Centre Number	Candidate Number

Candidate Name _____

MINISTRY OF EDUCATION, BOTSWANA
in collaboration with
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

Botswana General Certificate of Secondary Education

SCIENCE: DOUBLE AWARD 0569/4

PAPER 4 Alternative to Practical

Friday **24 NOVEMBER 2000** Morning 1 hour 30 minutes

Candidates answer on the question paper.
No additional materials are required.

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.
A copy of the Periodic Table is printed on page 16.

FOR EXAMINER'S USE	
1	
2	
3	
4	
5	
6	
TOTAL	

This question paper consists of 16 printed pages.

[Turn over

1 Fig. 1.1 shows some pieces of heat-resistant glassware used in a laboratory.

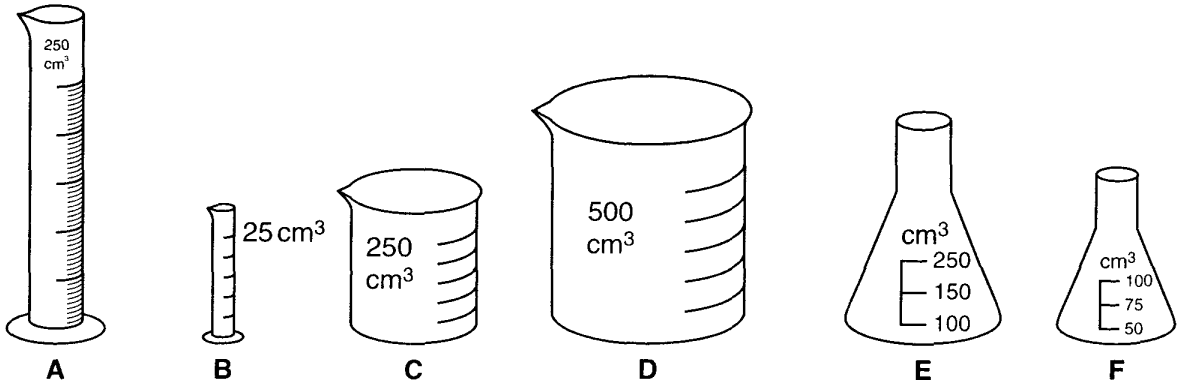


Fig. 1.1

(a) Write the letter which shows

(i) a beaker, ...

(ii) the piece of apparatus you would use to measure 200 cm^3 of water most accurately, ...

(iii) the piece of apparatus you would use as a container in which to boil 250 cm^3 of water safely. .....

[3]

(b) Describe exactly how you would use a thermometer to accurately measure the temperature of some water while it is being heated.

.....

.....

.....

.....[3]

For Examiner's Use

2 A student investigated the effect of wind speed on the transpiration rate of a leafy shoot. She could not measure transpiration directly so she decided to measure the rate of uptake of water by the shoot.

Fig. 2.1 shows the apparatus she used.

