INDIAN SCHOOL AL WADI AL KABIR
SAMPLE PAPER 1
CHEMISTRY (043) – SET I   Maximum Marks: 70
Class: XII   **Time: 3 Hours**

SET - I

General Instructions:

Read the following instructions carefully.

a) There are 33 questions in this question paper. All questions are compulsory.

b) Section A: Q. No. 1 to 16 are objective type questions. Q. No. 1 and 2 are passage based questions carrying 4 marks each while Q. No. 3 to 16 carry 1 mark each.

c) Section B: Q. No. 17 to 25 are short answer questions and carry 2 marks each.

d) Section C: Q. No. 26 to 30 are short answer questions and carry 3 marks each.

e) Section D: Q. No. 31 to 33 are long answer questions carrying 5 marks each.

f) There is no overall choice. However, internal choices have been provided.

g) Use of calculators and log tables is not permitted.

SECTION A (OBJECTIVE TYPE)

1. Read the passage given below and answer the following questions: **(1x4=4)**

There are four colligative properties; vapour pressure, boiling point, freezing point and osmotic pressure. When a non-volatile solute is added to a solvent, it effects the colligative properties. The vapour pressure of the solution is lower than the vapour pressure of the pure solvent. This means that a larger amount of energy needs to be applied to the solution to make to the vapour pressure equal the atmospheric pressure. The solution will then have a higher boiling point than the original solvent. This concept also applies to the freezing points of the solution. A solution will have a lower freezing point than the pure solvent.   (*Source : Abstract from the Science Journal*)

The following questions are multiple choice questions. Choose the most appropriate answer:

(i) The vapour pressure of a solution containing a non-volatile solute is directly proportional to the:
- (a) molality of the solvent.
- (b) osmotic pressure of the solute.
- (c) molarity of the solvent.
- (d) mole fraction of solvent.

(ii) Colligative properties depend upon:
- (a) The type of solute particles.
- (b) The number of solute particles.

(c) Both the type and number of solute particles.
(d) None of the above.

OR

The boiling point elevation is defined as:
(a) $T_b - T_b^o$
(b) $T_b + T_b^o$
(c) $T_b^o - T_b$
(d) $T_b^o \times T_b$

(iii) The boiling point of benzene is 353.23 K. When 1.80 g of a non-volatile solute was dissolved in 90 g of benzene, the boiling point is raised to 354.11 K. Calculate the molar mass of the solute. K_b for benzene is 2.53 K kg mol^{-1}.
(a) 58 g mol^{-1}
(b) 60 g mol^{-1}
(c) 62 g mol^{-1}
(d) 50 g mol^{-1}

(iv) The graph below contains dashed lines representing the measured vapour pressure, and solid lines representing the ideal vapour pressure for a mixture of volatile liquids **A** and **B**. The **A**-**B** intermolecular forces are:
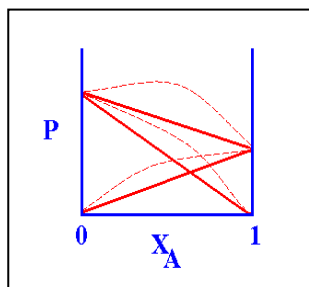
(a) Similar to **A**-**A** or **B**-**B** forces
(b) More repulsive than **A**-**A** or **B**-**B** forces
(c) More attractive than **A**-**A** or **B**-**B** forces
(d) No change in the given colligative property

2. Read the passage given below and answer the following questions: (1x4=4)

The noble gases are the group of elements—helium, neon, argon, krypton, xenon—in the rightmost column of the periodic table of the elements, those which have "filled" outermost shells of electrons (two for helium, eight for the others). This configuration of electrons results in a neutral atom that has relatively low electron affinity and relatively high ionisation energy. In consequence, in most natural circumstances these elements do not form chemical compounds, hence they are called "noble." Similarly, much more so than other elements in most circumstances, they partition strongly into a gas phase (as monatomic gas), so that they are called the "noble gases" (also, "inert gases"). (It should be noted, of course, that there is a sixth noble gas, radon, but all isotopes of radon are radioactive, with maximum half-life a few days, so that radon occurs in nature only .

(Source: F.A. Podosek, in Treatise on Geochemistry, 2003 / Science Direct / Journals & Books)

In these questions, 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 wrong statement.

(d) Assertion is wrong statement but reason is correct statement.

(i) Assertion : Noble gases have highest ionisation enthalpies in their respective periods.
   Reason   : Noble gases have stable closed shell electronic configuration.

(ii) Assertion: Noble gases have very low boiling point.
   Reason   : All noble gases have general electronic configuration of ns^2np^6 (except He)

(iii) Assertion : XeF_4 is isostructural with ICl_4^-
   Reason   : Both have different geometry.

