Indian School Al Wadi Al Kabir
Final Examination (2024-2025)

Class: XI	Subject: Chemistry (043)	Max. marks: 70
Date: 23/02/2025	SET 1	Time: 3 hours

General Instructions:
Read the following instructions carefully.
(a) There are 33 questions in this question paper with internal choice.
(b) SECTION A consists of 16 multiple -choice questions carrying 1 mark each.
(c) SECTION B consists of 5 short answer questions carrying 2 marks each.
(d) SECTION C consists of 7 short answer questions carrying 3 marks each.
(e) SECTION D consists of 2 case - based questions carrying 4 marks each.
(f) SECTION E consists of 3 long answer questions carrying 5 marks each.
(g) All questions are compulsory.
(h) Use of log tables and calculators is not allowed.

Section A

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section

1. The electronic configuration of element with atomic number 24 is
   a) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^4\ 4s^2$ b) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}$
   c) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ \ 3d^6$ d) $1s^2\ 2s^2\ 2p^6\ 3s^2\ \ 3p^6\ 3d^5\ 4s^1$

2. The principal quantum number of an atom represents:
   a) Size and energy of the orbit
   b) Spin angular momentum
   c) Orbital angular momentum
   d) Space orientation of the orbitals

3. Which of the following has the largest ionic radius?
   a) Na^+ b) K^+ c) Li^+ d) Cs^+

4. The number of sigma and pi (π) bonds present in benzene respectively are
   a) 12, 6 b) 6, 6 c) 6, 12 d) 12, 3

5. A reaction, A + B → C + D + q is found to have a positive entropy change. The reaction will be
   a) possible only at high temperature.
   b) possible only at low temperature.
   c) not possible at any temperature.
   d) possible at any temperature.

6. The enthalpies of all elements in their standard states are:
   a) unity

b) zero
c) < 0
d) different for each element.

7 We know that the relationship between Kc and Kp is
$Kp = Kc (RT)^{\Delta n}$
What would be the value of Δn for the reaction?
$NH_4Cl (s) \rightarrow NH_3 (g) + HCl (g)$
a) 1
b) 0.5
c) 1.5
d) 2

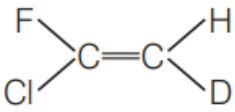
8. Which of the following is **not** a general characteristic of equilibria involving physical processes?
a) Equilibrium is possible only in a closed system at a given temperature.
b) All measurable properties of the system remain constant.
c) All the physical processes stop at equilibrium.
d) The opposing processes occur at the same rate and there is dynamic but stable condition.

9. The oxidation number of an element in a compound is evaluated on the basis of certain rules. Which of the following rules is **not correct** in this respect?
a) In all its compounds, the oxidation number of fluorine is – 1.
b) The oxidation number of hydrogen is always +1.
c) An element in the free or the uncombined state bears oxidation number zero.
d) The algebraic sum of all the oxidation numbers in a compound is zero.

10. Consider the elements: Cs, Ne, I and F. Identify the element(s) that exhibits only a negative oxidation state?
a) Sodium b) Fluorine c) Caesium and Fluorine d) Iodine

11. The fragrance of flowers is due to the presence of some steam volatile organic compounds called essential oils. These are generally insoluble in water at room temperature but are miscible with water vapour in the vapour phase. A a suitable method for the extraction of these oils from the flowers is:
a) Distillation
b) Crystallisation
c) Distillation under reduced pressure
d) Steam distillation

12. Which of the following will not show geometrical isomerism?
a)



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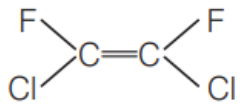

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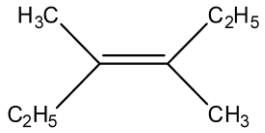
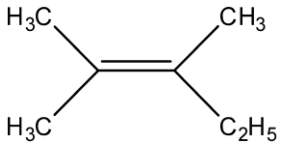


d)



13. Assertion (A): Combustion of 16 g of methane gives 18 g of water.
Reason (R): In the combustion of methane, water is one of the products.
Select the most appropriate answer from the options given below:
a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true R is not the correct explanation for A
c) A is true but R is false
d) A is false but R is true.

14. Assertion (A): The first ionisation energy generally increases across a period from left to right
Reason (R): The effective nuclear charge increases across a period
Select the most appropriate answer from the options given below:
a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true R is not the correct explanation for A
c) A is true but R is false
d) A is false but R is true.

15. Assertion(A): Among the O-H bonds in the H_2O molecule, the energy required to break the first O-H and the other O-H bond is the same.
Reason(R): The electronic environment around the Oxygen is not the same even after breaking one O-H bond.
Select the most appropriate answer from the options given below:
a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true R is not the correct explanation for A
c) A is true but R is false
d) A is false but R is true.

