

SPECTRA CLASSES
CLASS: XI
SUBJECT: CHEMISTRY

Time: 3Hrs

M.M:70

General Instructions. Read the following instructions carefully.

1. All questions are compulsory.
2. There are total 42 questions in this paper.
3. Q. no 1 is case based question carrying 5 marks.
4. Section A: Q.2 to Q.31 are MCQ, Reason Assertion type questions carrying 1 marks each.
5. Section B: Q.32 to Q.35 are short answer type questions carrying 2 marks each.
6. Section C: Q.36 to Q.39 are short answer type questions carrying 3 marks each.
7. Section D: Q.40 to Q.42 are long answer type questions carrying 5 marks each
8. There is no overall choice however, internal choice have been provided.
9. Use of calculator and log tables is not permitted.

1. Read the case study given below and answer the following questions:

The Valence Shell Electron Pair Repulsion Theory: Sidgwick and Powell in 1940, proposed a simple theory based on the repulsive interactions of the electron pairs in the valence shell of the atoms. It was further developed and redefined by Nyholm and Gillespie (1957) and they put forward the concept of important difference of lone pair and the bonding pairs of electrons. While the lone pairs are localized on the central atom, each bonded pair is shared between two atoms. In the molecule the bond pair, lone pairs (if any) will occupy such position around the central atom to obtained a minimum repulsion energy states. These repulsion effects result in deviation from idealized shapes and alteration in bond angles in molecules.

- (i) Predict the shape of BrF_3 based on VSEPR theory.
- (ii) Why PCl_5 dissociates to give PCl_3 and Cl_2 ?
- (iii) Why H-P-H bond angles in PH_3 is less than H-N-H bond angle in NH_3 ?
- (iv) At room temperature H_2O exists as liquid while H_2S exist as gas. Give reason.

OR

NH_3 has higher boiling point than PH_3 . Give reason.

(5 Marks)

SECTION (A)

Following questions (No. 2-16) are multiple choice questions carrying 1mark each

2. Which of the following option has incorrect UNIT

S. No.	Parameter	Unit
1.	Frequency	Hz
2.	Wave length	Cm^{-1}
3.	Energy	eV
4.	Wave number	cm^{-1}

- (a) Frequency (b) wavelength
(c) Energy (d) Wave number

3. Which of the following group has +R effect and -I effect

- (a) $-\text{CH}_3$ (b) $-\text{H}$
(c) $-\text{NH}_3^+$ (d) $-\text{F}$

OR

Among the following group, the group having highest priority in IUPAC nomenclature scheme is :

- (a) $-\text{F}$ (b) $-\text{OCH}_3$
(c) $-\text{CH}_3$ (d) $-\text{COOH}$

4. Which of the following molecule has coordinate bond

- (a) CH_4 (b) H_2O
(c) CO_2 (d) NH_4^+

OR

Which molecule has zero dipole moment

- (a) NH_3 (b) H_2O
(c) CO_2 (d) CHCl_3

5. Which of the following form is most stable for Ethane

- (a) Fully Staggered (b) Staggered
(c) Eclipsed (d) Fully Eclipsed

OR

IUPAC name of product formed by oxidation using heated acidic KMnO_4 followed by acidification of But-2-ene is

- (a) Propanone (b) Methanoic acid
(c) Ethanoic acid (d) Propanal

6. Which of the following element has highest electronegativity

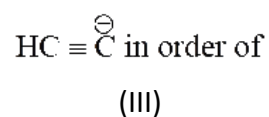
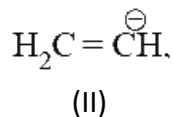
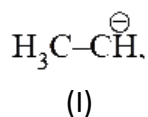
- (a) I (b) Br
(c) Cl (d) F

OR

Which block element forms the ionic bond type compounds mainly

- (a) 's' (b) 'p'
(c) 'd' (d) 'f'

