S5 Chemistry Practice Paper (Set 3) | Isomerism, functional group tests, esterification yield, saponification value, polymerisation, combustion analysis

S5 Chemistry | Time allowed: 75 minutes | Total: 100 marks | 24 questions

Section A: Structural isomers

Question 1 (16 marks)

1. Give the names of all the structural isomers of C4H10 and state how many there are. (4 marks)

2. Give the names of all the structural isomers of C5H12 and state how many there are. (4 marks)

3. How many chain compounds with molecular formula C4H8 contain one C=C bond, counting cis-trans isomers? Name each one. (4 marks)

4. Explain why 2-methylprop-1-ene does not show cis-trans isomerism. (4 marks)

Section B: Identifying functional groups

Question 2 (16 marks)

5. Bromine water is decolourised rapidly when compound A is added. State the functional group in A. (4 marks)

6. Bubbles are seen when compound B is added to sodium hydrogencarbonate solution. State the functional group in B and the formula of the gas released. (4 marks)

7. Compound C gives an orange-red precipitate with 2,4-dinitrophenylhydrazine. State the functional group in C and describe how an aldehyde can be distinguished from a ketone. (4 marks)

8. Compound D, warmed with ethanol and a little concentrated sulphuric acid, gives a liquid with a fruity smell. Name the reaction and state the functional groups required in the reactants. (4 marks)

Section C: Esterification and percentage yield

Question 3 (16 marks)

9. Calculate the number of moles in 12.0 g of ethanoic acid. (Relative atomic masses: C = 12.0, H = 1.0, O = 16.0) (4 marks)

10. If the ethanoic acid were completely esterified, what mass of ethyl ethanoate would be formed? (4 marks)

11. The experiment actually gives 13.2 g of ethyl ethanoate. Calculate the percentage yield. (4 marks)

12. Suggest two ways to increase the yield of the ester and explain each briefly. (4 marks)

Section D: Saponification value and fats

Question 4 (16 marks)

13. 2.00 g of a fat is completely saponified by 24.0 cm3 of 0.500 mol dm-3 potassium hydroxide solution. Calculate the number of moles of KOH used. (4 marks)

14. Calculate the saponification value of the fat in mg of KOH per gram. (K = 39.1, O = 16.0, H = 1.0) (4 marks)

15. The fat is a triglyceride and needs three KOH units per molecule for saponification. Estimate its average molar mass. (4 marks)

16. Explain how soap removes greasy dirt from cloth. (4 marks)

Section E: Addition and condensation polymerisation

Question 5 (16 marks)

17. Write the addition polymerisation of prop-1-ene (propene) and draw the repeat unit of the polymer. (4 marks)

18. A sample of poly(propene) has a relative molecular mass of 1.26 x 10^5 and the repeat unit has molar mass 42.0 g mol-1. Calculate the degree of polymerisation. (4 marks)

19. How does the polymerisation of poly(propene) differ from that of nylon-6,6? (4 marks)

20. Write the structure of the amide linkage in nylon-6,6 and name the other product of the condensation. (4 marks)

Section F: Combustion analysis and molecular formula

Question 6 (20 marks)

21. 0.580 g of an organic compound containing C, H and O is burnt completely to give 1.320 g of CO2 and 0.540 g of H2O. Calculate the moles of carbon and of hydrogen in the sample. (5 marks)

22. Calculate the moles of oxygen and hence deduce the empirical formula. (5 marks)

23. Mass spectrometry gives a relative molecular mass of 58. Deduce the molecular formula. (5 marks)

24. C3H6O has two isomers, propanal and propan-2-one (propanone). Describe one chemical test that distinguishes them and give the observations. (5 marks)