

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary GCE

CHEMISTRY

Foundation Chemistry

2811

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

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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	11	
2	11	
3	15	
4	12	
5	11	
TOTAL	60	

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

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*.

.....
.....
.....
..... [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.

.....

.....

.....

..... [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?

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

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

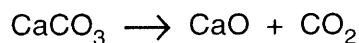
.....
..... [1]

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

.....
.....
..... [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.



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

[2]

- (b) In CaCO₃, 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 CaCO₃.

molar masses: CaCO₃, 100 g mol⁻¹; CaO, 56 g mol⁻¹.

1 tonne = 10⁶ g.

[2]

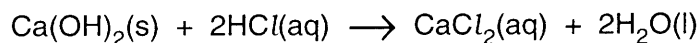
- (d) When water is added to quicklime, a vigorous reaction takes place forming slaked lime, Ca(OH)₂.

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 cm³ 0.200 mol dm⁻³ HCl with slaked lime.



(i) What is the molar mass of Ca(OH)₂?

[1]

(ii) How many moles of HCl were neutralised?

[1]

(iii) Calculate the mass of Ca(OH)₂ that neutralises this HCl.

[2]

(iv) The chemist neutralised the same amount of HCl with NaOH. Explain why the chemist would need to use more moles of NaOH than Ca(OH)₂.

.....

 [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.

.....

 [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?

.....

..... [1]

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

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

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

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

[Total: 12]