7. Select the incorrect statement for the Benzene structure
(a) C-C bond length is 139 pm
(b) π electron is delocalized above and below the benzene ring
(c) All the carbon atoms are 'sp' hybridized
(d) All C-H bonds are in the same plane.
8. Which of the following is heavier in weight
(a) 2g He (b) 22.4 L at STP- He
(c) 20 moles H_2 (d) 10 Moles N_2
9. The molarity of a solution obtained by mixing 750 mL of 0.5 M HCl with 250 mL of 2 M HCl will be
(a) 0.975 M (b) 0.875 M
(c) 1.00 M (d) 1.175 M
10. What transition in the hydrogen spectrum would have the same wavelength as the Balmer transition $n = 4$ to $n = 2$ in the He^+ spectrum?
(a) $n = 4$ to $n = 1$ (b) $n = 3$ to $n = 2$
(c) $n = 3$ to $n = 1$ (d) $n = 2$ to $n = 1$
11. The shape of XeF_4 molecule according to VSEPR theory is
(a) square planar (b) square pyramid
(c) Tetrahedral (d) pyramidal
12. The correct order of ionic radii of the species N^{3-} , O^{2-} , Na^+ and F^- is
(a) $Na^+ < F^- < O^{2-} > N^{3-}$ (b) $F^- < O^{2-} < N^{3-} > Na^+$
(c) $O^{2-} < N^{3-} < F^- > Na^+$ (d) $N^{3-} < Na^+ < F^- > O^{2-}$
13. According to second law of thermodynamics
(a) $\Delta S_{total} = +ve$ (b) $\Delta S_{total} = -ve$
(c) $\Delta S_{system} = +ve$ (d) $\Delta S_{system} = -ve$
14. For the reaction $CO(g) + Cl_2(g) \rightleftharpoons COCl_2(g)$ the value of K_c/K_p is equal to
(a) RT (b) $(RT)^2$
(c) $1/RT$ (d) 1
15. The methyl group in benzene ring is:
(a) Ortho directing (b) Meta directing
(c) Para directing (d) Ortho and Para directing
16. Basic strength of



- (a) I > III > II
(c) II > I > III

- (b) I > II > III
(d) III > II > I

In the following questions (Q. No. 17-21) 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 & 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.

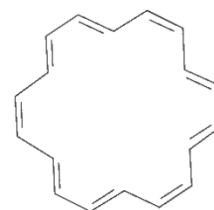
17. Assertion : Benzene is non-aromatic compound
Reason : Compound which follows Huckel's rule are Aromatic in nature
18. Assertion : NH_3 is a Lewis Base
Reason : NH_3 molecule is pyramidal in shape.
19. Assertion : Cis-But-2-ene is more polar than Trans-But-2-ene.
Reason : Trans-But-2-ene has higher melting point than Cis-2-But-2-ene.
20. Assertion : CH_4 can be prepared by Kolbe's electrolytic process
Reason : Even number alkane can be prepared in Kolbe's Electrolytic process generally.
21. Assertion : The shape of XeF_6 is distorted Octahedral.
Reason : The XeF_6 molecule has zero lone pair and 6 bond pair.

OR

- Assertion : The shape of I_3^- is linear.
Reason : The lone pairs occupy the equatorial position in I_3^- .

The following questions (Q. No. 22-31) are short answer type carrying 1mark each.

22. An alkene A on ozonolysis gives a mixture of ethanol and pentan-3-one. Write IUPAC name of element.
23. Whether the compound cyclooctadecanonaene is aromatic or not?
Give reason for your answer.



24. Name the product formed when Benzene reacts with propyl chloride in the presence of anhydrous aluminum chloride.
25. Draw the resonating structures of aniline.
26. An alkene C_4H_8 reacts with HBr both in presence and absence of peroxide to give the same product. Identify the alkene.
27. Give direction in which the reaction would proceed if $Q_c > K_c$
28. Arrange the following in increasing basic strength CH_3^- , NH_2^- , OH^- , F^-
29. Write the electronic configuration of Cu (Atomic No. 29)
30. State Gay-Lussac's law of chemical combination.
31. Which has the highest bond angle?
 NO_2 , NO_2^- , NO_2^+

SECTION (B)

Q.No. 32-35 are Short Answer Type and carry 2 marks each.

32. Answer the following
 - (a) Draw the Newman and Sawhorse structure of Ethane
 - (b) Illustrate with the help of one chemical test how you will distinguish between ethene and ethane

OR

Explain the following

- (i) Decarboxylation
 - (ii) Wurtz Reaction
33. (i) Arrange the following type of radiations in increasing order of frequency Radiation from microwave oven, Amber light from traffic signal, Cosmic rays from outer space, X-Ray, Radiation from FM radio
 - (ii) How many electrons in an atom of Na ($Z=11$) have $n = 2$, $l = 1$, $m_l = 0$, $m_s = +1/2$

34. Answer the following
 - (i) Draw the shape of (a) ClF_3 (b) XeF_4
 - (ii) Why He_2 does not exist, give reason based on Molecular Orbital theory.

OR

- (i) Explain why O_2 is paramagnetic on the basis of Molecular Orbital theory.
 - (ii) Why H_2O is liquid but H_2S is gas.
35. The uncertainty in the momentum of a particle is $2.5 \times 10^{-14} \text{ gcm s}^{-1}$, with what accuracy can its position be determined? ($h = 6.25 \times 10^{-27} \text{ gcm}^2 \text{ s}^{-1}$)

OR

What will be the wavelength of the emitted radiations when an electron jumps from a third orbit to a first orbit in a hydrogen atom? Rydberg constant, $R_H = 109677 \text{ cm}^{-1}$.

