Centre Number	Candidate Number	Candidate Name

NAMIBIA SENIOR SECONDARY CERTIFICATE

CHEMISTRY ORDINARY LEVEL

6117/3

PAPER 3 Alternative to Practical

1 hour 15 minutes

Marks 40

2022

Additional materials: Non-programmable calculator
Ruler

INSTRUCTIONS AND INFORMATION TO CANDIDATES

- Candidates answer on the Question Paper in the spaces provided.
- Write your Centre Number, Candidate Number and Name in the spaces at the top of this page.
- Write in dark blue or black pen.
- You may use a soft pencil for any diagrams, graphs or rough working.
- Do not use correction fluid.
- Do not write in the margin *For Examiner's Use*.

- Answer **all** questions.

- The number of marks is given in brackets [ ] at the end of each question or part question.
- You may use a non-programmable calculator.

For Examiner's Use	
1	
2	
3	
4	
TOTAL	

Marker	
Checker	

This document consists of **11** printed pages and **1** blank page.

Republic of Namibia

MINISTRY OF EDUCATION, ARTS AND CULTURE

1 A learner carried out a single titration between dilute nitric acid of known concentration and aqueous barium hydroxide to find the concentration of aqueous barium hydroxide.

$$Ba(OH)_2(aq) + 2HNO_3(aq) \rightarrow Ba(NO_3)_2(aq) + 2H_2O\ (l)$$

Step 1 He added 25.0 cm^3 of aqueous barium hydroxide into a conical flask.

Step 2 He added six drops of phenolphthalein indicator to the conical flask.

Step 3 He filled a burette with dilute nitric acid and recorded the initial burette reading.

Step 4 He added dilute nitric acid from the burette into the conical flask until the solution just changed colour.

Step 5 He recorded the final burette reading.

Step 6 He determined the concentration of aqueous barium hydroxide.

(a) Fig. 1.1 shows apparatus **X** used in **Step 1**.

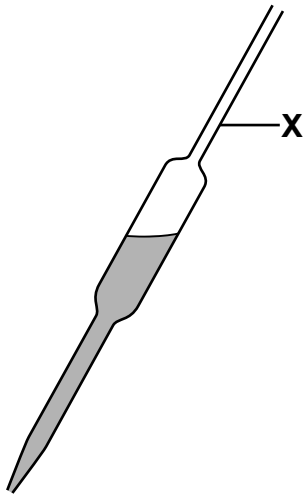

Fig. 1.1

Name apparatus **X**.

..... [1]

(b) State the colour change observed in **Step 4**.

From ..... to ..... [2]

(c) Suggest a reason why Universal indicator is **not** suitable to use in this experiment.

.....

..... [1]

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(d) Fig. 1.2 shows the initial and final burette readings obtained in **Step 3** and **Step 5**.

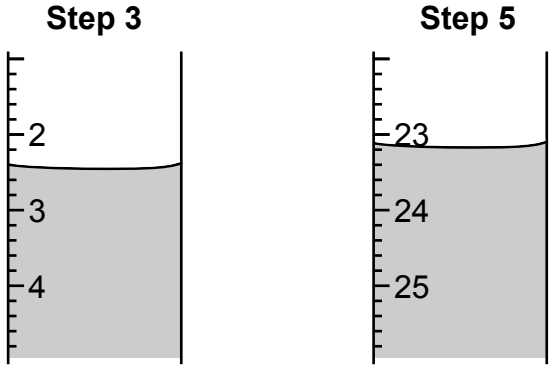


Fig. 1.2

(i) Use Fig. 1.2 to record the burette readings in Table 1.1. [1]

(ii) Determine the total volume added in this titration. [1]

Table 1.1

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

(e) Describe how the learner determined the concentration of aqueous barium hydroxide in **Step 6**.

.....

.....

.....

..... [2]

(f) Suggest how this experiment can be improved to make the results more reliable.

.....

.....

.....