16. Assertion (A): Simple distillation can help in separating a mixture of propan-1-ol (boiling point 97°C) and propanone (boiling point 56°C).

Reason (R): Liquids with a difference of more than 20°C in their boiling points can be separated by simple distillation.
Select the most appropriate answer from the options given below:
a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true R is not the correct explanation for A
c) A is true but R is false
d) A is false but R is true.

SECTION B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. (a) State Heisenberg's uncertainty principle.
(b) Calculate the uncertainty in the velocity of a cricket ball of mass 100g if the uncertainty in its position is $1A^0$.($h=6.62\times10^{-34}kgm^2s^{-1}$).

OR

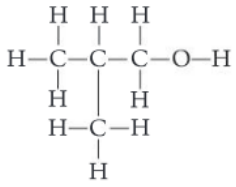
(a) The following set of quantum numbers is not possible. Why?
$n=1, l=1, m_l=0, m_s = +½$
(b) State Hund's rule of maximum multiplicity

18. Using molecular orbital theory, find the bond order of O_2^+

19. In a process, 701 J of heat is absorbed by a system and 394 J of work is done by the system. What is the change in internal energy for the process?

20. (a) Find the oxidation number of
(i) Cr in $Cr_2O_7^{2-}$
(ii) N in N_2O_5
(b) Using the standard electrode potential values given, predict if the reaction between the following is feasible:
$Ag^+_{(aq)}$ and $Cu_{(s)}$ Given $E^o_{(Ag^+/Ag)} = 0.80$ V and $E^o_{(Cu^{2+}/Cu)} = 0.34$ V
State the reason for your choice.

21. (a) Write bond line formula for



(b) What is the type of hybridisation of the carbon in CH_3Cl?
(c) Select nucleophiles from the following:
BF_3, NH_3, OH^-.

SECTION C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. (a) Give two differences between molality and molarity.
(b) 45.4 L of dinitrogen reacted with 22.7 L of dioxygen and 45.4 L of nitrous oxide was formed. The reaction is given below:

$2N_{2(g)} + O_{2(g)} \rightarrow 2N_2O_{(g)}$

(i) Which law is being obeyed in this experiment?
(ii) Write the statement of the law.

23. (a) Write down the quantum numbers n and l for the following orbitals.
(i) 2p (ii) 3d (iii) 5f
(b) What is an orbital?
(c) What will be the wavelength of a ball of mass 200 g moving with a velocity of $3ms^{-1}$? (Planck's constant h= $6.626x10^{-34}$ Js)

24. (I) Arrange the following.
(i) in the decreasing order of radii of ions O^{2-}, F^-, Na^+, Mg^{2+}
(ii) in the increasing order of first ionisation energy - Mg, Si, Al, Na.
(II) Account for the following - Electron gain enthalpy of noble gases is positive.

OR

(a) Calculate the number of orbitals and electrons associated with N shell.
(b) Write the IUPAC and symbol of the element with atomic number 118.
(c) Which among the following has higher negative Electron gain enthalpy? Oxygen or Sulphur. Justify your choice

25. (a) Enthalpies of formation of $CO_{(g)}$, $CO_{2(g)}$, $N_2O_{(g)}$ and $N_2O_{4(g)}$ are –110 kJ mol^{-1}, – 393 kJ mol^{-1}, 81 kJ mol^{-1} and 9.7 kJ mol^{-1} respectively. Find the value of Δ_rH for the reaction:

$N_2O_{4(g)} + 3CO_{(g)} \longrightarrow N_2O_{(g)} + 3CO_{2(g)}$

(b) Which among the following are extensive properties?
Mass, Internal energy, Pressure

26. (a) Using Stock notation to represent the following compounds
(i) $AuCl_3$ (ii) $SnCl_2$
(b) Balance the following redox reaction.

$MnO_4^-{}_{(aq)} + I^-{}_{(aq)} \longrightarrow MnO_{2(s)} + I_{2(s)}$ (In basic medium)

27. (a) Illustrate +R effect with a suitable example
(b) Name the type of isomerism exhibited by Propan-1-ol and Propan-2-ol
(c) Explain about the fission of covalent bonds resulting in the formation of Carbanion.

28. (a) How would you convert n-hexane to Benzene?
(b) Give the most stable conformation of Ethane using the Newman projection.
(c) What would be the product obtained when 1-Bromobutane is treated with alcoholic KOH?

SECTION D

The following questions are case-based questions. Each question has an internal choice and carries 4 (2+1+1) marks each. Read the passage carefully and answer the questions that follow.