SECTION (C)

Q.No 36-39 are Short Answer Type II carrying 3 mark each.

36. (a) The molar heats of combustions of $\text{C}_2\text{H}_2(\text{g})$, $\text{C}(\text{Graphite})$ and $\text{H}_2(\text{g})$ are 310.62 kcal, 94.05 kcal and 68.32 kcal respectively. Calculate the standard heat of formation of $\text{C}_2\text{H}_2(\text{g})$.
- (b) Explain the effect of following on the reaction
 $\text{N}_2(\text{gas}) + 3\text{H}_2(\text{gas}) \rightleftharpoons 2\text{NH}_3(\text{gas})$
- (i) Addition of $\text{HCl}(\text{gas})$
- (ii) Addition of $\text{NH}_3(\text{gas})$
37. Arrange the following in increasing order of property specified:
- (a) $\text{CH}_2=\text{CH}_2$, $\text{CH}_3\text{CH}=\text{CH}_2$, $\text{CH}_3\text{CH}=\text{CHCH}_3$ in order of increasing rate of reaction with HBr .
- (b) Cl_3CCOOH , Cl_2CHCOOH , ClCH_2COOH in increasing order of acidic strength
- (c) n-Pentane, iso-pentane, neo-pentane (boiling point).

OR

A hydrocarbon 'A', adds one mole of hydrogen in presence of platinum catalyst to form n-Hexane. When 'A' is oxidized vigorously with KMnO_4 , a single carboxylic acid containing three carbon atoms is isolated.

Give the structure of A and write the reaction involved.

38. At a certain temperature the equilibrium constant (K) is 16 for the reaction
 $\text{SO}_2(\text{g}) + \text{NO}_2(\text{g}) \rightleftharpoons \text{SO}_3(\text{g}) + \text{NO}(\text{g})$
If the container contain 1 M concentration of each component initially, then what is the concentration of SO_2 at the equilibrium.
- 39 Which of the following compound will shows geometrical isomerism. Write the 'cis' and 'trans' form (if exist) for the compound.
- (a) Propene (b) But-2-ene
(c) 1, 2-dichloroethene

SECTION (D)

Q.No 40 to 42 are long answer type carrying 5 marks each.

40. One mole of a hydrocarbon [A] reacts with 1 mole of bromine giving a dibromo compound [B], $C_5H_{10}Br_2$. Compound [A] on treatment with cold dilute alkaline $KMnO_4$ solution forms a compound, $[C]C_5H_{12}O_2$. On Ozonolysis, [A] gives equimolar quantities of propanone and ethanal. Deduce the structure of [A] and write the corresponding reactions. (5)

OR

Give answer of following:

- (i) (a) Give the stability order of the following carbocation:
 $(CH_3)_3C^+$, $(CH_3)_2HC^+$, $(CH_3)H_2C^+$, CH_3^+
(b) Out of Benzene, *m*-Dinitrobenzene, toluene which will undergoes nitration most easily and why?
- (ii) Explain the Markonikov Rule with the help of one example and relevant mechanism.
41. (a) What is an empirical formula.
(b) A compound containing sodium, sulphur, hydrogen and oxygen gave the following results on analysis: Na = 14.28%, S = 9.92%, H = 6.20%. Calculate the molecular formula of the anhydrous compound. If Hydrogen and Oxygen are present in the form of water of crystallization only, what is the structure of the crystalline salt?
(Molecular Weight of Crystalline Salt = 322) (1+4)

OR

- (a) Define Enthalpy of formation with one example.
(b) Calculate the C-C bond energy from the following data:
 $2C(\text{Graphite}) + 3H_2(g) \rightarrow C_2H_2(g)$, $\Delta H = -84.67 \text{ kJ}$...equation-1
 $C(\text{Graphite}) \rightarrow C(\text{gas})$, $\Delta H = 716.7 \text{ kJ}$...equation-2
 $H_2(\text{Graphite}) \rightarrow 2H(\text{gas})$, $\Delta H = 435.9 \text{ kJ}$...equation-3
Assume C-H bond energy is 416 kJ (1+4)
42. (a) Why do we prefer molality over molarity for expressing the concentration of a solution?
(b) A compound on analysis was found to contain C = 34.6%, H = 3.85% and O = 61.55%. Calculate its empirical formula and empirical formula mass.

OR

- (a) Calculate the mole fraction of benzene in a solution containing 30% by mass in CCl_4 .
(b) What volume of oxygen at STP is needed to cause the complete combustion of 200 mL of acetylene? Also calculate the volume of CO_2 formed.