(iv) Assertion: Neon signs are used in beacon lights
   Reason   : Neon lights are visible from long distances

OR

Assertion : Neil Bartlett found a blue-coloured compound, $Xe^+[PtF_6]^-$.
   Reason   : The first ionization energy of molecular oxygen (1175 kJ/mol) and Xe (1170 kJ/mol) is almost the same.

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

3. N forms NCl_3 whereas P can form PCl_3 and PCl_5 . Why?
   (a) N is less electronegative than P.
   (b) N atoms is larger than P in size.
   (c) P is more reactive towards Cl than N.
   (d) P has low lying 3d-orbitals, which can be used for bonding but N does not have 3d-orbitals in its valance shell.
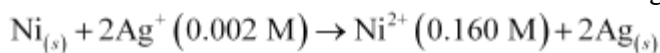
OR

Identify the correct order of acidic strength for H-X.
   (a) HCl>HBr>HI
   (b) HCl>HI>HBr
   (c) HI>HBr>HCl
   (d) HI>HCl>HBr

4. Each of the following solids shows the Frenkel defect except:

   (a) ZnS
   (b) AgBr
   (c) AgI
   (d) KCl

5. Calculate the emf of the cell in which the following reaction takes place:
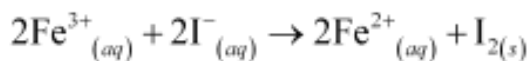
   $$Ni_{(s)} + 2Ag^+ (0.002 \text{ M}) \rightarrow Ni^{2+} (0.160 \text{ M}) + 2Ag_{(s)}$$

   Given that $E^0_{(cell)}$ = 1.05 V [log 4 × 10^4 = 4.6021]
   (a) 0.914 V
   (b) 0.904 V
   (c) 0.925 V
   (d) 0.906 V

   OR

   The cell in which the following reactions occurs:

   $$2Fe^{3+}_{(aq)} + 2I^-_{(aq)} \rightarrow 2Fe^{2+}_{(aq)} + I_{2(s)}$$

   has $E^0_{(cell)}$ = 0.236 V at 298 K.
   Calculate the standard Gibbs energy change.
   (a) −54.54 kJ mol^{-1}
   (b) −50.54 kJ mol^{-1}
   (c) −45.54 kJ mol^{-1}
   (d) −48.45 kJ mol^{-1}

6. When the rate of the reaction is equal to the rate constant, the order of the reaction is
   (a) zero order
   (b) first order
   (c) second order
   (d) third order

7. Which one of the following is an example of adsorption?
   (a) ammonia in contact with water
   (b) anhydrous $CaCl_2$ with water
   (c) silica gel in contact with water vapours
   (d) all of these

   OR
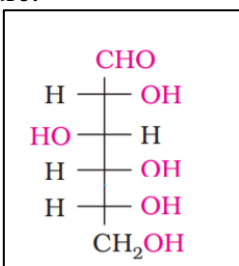   A colloidal system is which liquid is dispersed phase and solid is dispersion medium is classified as
   (a) sol
   (b) gel
   (c) emulsion
   (d) aerosol

8. Which of the following is a diamagnetic ion: (Atomic numbers of Sc, V, Mn and Cu are 21, 23, 25 and 29 respectively)
   (a) V^{2+}
   (b) Sc^{3+}
   (c) Cu^{2+}
   (d) Mn^{3+}

9. The number of unpaired electrons in gaseous species of Mn^{3+}, Cr^{3+} and V^{3+} respectively are:
   (a) 4, 4 and 2
   (b) 3, 3 and 2
   (c) 4, 3 and 2
   (d) 3, 3 and 3

10. The alcohol which does not react with Lucas reagent at room temperature is:
    (a) isobutyl alcohol
    (b) n-butanol
    (c) tert-butyl alcohol
    (d) sec-butyl alcohol

11. Name the simplest amino acid.
    (a) Alanine
    (b) Tyrosine
    (c) Glycine
    (d) Asparagine

                                    OR

    Identify the given structure:

    (a) D–(-) – Glucose
    (b) D–(+) – Glucose
    (c) L–(+) – Glucose
    (d) L–(-) – Glucose

    CHO
    H ——— OH
    HO ——— H
    H ——— OH
    H ——— OH
    CH_2OH

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 wrong statement.
(d)Assertion is wrong statement but reason is correct statement.

12. Assertion: Graphite is a good conductor of electricity however diamond belongs to the category of insulators.
    Reason : Graphite is soft in nature on the other hand diamond is very hard and brittle.

13. Assertion: Fe^{3+}(aq) and I^-(aq), the reaction is feasible
    Reason   : Because Fe^{3+}(aq) undergoes oxidation and I^-(aq) undergoes reduction.

