Acids, Bases and Salts

Question Paper 3

Level	IGCSE
Subject	Chemistry
Exam Board	CIE
Topic	Acids, Bases and Salts
Sub-Topic	
Paper Type	Alternative to Practical
Booklet	Question Paper 3

Time Allowed: **53 minutes**

Score: **/44**

Percentage: **/100**

1 A mixture of two solids, **E** and **F**, was analysed.
Solid **E** was the water-soluble salt aluminium chloride, $AlCl_3$, and solid **F** was an insoluble salt.
The tests on the mixture and some of the observations are in the following table.
Complete the observations in the table.

tests	observations
Distilled water was added to the mixture in a boiling tube. The contents of the boiling tube were shaken and filtered, keeping the filtrate and residue for the following tests.	
<u>tests on the filtrate</u> The filtrate was divided into five portions in five test-tubes. **(a)** The first portion was used to describe the appearance of the filtrate.	appearance ..... [1]
(b) Several drops of aqueous sodium hydroxide were added to the second portion of the solution. Excess aqueous sodium hydroxide was then added to the test-tube.	.... [3]
(c) Aqueous ammonia was added to the third portion, dropwise and then in excess.	.... [2]
(d) To the fourth portion of the solution, dilute nitric acid and aqueous silver nitrate were added.	..... [2]
(e) To the fifth portion of the solution, about 1 cm^3 of dilute nitric acid and barium nitrate solution were added.	..... [1]

tests	observations
<u>tests on the residue</u>	
(f) (i) To a little of the residue, dilute hydrochloric acid was added. The gas given off was tested.	rapid effervescence gas turned limewater milky
(ii) The residue was heated, gently then strongly.	solid changed colour from green to black

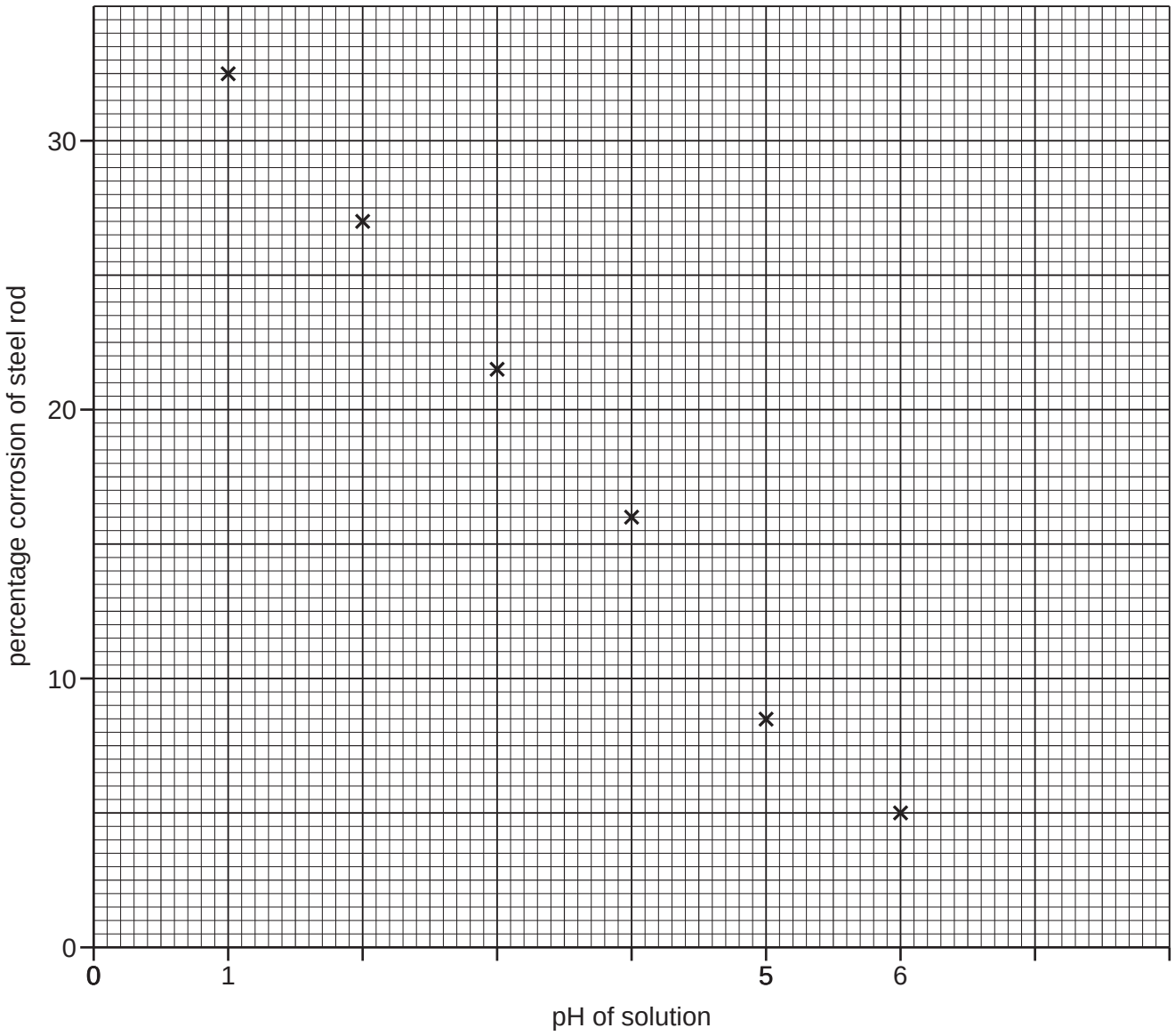
(g) What conclusions can you draw about solid **F**?