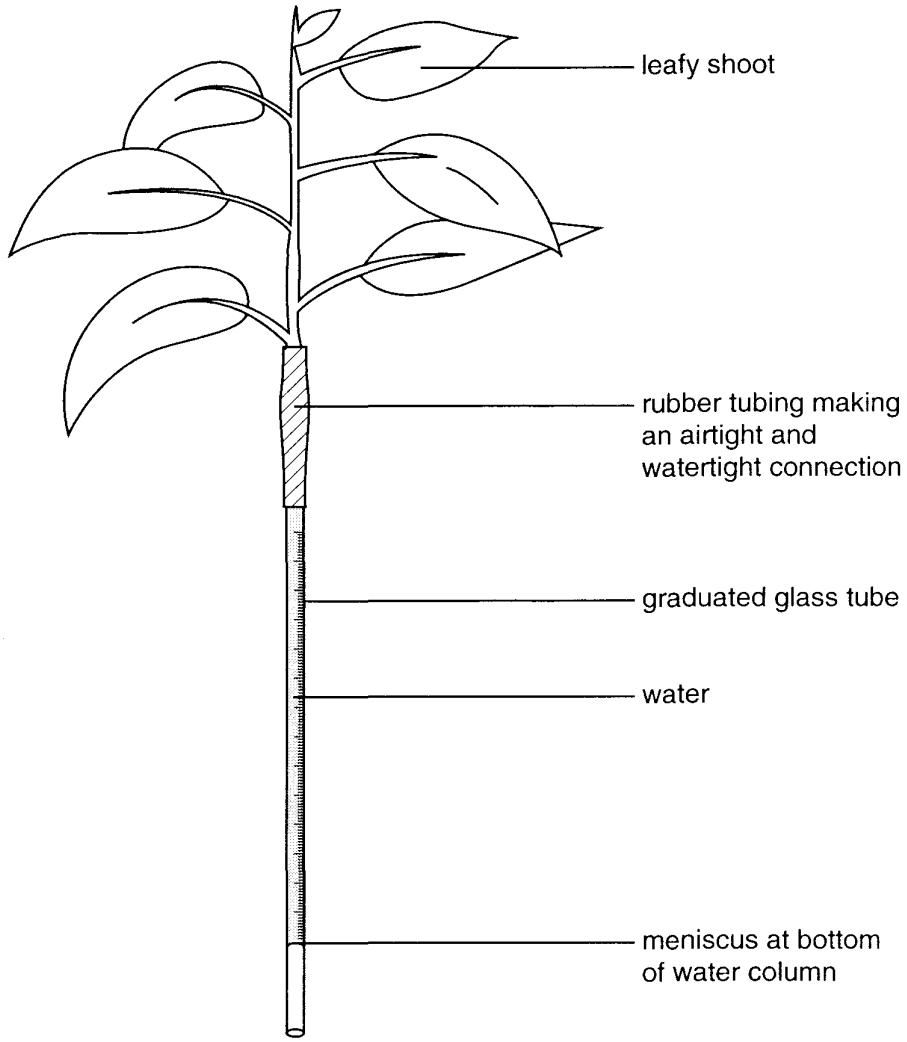


Fig. 2.1

[Turn over

First, the student placed the apparatus in a corner of the laboratory where the air was still. Fig. 2.2 shows the level of the water in the glass tube at the beginning of her experiment and at the end.

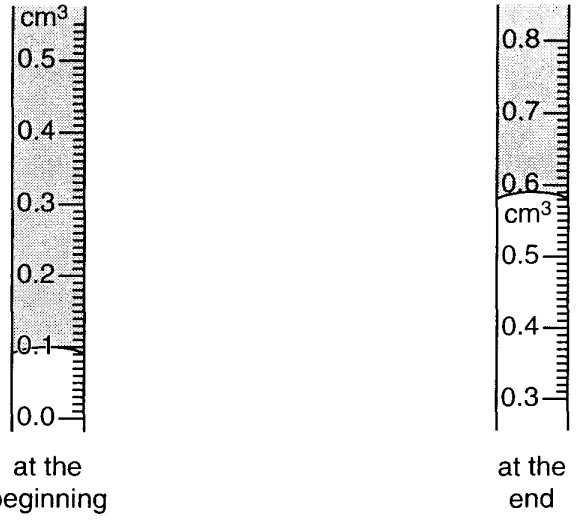


Fig. 2.2

(a) **(i)** Read the scales in Fig. 2.2 and record the level of the water in the tube at the beginning and at the end of the experiment.

level at the beginning .....

level at the end .....[2]

(ii) Calculate the volume of water that was taken up by the plant during the experiment.

.....[1]

(b) What other measurement would the student need to take in order to be able to calculate the **rate** at which the water was taken up by the shoot?

.....[1]

(c) The student then placed the apparatus near an open window, where the air was moving, so that she could find out if the moving air increased the plant's rate of transpiration. She made sure that all other variables were constant.

(i) State two variables that the student should keep constant in order to find out if the **moving air** affected the rate of transpiration of the plant.

1 .....

2 .....[2]

(ii) She found that the plant took up more water when it was by the open window than when it was in the corner of the laboratory.

What conclusion can the student draw from her results?

.....

.....[1]

(d) Explain **one** way in which the student could change or improve her experiment to make her results more reliable.

.....

.....

.....[2]

For Examiner's Use

3 A student decided to investigate whether there was any relationship between the size of a crater formed when a sphere hit the ground and the height from which it fell.

He dropped a steel ball from different heights into a bed of sand and measured the depth of crater formed.

