

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	C	entr	e Nı	umb	er	(Cand Num	lidate nber	

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		

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Answer all the questions.

1	The question below relates to chlorides of some of the elements in Period 3 of the Periodic Table.				
	(a)	Draw 'dot and cross' diagrams to show the bonding in magnesium chloride and silicon(IV) chloride. Only draw the outer shell electrons.			
	(b)	$\begin{tabular}{ll} \end{tabular} \begin{tabular}{ll} \end{tabular} \beg$			
		chloride are added separately to cold water. You may include in your answer			
		the pH of any resulting solution,			
		 relevant chemical equations, 			
		experimental observations,			
		the name of the process taking place.			

(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]

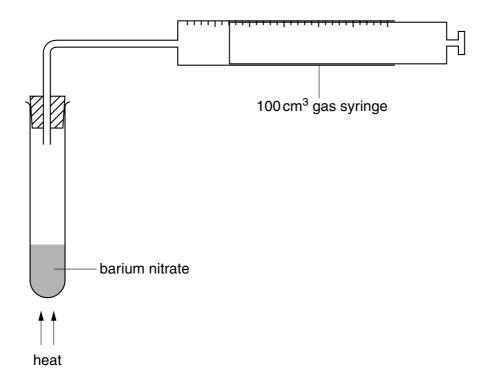
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The	The carbonates and nitrates of Group 2 elements decompose when heated.						
(a)	Cal	Calcium oxide is manufactured by the decomposition of calcium carbonate.					
	(i)	Write the equ	ation for this decomp	oosition.			
					[1]		
	(ii)		the decomposition to arium carbonate.	emperature of calciu	m carbonate is much lower		
					[2]		
(b)		ium nitrate ded gen.	composes when hea	ted to make barium	oxide, nitrogen dioxide and		
		2Ba	$(NO_3)_2(s) \rightarrow 2BaC$	$O(s) + 4NO_2(g) + C$	$O_2(g)$ Equation 2.1		
	(i)						
					[3]		
	(ii)	Calculate the decomposition given in the ta	n of barium nitrate	of reaction, $\Delta H_{ m r}$, in using the enthalpy	n kJ mol $^{-1}$, for the thermal changes of formation, $\Delta H_{ m f}$,		
			compound	$\Delta H_{ m f}$ / kJ mol $^{-1}$			
			Ba(NO ₃) ₂ (s)	-992			
				I			

compound	$\Delta H_{ m f}/{ m kJmol^{-1}}$
Ba(NO ₃) ₂ (s)	-992
BaO(s)	-558
NO ₂ (g)	+33

(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 cm³, of gas formed at room temperature and pressure.

1 mol of gas molecules occupies 24 000 cm³ at room temperature and pressure.

						answer			cm ³	[3]
(ii)	Suggest one investigation.	problem	that th	ne studen	t may	encounter	when	carrying	out	the
										[1]

(d)	the	um nitrate has a higher decomposition temperature than calcium nitrate. One of reasons for this is the difference between the lattice enthalpy of barium oxide and of calcium oxide.
	(i)	Explain what is meant by the term <i>lattice enthalpy</i> .
		[2]
		[4]
	(ii)	Explain why the lattice enthalpy of barium oxide is much less exothermic than that of calcium oxide.
		[2]
		[Total: 17]

3 In this question, one mark is available for the quality of use and organisation of scientific terms.

Copper and iron are typical transition elements. One of the characteristic properties of a transition element is that it can form complex ions.

- Explain in terms of electronic configuration why copper is a transition element.
- Give an example of a complex ion that contains copper. Draw the three dimensional shape of the ion and describe the bonding within this complex ion.

Transition elements show typical metallic properties. Describe three other typical

compounds.

 [11]
Quality of Written Communication [1]

END OF QUESTION PAPER

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