

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

CHEMISTRY

2815/01

Trends and Patterns

Tuesday

28 JUNE 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	16	
2	17	
3	12	
TOTAL	45	

This question paper consists of 8 printed pages.

- (c) The melting point of magnesium chloride is much higher than that of silicon(IV) chloride.

Explain this difference in terms of structure and bonding.

.....

 [3]

- (d) Hot aluminium reacts with dry chlorine to give a white compound which has a relative molecular mass of 267.

(i) Deduce the molecular formula for the white compound.

answer [1]

(ii) Write an equation for the reaction between aluminium and dry chlorine.

..... [1]

(iii) Explain why solid aluminium chloride does not conduct electricity, but when aluminium chloride is added to water, the resulting solution will conduct electricity.

.....

 [1]

- (e) Phosphorus reacts with excess chlorine to form a compound with an empirical formula PCl_5 . The solid compound has positive and negative ions.

The positive ion has the formula PCl_4^+ .

The formula of the negative ion includes one phosphorus atom.

Suggest the formula of the negative ion.

..... [1]

[Total: 16]

2 The carbonates and nitrates of Group 2 elements decompose when heated.

(a) Calcium oxide is manufactured by the decomposition of calcium carbonate.

(i) Write the equation for this decomposition.

..... [1]

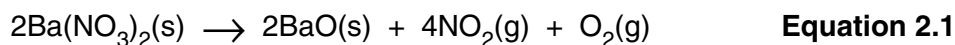
(ii) Explain why the decomposition temperature of calcium carbonate is much lower than that of barium carbonate.

.....

.....

..... [2]

(b) Barium nitrate decomposes when heated to make barium oxide, nitrogen dioxide and oxygen.



(i) Use oxidation states to explain why this decomposition reaction involves both oxidation **and** reduction.

.....

.....

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..... [3]

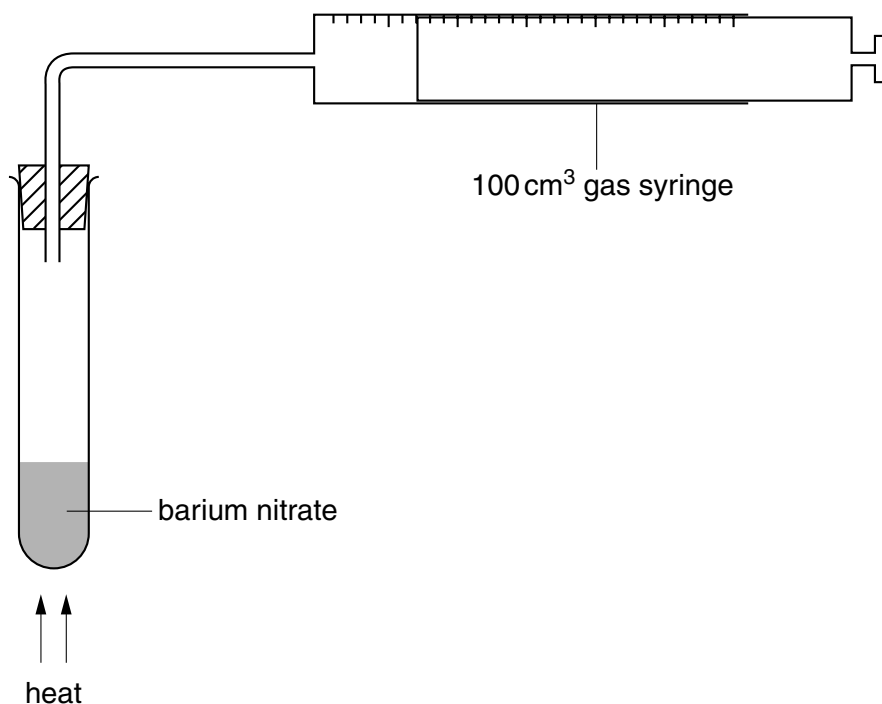
(ii) Calculate the enthalpy change of reaction, ΔH_r , in kJ mol^{-1} , for the thermal decomposition of barium nitrate using the enthalpy changes of formation, ΔH_f , given in the table.

compound	$\Delta H_f / \text{kJ mol}^{-1}$
$\text{Ba}(\text{NO}_3)_2(\text{s})$	-992
$\text{BaO}(\text{s})$	-558
$\text{NO}_2(\text{g})$	+33

answer kJ mol^{-1} [3]

- (c) A student investigates the volume of gas formed when barium nitrate is heated.

The diagram shows the apparatus the student uses.



- (i) A 1.31 g sample of barium nitrate is completely decomposed.

Use **Equation 2.1** to calculate the volume, in cm^3 , of gas formed at room temperature and pressure.

1 mol of gas molecules occupies $24\,000\text{ cm}^3$ at room temperature and pressure.

answer cm^3 [3]

- (ii) Suggest **one** problem that the student may encounter when carrying out the investigation.

.....

..... [1]

(d) Barium nitrate has a higher decomposition temperature than calcium nitrate. One of the reasons for this is the difference between the lattice enthalpy of barium oxide and that of calcium oxide.

(i) Explain what is meant by the term *lattice enthalpy*.

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

(ii) Explain why the lattice enthalpy of barium oxide is much **less exothermic** than that of calcium oxide.

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

[Total: 17]