.....

..... [2]

[Total: 11]

2 Eight steel rods of the same size were placed in solutions of different pH for one week.
The percentage corrosion of the rods was measured and the results plotted on the grid below.



(a) Draw a best fit straight line through the points. [1]

(b) Why were the steel rods the same size?

..... [1]

(c) State **one** other variable which should have been kept constant.

..... [1]

(d) State one conclusion that could be drawn from the results.

..... [1]

(e) Determine the percentage corrosion of a steel rod in a solution of pH 6.5.

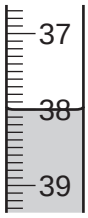
..... [1]

[Total: 5]

3 A student investigated the reaction between aqueous sodium hydroxide and acid **K**.
Two experiments were carried out.

(a) *Experiment 1*

Using a measuring cylinder, 25 cm^3 of acid **K** was poured into a conical flask. Phenolphthalein indicator was added to the flask. A burette was filled with aqueous sodium hydroxide to the 0.0 cm^3 mark. Aqueous sodium hydroxide was added from the burette to the flask and the mixture shaken until the solution showed a permanent colour change.
The final volume was measured. Use the burette diagram to record the final volume in the table and complete the table.



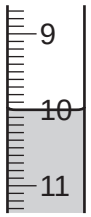
final volume

	burette reading
final volume / cm^3	
initial volume / cm^3	
difference / cm^3	

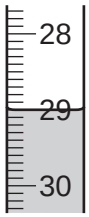
[2]

(b) *Experiment 2*

The solution was poured away and the conical flask rinsed.
Using a measuring cylinder, 50 cm^3 of acid **K** was poured into the conical flask. 0.3 g of powdered calcium carbonate was added to the flask and the flask shaken until no further reaction was observed.
Phenolphthalein was added to the mixture in the flask.
A burette was filled with the same aqueous sodium hydroxide and the initial volume measured. Aqueous sodium hydroxide was added from the burette to the flask and the mixture shaken until the solution showed a permanent colour change.
Use the burette diagrams to record the initial and final volumes in the table and complete the table.



initial volume



final volume

	burette reading
final volume / cm^3	
initial volume / cm^3	
difference / cm^3	

[2]

(c) What colour change was observed after the sodium hydroxide solution was added to the flask?

from ..... to ..... [2]

(d) What type of chemical reaction occurred when acid **K** reacted with sodium hydroxide?

..... [1]

(e) If Experiment 1 were repeated using 50 cm^3 of acid **K**, what volume of sodium hydroxide would be required to change the colour of the indicator?

..... [2]

(f) **(i)** What were the effects of adding 0.3 g of powdered calcium carbonate to acid **K**?

.....

..... [2]

(ii) Use your answer in **(e)** to work out the difference between the volume of sodium hydroxide needed to completely react with 50 cm^3 of acid **K** and the volume of sodium hydroxide used in Experiment 2.

.....

..... [2]

(iii) Estimate the mass of calcium carbonate that would be needed to be added to 50 cm^3 of acid **K** to require 0.0 cm^3 of sodium hydroxide.

..... [1]

(g) What would be the effect on the results if the solutions of acid **K** were warmed before adding the sodium hydroxide? Give a reason for your answer.

effect on results .....

reason ..... [2]

(h) Suggest the advantage, if any, of

(i) using a pipette to measure the volume of acid **K**.

.....

..... [2]

(ii) using a polystyrene cup instead of a flask.

.....

..... [2]

[Total: 20]

4 Coffee beans contain caffeine and other compounds. Caffeine is soluble in water and in trichloromethane, an organic solvent.
A student obtained crystals of caffeine by the following method.

Stage 1 Some coffee beans were crushed into small pieces.

Stage 2 Hot water was added to the crushed beans to dissolve the soluble substances.

Stage 3 The crushed beans were separated from the liquid solution.

Stage 4 The liquid was allowed to cool and shaken with trichloromethane to extract the caffeine from the water.

Stage 5 The caffeine was crystallised from the trichloromethane solution.

Stage 6 The caffeine crystals were checked for purity.

(a) What apparatus should be used to crush the beans in Stage 1?

..... [2]

(b) How could the dissolving process in Stage 2 be speeded up?

..... [1]

(c) Draw a diagram of the apparatus used in Stage 3.

[2]

(d) How should Stage 5 be carried out?

.....

..... [2]

(e) What method could be used to check the purity of the crystals in Stage 6?

..... [1]

[Total: 8]