Practice Questions 2021-22

Class XII

Term 2

Subject: Chemistry

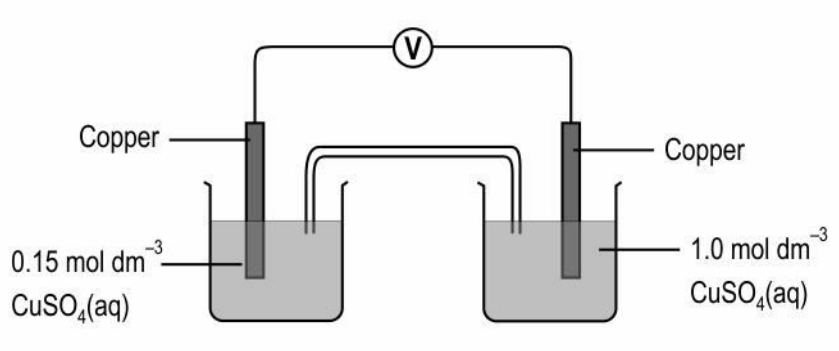
Time: 2 hours
Max. marks: 35

General instructions:

1. There are **12** questions in this question paper with internal choice
2. **SECTION A - Q. No. 1 to 3** are very short answer questions carrying 2 marks each.
3. **SECTION B - Q. No. 4 to 11** are short answer questions carrying 3 marks each.
4. **SECTION C- Q. No. 12** is case based question carrying 5 marks.
5. **All questions are compulsory.**
6. **Use of log tables and calculators is not allowed.**

SECTION A

1. In the chemistry lab, Zoya set up an electrochemical cell as shown below:



At room temperature, she found that the initial voltmeter reading was +0.16v.

(i) The standard electrode potential for the Cu^{2+}/Cu electrode is given by

$$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s);\ E^o = +\ 0.34\ V$$

Calculate the electrode potential of the electrode on the left-hand side of the above electrochemical cell.

(ii) Indicate the direction of current in the above cell. Also what will be the emf of the cell if the concentration of the beaker in the left side is raised to 1 mol dm^{-3}?

[2 marks]

2. (a) An aldehyde was produced on hydration of an alkyne P in the presence of H_2SO_4 and $HgSO_4$. Identify the alkyne P.

   (b) Arrange the following compounds in the increasing order of electrophilicity of the carbon atom of the carbonyl group.

   CH_3CH_2-CHO, CH_3CH_2-CO-CH_3, HCHO, CH_3-CO-CH_3

[2 marks]

3. Answer any two of the following questions.

   (a) C_6H_5-CH_2-CH_2-CH_2- C_6H_5 is heated with alkaline potassium permanganate and the reaction mixture is then acidified with dilute hydrochloric acid. Name the product that will be formed.

   (b) Give the IUPAC name of HOOC - $CH_2CH_2CH_2CH_2$ -COOH.

   (c) Arrange the following in the increasing order of acidity:

   4-chlorobenzoic acid, 4-nitrobenzoic acid, 4-methylbenzoic acid

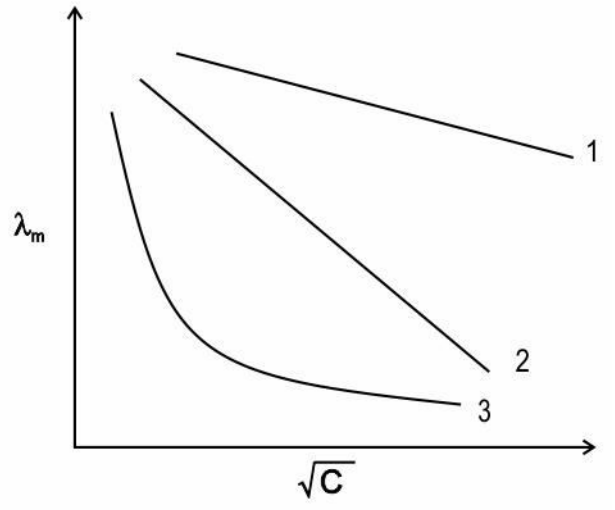
[2 marks]

SECTION B

4. A sample of benzaldehyde contains a small amount of a water-insoluble alcohol. Explain the steps involved in a chemical method to obtain pure benzaldehyde from the mixture.