..... [2]

[10]

2 A learner investigates how the rate of reaction between lumps of calcium carbonate and excess dilute hydrochloric acid changes with time.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$$

Fig. 2.1 shows the setup of the experiment.

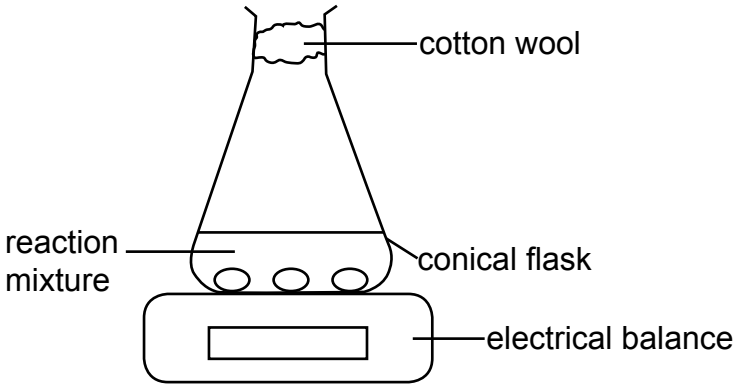
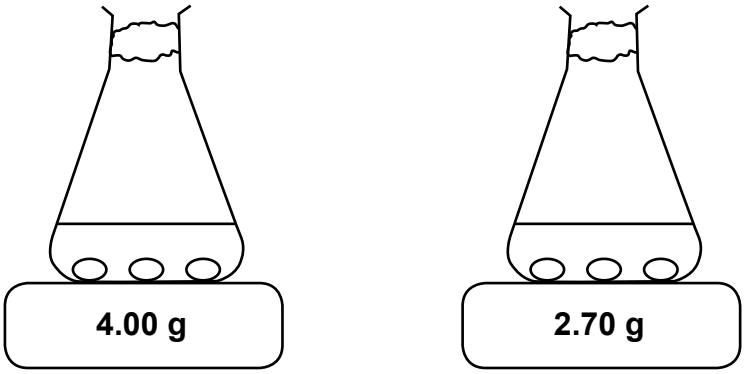


Fig. 2.1

- The learner measures 10 cm^3 of dilute hydrochloric acid and pours it into a conical flask.
- She places the conical flask with dilute hydrochloric acid on the electronic balance and then zeroes the electronic balance.
- She carefully adds two lumps of calcium carbonate into the conical flask and places cotton wool at the neck of the conical flask.
- She starts a stop-watch and records the initial mass.
- She continues to record the mass readings every one minute for 12 minutes.
- She records the results in Table 2.1.

(a) Fig. 2.2 shows the electronic balance readings at 0 minutes and 7 minutes of the experiment.



at 0 minutes at 7 minutes

Fig. 2.2

Record the mass of mixture readings in Table 2.1.

time / min	mass / g
0	**(i)** …….....
1	3.52
2	3.19
3	3.04
4	2.90
5	2.80
6	2.77
7	**(ii)** …….....
8	2.65
9	2.58
10	2.50
11	2.48
12	2.48
13	2.48
14	2.48

[2]

