

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	
TOTAL	60	

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_2 , has ionic bonding.

(i) How does *ionic bonding* hold particles in MgF_2 together?

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

(ii) Draw a '*dot-and-cross*' diagram for magnesium fluoride, MgF_2 . 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.

$\text{Mg} \rightarrow \dots\dots\dots + \dots\dots\dots$

$\text{F}_2 + \dots\dots\dots \rightarrow \dots\dots\dots$ [2]

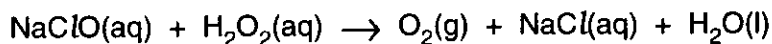
(iv) A student found that magnesium fluoride has different electrical conductivities when solid and when dissolved in water.

Explain these **two** observations.

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

[Total: 14]

- 3 A household bleach contains sodium chlorate(I), NaClO, as its active ingredient. The concentration of NaClO in the bleach can be found by using its reaction with hydrogen peroxide, H₂O₂.



- (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 cm³ of the bleach. 84 cm³ of oxygen gas were released.

- (i) How many moles of O₂ were released?

Assume that, under the laboratory conditions, 1.00 mol of gas molecules occupies 24 dm³.

answer mol [1]

- (ii) How many moles of NaClO were in 5.0 cm³ of the bleach?

answer mol [1]

- (iii) What was the concentration, in mol dm⁻³, of NaClO in the bleach?

answer 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 cm³ 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.

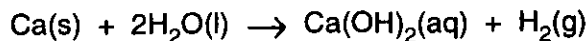
Suggest an equation for the reaction of an excess of hydrochloric acid with household bleach.

.....[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)₂(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]

(c) When barium metal is added to water, the reaction taking place is much more vigorous than with calcium.

Explain why barium is more reactive than calcium.

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.....

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[4]

[Total: 12]

END OF QUESTION PAPER

