Chemistry Practice Paper

Level: Secondary 6 | Subject: Chemistry | Time allowed: 75 minutes | Total marks: 100 | Number of questions: 24

Part 1. Nomenclature and Isomerism of Organic Compounds (16 marks)

Show all working or draw the structure. Give units in every answer.

#	Question
1	How many structural isomers does the alkane with molecular formula C5H12 have? Name each isomer. **[4 marks]**
2	Give the systematic name of (CH3)2CHCH2CH3 and state the number of carbon atoms in its principal chain. **[4 marks]**
3	How many geometric isomers does but-2-ene have? Explain why geometric isomerism arises. **[4 marks]**
4	Styrene is the monomer of polystyrene. Write the condensed structural formula of styrene and state how addition polymerisation differs from condensation polymerisation in terms of by-products. **[4 marks]**

Part 2. Esterification, Saponification and Fats (16 marks)

Relative atomic masses: H 1.0, C 12.0, O 16.0, K 39.0.

#	Question
1	With concentrated sulphuric acid as catalyst, 46.0 g of ethanol reacts with excess ethanoic acid. Assuming complete reaction, calculate the theoretical mass of ethyl ethanoate. **[4 marks]**
2	100 g of a fat is completely saponified and consumes 0.300 mol of potassium hydroxide. Calculate the saponification value in mg of KOH per gram of fat. **[4 marks]**
3	Name the two reactants and the two products of the saponification of a fat. **[4 marks]**
4	Explain the purpose of heating during saponification and the purpose of adding common salt afterwards. **[4 marks]**

Part 3. Electrolysis, Electroplating and Electrochemical Cells (18 marks)

Faraday constant = 96500 C/mol.

#	Question
1	A current of 2.00 A passes through copper(II) sulphate solution for 1930 s. Calculate the mass of copper deposited at the cathode. (Cu = 63.5) **[4 marks]**
2	Silver is electroplated onto a metal spoon using a current of 5.00 A. Calculate the time needed to deposit 10.8 g of silver, giving the answer in minutes. (Ag = 108) **[5 marks]**
3	In acidic solution MnO4- is reduced to Mn2+. Write the half-equation and state the number of moles of electrons transferred per mole of MnO4-. **[4 marks]**
4	For a zinc-copper cell, E(Zn2+/Zn) = -0.76 V and E(Cu2+/Cu) = +0.34 V. Calculate the standard cell e.m.f. and state which metal is the anode during discharge. **[5 marks]**

Part 4. Chemical Equilibrium (18 marks)

All concentrations are in mol/dm3 and the temperature is constant.

#	Question
1	In a 1.0 dm3 vessel, 1.00 mol of hydrogen reacts with 1.00 mol of iodine vapour. At equilibrium 1.56 mol of hydrogen iodide is present. Calculate Kc at that temperature. **[5 marks]**
2	For the reaction in the previous question, would doubling the volume at constant temperature shift the position of equilibrium? Explain. **[4 marks]**
3	State the general form of an equilibrium constant Kc and explain why pure solids do not appear in the expression. **[4 marks]**
4	For 2SO2(g) + O2(g) reversible 2SO3(g), Kc = 280 dm3/mol at a certain temperature. At equilibrium [SO2] = 0.100 mol/dm3 and [SO3] = 0.500 mol/dm3. Calculate [O2]. **[5 marks]**

Part 5. Industrial Chemistry and Yield (16 marks)

Give percentage yields to three significant figures.

#	Question
1	In the Haber process 6.00 g of hydrogen reacts with excess nitrogen. The theoretical mass of ammonia is 34.0 g but only 27.2 g is obtained. Calculate the percentage yield. **[4 marks]**
2	In the Contact process, 3.20 g of sulphur is converted completely into sulphuric acid. Calculate the theoretical mass of sulphuric acid. (S = 32.0, H2SO4 = 98.0) **[4 marks]**
3	Ethene is hydrated to ethanol: C2H4 + H2O gives C2H5OH. Calculate the atom economy and justify it with molar masses. **[4 marks]**
4	The Haber process operates at about 450 degrees Celsius and 200 atmospheres. Explain, in terms of rate and equilibrium, why a lower temperature is not used. **[4 marks]**

Part 6. Polymers and Plastics Recycling (16 marks)

Answers must match the polymer structures and the recycling codes.

#	Question
1	A sample of polyvinyl chloride has an average molecular mass of 62500. Calculate its degree of polymerisation. (Molar mass of the monomer C2H3Cl = 62.5 g/mol) **[4 marks]**
2	State the type of polymerisation for polyethylene and for nylon-6,6, and give one structural difference between their main chains. **[4 marks]**
3	Write the condensed formula of the repeating unit of polystyrene and name its monomer. **[4 marks]**
4	In the plastics recycling coding system, what number is given to polyethylene terephthalate (PET)? State one major use of recycled PET. **[4 marks]**