

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

CHEMISTRY

2815/06

Transition Elements

Wednesday

29 JANUARY 2003

Afternoon

50 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 50 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 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.

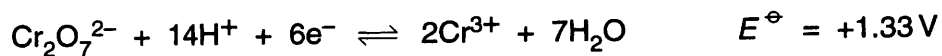
FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	10	
2	11	
3	7	
4	10	
5	7	
TOTAL	45	

This question paper consists of 8 printed pages.

Answer **all** the questions.

- 1 (a) A student wished to analyse the iron(II) content of a tablet given to pregnant women. He decided to oxidise the iron(II) with acidified potassium dichromate(VI).

The standard electrode potentials for the reactions involved are given below.



- (i) Define the term *standard electrode potential*.

.....

 [3]

- (ii) Explain, using the data given, why acidified dichromate(VI), $\text{Cr}_2\text{O}_7^{2-}$, is able to oxidise iron(II), Fe^{2+} .

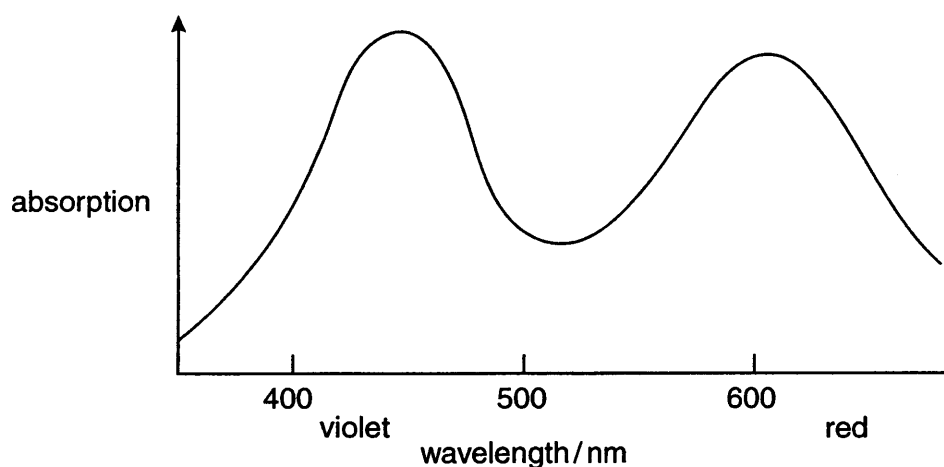
.....
 [1]

- (iii) Construct the equation for this oxidation.

[2]

(b) Aqueous chromium(III) contains the complex ion $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$.

The absorption spectrum of an aqueous solution of chromium(III) is shown below.



Suggest the colour of the solution. Explain your answer.

.....

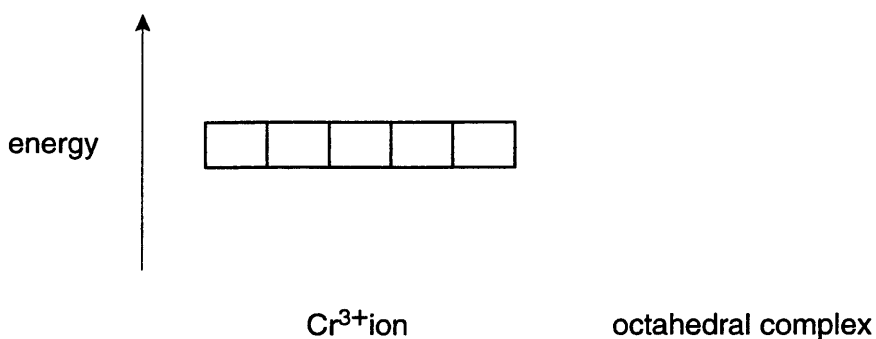
.....

..... [2]

(c) In a Cr^{3+} ion, all five 3d-orbitals have the same energy.

Complete the diagram below to show the splitting of the d-orbital energy levels when the octahedral complex ion, $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$, is formed.

Note: you are **not** required to show the arrangement of electrons in the orbitals.



[2]

[Total: 10]

2 Brass is a copper-containing alloy which is widely used for decorative purposes.

(a) What is the other main metal present in brass?

..... [1]

(b) A sample of brass was analysed to find the percentage copper that it contained.

- 0.500 g of brass was used
- the copper in the brass was converted into Cu^{2+} ions

$$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^{-}$$
- the Cu^{2+} ions were reacted with I^{-} ions to make I_2

$$\text{Cu}^{2+} + 2\text{I}^{-} \rightarrow \frac{1}{2}\text{I}_2 + \text{CuI}$$
- the I_2 was titrated with thiosulphate ions, $\text{S}_2\text{O}_3^{2-}$, using starch indicator

$$\text{I}_2 + 2\text{S}_2\text{O}_3^{2-} \rightarrow \text{S}_4\text{O}_6^{2-} + 2\text{I}^{-}$$
- 22.3 cm^3 of 0.200 mol dm^{-3} thiosulphate were needed for the titration.

(i) Calculate the amount of thiosulphate used in the titration.

..... mol [1]

(ii) Deduce the amount of I_2 that was titrated.

..... mol [1]

(iii) Deduce the amount of copper present in the sample of brass.

..... mol [1]

(iv) Calculate the percentage of copper present in the sample of brass.

[2]

(c) A student carried out the titration but forgot to add the starch indicator.

(i) What colour change would the student see at the end point **without** starch indicator?

from to [2]

(ii) Why is the colour change at the end point easier to see if starch is used?

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

(d) Name another common alloy of copper and give a use for this alloy.

name

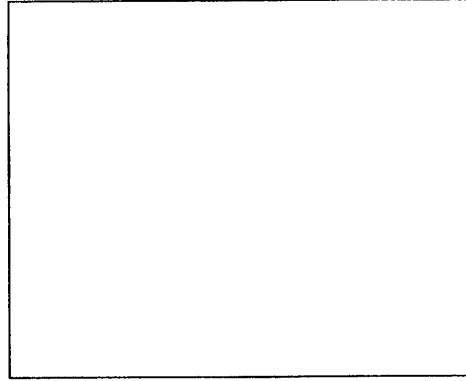
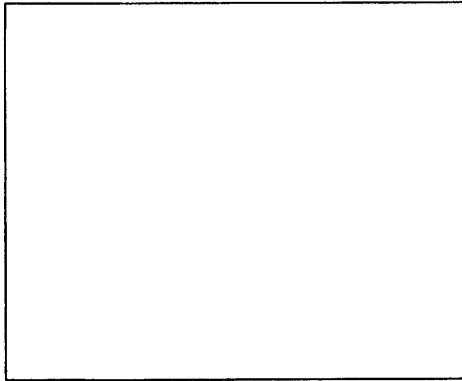
use [2]

[Total: 11]

3 (a) A complex ion contains one Fe^{3+} ion, four molecules of ammonia and two chloride ions.

(i) What is the formula of this complex ion? [1]

(ii) This complex shows *cis-trans* isomerism. Draw diagrams to show the structures of the *cis* and *trans* isomers.



[3]

(iii) What is the co-ordination number of this complex ion?

.....

[1]

(b) Describe the role of *cis*-platin as an important therapeutic drug.

.....

.....

..... [2]

[Total: 7]

