BUDHA DAL PUBLIC SCHOOL, PATIALA
Final Examination (12 March 2025)
Class XI (Science)
Subject - Chemistry
(Set - A)

Time: 3hrs.   M.M. 70

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. Section A consists of 16 multiple-choice questions carrying 1 mark each.
3. Section B consists of 5 short answer questions carrying 2 marks each.
4. Section C consists of 7 short answer questions carrying 3 marks each.
5. Section D consists of 2 case-based questions carrying 4 marks each.
6. Section E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. Use of log tables and calculators is not allowed.

Section - A

Q1. SI unit of energy, density respectively are
a) Ergs, g cm^{-3} b) Joule, kg m^{-3} c) Ergs, kg m^{-3} d) Joule, g cm^{-3}

Q2. Which of the following is not permissible?
a) $n = 4$ $l = 0$ $m = 0$ $s = +1/2$ b) $n = 5$ $l = 3$ $m = 0$ $s = -1/2$
c) $n = 3$ $l = 2$ $m = -2$ $s = +1/2$ d) $n = 3$ $l = 2$ $m = -3$ $s = +1/2$

Q3. The number of radial nodes in 3p orbitals are
a) 0   b) 1   c) 2   d) 3

Q4. The de-Broglie wavelength associated with a body of 1000 g moving with a velocity 100 ms^{-1} is
a) 6.62×10^{-39} m   b) 6.62×10^{-30} m   c) 6.62×10^{-36} m   d) 3.31×10^{-32} m

Q5. Which of the following is true about ψ^2 ?
a) It represents atomic orbital
b) Probability of finding electron
c) Always positive
d) Both (b) and (c)

Q6. Which of the following is T-shaped?
a) SF_4 b) ClF_3 c) I_3^- d) CH_4

Q7. The order of decreasing boiling point is
a) $HF > H_2O > NH_3$ b) $H_2O > HF > NH_3$ c) $NH_3 > H_2O > HF$ d) $HF > NH_3 > H_2O$

Q8. SF_6 has hybridisation:
a) $SP^3 d^2$ b) $SP^3 d$ c) dsp^2 d) $SP^3 d^3$

Q9. In a reversible process the system absorbs 600 kJ and perform 250 kJ of work on the surroundings. What is increase in ΔU of the system?
a) 850 kJ   b) 600 kJ   c) 350 kJ   d) 250 kJ

Q10. For which of the following processes ΔS is negative?
a) $H_2 g \rightarrow 2H(g)$
b) $N_2(g)$ as 1 atm $\rightarrow N_2(g)$ (8 atm)
c) $2SO_2(g) \rightarrow 2SO_2(g) + O_2$
d) C (diamond) $\rightarrow C(Graphite)$

Q11. $2NO_2(g) \rightleftharpoons N_2O_4(g) + 60.0$ kJ, the increase in temperature
a) favour the formation of N_2O_4

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b) favour the decomposition of N_2O_4

c) does not affect the equilibrium

d) stops the process

Q12. Higher the value of K_a :

a) Stronger will be acid   b) Weaker will be acid   c) Stronger will be base   d) Weaker will be base

The questions (Q.No. 13 – 16) given below consist of Assertion and Reason. Use the following key of select the correct answer.

a) Assertion and Reason both are correct and reason is correct explanation for assertion.

b) Assertion and Reason both are correct but reason is not correct explanation for assertion.

c) Assertion is correct but Reason is incorrect.

d) Assertion is incorrect but Reason is correct.

Q13. Assertion : Oxidation state of oxygen H_2O_2 is -1.
Reason : H_2O_2 has peroxide linkage.

Q14. Assertion : Energy of resonance hybrid is equal to the average of energies of all canonical forms.
Reason : Resonance hybrid cannot be represented by a single structure.

Q15. Assertion : Halogenation of alkanes in presence of sunlight is free radical substitution.
Reason : Homolytic fission leads to formation of free radical in presence of sunlight.

Q16. Assertion : Addition of HBr to alkene follows free radical mechanism.

Reason : Addition of HBr in presence of peroxide follows free radical mechanism.

Section - B

Q17. a) Define Molarity

b) State law of Multiple proportion

Q18. In terms of period and group where would you locate the element with Z = 114 ?