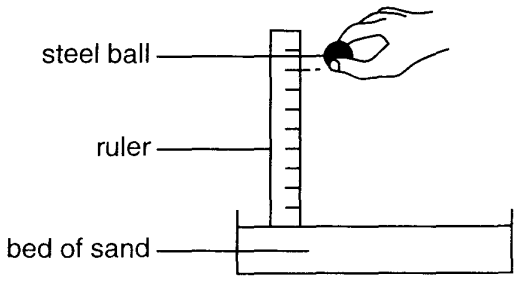
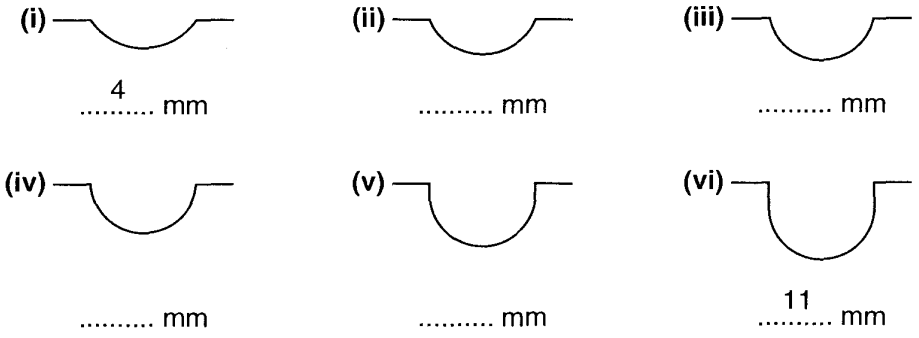


Fig. 3.1

(a) Fig. 3.2 shows six craters.

Measure the depth of each one and record the measurement in the space provided. The first and last are done for you.



[2]

Fig. 3.2

(b) The height from which the steel ball was dropped, ***h***, was measured each time. Four of the measurements are given opposite.

Take the readings of the height, ***h***, for the other two from Fig. 3.3 and record them in the spaces opposite.

