Paper 3

Questions are applicable for both core and extended candidates

1 **(a)** Fig. 6.1 shows the displayed formula of a molecule of crotyl alcohol.

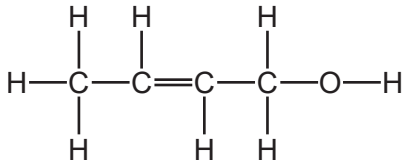

Fig. 6.1

(i) On Fig. 6.1 draw a circle around the alcohol functional group. [1]

(ii) Describe the feature of crotyl alcohol that shows it is an unsaturated compound.

..... [1]

(iii) Deduce the molecular formula of crotyl alcohol.

..... [1]

(iv) Crotyl alcohol is soluble in water.

The boiling point of crotyl alcohol is 121 °C.
The boiling point of water is 100 °C.

Suggest how fractional distillation can be used to separate a mixture of crotyl alcohol and water.

.....

.....

..... [2]

2 This question is about iron.

(d) Crystals of iron(II) chloride can be prepared by adding excess iron to dilute hydrochloric acid.

(i) Suggest how the unreacted iron is removed from the reaction mixture.

..... [1]

(ii) Describe how dry crystals of iron(II) chloride are made from a dilute solution of iron(II) chloride.

.....

.....

..... [2]

3 (b) Crystals of zinc chloride can be prepared by reacting excess zinc with dilute hydrochloric acid.

Choose from the list, the method used to separate the unreacted zinc from the reaction mixture.

Draw a circle around your chosen answer.

chromatography **crystallisation** **evaporation** **filtration** [1]

4 **(a)** Fig. 2.1 shows the distillation apparatus that can be used to separate water from aqueous copper(II) sulfate.

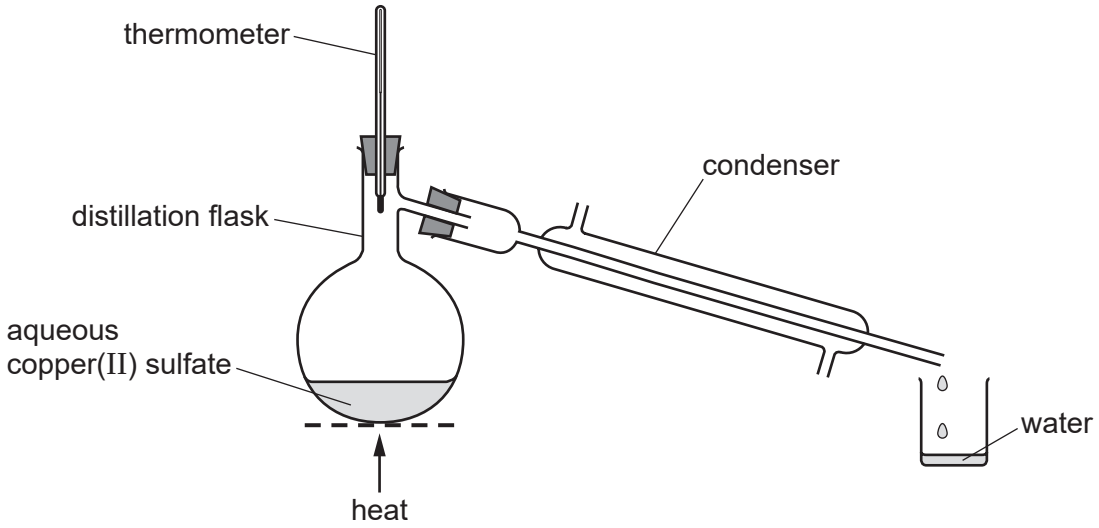

Fig. 2.1

Explain how distillation separates water from aqueous copper(II) sulfate.

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.....

..... [2]

5 This question is about acids, bases and salts.

(b) Describe how to prepare pure, dry crystals of the salt zinc sulfate from an aqueous solution of zinc sulfate.

.....

.....

..... [2]

6 This question is about acids, bases and salts.

(f) Describe how to prepare pure dry crystals of sodium sulfate from an aqueous solution of sodium sulfate.

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..... [2]

Paper 4

Questions are applicable for both core and extended candidates unless indicated in the question

7 This question is about sulfur and compounds of sulfur.

(d) Lead(II) sulfate is an insoluble salt.

Lead(II) sulfate can be made from aqueous ammonium sulfate using a precipitation reaction.

(i) Name a solution that can be added to aqueous ammonium sulfate to produce a precipitate of lead(II) sulfate.

..... [1]

(ii) Write an ionic equation for this precipitation reaction. Include state symbols.

..... [3]

(iii) The precipitate of lead(II) sulfate forms in an aqueous solution.

Describe how pure lead(II) sulfate can be obtained from the mixture.

.....

.....

..... [3]

8 The names of four esters are listed.

methyl propanoate

ethyl propanoate

propyl propanoate

butyl propanoate

(b) All four of the esters in the list are liquids at room temperature.

Name the technique used to separate ethyl propanoate from a mixture of the four esters.

..... [2]

9 This question is about zinc and its compounds.

(b) Zinc sulfate crystals, $ZnSO_4 \cdot 7H_2O$, are hydrated.

Zinc sulfate crystals are made by reacting zinc carbonate with dilute sulfuric acid.

The equation for the overall process is shown.

$$ZnCO_3 + H_2SO_4 + 6H_2O \rightarrow ZnSO_4 \cdot 7H_2O + CO_2$$

step 1 Large pieces of solid zinc carbonate are added to dilute sulfuric acid until the zinc carbonate is in excess. This forms aqueous zinc sulfate.

step 2 The excess zinc carbonate is separated from the aqueous zinc sulfate.

step 3 The aqueous zinc sulfate is heated until a saturated solution is formed.

step 4 The saturated solution is allowed to cool and crystallise.

step 5 The crystals are removed and dried.

(i) In **step 1**, zinc carbonate is in excess when no more zinc carbonate dissolves.

State one **other** observation that indicates the zinc carbonate is in excess in **step 1**.

..... [1]

(ii) Name a different substance, other than zinc carbonate, that can be added to dilute sulfuric acid to produce aqueous zinc sulfate in **step 1**.

..... [1]

(iii) **Step 1** is repeated using powdered zinc carbonate instead of large pieces.

All other conditions are kept the same.

The rate of reaction increases.

Give a reason why the rate of reaction increases. Explain your answer in terms of particles.

.....

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..... [2]

(iv) Suggest what is observed when the solution is saturated in **step 3**.

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..... [1]

(v) The formula of zinc sulfate crystals is $ZnSO_4 \cdot 7H_2O$.

Give the formula of the solid formed if the crystals are heated to dryness in **step 3**.

..... [1]