Q19. An organic compound containing carbon, hydrogen and oxygen has 27.4%, carbon and 10.5% hydrogen by mass. Determine the empirical formula of the compound.

Q20. Define disproportionation reaction. Give example.

Q21. What are carbocations? Give their order of stability?
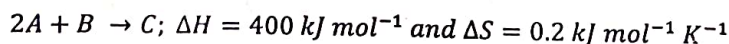
OR

What is electromeric effect? Give its types.

Section – C

Q22. Among the second period elements the actual ionization enthalpies are in the order

Li < B < Be < C < O < N < F < Ne, explain why

a) Be has higher $\Delta_i H$ than B?

b) O has lower $\Delta_i H$ than N and F?

Q23. For the reaction at 298 K:

$$2A + B \rightarrow C; \Delta H = 400 \ kJ \ mol^{-1} \ and \ \Delta S = 0.2 \ kJ \ mol^{-1} \ K^{-1}$$

At what temperature will the reaction become spontaneous considering ΔH and ΔS to be constant over the temperature range.

Q24. At a certain temperature and a total pressure of 10^5 Pa, iodine vapour contains 40% by volume of Iodine atoms:

$I_2(g) \rightleftharpoons 2I(g)$ Calculate K_p for the equilibrium.

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Balanced the following redox reactions by oxidation number method:

$$MnO_4^-(aq) + I^-(aq) \rightarrow MnO_2(s) + I_2(s) \text{ (in basic medium)}$$
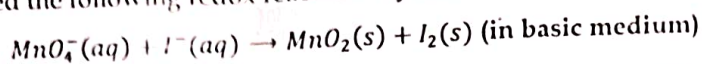
Draw the cis and trans structures of hex-2-ene. Which isomer will have higher b.p. and why?

7. 0.5 g of organic compound containing bromine gives 0.40 g of AgBr. Calculate % ge of bromine present in organic compound.

28. Draw energy level diagram of O_2 molecule. Predicts its bond order and magnetic character.

OR

Draw Lewis dot structure of H_2S molecule and calculate formal charge on each atom.

Section – D

Q29. Read the following passage and answer the questions that follow:

Orbitals are region or space where there is maximum probability of finding electrons. Qualitatively, these orbitals can be distinguished by their size, shape and orientation. An orbital of small size means there is more chance of finding the electron near the nucleus. Shape and orientation means the direction in which probability of finding electron is maximum. Atomic orbitals can be distinguished by quantum numbers. Each orbital is designated by three quantum number n, l and m_l (magnetic quantum number) which define energy, shape and orientation but these are not sufficient to explain spectra of multi-electrons atoms. Spin quantum number (m_s) determines the spin of electron. Spin angular momentum of electron has two orientations relative to chosen axis which are distinguished by spin quantum numbers m_s which can take values +1/2 and -1/2.

Value of 'l'	0	1	2	3	4
Notation for subshell	s	p	d	f	g

Based on the above paragraph, answer the following questions:

a) How many orbitals in 3rd shell are present?

b) Which orbital represents n = 2, l = 1 and n = 4, l = 0 respectively?

c) (i) Write electronic configuration of Cu (29)

(ii) What are values of n, l, m, s for valence electron of Cu (29)

OR

(i) Write electronic configuration of Cr^{3+} (24).

(ii) How many electrons can 3p orbitals have?

Q30. Read the given passage and answer the questions that follow:

The general reaction is depicted as follows:

Organic molecule ⟶ [Intermediate] ⟶ Product(s)
↓
By-Product
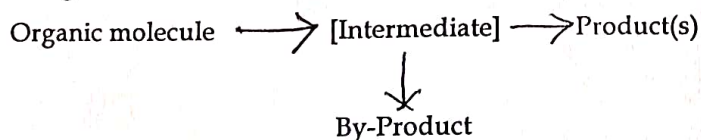
Substrate is that reactant which supplies carbon to the new bond and the other reactant is called reagent. If both the reactants supply carbon to the new bond then choice is arbitrary and in that case the molecule on which attention is focused is called substrate.

