



Attempt all questions before checking the answer key. Write structural formulae for organic products, specify major products and include reagents/conditions.

A. Very short answers - 1 mark each

1. State the general formula of open-chain alkanes.
2. How many σ and π bonds are in ethene?
3. Why does ethene undergo addition reactions readily?
4. What is meant by aromaticity?
5. State Markovnikov's rule.
6. Which reagent effect reverses the usual orientation of HBr addition to propene?

B. Short answers / practice - 2 marks each

7. Write preparation of ethane by Wurtz reaction and state one limitation.
8. Write the products of propene with HBr, with and without peroxide.
9. Explain why ethyne is more acidic than ethene.
10. Write ozonolysis of but-2-ene with reductive work-up.
11. Why does benzene favour substitution rather than addition under ordinary conditions?
12. Give a chemical test to distinguish ethane from ethene, with the observation.
13. Find total σ and π bonds in ethyne.
14. Does benzene readily decolourise bromine water without a catalyst under ordinary conditions?
15. Name the major product of propene hydration in acid.
16. Find H_2 moles needed to hydrogenate one mole of ethyne completely.
17. Write the molecular formula of the acyclic alkane with six carbons.

18. Explain why terminal alkynes react with ammoniacal silver nitrate whereas internal alkynes do not.

C. Short answers - 3 marks each

19. Describe conformations of ethane and explain why the staggered form is more stable than the eclipsed form.

20. Write steps for converting ethene to ethyne, giving reagents and equations.

21. An alkene gives only ethanal on reductive ozonolysis. Identify it and draw its geometrical isomers.

22. Write nitration and sulphonation of benzene with reagents and conditions.

23. Explain the orientation effect of a methyl group and a nitro group in electrophilic aromatic substitution.

24. Write reactions of ethyne with sodium, ammoniacal silver nitrate and excess hydrogen/Ni. State observations or products as appropriate.

D. Long answers - 5 marks each

25. Describe the free-radical mechanism for chlorination of methane, showing initiation, propagation and two termination steps. Explain why further substitution can occur.
26. Explain the electrophilic addition mechanism of HBr to propene without peroxide. Account for the major product through carbocation stability and contrast the peroxide case.
27. Explain nitration of benzene through electrophile generation, attack and restoration of aromaticity. Draw the intermediate and state the role of the acid mixture.
28. Give conversions with reagents and equations: ethyne to benzene, benzene to nitrobenzene, benzene to toluene, and toluene to benzoic acid.
29. Distinguish ethane, ethene and ethyne using suitable chemical tests. Give reagents, observations and equations, explaining the limitation of using bromine water alone.
30. An open-chain hydrocarbon C_4H_6 forms a precipitate with ammoniacal $AgNO_3$ and gives butane on complete hydrogenation. Identify it, justify the structure and write reactions with water/ $HgSO_4/H_2SO_4$ and two moles of H_2/Ni .

ANSWER KEY - Numerical / short answers

- 2) 5 σ and 1 π . 13) 3 σ and 2 π . 14) No. 15) Propan-2-ol. 16) 2 mol. 17) C_6H_{14} . 21) But-2-ene; cis and trans forms. 30) But-1-yne; hydration gives butan-2-one; complete hydrogenation gives butane.