

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

CHEMISTRY

2815/06

Transition Elements

Friday

23 JANUARY 2004

Afternoon

50 minutes

Candidates answer on the question paper.

Additional materials:

Data Sheet for Chemistry

Scientific calculator

Candidate
Number

Candidate Name

Centre 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 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	7	
2	10	
3	9	
4	9	
5	10	
TOTAL	45	

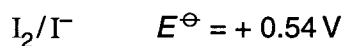
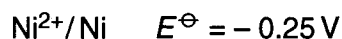
This question paper consists of 8 printed pages.

2 A cell can be constructed between a Ni^{2+}/Ni half-cell and an I_2/I^- half-cell.

(a) Draw a labelled diagram of this cell operating under standard conditions.

[5]

(b) The standard electrode potentials for the half-cells in this cell are given below.



(i) What is the standard cell potential of this cell?

..... V [1]

(ii) Write equations for the reactions that occur in each half-cell.

.....
 [2]

(iii) Write the overall equation for the reaction that occurs in the cell.

..... [1]

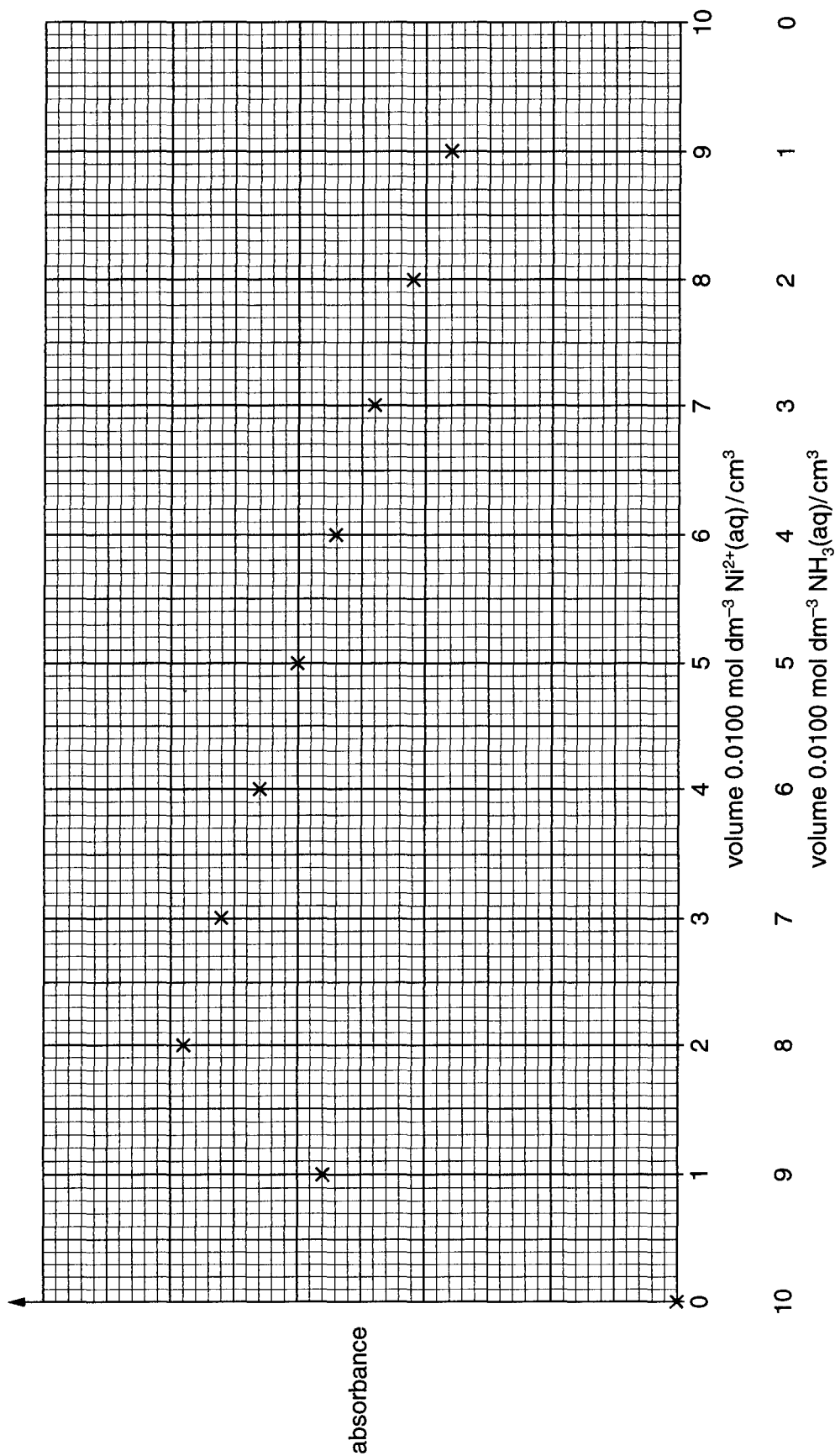
(iv) State, and explain, the direction of flow of electrons in the external circuit.