29. A chemical formula is a symbolic representation of one molecule of the substance which tells the number and kind of atoms of various elements present in its molecule. The determination of the formula of a substance involves first the determination of its "Empirical formula" and then the "Molecular formula". Empirical formula expresses the simplest whole number ratio of the atoms of constituent elements whereas molecular formula expresses the actual number of atoms of constituent elements present in one molecule of the compound. The chemical formula of different substances (i.e., reactants and products) are used to represent a chemical equation. Balanced chemical equation is very useful for theoretical calculation of amount of product from known amount of reactant or vice-versa. It also helps to calculate the percentage of different compounds present in a mixture or percentage purity of a compound or actual percent yield of a product etc. Knowing the concepts of molarity, normality etc., the calculations can be done for reactions in solution also. In many reactions, generally involving two reactants, one of the reactants is completely consumed while some amount of the second reactant is left behind. The former is called limiting reagent while the latter is called excess reagent. (Atomic mass of H=1u, C=12 u, O=16 u)

(a) 3.0 g of H_2 react with 30 g of O_2 to form H_2O. Which is the limiting reagent?
(b) Calculate the maximum amount of H_2O that can be formed
(c) The empirical formula and molecular mass of a compound are CH_2O and 180 g respectively. What will be the molecular formula of the compound?

OR

(c) How many atoms of Carbon are present in 0.1 mole of $C_{12}H_{22}O_{11}$?

30. Four elements A, B, C and D have atomic numbers 11,12,17 and 18 respectively. Out of these four elements two are solids while the other two are gases. One of the gaseous elements does not show chemical reactivity while the other is highly reactive.
(a) Among the elements A, B, C and D, which is the most reactive non-metallic element? Give reason for your choice.
(b) Out of A, B, C and D, which are solid elements?
(i) A and B (ii) B and C (iii) C and D (iv) A and D

(c) The group and period of element C is
(i) 3 and 7 (ii) 3 and 17 (iii) 17 and 3 (iv) 7 and 3

OR

(c) The two metallic elements in the order of increasing reactivity are
(i) B,C (ii) A,B (iii) B,A (iv) C,D

SECTION E

The following questions are long answer type and carry 5 marks each. All questions have an internal choice

31. (a) Describe hybridisation in PCl_5

(b) The axial bonds are longer than the equatorial bonds in PCl_5.Give reason.

(c) Draw the resonating structures of CO_3^{2-}

OR

(a) Draw the resonating structures of O_3.

(b) Compare the magnetic nature of O_2 & N_2 on the basis of MOT.

(c) Explain the shape of H_2O using VSEPR theory.

32. (a) The value of Kc for the following reaction is 4.7.

$2NO_{2(g)} \Leftrightarrow N_2O_{4\ (g)}$ is 1.7×10^2.

At a given time, the composition of the reaction mixture is $[NO_2]=[N_2O_4] = 2M$.In which direction will the reaction proceed?

(b) Find the conjugate acid/base for the species: (i) NH_4^+ and (ii) CO_3^{2-}.

(c) The hydrogen ion concentration of a sample of black coffee is 10^{-5}. Calculate pH.

(d) Which of the following are Lewis acids? H_2O, BF_3 and H^+

OR

(a) What do you mean by buffer solution? Give its types with suitable example of each.

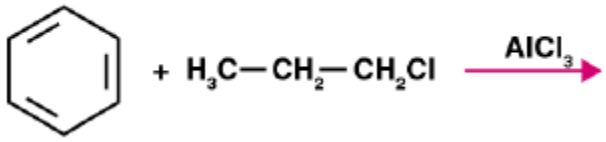
(b) What is meant by the conjugate acid-base pair?

(c) Find the conjugate acid/base for the following species:

(i) HNO_2 (ii) CN^-

33. (a) How would you convert Ethyne to Benzene?

(b) What will be the product obtained as a result of the following reaction?



(c) The dipole moment of cis-But-2-ene is more than that of trans-But-2-ene. Justify.

(d) An alkene on ozonolysis forms Propanone and Ethanal.Predict the structure of alkene. Write its IUPAC name. Write the reaction involved.

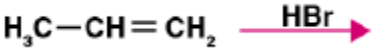
OR

(a) Convert Benzene to 2-Nitrotoluene

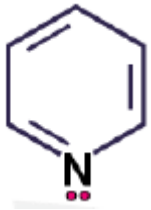
(b) Trans-But-2-ene has a higher melting point than cis-But-2-ene. Justify.

(c) Illustrate Wurtz reaction with chemical equation.

(d) Predict the major product (s) of the following reaction.



(e) Identify the aromatic compounds from the following. Justify your choice.

(i) 

(ii) 

(iii)