Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature		Date	

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General Certificate of Secondary Education
June 2008 / June 2009

ADDITIONAL SCIENCE / CHEMISTRY ASCC/CHYC/C2.2
ISA C2.2 Electrolysis

To be conducted before 4 May 2009
For submission in May 2008 or May 2009 or May 2010

For this paper you must have:
- results tables and charts or graphs from your own investigation.

You may use a calculator.

For Teacher's Use	
Section	Mark
1	
2	
Total (max 34)	

Time allowed: 45 minutes

Instructions
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in **Section 1** and **Section 2**.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The maximum mark for this paper is 34.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

Did this candidate take part in the practical activity?	**YES / NO**

Signature of teacher marking this ISA ..... Date .....

SECTION 1

These questions are about the investigation that **you** did.

Answer **all** questions in the spaces provided.

1 What were you trying to find out in your investigation?

.....

.....

.....

.....

(2 marks)

2 In your investigation:

(a) state **one** variable that it was important to keep the same to make it a fair test;

.....

(1 mark)

(b) say how you kept this variable the same;

.....

.....

(1 mark)

(c) explain why it was important to keep this variable the same.

.....

.....

(1 mark)

3 Which **one** of the following terms best describes your **independent** variable (the variable that you deliberately changed)?

Draw a ring around your answer.

categoric **continuous** **discrete** **ordered**

(1 mark)

4 In your investigation, you used at least one measuring instrument.

(a) Name **one** measuring instrument that you used.

.....

(1 mark)

(b) You could have used a measuring instrument with a smaller scale division.

What effect would this have had on your measurements?

.....

.....

(1 mark)

5 Repeating the measurements may make the calculated mean more **reliable**.

Explain why.

.....

.....

.....

.....

(2 marks)

6 What did you find out from your investigation?

I found out that .....

.....

.....

.....

(2 marks)

7 Make sure that **your** results tables and charts or graphs are handed in with this paper.
You will be awarded up to 6 marks for these. *(6 marks)*

18

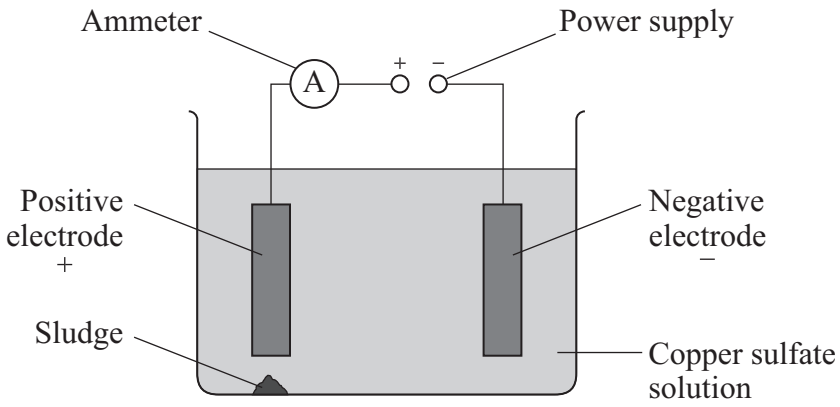
SECTION 2

These questions are about an investigation that may be similar to the one that you did.

Answer **all** questions in the spaces provided.

A company made an impure version of copper called blister copper.
The company wanted to purify the blister copper using electrolysis.

The electrolysis cell, containing copper sulfate solution, is shown below. The positive electrode is the blister copper and the negative electrode is a block of pure copper. During electrolysis, the copper metal is transferred from the positive electrode to the negative electrode. Any impurities are left behind as a sludge underneath the positive electrode.



The company used a current of 100 amps and measured the mass of copper deposited over different lengths of time.

Look at the results in **Table 1** and then answer the questions that follow.

Table 1

Time in hours	Mass of copper deposited in kg			
	Test 1	Test 2	Test 3	Mean
5	0.61	0.58	0.58	0.59
10	1.49	1.22	1.16	1.19
15	1.77	1.79	1.78	1.78
20	2.39	2.35	2.64	
25	3.00	2.94	2.94	2.96

8 (a) What interval did the company use when changing the time? ..... hours

(1 mark)

(b) What range did the company choose when changing the time?

The range was from ..... hours to ..... hours.

(1 mark)

9 Use **Table 1** to calculate the mean mass of copper deposited in 20 hours.

Remember to take account of any anomalous results.
Show clearly how you work out your answer.

.....

.....

Write your answer into the table.

(2 marks)

10 Look at **Table 1**.

Which **one** of the following would be the best way to present the results in the table?
Put a tick (✓) in the box next to your choice.

Bar chart	☐
Line graph	☐
Pie chart	☐
Scattergram	☐

(1 mark)

11 The company analysed the sludge found beneath the positive electrode after electrolysis. The sludge contained a mixture of elements including gold, silver and arsenic.