14. Assertion : Hydrolysis of ester in water is a first order reaction.
    Reason   : Because the water is kept as the constant concentration.

15. Assertion : Cr^{2+} is a better reducing agent that Fe^{3+}.
    Reason   : Cr^{2+} can be easily oxidised to Cr^{3+}, but Fe^{2+} does not get oxidised to Fe^{3+} easily.

16. Assertion : Increasing order of boiling points:
                Chloromethane < Bromomethane < Dibromomethane < Bromoform.
    Reason   : Always bromine atom is larger in size and lesser in electronegativity than the chlorine atom

OR

Assertion : 3−Chloro−3−methylpentane is a tertiary alkyl halide
Reason   : Atleast one sp^2 hybridised carbon is present.
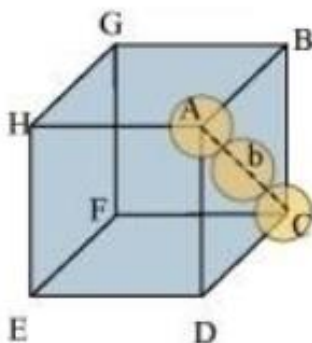
SECTION B

The following questions, Q. No. 17 – 25 are short answer type and carry 2 marks each.

17. Niobium crystallises in body-centred cubic structure. If density is 8.55 g cm^{-3}, calculate edge length of niobium using its atomic mass 93 u.
.

OR

Calculate the efficiency of packing in case of a metal crystal for the unit cell shown:

18. Explain what is observed:
      (i) When a beam of light is passed through a colloidal sol.
      (ii) Electric current is passed through a colloidal sol?

19. Conductivity of 0·002 M acetic acid is 8×10^{-5} S cm^{-1}. Calculate its molar conductivity.

20. Give the reason for bleaching action of Cl_2.

                                OR

    Illustrate how copper metal can give different products on reaction with HNO_3.

21. a. Give the chemical formula of: Hexaamminecobalt(III) sulphate
    b. Give the IUPAC name of: $[Co(en)_3]^{3+}$

22. Discuss the nature of bonding in: $[FeF_6]^{3-}$

23. Write short notes on:
     a. Sandmeyer's reaction
     b. Substitution nucleophilic bimolecular (S_N2) reaction.

24. What happens when D-glucose is treated with the following reagents?
     (i) HI **(ii)** Bromine water

                                OR

     Enumerate the reactions of D-glucose which cannot be explained by its open chain structure.

25. How is 1-propoxypropane synthesised from propan-1-ol? Write mechanism of this reaction.

SECTION C

No. 26-30 are Short Answer Type II carrying 3 marks each.
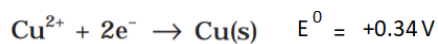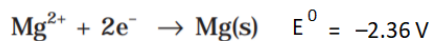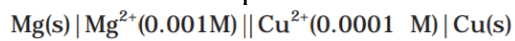
26. Answer the following:

    a. Explain how vacancies are introduced in an ionic solid when a cation of higher valence is
       added as an impurity in it.
    b. What type of stoichiometric defect is shown by: (i) ZnS (ii) AgBr
    c. Zinc oxide is yellow when hot, white in colour at room temperature.
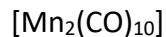
                                OR

    Analysis shows that nickel oxide has the formula $Ni_{0.98} O_{1.00}$. What fractions of nickel exist as

    Ni^{2+} and Ni^{3+} ions?

27. The vapour pressure of pure benzene at a certain temperature is 0.850 bar. A non-volatile,
    non-electrolyte solid weighing 0.5 g when added to 39.0 g of benzene
    (molar mass 78 g mol^{-1}). Vapour pressure of the solution, then, is 0.845 bar.
    What is the molar mass of the solid substance?

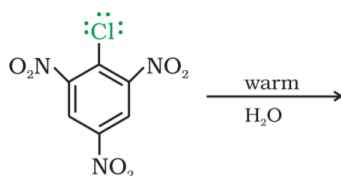28. Write the Nernst equation and emf of the following cell at 298 K:

$Mg(s) | Mg^{2+}(0.001M) || Cu^{2+}(0.0001 \ M) | Cu(s)$

$Mg^{2+} + 2e^- \rightarrow Mg(s) \quad E^0 = -2.36 \ V$

$Cu^{2+} + 2e^- \rightarrow Cu(s) \quad E^0 = +0.34 \ V$

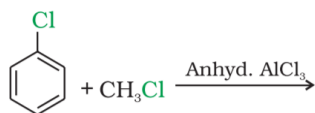29. a. Write the IUPAC name of this compound?