[3 marks]

5. (i) The molar conductivity vs √c curve for NaCl, HCl, and NH_4OH are shown below in random order.



Identify which graph corresponds to HCl, NaCl, and NH_4OH.

(ii) Give reasons to justify your answer in (i).

[3 marks]

6. An alkyl amide R-CO-NH_2 is converted to an amine in the following ways:
(i) by reduction with $LiAlH_4$
(ii) by treating with bromine in alcoholic NaOH

(a) Classify the type of amine produced in the methods above as primary, secondary or tertiary.
(b) State one major difference in the amine products produced in the two methods above.
(c) What advantages do these two methods of producing an amine have over producing an amine by treating an alkyl halide with alcoholic ammonia solution?

[3 marks]

OR

(a) Arrange the following amines in the increasing order of basicity. Consider all to be in the gaseous state.

$C_6H_5NH_2$, NH_3, $(C_2H_5)_2NH$, 4-nitro$C_6H_5NH_2$, $C_2H_5NH_2$

(b) Name the factor that exerts the most influence on the order of basicity of the compounds when in the gaseous state.

(c) Of the following two compounds (ii) is more acidic than (i). Explain why.

(i) C_6H_5 - CO - NH - C_2H_5

(ii) C_6H_5 - SO_2 -NH - C_2H_5

[3 marks]

7. Richa uses a rough charcoal surface instead of a flat surface to adsorb 'x' g of N_2 at room temperature (T_o). $\Delta H_{adsorption}$ was found to be very low and positive.

(i) Why is a rough surface better than a flat surface for adsorption. *(assume all the other variables are the same)*
(ii) Is the adsorption physical or chemical? Give a reason for your answer.
(iii) If x+20 g of N_2 is adsorbed at temperature T1, then compare T_o and T_1.

[3 marks]

OR

(i) The table below shows the volumes of nitrogen adsorbed by a sample of 3g of activated charcoal at 0°C:

pressure (mm)	180	540
volume (cm^3/g)	16.5	38.1

Evaluate the constants k and n if the above data fits Freundlich's adsorption isotherm.

(ii) Draw the adsorption vs temperature curve for the above case at p= 180 mm.

[3 marks]

8. The table below shows the oxidation potential for some of the first-row transition elements:

Element	Cr	Mn	Fe
$E^{o}(M^{2+}/M)$	-0.9 V	-1.18 V	-0.4 V
$E^{o}(M^{3+}/M^{2+})$	-0.41 V	+1.57 V	+0.8 V

Based on the above data,

(i) Why is the E^{o} value for Mn^{3+}/Mn^{2+} couple much more positive than that for Cr^{3+}/Cr^{2+} or Fe^{3+}/Fe^{2+}?
(ii) Arrange these elements in the decreasing order of their ease of getting oxidized.
(iii) Comment on the comparative stability of Fe^{3+} and Mn^{3+} in acid solutions.

[3 marks]

9. Answer the following:

(i) Arrange Ti^{3+}, Cr^{3+}, Ni^{3+}, Cu^{+1} in the increasing order of their magnetic moments.
(ii) Give the reason behind Zinc having the lowest melting point in the 3d series.
(iii) Although Mn has d^0 configuration in $KMnO_4$, it imparts color. Explain the reason behind this.

[3 marks]

10. Give reasons for the following:

(i) Both $[FeF_6]^{3-}$ and $[CoF_6]^{3-}$ contain F_6 as ligands but the former is a colorless compound and the latter is colored.
(ii) $[Co(NH_3)_6]^{3+}$ is diamagnetic whereas $[CoF_6]^{3-}$ is paramagnetic in nature.

(iii) Zn^{2+} is colorless whereas Cu^{2+} is colored.

