_{(AB_2)} = 110.87$ g mol^{-1}, $M_{(AB_4)} = 196.15$ g mol^{-1} **Step II** $A = 25.59$ g mol^{-1}, $B = 42.64$ g mol^{-1}
30. (0.31 V) **31.** 255.8 min or 8 times (rate)