$[Mn_2(CO)_{10}]$

b. Also explain the type of bonding that takes place?
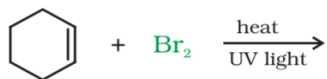
30. Complete the following organic equations:

a.

b.

c.

OR

Explain S_N1 mechanism with an example.

SECTION D

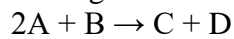**Q. No 31 to 33 are long answer type carrying 5 marks each.**

31. a. Derive the rate constant of the first order reactions.
    b. Plot a graph log $[R]_0/[R]$ vs time for a first order reaction.
    c. Show that for first order reaction $t_{1/2}$ is independent of $[R]_0$.

OR

The following results have been obtained during the kinetic studies of the reaction:
$2A + B \rightarrow C + D$

Experiment	[A]/mol L^{-1}	[B]/mol L^{-1}	Initial rate of formation of D/mol L^{-1} min^{-1}
I	0.1	0.1	6.0×10^{-3}
II	0.3	0.2	7.2×10^{-2}
III	0.3	0.4	2.88×10^{-1}
IV	0.4	0.1	2.40×10^{-2}

(i) Find the order of reaction with respect to A and B
(ii) Write the rate law and overall order of reaction.
(iii) Calculate the rate constant (k).

32.

a. Observed and calculated values for the standard electrode potentials of elements from Ti to Zn in the first reactivity series are depicted in figure (1):
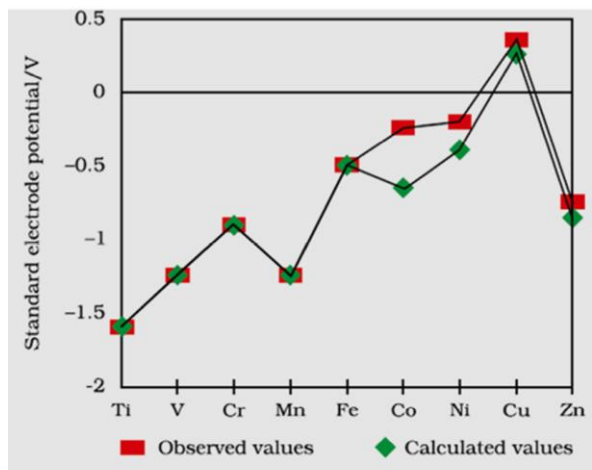

FIGURE 1 (source NCERT)

Explain the following observations:

i. The general trend towards less negative E^0 values across the series.

ii. The unique behaviour of Copper

iii. More negative E^0 values of Mn and Zn

b. Give reasons for the following:

i. Transition elements act as catalysts.

ii. It is difficult to obtain oxidation state greater than two for Copper.

OR

a. Explain briefly how +2 state becomes more and more stable in the first half of the first row transition elements with increasing atomic number?

b. How would you account for the following: Of the d^4 species, Cr^{2+} is strongly reducing while manganese (III) is strongly oxidising.

c. Use Hund's rule to derive the electronic configuration of Ce^{3+} ion and calculate its magnetic moment on the basis of 'spin-only' formula. (Atomic number of Ce = 58)

d. The highest oxidation state of a metal is exhibited in its oxide or fluoride.

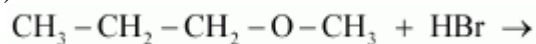e. The $E^0(M^{2+}/M)$ value for copper is positive (+0.34V). What is possibly the reason for this?

33. a. Explain the following with an example.
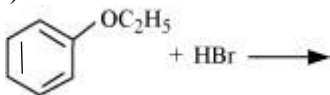
   (i) Kolbe's reaction.
   (ii) Williamson ether synthesis.

b. Predict the products of the following reactions:
   (i)

   $$CH_3 - CH_2 - CH_2 - O - CH_3 \ + \ HBr \ \rightarrow$$

   (ii)

   + HBr ⟶

c. While separating a mixture of ortho and para nitrophenols by steam distillation, name the isomer which will be steam volatile. Give reason.
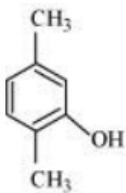
OR

a. Explain the following with an example.
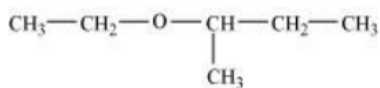 **(i)** Reimer-Tiemann reaction.
 (ii) Unsymmetrical ether.

b. Write IUPAC names of the following compounds:
 (i)

(ii)

 $$CH_3—CH_2—O—CH—CH_2—CH_3$$
 $$|$$
 $$CH_3$$

c. Explain why is *ortho* nitrophenol more acidic than *ortho* methoxyphenol?

Prepared by : The Department of Science 2020 -21
Checked by : HOD – SCIENCE