

**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 |  |  |  |  |  |  |  |  |  |
|----------------|---|------------------|--|--|--|--|--|--|--|--|--|
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|                |   |                  |  |  |  |  |  |  |  |  |  |

**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.

| <b>FOR EXAMINER'S USE</b> |           |      |
|---------------------------|-----------|------|
| Qu.                       | Max.      | Mark |
| 1                         | 11        |      |
| 2                         | 13        |      |
| 3                         | 10        |      |
| 4                         | 11        |      |
| <b>TOTAL</b>              | <b>45</b> |      |

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**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]

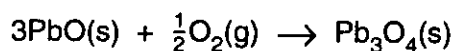
(ii) What are the standard conditions of temperature and pressure used in enthalpy calculations?

.....[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.



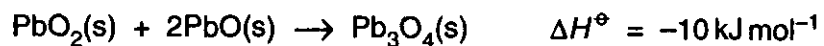
(i) Use the  $\Delta H_f^\ominus$  values in Table 1.1 to calculate the standard enthalpy change for the above reaction.

**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  $\text{PbO}$ .

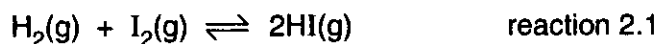


Use the value of  $\Delta H^\ominus$  for this reaction, together with the values of  $\Delta H_f^\ominus$  in Table 1.1, to calculate a value for the enthalpy change of formation of  $\text{PbO}_2(\text{s})$ .

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

[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.

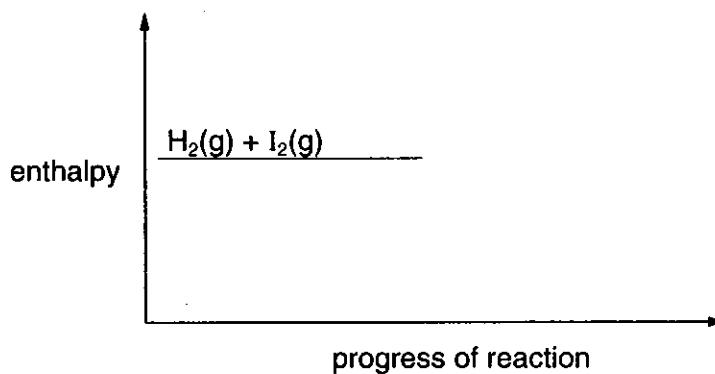
.....[2]

- (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]

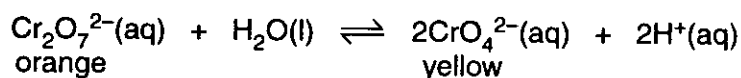
- 3 (a) State le Chatelier's principle.

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

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

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

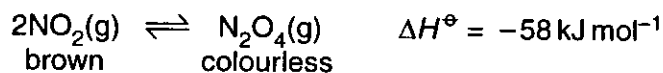
- (c) The following equation represents an equilibrium reaction.



Use le Chatelier's principle to describe and explain the colour change (if any) that might take place when dilute HCl(aq) is added to a solution containing K<sub>2</sub>CrO<sub>4</sub>(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 NO<sub>2</sub>(g) and N<sub>2</sub>O<sub>4</sub>(g) is compressed at constant temperature,

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

- (ii) a mixture of NO<sub>2</sub>(g) and N<sub>2</sub>O<sub>4</sub>(g) is heated at constant pressure.

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

[Total: 10]



**END OF QUESTION PAPER**