

CALCULATION

[10 Marks]

1. Spirits of salts is used in the building industry to clean excess mortar from new brickwork. The active ingredient is hydrochloric acid with a concentration of around 13 mol L^{-1} . In order to precisely determine the concentration of hydrochloric acid in some spirits of salts, a chemist takes a 20.00 mL aliquot and makes this up to 500.0 mL in a volumetric flask. The diluted spirits of salts is analysed by taking 20.00 mL samples of the diluted solution and titrating this with $0.4590 \text{ mol L}^{-1}$ sodium hydroxide solution. An average titre of 21.25 mL of base was obtained for the end point. Use this information to determine the following:

a) The moles of sodium hydroxide used in the titration.

[2 marks]

b) The concentration of hydrochloric acid in the diluted solution.

[3 marks]

c) The concentration of the hydrochloric acid in the original spirits of salts.

[2 marks]

d) The percentage of hydrochloric acid by mass in the original undiluted spirits of salts. Assume the original solution has a density of 1.18 g mL^{-1} .

[3 marks]