

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**Advanced Subsidiary GCE**

**CHEMISTRY**

**2813/01**

How Far, How Fast?

Friday

**9 JANUARY 2004**

Morning

45 minutes

Candidates answer on the question paper.

Additional materials:

*Data Sheet for Chemistry*

Scientific calculator

Candidate Name	Centre Number	Candidate Number												
	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> </table>							<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> </table>						

**TIME** 45 minutes

**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	13	
3	10	
4	11	
<b>TOTAL</b>	<b>45</b>	

**This question paper consists of 8 printed pages.**

Answer **all** the questions.

- 1 There are several oxides of lead. This question is about the enthalpy changes that occur during the reactions of some of these oxides.

(a) (i) Define the term *enthalpy change of formation*.

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

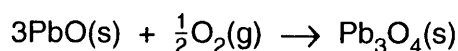
(ii) What are the standard conditions of temperature and pressure used in enthalpy calculations?

.....[1]

(b) Write an equation, including state symbols, representing the standard enthalpy change of formation of PbO.

.....[2]

(c) Metal priming paints often contain 'red lead', Pb<sub>3</sub>O<sub>4</sub>. Red lead can be made by heating PbO in the presence of air.



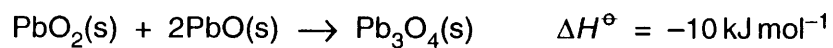
(i) Use the  $\Delta H_f^\ominus$  values in Table 1.1 to calculate the standard enthalpy change for the above reaction.

**Table 1.1**

compound	$\Delta H_f^\ominus / \text{kJ mol}^{-1}$
PbO(s)	-217
Pb <sub>3</sub> O <sub>4</sub> (s)	-718

$\Delta H^\ominus = \dots\dots\dots \text{kJ mol}^{-1}$  [3]

- (ii) Red lead can also be obtained by reacting  $\text{PbO}_2$  with  $\text{PbO}$ .

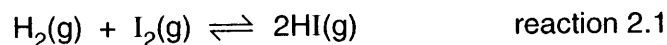


Use the value of  $\Delta H^\ominus$  for this reaction, together with the values of  $\Delta H_f^\ominus$  in Table 1.1, to calculate a value for the enthalpy change of formation of  $\text{PbO}_2(\text{s})$ .

$$\Delta H_f^\ominus = \dots\dots\dots \text{ kJ mol}^{-1} \quad [3]$$

[Total: 11]

- 2 In the vapour state, hydrogen and iodine undergo the following reaction.



- (a) Write an equation, including state symbols, for the bond enthalpy of I–I.

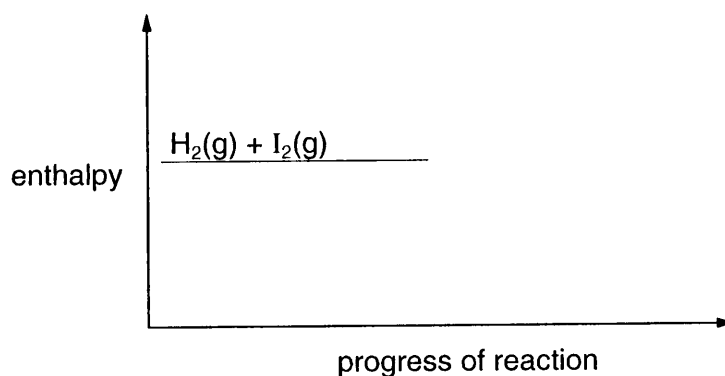
.....[2]

- (b) Use the bond enthalpies given below to calculate the enthalpy change,  $\Delta H_r$ , for the forward reaction in reaction 2.1.

bond	bond enthalpy / $\text{kJ mol}^{-1}$
H–H	+ 436
I–I	+ 151
H–I	+ 298

$$\Delta H_r = \dots\dots\dots \text{kJ mol}^{-1} \quad [3]$$

- (c) Draw an enthalpy profile diagram for the forward reaction, labelling the products and  $\Delta H_r$ .



[2]

(d) Hydrogen iodide dissolves in water to give a solution of hydro-iodic acid, HI(aq). Its reactions are similar to those of hydrochloric acid, HCl(aq).

(i) A length of magnesium ribbon is added to hydrochloric acid.

Describe what you would see in this reaction.

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

(ii) Write a balanced equation for this reaction.

.....[2]

(iii) Write an ionic equation for this reaction.

.....[1]

(e) Hydro-iodic acid and hydrochloric acid are strong acids, whereas hydrofluoric acid, HF(aq), is a weak acid.

Explain the difference between strong and weak acids.

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

[Total: 13]

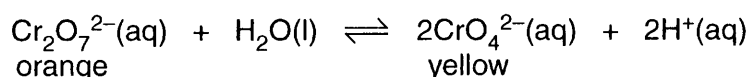
3 (a) State le Chatelier's principle.

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

(b) State **two** characteristics of a dynamic equilibrium.

1 .....  
 2 ..... [2]

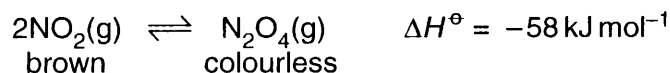
(c) The following equation represents an equilibrium reaction.



Use le Chatelier's principle to describe and explain the colour change (if any) that might take place when dilute  $\text{HCl}(\text{aq})$  is added to a solution containing  $\text{K}_2\text{CrO}_4(\text{aq})$ .

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

(d) The following equation represents another equilibrium reaction.



Use le Chatelier's principle to describe and explain the colour change (if any) that might take place when

(i) a mixture of  $\text{NO}_2(\text{g})$  and  $\text{N}_2\text{O}_4(\text{g})$  is compressed at constant temperature,

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

(ii) a mixture of  $\text{NO}_2(\text{g})$  and  $\text{N}_2\text{O}_4(\text{g})$  is heated at constant pressure.

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

[Total: 10]

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

(a) What effect does a catalyst have on the rate of a reaction, and how does it achieve this effect?

.....  
.....  
.....  
.....  
.....  
.....[4]

(b) Some catalysts are of economic or environmental importance.

Outline **two** examples of processes that involve the use of catalysts. For each example,

- state the starting materials and products,
- state the catalyst,
- and explain whether the catalyst is a heterogeneous or a homogeneous catalyst.

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....[6]

Quality of Written Communication [1]

[Total: 11]