Explain why the company does not throw away the sludge.

.....

.....

.....

.....

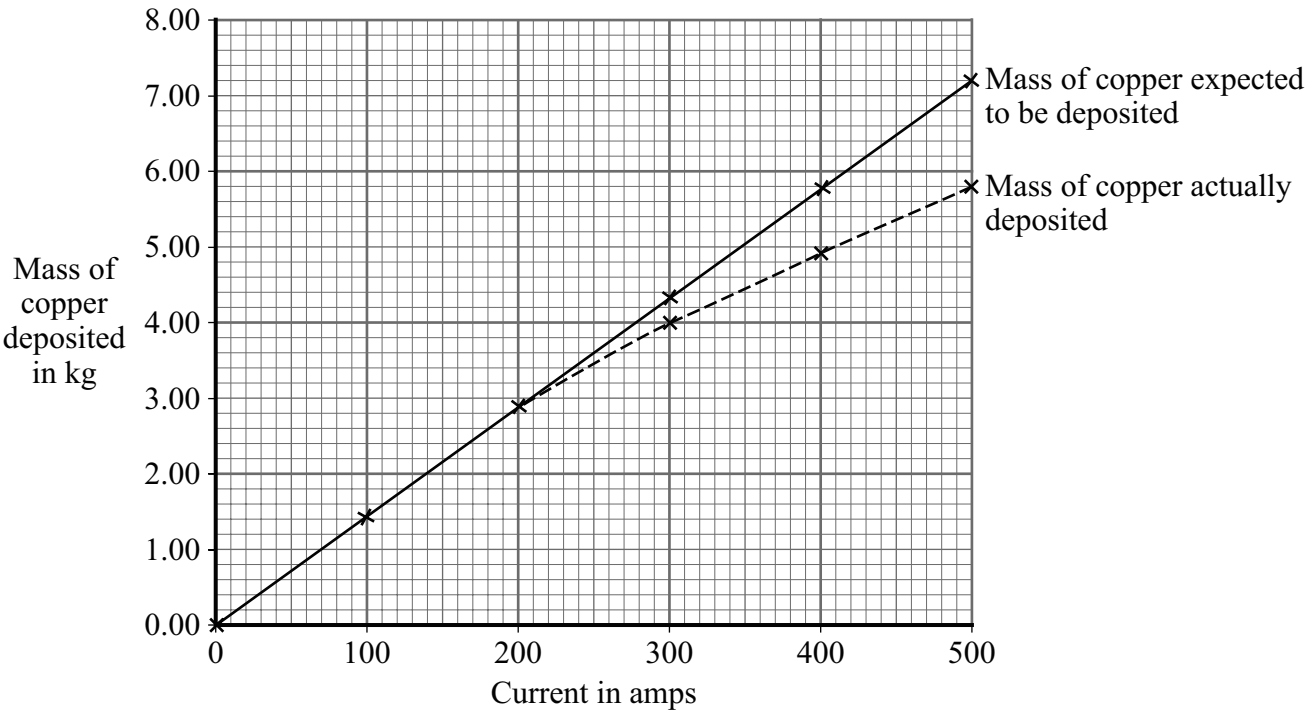
(2 marks)

12 The company decided that it was taking too long to deposit the copper. The company increased the current and measured the mass of copper deposited on the negative electrode.

The company worked out the mass of copper that it expected to be deposited and compared this mass with the mass of copper that was actually deposited.

The results are shown in **Graph 1**.

Graph 1



(a) Describe in detail how the mass of copper expected to be deposited differs from the mass of copper that was actually deposited.

.....

.....

.....

.....

(2 marks)

(b) What would you expect to see under the negative electrode as a result of this difference in mass?

.....

.....

(1 mark)

(c) What is the highest value of current that the company should use in its purification process?

..... amps

Explain your answer.

.....

.....

.....

.....

(2 marks)

13 **Table 2** shows the properties of some metals that could be used for making the negative electrode.

Table 2

Metal	Cost in £/tonne	Relative strength	Density in g/cm^3
Copper	2600	30	8.9
Steel	400	40	7.7
Titanium	9000	20	4.5
Aluminium	1300	10	2.7

The company decided to make the negative electrodes out of steel.

Do you agree with the company's choice?

Draw a ring around your answer. **Yes / No**

Explain your answer.

.....

.....

(1 mark)

Turn over for the next question

LEAVE MARGIN BLANK

14 The company claimed that its copper process was 'clean' because its purification process used electricity and had very little effect on the environment.

Discuss the claim made by the company.

You should explain why you agree or disagree with the company's claims.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

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.....

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(3 marks)

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END OF QUESTIONS