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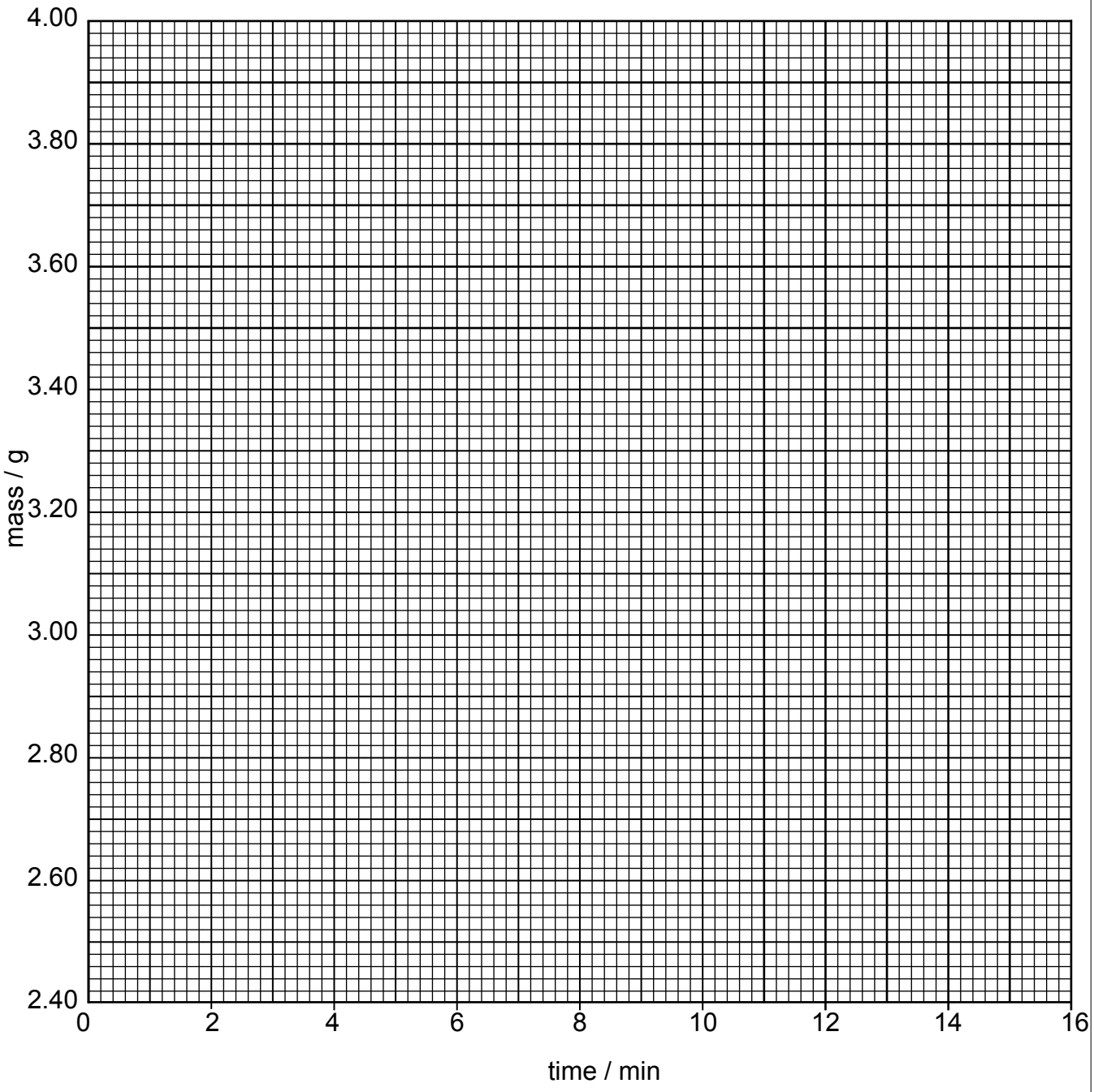
(b) Plot the results from Table 2.1 on the grid below. Draw a smooth line graph.



[3]

(c) **From your graph**, deduce the time taken for the initial mass of the reaction mixture to change by 1 g.

Show clearly **on the graph** how you worked out your answer.

..... min [3]

(d) Predict the value of the mass at 16 minutes and give an explanation for your prediction.

prediction ..... g

explanation

.....

.....

..... [2]

(e) The average rate of the reaction can be calculated using the equation shown.

$$\text{average rate of reaction} = \frac{total\ change\ in\ mass\ /\ g}{total\ time\ taken\ /\ min}$$

(i) Calculate the total change in mass between 1 minute and 9 minutes.

.....

..... [1]

(ii) Calculate the average rate of reaction between 1 minute and 9 minutes.