.....
 [1]

[Total: 10]

- 3 A student carried out an experiment to determine the formula of the complex ion formed between $\text{Ni}^{2+}(\text{aq})$ and $\text{NH}_3(\text{aq})$ using colorimetry.

He obtained the results plotted on the axes below.



- (a) Outline the experimental procedure used by the student to obtain these results.

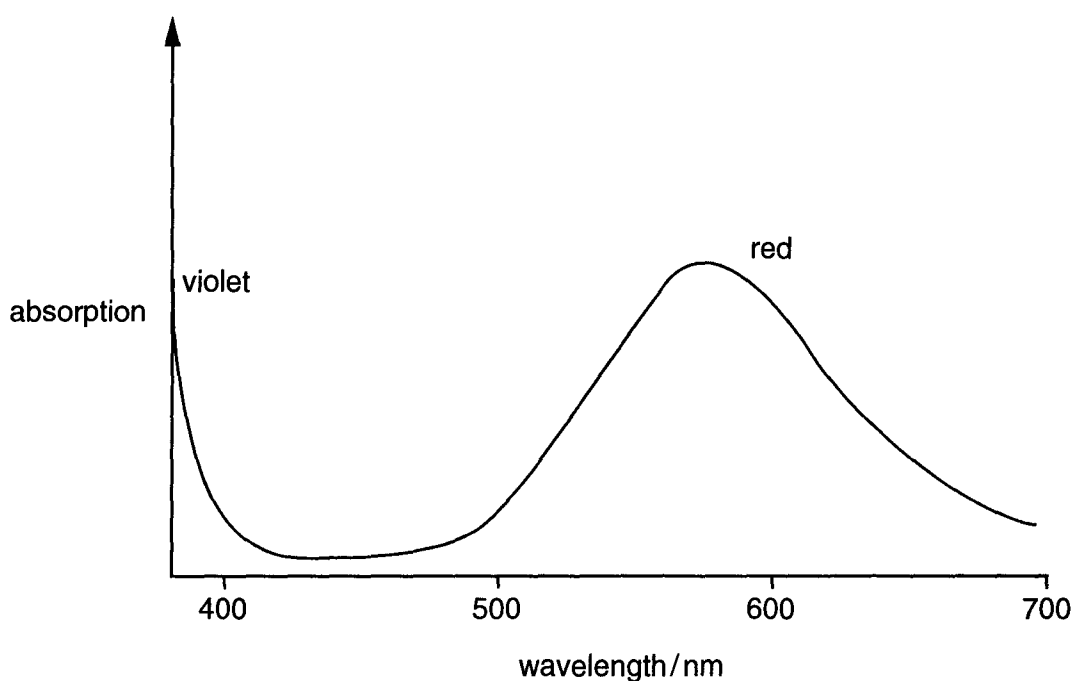
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[3]

- (b) Complete the graph and hence determine the formula of the complex ion. Show how you worked out your answer.

[4]

- (c) The visible spectrum for this complex ion is shown below.



Suggest, with a reason, the colour of this complex ion.

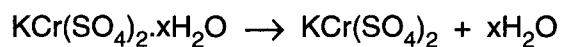
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[2]

[Total: 9]

5 Chrome alum is used in dyeing and in tanning leather.

- (a) On heating chrome alum gently, it loses its water of crystallisation. The equation for this is given below.



chrome alum

It was found that when 1.73 g of chrome alum was heated, 0.75 g of water was lost.

Show that the value of x in the formula $\text{KCr}(\text{SO}_4)_2 \cdot x\text{H}_2\text{O}$ is 12.

[3]

- (b) Chrome alum contains the complex ion $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$.

(i) Draw a diagram of this complex ion showing its shape and bond angle clearly.

[2]

- (ii) What name is given to this shape of complex ion?

.....[1]

(c) Another complex ion of chromium contains one chromium(III) ion, four molecules of water and two chloride ions. This complex shows *cis-trans* isomerism.

(i) Write the formula of this complex ion.

.....[1]

(ii) Draw labelled diagrams to show the *cis* and *trans* isomers of this complex ion.

[3]

[Total: 10]

END OF QUESTION PAPER