OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary GCE

CHEMISTRY 2811

Foundation Chemistry

Wednesday **4 JUNE 2003** Morning 1 hour

Candidates answer on the question paper.
Additional materials:
Data Sheet for Chemistry
Scientific calculator

Candidate Name	Centre Number	Candidate Number

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	11	
2	11	
3	15	
4	12	
5	11	
TOTAL	60	

This question paper consists of 11 printed pages and 1 blank page.

Registered Charity Number: 1066969
[Turn over

Answer **all** the questions.

1 This question is about two elements, **A** and **B**, in the Periodic Table.

(a) Each atom of element **A** has 15 electrons.

(i) Identify element **A**.

..... [1]

(ii) Complete the electronic configuration of an atom of **A**.

$1s^2$ ..... [1]

(iii) Predict the charge on an ion of **A** and complete its electronic configuration.

charge on ion .....

electronic configuration of ion of **A** $1s^2$ ..... [2]

(b) Element **B** exists as a mixture of three isotopes.

(i) What is the difference between the atomic structures of isotopes?

..... [1]

(ii) The atoms of element **B** have eight electrons in the 3d sub-shell.

Identify element **B**.

..... [1]

(c) A sample of element **B** was analysed in a mass spectrometer. The relative atomic mass of element **B** can be calculated from the results shown in Table 1.1 below.

Table 1.1

	isotope 1	isotope 2	isotope 3
relative isotopic mass	58.0	60.0	62.0
percentage composition / %	68.2	27.3	4.5

(i) Explain what is meant by the *relative atomic mass of element **B***.

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..... [3]

(ii) Using the information in Table 1.1, calculate the relative atomic mass of this sample of **B**. Give your answer to three significant figures.

[2]

[Total: 11]

2 The halogens chlorine, bromine and iodine each exist as diatomic molecules at room temperature and pressure.

(a) Draw a '*dot-and-cross*' diagram of a bromine molecule, showing outer electrons only.

[1]

(b) The boiling points of the halogens chlorine to iodine are shown below.

halogen	boiling point / °C
chlorine	–35
bromine	59
iodine	184

Explain why the halogens show this trend in boiling points.

.....

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..... [3]

(c) When chlorine, Cl_2, is added to aqueous sodium bromide, NaBr, a reaction takes place.

(i) State what you would see in this reaction.

..... [1]

(ii) Write an equation for this reaction.

..... [1]

(iii) What happens to electrons during this reaction?

.....

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..... [2]

(iv) Why does no reaction take place when bromine is added to aqueous sodium chloride?

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..... [1]

(v) Describe a simple test to confirm the presence of iodide ions in aqueous sodium iodide.

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..... [2]

[Total: 11]

3 Calcium oxide, CaO, is used for making cement which is widely used in the construction industry. Calcium oxide can be prepared as 'quicklime' by heating limestone in a lime kiln to about 550 °C. The calcium carbonate in the limestone decomposes into calcium oxide and carbon dioxide.

$$CaCO_3 \longrightarrow CaO + CO_2$$

(a) Draw a *'dot-and-cross'* diagram of calcium oxide, showing outer electrons only.

[2]

(b) In $CaCO_3$, what is the oxidation state of

(i) Ca,

..... [1]

(ii) C?

..... [1]

(c) Calculate the mass of CaO that could be made from limestone containing 20 tonnes of $CaCO_3$.

molar masses: $CaCO_3$, 100 g mol^{-1}; CaO, 56 g mol^{-1}.

1 tonne = 10^6 g.

[2]

(d) When water is added to quicklime, a vigorous reaction takes place forming slaked lime, $Ca(OH)_2$.

Write an equation for the formation of slaked lime in this reaction.

..... [1]

(e) Farmers often add 'lime' to acid soils. The lime is mostly present as slaked lime.

A chemist neutralised 25.0 cm^3 0.200 mol dm^{-3} HC*l* with slaked lime.

$$Ca(OH)_2(s) + 2HCl(aq) \longrightarrow CaCl_2(aq) + 2H_2O(l)$$

(i) What is the molar mass of $Ca(OH)_2$?

[1]

(ii) How many moles of HC*l* were neutralised?

[1]

(iii) Calculate the mass of $Ca(OH)_2$ that neutralises this HC*l*.

[2]

(iv) The chemist neutralised the same amount of HC*l* with NaOH. Explain why the chemist would need to use more moles of NaOH than $Ca(OH)_2$.

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..... [2]

(f) A clear solution of slaked lime in water was made by dissolving $Ca(OH)_2$ in an excess of water. When this solution was left exposed to the air, the solution slowly became milky as a fine white precipitate formed.

Suggest why this happened.

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..... [2]

[Total: 15]

4 Chemicals show a range of different structures. The table below shows four types of structure.

structure	example
giant metallic	
giant ionic	
giant molecular	
simple molecular	

(a) Complete the table by giving an example of each type of structure. Write its name or formula in the second column.

[4]

(b) A giant metallic structure has metallic bonding.

(i) Draw a labelled diagram to show metallic bonding.

[2]

(ii) How does a substance with a giant metallic structure conduct electricity?

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..... [1]

(c) Explain why a substance with a giant ionic lattice conducts electricity when molten but **not** when solid.

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..... [2]

(d) Explain why a substance with a **giant** molecular structure has a higher boiling point than a substance with a **simple** molecular structure.

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..... [3]

[Total: 12]

5 In this question, one mark is available for the quality of written communication.

Explain how you can predict the shapes of, and bond angles in, simple molecules. In your answer, you should choose examples of **four** different molecular shapes.

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Quality of Written Communication [1]

[Total: 11]