2001 HIGHER SCHOOL CERTIFICATE EXAMINATION

Chemistry

Section I – Part B (continued)

Marks

Question 22 (6 marks)

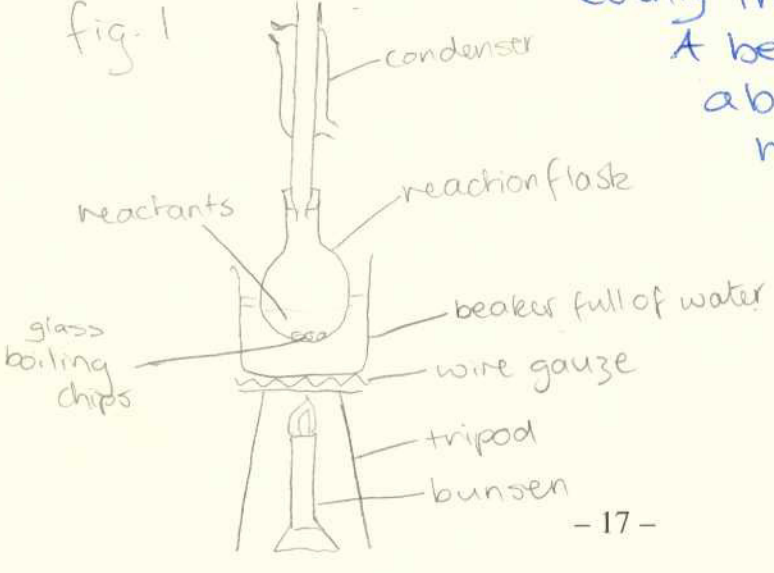
Justify the procedure you used to prepare an ester in a school laboratory. Include relevant chemical equations in your answer. **6**

In our school lab., we created butyle ethanoate, from butanol & ethanoic acid.

$C_4H_9OH_{(aq)} + CH_3COOH_{(aq)} \rightarrow C_6H_{12}O_{2(aq)} + H_2O_{(l)}$

The procedure used was reflux (fig.1). This procedure was used because the chemicals involved (butanol & ethanoic acid) were very volatile. The condensed used prevented the loss of reactants while also ensuring there was no explosive build-up of pressure. This procedure also kept the butanol & ethanoic acid away from naked flame, which was important, as they are very flammable. Boiling chips were used to help disperse heat evenly throughout reactants. A beaker of water over a bunsen was used for heating to control heating & because it was the only practical, available method.

fig. 1



Marks

Question 23 (4 marks)

A household cleaning agent contains a weak base of general formula NaX. 1.00 g of this compound was dissolved in 100.0 mL of water. A 20.0 mL sample of the solution was titrated with 0.1000 mol L^{-1} hydrochloric acid and required 24.4 mL of the acid for neutralisation.

(a) What is the Brönsted–Lowry definition of a base? **1**

A base is a proton acceptor.

(b) What is the molar mass of this base? **3**

$NaX + HCl \rightarrow NaCl + HX$

∴ acid to base ratio is 1:1.

$\frac{n_A}{n_B} = \frac{C_{acid} \times V_{acid}}{C_{Base} \times Vol_{Base}} = 1$ where C = Concentration, V = Volume, n = no moles.

$= \frac{0.1000 mol/L \times 24.4 mL}{C_{Base} \times 20 mL} = 1$

$C_{Base} = 0.122$ mol / Litre.

Molarity = $\frac{\text{Number of moles}}{\text{Volume}}$ Molarity = 0.122 mole/L, Volume = 100 mL.

$0.122 = \frac{\text{No moles}}{0.1}$

No mole = 0.0122

No moles = $\frac{\text{Mass}}{\text{Molar Mass}}$

∴ Molar mass = $\frac{\text{Mass}}{\text{No moles}} = \frac{1.00g}{0.0122}$

Molar Mass = 81.97 grams/mole

Marks

Question 24 (6 marks)

In the early twentieth century, Fritz Haber developed a method for producing ammonia, as shown by the equation:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

(a) Ammonia is used as a cleaning agent. State ONE other use of ammonia. **1**

fertiliser basis for fertiliser

(b) Explain the effect of liquefying the ammonia on the yield of the reaction. **2**

by the liquefying the ammonia, it is brought out of the equilibrium, thereby pushing the equilibrium to the right and producing more ammonia (le chateliers principle)

(c) Explain why it is essential to monitor the temperature and pressure inside the reaction vessel. **3**

the ~~proc~~ Haber process is dependent upon a delicate balance between the yield of product, rate of reaction and energy used. The levels of temp. and press. must be monitored, so as if the go to high, it will require too much energy, and as the reaction is exothermic, the ~~be~~ high temp. will push it to the left. With levels too low the rate of reaction will be far too slow and the low pressure will push the equilibrium to the left. Also high temp. and press. are a dagerous hazard.