In such a reaction a covalent bond is formed. A sequential account of each step, describing details electron movement, energetic during bond cleavage and bond formation, and the rates of transformation of reactants into products (kinetic) is referred to as reaction mechanism.

a) Identify the reagent shown underlined as electrophile or nucleophile :

$$CH_3COOH + \underline{OH^-} \rightarrow CH_3COO^- + H_2O$$

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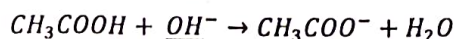
b) What is the state of hybridization of underlined carbon atom is $CH_3 \underline{CH} = CH_2$

c) Which of the two: $O_2NCH_2CH_2O^-$ or $CH_3 CH_2 O^-$ is expected to be more stable and why?

OR

Arrange the following:

c) (i) $-I, -Br, -Cl, -F$ [Decreasing order of $-I$ effect]

(ii) $(CH_3)_3C, CH_3 CH_2, CH_3 CHCH_3, CH_3$ [Increasing order of stability]

Section – E

Q31. I) Write equation for

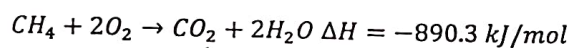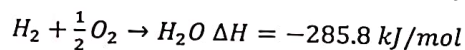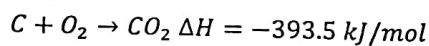 a) Wurtz reaction   b) Friedal Craft Alkylation   c) Friedal Caft Acylation

II) Propanal and pentan-3-one are the ozonlysis products of an alkene. Write the name and structural formula of alkene.

OR

I) What are conformational isomers. Explain Sawhorse and Newman's projection formula of ethane.

II) Arrange benzene, n-hexane and ethyne in decreasing order of acidic behaviour. Also, give reason for this behaviour.

Q32. a) The enthalpy of combustion of methane, graphite and dihydrogen at 298K are, -890.5 kJ mol⁻¹, -393.5 kJ/ mol⁻¹. Calculate enthalpy of formation of $CH_4(g)$ from give data.

$$C + O_2 \rightarrow CO_2 \ \Delta H = -393.5 \ kJ/mol$$

$$H_2 + \frac{1}{2}O_2 \rightarrow H_2O \ \Delta H = -285.8 \ kJ/mol$$

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O \ \Delta H = -890.3 \ kJ/mol$$

b) Derive relation between Cp & Cv

OR

a) Enthalpies of formation of CO(g), N₂O(g) and N₂O₄(g) are -110, -393, 81 and 9.7 kJ mol⁻¹ respectively. Find the value of $\Delta_r H$ for reaction: $N_2O_4(g) + 3CO(g) \rightarrow N_2O(g) + 3CO_2(g)$

b) Define (i) Extensive properties   (ii) Adiabatic process

Q33. Dihydrogen gas is obtained from natural gas by partial oxidation with steam as per following endothermic reaction : $CH_4(g) + H_2O(g) \rightleftharpoons CO9g) + 3H_2(g)$;

  a) Write an expression of K_P for the above reaction.

  b) How will the value of K_P and composition of equilibrium mixture be affected by

  i) increasing the pressure;   ii) increasing the temperature;   iii) using a catalyst

OR

Find out the value of K_C for each of the following equilibrium from the value of K_P :
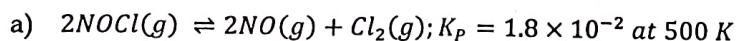
  a) $2NOCl(g) \rightleftharpoons 2NO(g) + Cl_2(g); K_P = 1.8 \times 10^{-2} \ at \ 500 \ K$

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Section - A

Q1. The number of significant figures of 0.001620 are
a) 4   b) 3   c) 6   d) 2

Q2. What are the possible values of four quantum numbers for an electron in 4f-orbital?
a) $4, 2, 2, +1/2$ b) $4, 3, 2, +1/2$ c) $5, 3, 2, -1/2$ d) $3, 3, 1, +1/2$

Q3. The angular moment of electron in d-orbit is equal to
a) $2\sqrt{3}h$ b) $0\ h$ c) $\sqrt{6}h$ d) $\sqrt{2}h$

Q4. The shape of XeF_4 molecule on the basis of VSEPR theory is
a) square planar   b) tetrahedral   c) octahedral   d) square pyramidal

Q5. Which of the following has lowest boiling point?
a) NH_3 b) PH_3 c) SbH_3 d) AsH_3

