

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.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	11	
2	13	
3	10	
4	11	
TOTAL	45	

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]

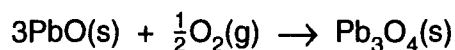
(ii) What are the standard conditions of temperature and pressure used in enthalpy calculations?

.....[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', Pb₃O₄. Red lead can be made by heating PbO in the presence of air.



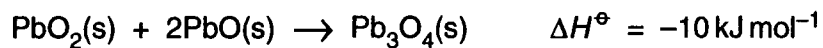
(i) Use the ΔH_f^\ominus values in Table 1.1 to calculate the standard enthalpy change for the above reaction.

Table 1.1

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

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

(ii) Red lead can also be obtained by reacting PbO_2 with PbO .

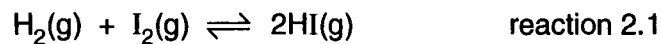


Use the value of ΔH^\ominus for this reaction, together with the values of ΔH_f^\ominus in Table 1.1, to calculate a value for the enthalpy change of formation of $\text{PbO}_2(\text{s})$.

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

[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.

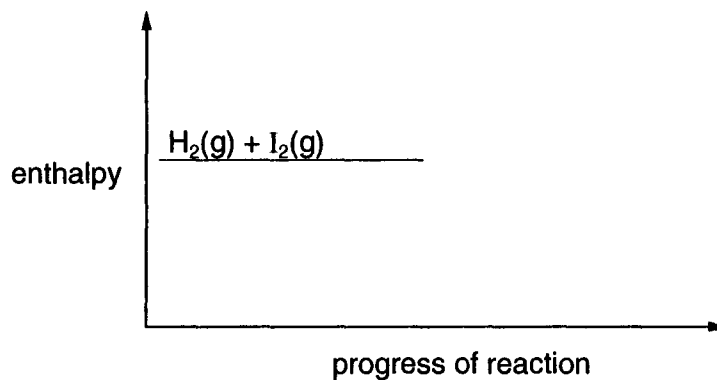
.....[2]

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

bond	bond enthalpy / 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 ΔH_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.

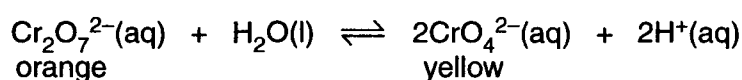
.....

[2]

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

1
 2
[2]

(c) The following equation represents an equilibrium reaction.

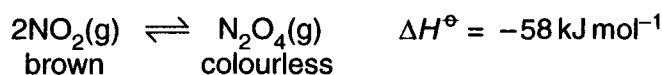


Use le Chatelier's principle to describe and explain the colour change (if any) that might take place when dilute HCl(aq) is added to a solution containing K₂CrO₄(aq).

.....

[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 NO₂(g) and N₂O₄(g) is compressed at constant temperature,

.....

[2]

(ii) a mixture of NO₂(g) and N₂O₄(g) is heated at constant pressure.

.....

[2]

[Total: 10]

