

SPECTRA PRACTICE PAPER 2024-25
SUBJECT- CHEMISTRY (043)
CLASS-XI

Time-3 hrs.

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 ideas underlying our modern understanding of thermodynamics and kinetic theory were developed during the nineteenth century. Central to these developments was the discovery that matter reacting chemically does not do so simply between equal masses of the samples involved. We now call the study of this phenomenon 'stoichiometry', defined as: 'the relationship between the amounts of substance that react together, and the products that are formed'.

Another development during the nineteenth century that was central to our modern understanding of the chemical nature of matter was the observation by Avogadro that 'equal volumes of ideal or perfect gases, at the same temperature and pressure, contain the same number of particles, or molecules'. This is now known as Avogadro's law. It provides the motivation to formulate expressions for the quantity of a sample that reacts with another sample. The most notable example of such a formulation is the gram-molecule, which has been used to refer to both a unit and a quantity

- (i) How much gram-molecules of H_2O are produced on combustion of 32 g of methane in excess oxygen?
- (ii) When an antacid tablet is used, $Ca(OH)_2$ reacts with HCl in the stomach to form inert $CaCl_2$ and H_2O . If the molar mass of $Ca(OH)_2$ is 75 g/mol, how many moles of HCl are required to fully react with 150 g of $Ca(OH)_2$?
- (iii) What must be held constant when applying Avogadro's law?

(2+2+1 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. Condition not required for the molecule to be aromatic
(a) cyclic (b) planar
(c) Conjugated system (d) $4n+2 \pi$ electron
4. Which of the following molecule has coordinate bond
(a) CH_4 (b) H_2O
(c) CO_2 (d) NH_4^+
5. IUPAC name of product formed by Action of acetylene on dilute $\text{H}_2\text{SO}_4/\text{dil.HgSO}_4$
(a) Methanal (b) Ethanal
(c) Ethanoic acid (d) Propanone
6. Which of the following element has highest metallic character
(a) C (b) N
(c) O (d) F
7. Select the incorrect statement for the Benzene structure
(a) C-C bond length is 139 pm
(b) Pie electron is delocalized above and below the benzene ring
(c) All the carbon atom are 'sp' hybridized
(d) All C-H bond are in the same plane.
8. 7.5 grams of a gas occupy 5.6 litres of volume at STP the gas is
(a) NO (b) N_2O
(c) CO (d) CO_2
9. Number of atoms of He in 100 u of He (Atomic mass of He is 4 u)
(a) 25 (b) 50
(c) 100 (d) 400
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?

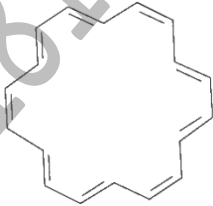
- (a) $n = 4$ to $n = 1$ (b) $n = 3$ to $n = 2$
 (c) $n = 3$ to $n = 1$ (d) $n = 2$ to $n = 1$
11. The shape of SF_4 molecule according to VSEPR theory is
 (a) square planar (b) See-saw
 (c) Tetrahedral (d) pyramidal
12. The correct order of ionic radii of the species N^{3-} , O^{2-} , Na^+ and F^- is
 (a) $\text{Na}^+ < \text{F}^- < \text{O}^{2-} > \text{N}^{3-}$ (b) $\text{F}^- < \text{O}^{2-} < \text{N}^{3-} > \text{Na}^+$
 (c) $\text{O}^{2-} < \text{N}^{3-} < \text{F}^- > \text{Na}^+$ (d) $\text{N}^{3-} < \text{Na}^+ < \text{F}^- > \text{O}^{2-}$
13. A system suffers an increase in internal energy of 80 J and at the same time has 50 J of work done on it. What is the heat change of the system?
 (a) 130 J (b) 30 J
 (c) -130 J (d) -30 J
14. For the reaction $\text{CO(g)} + \text{Cl}_2\text{(g)} \rightleftharpoons \text{COCl}_2\text{(g)}$ the value of K_c/K_p is equal to
 (a) RT (b) $(RT)^2$
 (c) $1/RT$ (d) 1
15. The nitro group in benzene ring is:
 (a) Ortho directing (b) Meta directing
 (c) Para directing (d) Ortho and Para directing
16. Basic strength of
 (I) $\text{H}_3\text{C}-\text{CH}_2^-$ (II) $\text{H}_2\text{C}=\text{CH}^-$ (III) $\text{HC}\equiv\text{C}^-$ in order of
 (a) $\text{I} > \text{III} > \text{II}$ (b) $\text{I} > \text{II} > \text{III}$
 (c) $\text{II} > \text{I} > \text{III}$ (d) $\text{III} > \text{II} > \text{I}$

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 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.
17. Assertion : Benzene is Aromatic compound
 Reason : Compound which follows Huckel's rule are Aromatic in nature
18. Assertion : H_2O is a Lewis Base
 Reason : H_2O molecule is pyramidal in shape.
19. Assertion : Cis-But-2-ene is less 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.

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

22. An alkene A on ozonolysis gives a mixture of propanal and pentan-3-one. Write IUPAC name of element.
23. Whether the compound cyclooctadecanonaene is aromatic or not?
Give reason for your answer.
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24. Name the product formed when Benzene reacts with acetylchloride in the presence of anhydrous aluminium chloride.
25. Draw the resonating structures of phenol.
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 Cr (Atomic No. 24)
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
- Draw the Newman and Sawhorse structure of Ethane
 - 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. Calculate the wavelength of a tennis ball of mass 60 gm moving with a velocity of 10 m per second.

OR

Calculate the uncertainty in the velocity of a cricket ball of mass 150 g, if uncertainty in its position is of the order of 1 \AA .

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 HCl (gas)
 - (ii) Addition of NH_3 (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 contains 1 M concentration of each component initially, then what is the concentration of SO_2 at the equilibrium.
39. An alkene 'A' of molecular mass '28u' on treatment with bromine gives a product 'B'. The Compound 'B' on further dehalogenation with zinc gives back 'A'. Give the structures of 'A' and 'B' and also the sequence of reactions.

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], $\text{C}_5\text{H}_{10}\text{Br}_2$. Compound [A] on treatment with cold dilute alkaline KMnO_4 solution forms a compound, $[\text{C}]\text{C}_5\text{H}_{12}\text{O}_2$. 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:
 $(\text{CH}_3)_3\text{C}^+$, $(\text{CH}_3)_2\text{HC}^+$, $(\text{CH}_3)\text{H}_2\text{C}^+$, 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:
 $2\text{C}(\text{Graphite}) + 3\text{H}_2(\text{g}) \rightarrow \text{C}_2\text{H}_2(\text{g}), \Delta H = -84.67 \text{ kJ}$...equation-1
 $\text{C}(\text{Graphite}) \rightarrow \text{C}(\text{gas}), \Delta H = 716.7 \text{ kJ}$...equation-2
 $\text{H}_2(\text{Graphite}) \rightarrow 2\text{H}(\text{gas}), \Delta H = 435.9 \text{ kJ}$...equation-3

Assume C-H bond energy is 416 kJ

(1+4)

42. Give molecular orbital energy level diagram of N_2 . Write its electronic configuration, magnetic behavior and bond order.

(5).