

**ADVANCED SUBSIDIARY GCE
CHEMISTRY**

Foundation Chemistry

WEDNESDAY 4 JUNE 2008

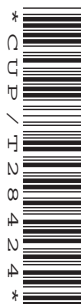
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Morning
Time: 1 hour

Candidates answer on the question paper

Additional materials (enclosed): *Data Sheet for Chemistry* (Inserted)

Additional materials (required):
Scientific calculator



Candidate
Forename

Candidate
Surname

Centre
Number

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Candidate
Number

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INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use a scientific calculator.
- A copy of the *Data Sheet for Chemistry* is provided as an insert with this question paper.
- You are advised to show all the steps in any calculations.

FOR EXAMINER'S USE

Qu.	Max.	Mark
1	12	
2	14	
3	18	
4	16	
TOTAL	60	

This document consists of **10** printed pages, **2** blank pages and a *Data Sheet for Chemistry*.

Answer **all** the questions.

- 1 The element indium, atomic number 49, is a very soft, silvery-white metal with a brilliant shine. One strange property of indium is that it makes a high-pitched 'scream' when bent! It occurs as a mixture of two isotopes, ^{113}In and ^{115}In .

(a) Complete the table below for the isotopes of indium.

isotope	protons	neutrons	electrons
^{113}In			
^{115}In			

[2]

- (b) A sample of indium contains 4.23% of ^{113}In and 95.77% ^{115}In .

Calculate the relative atomic mass of the indium sample.

Give your answer to one decimal place.

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

- (c) Indium has metallic bonding.

Draw a **labelled** diagram to show metallic bonding.

[2]

(d) A compound of indium and iodine has the following percentage composition by mass:

In, 23.19%; I, 76.81%. The relative molecular mass of this compound is 992.

(i) Define the term *relative molecular mass*.

.....

.....

.....

.....[3]

(ii) Calculate the molecular formula of this compound.

molecular formula = [3]

[Total: 12]

(a) From these first 20 elements **only**, identify an element that fits each of the following descriptions.

- [1]

- [1]

- [1]

- [1]

- [1]

- [1]

(b) Elements form many compounds.

Choose compounds, formed from the first 20 elements **only**, to illustrate ionic and covalent bonding.

Showing outer electrons only, draw '*dot-and-cross*' diagrams of your chosen examples.

(i) '*Dot-and-cross*' diagram for a compound with ionic bonding.

[2]

(ii) '*Dot-and-cross*' diagram for a compound with covalent bonding.

[2]

(c) Across a period in the Periodic Table, elements often show characteristic trends.

Describe and explain the trend in atomic radius across Period 3.

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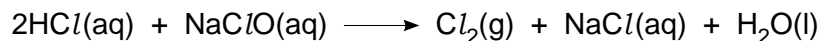
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.....[4]

[Total: 14]

- 3 (a) A student prepared some chlorine gas on a small scale by reacting hydrochloric acid with household bleach.

The reaction is shown below.



The student reacted 1.0 cm^3 of 6.0 mol dm^{-3} HCl with 3.0 cm^3 household bleach. 55 cm^3 of chlorine gas were produced. The hydrochloric acid was in excess and this ensured that all the NaClO in the bleach was reacted.

Under these conditions, 1.0 mol of $\text{Cl}_2(\text{g})$ has a volume of 24 dm^3 .

- (i) Calculate how many moles of $\text{Cl}_2(\text{g})$ were produced.

answer = mol [1]

- (ii) Calculate the concentration, in mol dm^{-3} , of NaClO in the bleach.

concentration = mol dm^{-3} [1]

- (iii) Calculate the number of moles of HCl that remained **after** the reaction.

answer = mol [3]

- (b) A student carries out two experiments.

- (i) The student bubbles some chlorine gas through a solution of sodium iodide. The solution turns a brown colour.

Explain this observation and write an equation for the reaction that takes place.

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[2]

- (ii) The student bubbles chlorine gas through aqueous silver nitrate. A white precipitate forms. Explain this observation including equations for any reactions that take place.

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.....[4]

- (c) HCl is a polar molecule but CCl_4 is a non-polar molecule. This difference can be explained by consideration of electronegativity and molecular shapes.