Q6. Which of the compound has sp^3d hybridization?
a) SF_6 b) PF_5 c) CF_4 d) IF_7

Q7. Which of the following is intensive property?
a) Temperature   b) Surface tension   c) Viscosity   d) All of these

Q8. The correct thermodynamic conditions for the spontaneous reaction at all temperature is
a) $\Delta H < 0\ and\ \Delta S > 0$ b) $\Delta H < 0\ and\ \Delta S < 0$ c) $\Delta H < 0\ and\ \Delta S = 0$ d) $\Delta H > 0\ and\ \Delta S < 0$

Q9. $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + 92\ kJ$, the reaction will proceed to forward direction at
a) High temperature   b) low pressure   c) low temperature and high pressure d) none of these

Q10. Which of the following is pair of Lewis acids?
a) PH_3, B_2H_6 b) CCl_4, NH_3 c) BCl_3, B_2H_6 d) LiH, BCl_3

Q11. Which has highest boiling point?
a) n-pentane   b) iso-pentane   c) Neopentane   d) n-Butane

Q12. $CH_4 + O_2 \xrightarrow[\Delta]{Mo_2O_3} 'X'$ is
a) CH_3OH b) $HCHO$ c) $HCOOH$ d) CH_3CHO

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B-1

Q13. Assertion : $3^0 > 2^0 > 1^0$ is order of stability of carbocation.
Reason : It is due to +I effect and hyperconjugation.

Q14. Assertion : Allyl free radical is more stable than n-propyl free radical.
Reason : Allyl free radical is stabilized by resonance.

Q15. Assertion : If $\Delta x = 0, \Delta v$ will be infinite.
Reason : Position of electron can be determined accurately.

Q16. Assertion : An orbital cannot have more than 2 electrons with opposite spin.

Reason : No two electrons can have same set of all the four quantum numbers same.

<div align="center">Section - B</div>

Q17. a) Define Molality

  b) State law of constant proportions

Q18. Calculate the number of atoms in each of the following: (Atomic mass of He = 4u)

  a) 52 moles of Ar   b) 52 u of He

Q19. What do you understand by isoelectronic species? Name a species that will be isoelectronic with each of the following atoms or ions.

  a) F⁻   b) Ar   c) Mg^{2+} d) Ca^{2+}

Q20. Write two functions of salt bridge.

Q21. What are carboanions? Give their order of stability?

<div align="center">OR</div>

What is inductive effect? Give its types.

<div align="center">Section – C</div>

Q22. Assign the position of the element having outer electronic configuration

  a) ns^2np^4 for n = 3

  b) $(n – 1) d^2ns^2$ for n = 4, and

  c) $(n – 2) f^7 (n – 1) d^1 ns^2$ for n = 6, in the periodic table

Q23. For the reaction at 298 K:

$$2A(g) + B\ (g) \rightarrow 2D(g)\Delta U^\ominus = -10.5\ kJ\ and\ \Delta S^\ominus = -44.1\ J\ K^{-1}$$

Calculate $\Delta G^\ominus$ for the reaction and predict whether the reaction may occur spontaneously.

Q24. Find out the value of K_C for the following equilibrium from the value of K_P :

$2NOCI(g) \rightleftharpoons 2NO(g) + CO_2(g); \ K_P = 1.8 \times 10^{-2}$ at 500 K

Q25. Balanced the following redox reaction by oxidation number method:

$MnO_4^-(aq) + SO_2(g) \longrightarrow Mn^{2+}(aq) + HSO_4^-(aq)$ (in acidic solution)

Q26. Why is benzene extra ordinary stable though it contains three double bonds?

Q27. In the estimation of sulphur by Carius method, 0.468 g of an organic sulphur compound afforded 0.668 g of barium sulphate.'Find out the percentage of sulphur in the given compound.

Q28. Draw energy level diagram of Nitrogen molecule. Predicts its bond order and magnetic character.
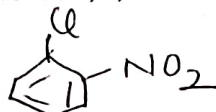
<div align="center">OR</div>

Draw Lewis dot structure of CO_3^{2-} molecule and calculate formal charge on each atoms.