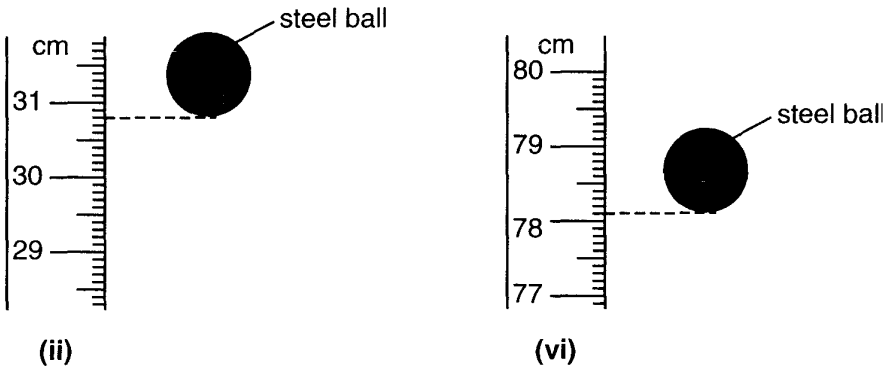


Fig. 3.3

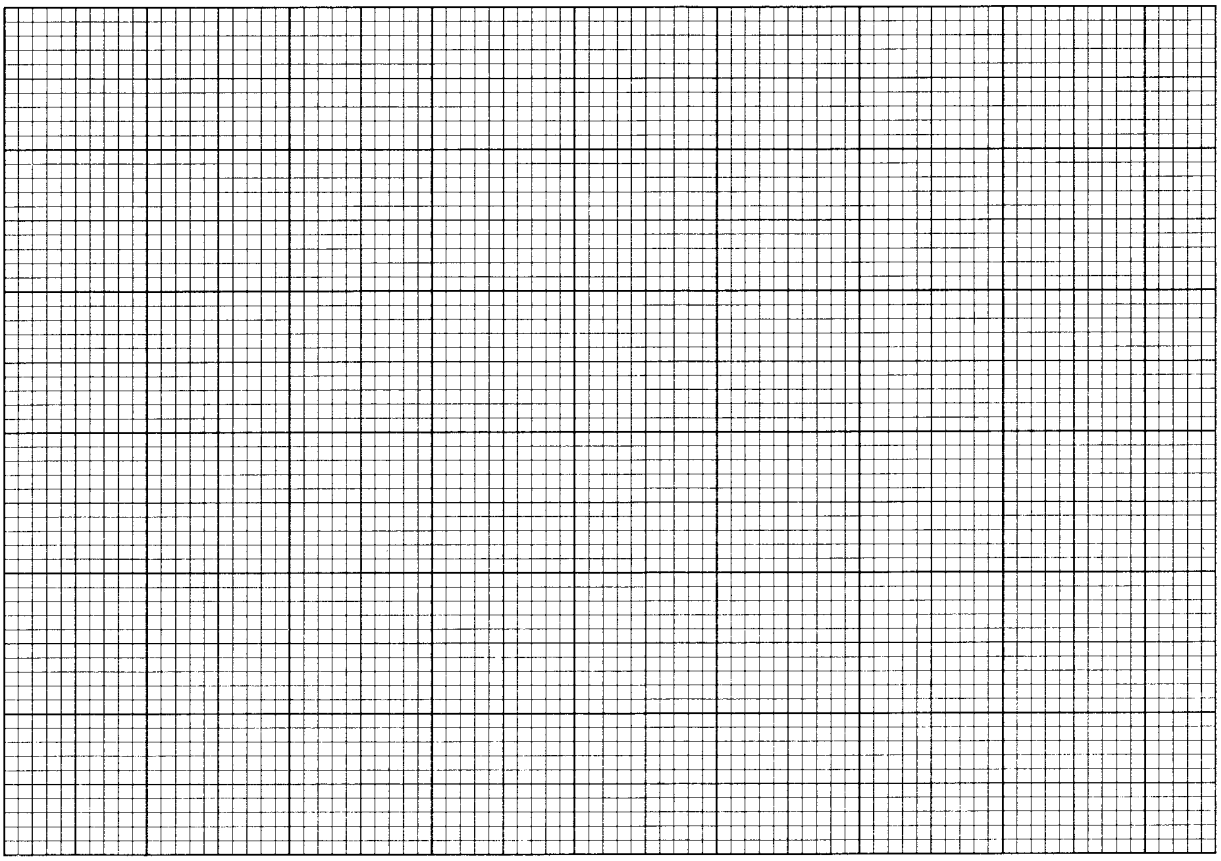
For Examiner's Use

Measurements of height, ***h***:

(i) 200 mm **(ii)** ..... **(iii)** 420 mm

(iv) 490 mm **(v)** 600 mm **(vi)** ..... [1]

(c) **(i)** Plot a graph of depth of crater against height, ***h***. [4]



(ii) Draw the best line through the points. [1]

(iii) Read off the value of the depth of crater when $h = 0$ and record it.

depth = ... [1]

(d) Why is there a value for the depth when $h = 0$?

.....

.....[1]

[Turn over

For Examiner's Use

(e) Two students each made a statement about the graph.

1. There is a linear relationship between the depth of the crater and the height from which the ball fell.

2. The depth of the crater is directly proportional to the height from which the ball fell.

Which of these two statements is correct? .....

Explain your answer.

.....

.....

.....[1]

(f) The teacher suggested that the density of the sphere might make a difference to the results. The students were asked to carry out an experiment to decide whether this was so.

First, they carried out an experiment to determine the density of the steel ball already used. This is what they did.

(i) 50 cm^3 of water was placed in a measuring cylinder.

The sphere was carefully placed in the water, as shown in Fig. 3.4, and the new volume read.

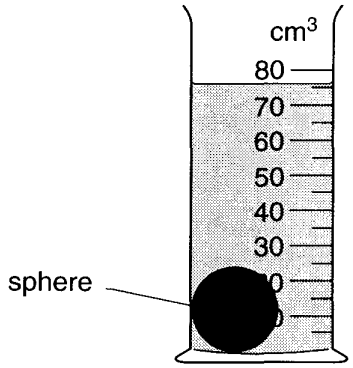


Fig. 3.4

Read and record this value below.

new volume = ...cm^3 [1]

For Examiner's Use

(ii) The mass of the sphere was 200 g.

Calculate the density using the following formula. State the units.

density = mass / volume

density = ... [2]

(iii) Would this method be suitable for finding the density of a sphere made from cork?

Explain your answer.

.....

.....[1]

(g) Describe how you would carry out an experiment to test the suggestion made by the teacher.

.....

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.....

.....[3]

4 A student was asked to investigate how the rate of the reaction between hydrochloric acid and calcium carbonate changed when the concentration of the acid was changed.

