

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**Advanced Subsidiary GCE**

**CHEMISTRY**

**2811**

Foundation Chemistry

Thursday

**10 JUNE 2004**

Morning

1 hour

Candidates answer on the question paper.

Additional materials:

*Data Sheet for Chemistry*

Scientific Calculator

Candidate Name	Centre Number	Candidate Number												
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**TIME** 1 hour

**INSTRUCTIONS TO CANDIDATES**

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers in the spaces provided on the question paper.
- Read each question carefully and make sure you know what you have to do before starting your answer.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use a scientific calculator.
- You may use the *Data Sheet for Chemistry*.
- You are advised to show all the steps in any calculations.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	13	
2	14	
3	10	
4	12	
5	11	
<b>TOTAL</b>	<b>60</b>	

**This question paper consists of 12 printed pages.**

Answer **all** the questions.

1 A fifty pence coin contains nickel alloyed with a metal **A**.

(a) Nickel exists as a mixture of three isotopes, nickel-58, nickel-60 and nickel-62.

Complete the table below to show the atomic structures of the isotopes in metallic nickel.

isotope	protons	neutrons	electrons
nickel-58			
nickel-60			
nickel-62			

[3]

(b) Metal **A** can be identified from its relative atomic mass.

Analysis of a fifty pence coin showed that two isotopes of metal **A** were present with the following percentage abundances.

isotope	isotope 1	isotope 2
relative isotopic mass	63.0	65.0
% abundance	77.2	22.8

(i) What analytical method is used to obtain this information?

.....[1]

(ii) Define the term *relative atomic mass*.

.....  
 .....  
 .....  
 .....[3]

- (iii) Calculate the relative atomic mass of the sample of metal **A**.  
Give your answer to three significant figures.

answer .....[2]

- (iv) Use your answer to (b)(iii) and the *Data Sheet* to suggest the identify of metal **A**.

.....[1]

- (c) Nickel makes up 25% of the total mass of a fifty pence coin. A fifty pence coin has a mass of 8.0 g.

- (i) Calculate how many **moles** of nickel atoms are in a fifty pence coin.

answer ..... mol [2]

- (ii) Calculate the **number** of atoms of nickel in a fifty pence coin.

$$L = 6.02 \times 10^{23} \text{ mol}^{-1}$$

answer ..... atoms [1]

[Total: 13]

2 Magnesium, fluorine and magnesium fluoride have different types of bonding and different properties.

(a) Magnesium has metallic bonding.

(i) Draw a diagram to show what is meant by *metallic* bonding.

Label the diagram.

[2]

(ii) Why is magnesium a good conductor of electricity?

.....  
.....[1]

(b) Fluorine,  $F_2$ , has covalent bonding.

(i) State what is meant by a *covalent* bond.

.....  
.....[2]

(ii) Draw a '*dot-and-cross*' diagram to show the covalent bonding in fluorine. Show outer electron shells only.

[1]

(c) Magnesium fluoride, MgF<sub>2</sub>, has ionic bonding.

(i) How does *ionic bonding* hold particles in MgF<sub>2</sub> together?

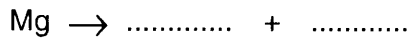
.....  
.....[2]

(ii) Draw a '*dot-and-cross*' diagram for magnesium fluoride, MgF<sub>2</sub>. Show outer electron shells only.

[2]

(iii) Magnesium fluoride is produced when magnesium reacts with fluorine.

Complete the half-equations below to show the formation of the ions in magnesium fluoride in this reaction.



(iv) A student found that magnesium fluoride has different electrical conductivities when solid and when dissolved in water.

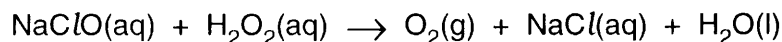
Explain these **two** observations.

.....  
.....  
.....  
.....[2]

[Total: 14]

- 3 A household bleach contains sodium chlorate(I),  $\text{NaClO}$ , as its active ingredient.

The concentration of  $\text{NaClO}$  in the bleach can be found by using its reaction with hydrogen peroxide,  $\text{H}_2\text{O}_2$ .



- (a) Chlorine has been reduced in this reaction.

Use oxidation numbers to prove this.

.....  
 .....  
 .....[2]

- (b) A student added an excess of aqueous hydrogen peroxide to  $5.0 \text{ cm}^3$  of the bleach.  $84 \text{ cm}^3$  of oxygen gas were released.

- (i) How many moles of  $\text{O}_2$  were released?

Assume that, under the laboratory conditions,  $1.00 \text{ mol}$  of gas molecules occupies  $24 \text{ dm}^3$ .

answer ..... mol [1]

- (ii) How many moles of  $\text{NaClO}$  were in  $5.0 \text{ cm}^3$  of the bleach?

answer ..... mol [1]

- (iii) What was the concentration, in  $\text{mol dm}^{-3}$ , of  $\text{NaClO}$  in the bleach?

answer .....  $\text{mol dm}^{-3}$  [1]

- (c) The label on the bottle of household bleach states that the bleach contains a minimum of 4.5 g per 100 cm<sup>3</sup> of NaClO.

Use your answer to (b)(iii) to decide whether or not the information on the label is correct.

[3]

- (d) It is extremely important that household bleach is not used with acids. This is because a reaction takes place that releases toxic chlorine gas.

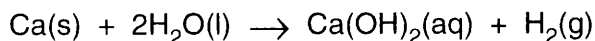
Suggest an equation for the reaction of an excess of hydrochloric acid with household bleach.

.....[2]

[Total: 10]

4 This question is about elements and compounds of Group 2 of the Periodic Table.

- (a) When calcium is added to water, a vigorous reaction takes place, releasing hydrogen gas.



- (i) Suggest a value for the pH of the solution formed in this reaction.

.....[1]

- (ii) Complete the electronic configuration of calcium in

Ca(s)                     $1s^22s^22p^6$  .....

Ca(OH)<sub>2</sub>(aq)         $1s^22s^22p^6$  ..... [2]

(b) Carbon dioxide is bubbled through aqueous calcium hydroxide.

- (i) A milky white precipitate **A** forms.

Identify precipitate **A** and write down an equation for its formation.

identity of precipitate **A** .....

equation ..... [2]

- (ii) As more carbon dioxide is bubbled through the solution, precipitate **A** disappears and a colourless solution **B** forms.

Identify solution **B** and write down an equation for its formation.

identity of solution **B** .....

equation ..... [2]

- (iii) Dilute hydrochloric acid is added to solution **B**. A gas is given off and a colourless solution **C** forms.

Suggest the identity of solution **C**.

..... [1]