B-2

Section – D

Read the following passage and answer the questions that follow:

For IUPAC nomenclature of substituted benzene compounds, the substituent is placed as prefix to the word benzene. If benzene ring is disubstituted, lowest possible numbers are assigned to them. IN trisubstituted, base compound is assigned number 1 and then direction of numbering is chosen suc that next substituent gets lowest number when a benzene ring is attached to an alkane with functional group, it is considered as substituent, instead of parent. The name of benzene as substituent is phenyl (C6H5), also abbreviated as Ph. 1, 2 is called as ortho 1, 3 is called as meta, 1, 4 is called as para in common system in case of disubstituted benzene.

(a) Write the IUPAC name of [structure of benzene ring with Cl and NO$_2$]

(b) Write structural formula of 2, 4 - Dimethyl phenol.

(c) Give two examples each of (i) ortho - directing group (ii) meta - directing group.

or

(c) Write structure of (i) 2- hydroxybenzoic acid (ii) Aniline

Q30. Read the given passage and answer the questions that follow:

Spectrum is combination of radiations of different wavelengths. Visible spectrum is continuous spectrum. Atomic spectrum (line spectrum) is discontinuous spectrum. It can be absorption or emission spectrum when energy is supplied to electrons, these get excited to higher energy levels. When they come back to lower energy level, they radiate energy in form of bright spectral lines separated by dark bands. Each element has its unique spectrum by which it can be identified.

    a) In Lyman series electron jump from which energy level to which energy level?

    b) To which region of spectrum Balmar series belong?

    c) Calculate mass of 1 mole of electrons. ($m_e = 9.1 \times 10^{-31}$ kg)

<div align="center">OR</div>

c) Calculate charge on 1 mole of electrons (e = 1.602×10^{-19} C)

<div align="center">Section - E</div>

Q31.
    a) State and explain Huckel's Rue by taking an example.

    b) Define Markovnikov's rule.

    c) Write equations for (i) Wurtz reaction   (ii) Friedel Craft alkylation

<div align="center">OR</div>

    a) An alkene 'A' contains three C – C eight C – H σ –bonds and one C – C π –bond. 'A' on ozonolysis gives two moles of an aldehyde of molar mass 44u. Write IUPAC name of 'A'.

    b) How will you convert benzene into

      (i) p-nitrobromobenzene   (ii) m-nitrochlorobenzene   (iii) p-nitrotoluene

Q32. a) Calculate the enthalpy of formation of benzene. Give the enthalpy of combustion of benzene is -3267.7 kJ and the enthalpies of formation of CO_2 & H_2O are -393.3 kJ and -286.6 kJ respectively.

1. $C_6H_6 + \frac{15}{2} O_2 \rightarrow 6CO_2 + 3H_2O$

2. $C + O_2 \rightarrow CO_2$

3. $H_2 + \frac{1}{2} O_2 \rightarrow H_2O$
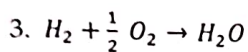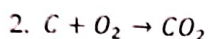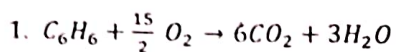
b) Derive relation between ΔH & ΔU

<div align="center">OR</div>

a) The reaction of cyanamide, $NH_2CN(s)$, with dioxygen was carried out in a bomb calorimeter and ΔU was found to be -742.7 kJ mol⁻¹ at 298 K. Calculate enthalpy change for the reaction at 298 K.

$$NH_2CN(g) + \frac{3}{2} O_2(g) \rightarrow N_2(g) + CO_2(g) + H_2O(l)$$
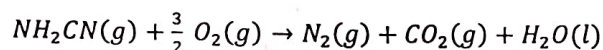
b) Define (i) State function   (ii) Intensive property

Q33. i) At 473 K, equilibrium constant, K_C for decomeposition of phosphorus pentachloride, PCl_5 is 8.3 × 10⁻³. If decomposition is depicted as : $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g); \Delta_r H^\ominus = 124.0\ kJ\ mol^{-1}$

   a) Write an expression of K_C for the reaction.

   b) What is the value of K_C for the reverse reaction at the same temperature?

   c) What would be the effect on K_C if

      (i) more PCl_5 is added   (ii) pressure is increased   (iii) the temperature is increased?

ii) Write the conjugate acids for Bronsted bases: NH_2^-, NH_3 and $HCOO^-$?

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