She decided to measure the rate of the reaction by passing the gas given off through a glass tube into water. She counted the number of bubbles given off every minute for five minutes.

(a) Draw a diagram of suitable apparatus that she could use.

[3]

(b) The same volume of acid was used each time, measured in a cylinder. Read off the volume used from Fig. 4.1 and record it in the space below.

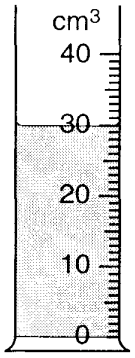

Fig. 4.1

volume used = ...cm^3 [1]

(c) The same mass of calcium carbonate was used each time, weighed on a balance. Fig. 4.2 shows the reading of the balance. Record this mass in the space.

Fig. 4.2

mass = ...g [1]

(d) Fig. 4.3 shows a graph of the results obtained for two different concentrations of acid.

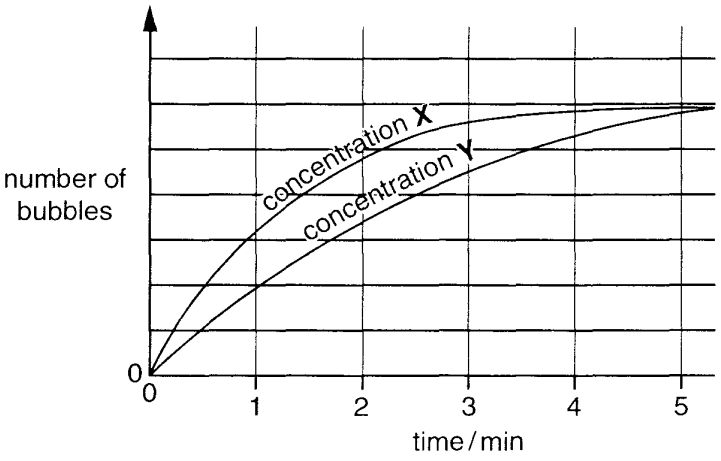

Fig. 4.3

Which of the two concentrations, **X** and **Y**, is the most concentrated?

Give a reason for your answer.

.....

.....

.....[2]

For Examiner's Use

5 Lactose is a sugar found in milk. It is a reducing sugar, so when it is heated with Benedict's solution an orange-red precipitate is formed. The more lactose present, the greater the mass of precipitate formed.

(a) A student has two samples of milk, sample **A** and sample **B**.

Describe how she could use the Benedict's test to find out which sample of milk contains the greater concentration of lactose.

.....

.....

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.....

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.....[5]

(b) The student carried out two other tests on sample **A**. Her results are shown in Fig. 5.1.

test	results	conclusion
biuret solution added	solution became violet/purple	
		no starch present

Fig. 5.1

Complete the table by writing:

- the conclusion the student could make from the biuret test,
- the test she carried out, and the results she obtained, that enabled her to conclude that no starch was present. [3]

For Examiner's Use

(c) The student also wanted to test the milk samples for fats. However, she decided that she could not use the ethanol test, because she would be unable to interpret the results.

Using your knowledge of the appearance of milk, and also of the ethanol test for fats, explain why the student's decision is correct.

.....

.....

.....

.....

.....[2]

For Examiner's Use

6 When aqueous ammonia is added to aqueous copper(II) sulphate a precipitate of copper(II) hydroxide is formed, which then dissolves as more aqueous ammonia is added.

