CHEMISTRY (CODE - 043)

CHAPTER TEST - QUESTION PAPER

Class XI (2026-27) | Chapter 9: Hydrocarbons

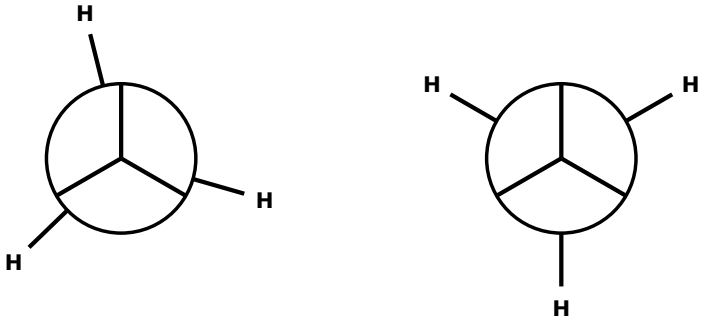
Time: 1 hour 30 minutes | Max. Marks: 35

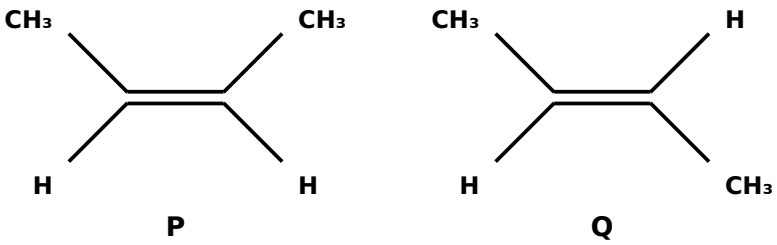
GENERAL INSTRUCTIONS:

1. Read the following instructions carefully.
2. There are 20 questions in this question paper with internal choice.
3. SECTION A consists of 12 questions carrying 1 mark each (Q. 1 to 9 are multiple-choice questions and Q. 10 to 12 are Assertion–Reason questions).
4. SECTION B consists of 4 very short answer questions carrying 2 marks each.
5. SECTION C consists of 2 short answer questions carrying 3 marks each.
6. SECTION D consists of 1 case-based question carrying 4 marks.
7. SECTION E consists of 1 long answer question carrying 5 marks.
8. All questions are compulsory. Internal choice is provided in Q. 16 (Section B) and Q. 20 (Section E).
9. Use of log tables and calculators is not allowed.
10. Write chemical equations with the conditions wherever required.

SECTION A

Questions 1 to 9 are multiple-choice questions. Only one of the choices is correct. Questions 10 to 12 are Assertion–Reason questions.

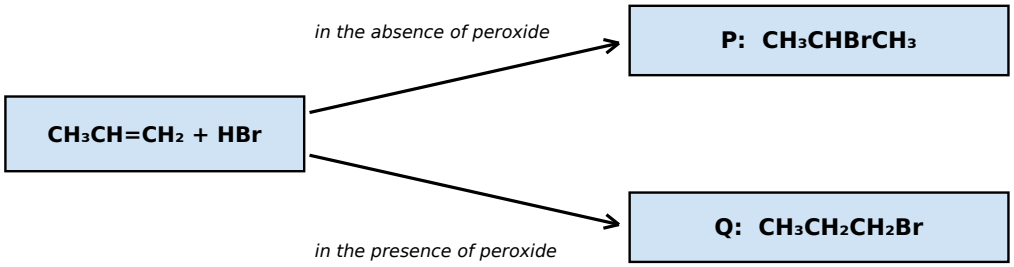
1	The number of chain isomers possible for the alkane C_5H_{12} is: A. 2 B. 3 C. 4 D. 5	1
2	The Newman projections P and Q of ethane are shown below.  **P** **Q** Which of the following statements is correct? A. P is the staggered conformation B. P has the minimum torsional strain C. P and Q are structural isomers of ethane D. Q is more stable than P	1
3	Electrolysis of an aqueous solution of sodium acetate gives which alkane at the anode? A. Methane B. Propane C. Ethane D. Butane	1

4	The structures P and Q of but-2-ene are shown below.  Which of the following statements is correct? A. P is cis and has a higher dipole moment than Q B. P is trans and is non-polar C. Q is cis and has a higher boiling point than P D. P and Q are chain isomers	1
5	The major product of the addition of HBr to propene in the absence of peroxide is: A. 1-Bromopropane B. 2-Bromopropane C. 1,2-Dibromopropane D. 2,2-Dibromopropane	1
6	Ozonolysis of propene followed by reduction with Zn and water gives: A. Ethanal and methanal B. Propanone and methanal C. Two molecules of ethanal D. Propanal and methanal	1
7	Which of the following reacts with sodium metal to liberate hydrogen gas? A. Ethane B. Ethyne C. Ethene D. Benzene	1
8	Which one of the following is aromatic? A. Cyclooctatetraene B. Cyclopentadiene C. Cyclohexene D. Cyclopentadienyl anion	1
9	Which of the following groups is a *meta*-directing group in electrophilic substitution of benzene? A. –OH B. $-CH_3$ C. $-NO_2$ D. $-NH_2$	1
10	Questions 10 to 12 are Assertion (A) and Reason (R) type questions. Select the correct option. **Assertion (A):** The staggered conformation of ethane is more stable than the eclipsed conformation. **Reason (R):** In the staggered conformation the electron clouds of the C–H bonds are farthest apart, so the torsional strain is minimum. A. Both A and R are true, and R is the correct explanation of A. B. Both A and R are true, and R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true.	1
11	**Assertion (A):** Addition of HBr to propene in the presence of peroxide gives 1-bromopropane. **Reason (R):** The peroxide effect is observed with HCl, HBr and HI. A. Both A and R are true, and R is the correct explanation of A. B. Both A and R are true, and R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true.	1

12	**Assertion (A):** Benzene readily undergoes addition reactions like alkenes. **Reason (R):** The delocalised π-electron cloud makes benzene unusually stable. A. Both A and R are true, and R is the correct explanation of A. B. Both A and R are true, and R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true.	1

SECTION B

Questions 13 to 16 are very short answer questions carrying 2 marks each.