[3 marks]

OR

(a) Ti^{3+} in an aqueous solution forms a complex and can absorb light of wavelength 5000 Å. Name one ligand which would form a titanium(III) complex such that this complex can absorb light of lower wavelength than 5000 Å. Similarly, name one ligand which would form a titanium(III) complex such that this complex can absorb light of higher wavelength than 5000 Å.
(b) Arrange the metal ions of the following compounds in the descending order of spin only magnetic moment:
$[V(CN)_6]^{4-}$, $[Fe(CN)_6]^{4-}$, $[Ru(NH_3)_6]^{3+}$, and $[Cr(NH_3)_6]^{2+}$

[3 marks]

11. Show how aniline can be converted to 4-bromoiodobenzene. (Mention all the steps involved.)

[3 marks]

OR

(a) Write the IUPAC name and structure of the product obtained by the reaction of ethanamine and benzoyl chloride.
(b) Can the product obtained in (a) undergo the Hoffmann degradation reaction? If yes, write the structure of the product that will be formed. If no, explain why.

[3 marks]

SECTION C

A major goal for the food scientist is the prediction of the change in the quality of a particular food as a function of both time and environmental conditions. This has become the focus of many research and development projects because the information obtained is needed by those in the food industry so that they can set an open date for the food on the package (e.g., a "use by" or "best if used by" date) so that consumers are better informed in handling the product.

In order to make useful predictions about shelf life, the research scientist needs information regarding the kinetics of the reactions leading to **loss of quality** or nutritional value as a function of the reaction phase conditions in the food and the external environment.

Some general modes of food deterioration are:

(1) Microbial decay of food: The initial population load and endpoint in terms of toxin level or the maximum allowed organism numbers are needed to make predictions of the change in the concentration level of the microbe with time. Much literature data exist for the growth rate constants of microbes under certain conditions.

To keep this mode of food deterioration in mind, the food corporation of India (FCI) mandates that the concentration of a microbial in any particular canned food would be unacceptable with a maximum +30% change from the initial value of a microbial.

(2) Senescence: Once a plant is harvested or an animal slaughtered the tissues are deprived of any external source of carbon or nitrogen, and thus utilize their internal carbohydrate, protein, or fat as a source of energy. They do this by continuing their normal enzymatic reactions in an aging process usually termed senescence. Eventually, the energy sources run out, or end products accumulate to render the food unacceptable. A familiar illustration of this process is the loss of sweetness in corn on the cob during storage. The study of the rates of these senescence reactions is important to the processor who wishes to ensure high-quality ingredients in processed food. It is also important for the fresh produce supplier

(3) Enzymatic Chemical Deterioration: When a food is processed in some way (heated, salted, dried, frozen, etc.) its internal structures are disrupted so that membranes are damaged. Thus, the neatly compartmentalized system is destroyed, and chemicals normally separated can now come into contact and react. These reactions then become the **major modes for loss in quality.**

As noted above, many of the chemical reactions that cause loss of quality also lead to physical changes, such as decreased solubility (NEB, oxidation) or mushiness (enzymatic reaction, senescence). Thus, **a physical property can be used as a quality index and its change over time can be treated kinetically.** Other physical reactions are almost all-or-none phenomena (thawing of ice or melting of fat), or they increase in rate as temperature decreases rather than as it increases, a situation that is not treatable by most simple kinetics models. An example of the first is the sudden loss of crispness of dry snack or cereal foods when they gain moisture and reach a certain water activity. The second type is represented by **loss of quality** in some frozen foods due to concentration acceleration and membrane damage as temperature decreases and by the physical staling of bread, which becomes tougher faster when it is stored refrigerated as compared to room temperature.

(Source: Application of Chemical Kinetics to Deterioration of Foods T. P. Labuza Department of Food Science and Nutrition, University of Minnesota, St. Paul, MN 55108)

12. (i) If the manufacturing date of a canned food is 1st June 2021, what should be the expiry date of this food as per the mandate of FCI? (given the average rate constant of microbial decay is 2 units day^{-1})

    (ii) The archaeological department uses kinetics theory to find the age of plants/trees. The department found an artifact of a rare tree having only 80% of the ^{14}C found in the living tree. Find the age of the sample if $t_{1/2}$ of the ^{14}C is 5730 years.

    (iii) Through the help of a graph, show the variation in the amount of quality index(factor) of food vs time for zero and 1st order reaction.

[5 marks]

*****End of Paper*****