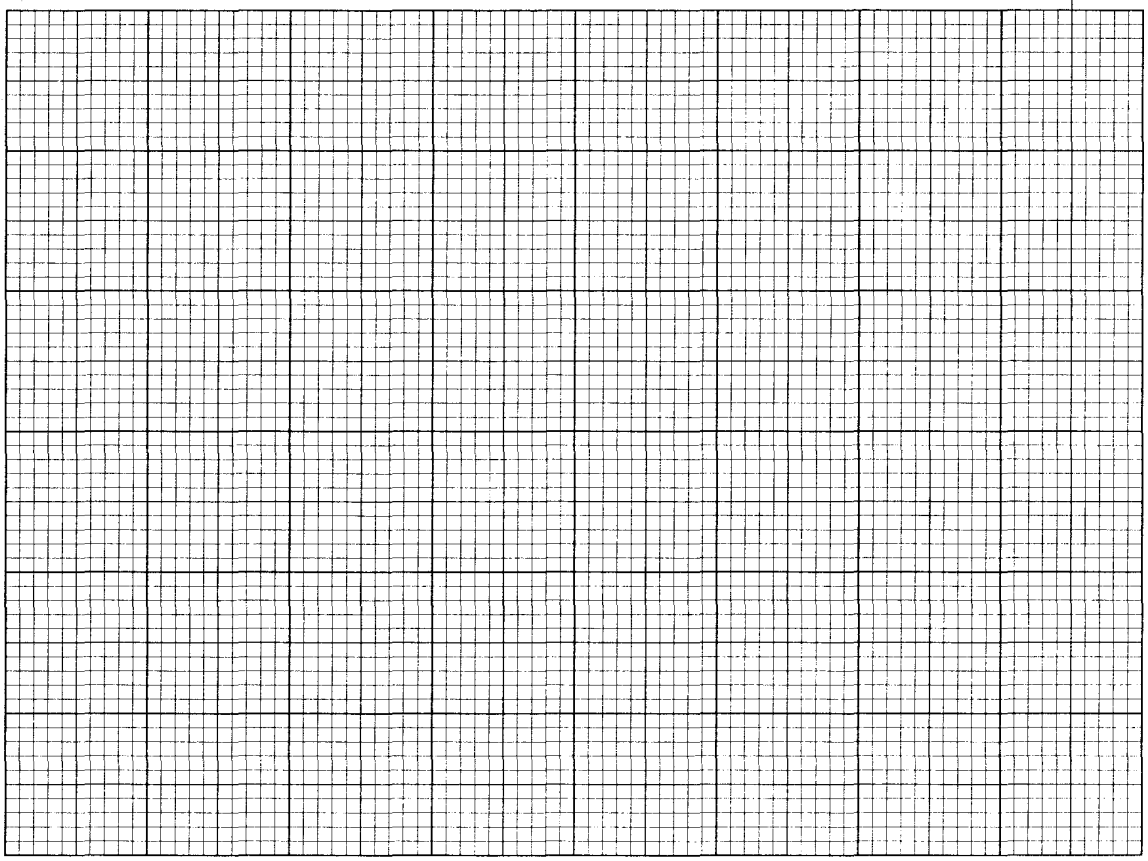
A student was asked to use this reaction to discover the ratio in which these two substances react.

She placed 20 cm^3 of the aqueous copper(II) sulphate in each of 8 test-tubes. Different volumes of the aqueous ammonia were added to each tube, together with a volume of water to make a total volume of 60 cm^3 in each tube. Each tube was shaken and left to stand for an hour. The height of the precipitate was then measured in each tube. The results are shown in Fig. 6.1.

volume of aqueous ammonia added/cm^3	5	10	15	20	25	30	35	40
volume of water added/cm^3	35	30	25	20	15	10	5	0
height of precipitate/mm	7	13	22	28	21	15	8	0

Fig. 6.1

(a) (i) Draw a graph of height of precipitate against volume of aqueous ammonia added.



[2]

(ii) Explain the shape of your graph.

.....

.....

.....[2]

(iii) If the concentration of the aqueous copper(II) sulphate is 1.0 mol/dm^3 and of the aqueous ammonia is 2 mol/dm^3, which of the following statements about the formation of copper(II) hydroxide, **A**, **B** or **C**, is correct?

A 1 mole of copper(II) sulphate requires 1 mole of ammonia to form 1 mole of copper(II) hydroxide.

B 1 mole of copper(II) sulphate requires 2 moles of ammonia to form 2 moles of copper(II) hydroxide.

C 2 moles of copper(II) sulphate require 1 mole of ammonia to form 2 moles of copper(II) hydroxide.

answer ..... [1]

Explain your answer.

.....

.....

.....[1]

(b) Describe all the changes you would see when 40 cm^3 of ammonia is **gradually** added to 20 cm^3 of copper(II) sulphate.

.....

.....[2]

(c) The reaction between ammonia and copper(II) sulphate is exothermic.

Describe another method of finding the ratio in which these two substances react.

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.....[2]

DATA SHEET
The Periodic Table of the Elements

Group I	Group II						Group III	Group IV	Group V	Group VI	Group VII	Group 0
					1 H Hydrogen 1							4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4						11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12						27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key

a
X
b

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).