- (i) Explain the term *electronegativity*.

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.....

.....[2]

- (ii) Draw a 3-D diagram to show the shape of a molecule of CCl_4 . State the bond angle.

[2]

- (iii) Explain why HCl is a polar molecule but CCl_4 is a non-polar molecule.

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.....[3]

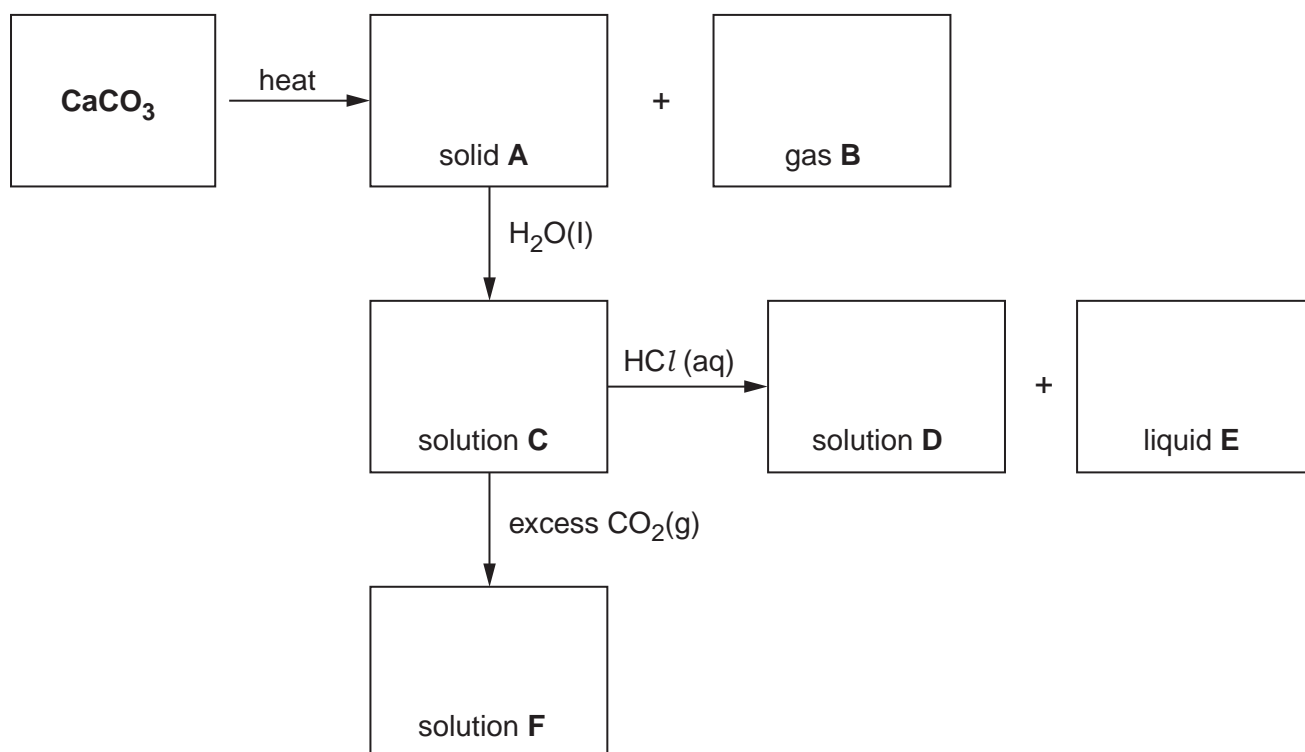
[Total: 18]

[Turn over

4 This question looks at the chemistry of Group 2 elements and their compounds.

(a) The flowchart below shows some reactions involving calcium compounds.

Identify substances **A–F** by writing their **formulae** in the boxes.



[6]

(b) In this question, one mark is available for the quality of spelling, punctuation and grammar.

All the Group 2 elements react with oxygen.

- Write a balanced equation, with state symbols, for the reaction of calcium with oxygen.
Using this reaction, explain what is meant by oxidation and reduction in terms of electrons. [4]
- State and explain the trend in reactivity of the Group 2 elements with oxygen. [5]

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[Total: 16]

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