Include the unit in your answer.

average rate of reaction = ...

unit = ...

[2]

(f) In this experiment, lumps of calcium carbonate are used.

Another learner wishes to repeat the experiment using calcium carbonate powder instead of lumps.

Suggest **two** factors which must be kept constant to ensure fairness of the experiment.

1 .....

.....

2 .....

..... [2]

[15]

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3 A learner prepared copper(II) chloride crystals.

The preparation was carried out in a sequence of stages.

Stage 1

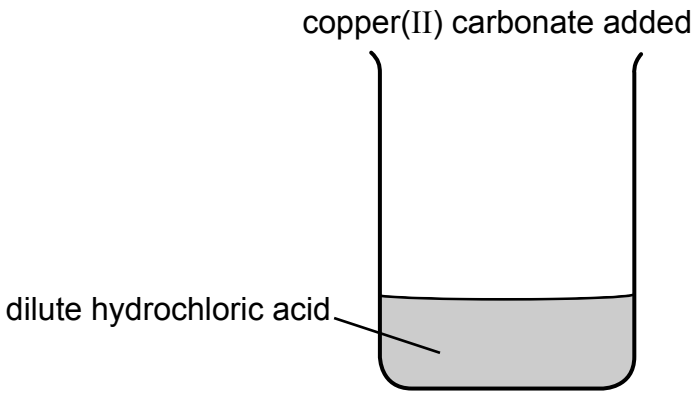

Fig. 3.1

(a) Describe the appearance of copper(II) carbonate.

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..... [1]

Stage 2

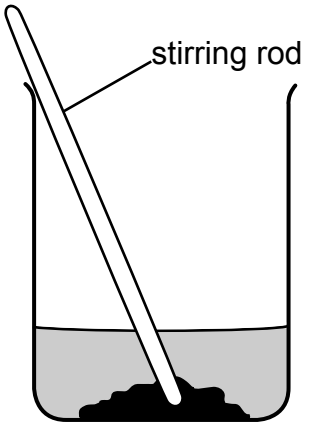

Fig. 3.2

(b) Give **one** expected observation in Stage 2.

.....

..... [1]

Stage 3

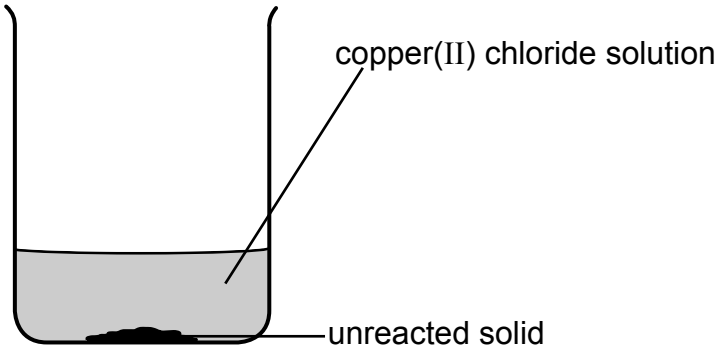

Fig. 3.3

(c) In the box, insert a tick (✓) to select the reactant which is in excess.

Give a reason for your answer.

reactant in excess

dilute hydrochloric acid	
copper(II) carbonate	

reason .....

.....

.....

..... [2]

(d) Describe how crystals of copper(II) chloride could be obtained from the mixture in Fig. 3.3.

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..... [3]

(e) Describe how a flame test is carried out.

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..... [2]

[9]

4 An NSSCO Chemistry teacher is demonstrating to a class how to extract and investigate the mixture of colours present in purple flower petals.

The following materials are provided.

- purple flower petals
- mortar and pestle
- ethanol
- filter paper
- beaker
- pencil

Plan an experiment to investigate how to extract and investigate the colours present in purple flower petals.

Your answer should include:

- a description on how to extract the colours present in purple flower petals.
- a description on how to investigate the colours present in purple flower petals.

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