

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary GCE

CHEMISTRY

2811

Foundation Chemistry

Tuesday

11 JANUARY 2005

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	17	
2	14	
3	17	
4	12	
TOTAL	60	

This question paper consists of 10 printed pages and 2 blank pages.

Answer **all** the questions.

1 Carbon is in the p-block of the Periodic Table. Naturally occurring carbon contains a mixture of two isotopes, ^{12}C and ^{13}C .

(a) Complete the table below for the atomic structure of the isotopes ^{12}C and ^{13}C .

isotope	protons	neutrons	electrons
^{12}C			
^{13}C			

[2]

(b) A sample of carbon was found to contain 95% of ^{12}C and 5% of ^{13}C .

(i) How could this information be obtained experimentally?

.....[1]

(ii) The ^{13}C isotope has a relative isotopic mass of 13.00.
Define the term *relative isotopic mass*.

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

(iii) Calculate the relative atomic mass of this sample of carbon to three significant figures.

$A_r = \dots\dots\dots$ [2]

(c) Complete the electronic configuration of carbon.

$1s^2 \dots\dots\dots$ [1]

(d) The burning of fossil fuels containing carbon produces carbon dioxide.
Draw a 'dot-and-cross' diagram of carbon dioxide, showing outer shell electrons only.

[2]

(e) Lime water is used as the common laboratory test for carbon dioxide.

(i) State the name or formula of the chemical that is dissolved in water to make lime water.

.....[1]

(ii) Write the chemical equation that takes place in this test for carbon dioxide. Include state symbols.

.....[2]

(f) Carbon dioxide can be prepared easily in the laboratory by the action of heat on most carbonates.

Construct an equation to illustrate this reaction.

.....[1]

(g) In 2000, the mass of CO₂ emitted in the UK was equivalent to 1 kg per person in every hour.

(i) Calculate the volume of 1 kg of carbon dioxide. Assume that 1 mole of CO₂ occupies 24 dm³.

volume = dm³ [2]

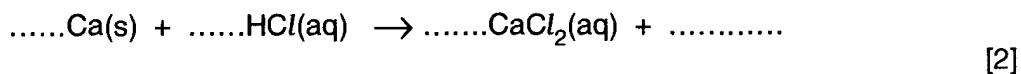
(ii) The UK has set a target to cut CO₂ emissions by 60% of the 2000 value by 2050. Calculate the reduction needed in the volume of CO₂ emissions each hour per person if the target is to be met.

answer: dm³
[1]

[Total: 17]

2 A student prepared an aqueous solution of calcium chloride by reacting calcium with hydrochloric acid. Calcium chloride contains Ca^{2+} and Cl^- ions.

(a) Complete and balance the following equation for this reaction.



(b) This is a redox reaction.
Use oxidation states to show that calcium has been oxidised.

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

(c) Draw a 'dot-and-cross' diagram for CaCl₂.

[2]

(d) Aqueous silver nitrate was added to the solution of CaCl₂.

(i) State what you would expect to see.

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

(ii) Write an ionic equation for this reaction.

..... [1]

(e) To prepare the aqueous calcium chloride, the student added the exact amount of calcium so that all the hydrochloric acid had reacted. She used 50 cm³ of 2.0 mol dm⁻³ HCl.

(i) How many moles of HCl had she used?

[1]

(ii) Calculate the mass of calcium that she used.

[2]

(iii) The student added some more calcium and she was surprised that a reaction still took place.

- Explain this observation.
- Write a balanced equation for this reaction.

.....

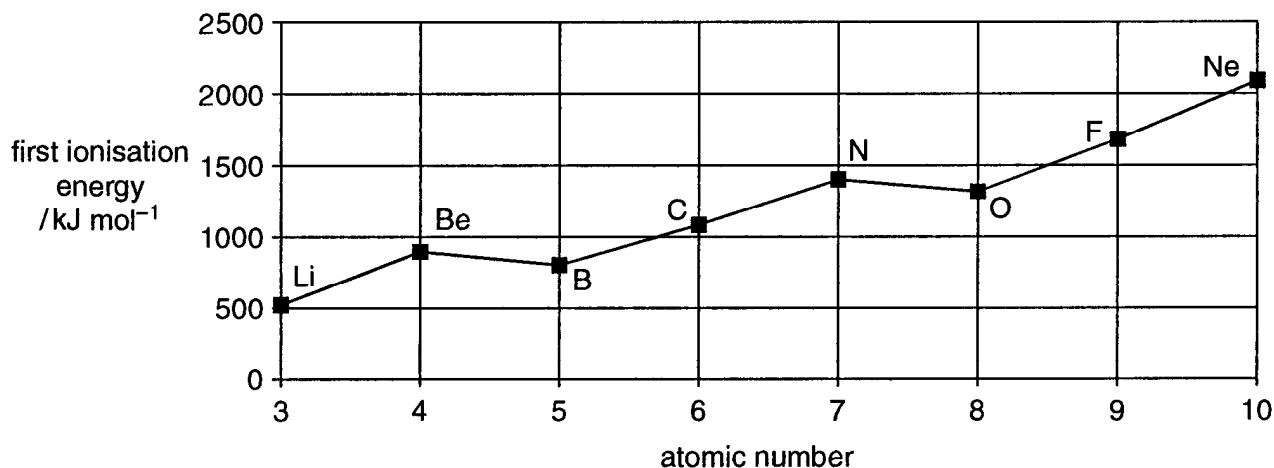
.....

.....

.....[3]

[Total: 14]

(b) The diagram below shows the variation in the first ionisation energies of elements across Period 2 of the Periodic Table.



(i) Define the term *first ionisation energy*.

.....

 [3]

(ii) Explain why the first ionisation energies show a **general** increase across Period 2.

.....

 [2]

(iii) Explain why the first ionisation energy of B is **less** than that of Be.

.....

 [2]

(iv) Estimate a value for the first ionisation energy of the element with atomic number 11. Explain how you made your choice.

First ionisation energy = kJ mol⁻¹

.....

 [2]

[Total: 17]