13	The addition of HBr to propene gives different products P and Q under different conditions, as shown below.  (i) Name P and Q. Which rule is followed in the formation of P? [1] (ii) Name the effect responsible for the formation of Q and state the type of mechanism involved. [1]	2
14	The boiling points of the three isomers of C_5H_{12} are given below. **Isomer** | **Structure type** | **Boiling point / K** Pentane | continuous chain | 309.1 2-Methylbutane | one branch | 300.9 2,2-Dimethylpropane | two branches | 282.5 (i) Which isomer has the highest boiling point? [½] (ii) Explain the effect of branching on the boiling point of alkanes. [1½]	2
15	Write the chemical equation for the preparation of ethane by: (i) Wurtz reaction, starting from bromomethane [1] (ii) decarboxylation of sodium propanoate with soda lime [1]	2
16	Classify each of the following groups attached to a benzene ring as *ortho/para* directing or *meta* directing: –OH, $–NO_2$, –Cl, $–CH_3$. [½ each] **OR** State the conditions that a system must satisfy to be aromatic. Show that benzene satisfies the (4n + 2) π-electron rule. [1 + 1]	2

SECTION C

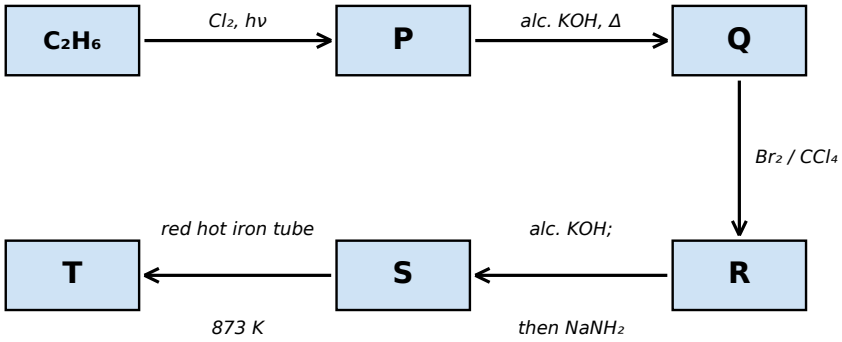
Questions 17 and 18 are short answer questions carrying 3 marks each.

17	Methane reacts with chlorine in the presence of sunlight to form chloromethane by a free radical chain mechanism. (i) Write the initiation step. [1] (ii) Write the two propagation steps. [1] (iii) Write a termination step which explains the formation of ethane as a by-product. [1]	3

18	An alkene A (C_5H_{10}) gives a mixture of ethanal and propanal on ozonolysis (reductive work-up with Zn and H_2O). (i) Write the structure and IUPAC name of A. [1] (ii) Write the reactions involved in the ozonolysis of A. [1] (iii) Does A show geometrical isomerism? Draw the *cis* and *trans* isomers. [1]	3

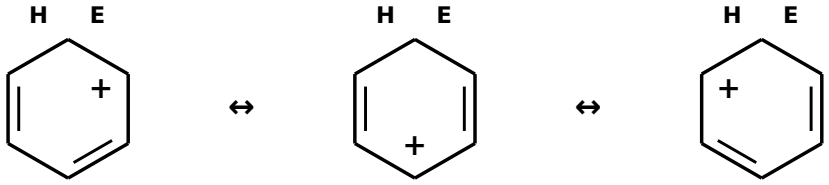
SECTION D

Question 19 is a case-based question carrying 4 marks.

19	**From aliphatic to aromatic** Ethane can be converted into benzene by the sequence of reactions shown below. Ethane is first treated with chlorine in the presence of light to give P. Each step of the sequence introduces a characteristic functional change, and the last step is the best route for entering from aliphatic to aromatic compounds.  (i) Identify the compounds P, Q, R and S. [1] (ii) Name the reaction type in the conversion of P to Q and of Q to R. What is observed when R is formed from Q with bromine in carbon tetrachloride, and what does it indicate? [1] (iii) Write the equation for the conversion of S to T and name the reaction. [1] (iv) Name the mechanism of the first step (ethane to P) and write its initiation step. [1]	4

SECTION E

Question 20 is a long answer question carrying 5 marks.

20	Benzene reacts with chloromethane in the presence of anhydrous $AlCl_3$ to form toluene. The reaction goes through a carbocation intermediate whose resonance contributors I, II and III are shown below (E^+ = the attacking electrophile).  **I** **II** **III** (i) Write the equation for the reaction. Name this reaction and write the equation for the generation of the electrophile. [1] (ii) Name the intermediate shown in the figure. What is the hybridisation of the carbon atom bearing E and H, and why is the intermediate stabilised? [1] (iii) Write the last step of the mechanism by which the aromatic character is restored. [1] (iv) Why is nitrobenzene less reactive than benzene towards electrophiles, and why does the electrophile attack its *meta* position? [2] **OR** (i) Write the balanced equation for the complete combustion of butane and the general combustion equation for an alkane C_nH_{2n+2}. [1½] (ii) How is n-hexane converted into benzene? Write the equation with the catalyst and conditions. [1½] (iii) n-Hexane is heated with anhydrous $AlCl_3$ and HCl. Name the process and write the structures of two products. [1] (iv) Which alkane should be used for the preparation of toluene by the above method? [1]	5

***** END OF QUESTION PAPER *****