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NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

For Supervisor's use only

Level 3 Chemistry, 2009

90696 Describe oxidation-reduction processes

Credits: Three
9.30 am Tuesday 17 November 2009

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should answer ALL the questions in this booklet.

A periodic table is provided on the Resource Sheet L3–CHEMR.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–8 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

For Assessor's use only	**Achievement Criteria**		
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Describe oxidation-reduction processes. ☐	Explain and apply oxidation-reduction processes. ☐	Discuss oxidation-reduction processes. ☐
Overall Level of Performance ☐		

You are advised to spend 35 minutes answering the questions in this booklet.

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QUESTION ONE

Potassium iodide (KI) reacts with acidified potassium permanganate solution in a test tube.

(a) Write balanced half-equations for the oxidation and reduction reactions and then write a balanced equation for the overall reaction.

Oxidation half-equation

Reduction half-equation

Balanced equation for overall reaction

(b) Compare the reaction of KI and acidified potassium permanganate with the reaction carried out without acid.

Your discussion should include:

- observations linked to the species involved
- identification of the oxidant and the reductant
- justification for these being oxidation–reduction processes.

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QUESTION TWO

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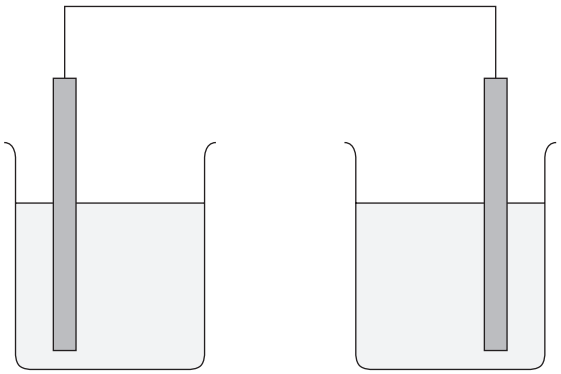
An electrochemical cell is set up based on the reaction between bromide ions and dichromate ions.

$$E^{o}(Cr_2O_7^{2-}/Cr^{3+}) = +1.33 \text{ V}$$
$$E^{o}(Br_2/Br^{-}) = +1.07 \text{ V}$$

(a) (i) On the diagram below, identify the solutions used in the beakers and the electrode substances, and show the direction of the electron flow and anything else required for a fully operational cell.



(ii) Complete the standard cell diagram below for the cell drawn above.

(iii) Calculate the cell potential.

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(b) In order to increase the cell potential, the $Cr_2O_7^{2-}/Cr^{3+}$ half cell is replaced by a half cell chosen from the $E°$ list below.

$E^o(Cu^{2+}/Cu) = +0.34$ V

$E^o(BrO_3^-/Br_2) = +1.51$ V

$E^o(Fe^{3+}/Fe^{2+}) = +0.77$ V

(i) Choose the half cell that will combine with the Br_2/Br^- half cell to give greatest cell potential. Justify your answer.

Half cell is: _____

Justification: _____

_____

_____

_____

(ii) Compare the observations that would be made in the Br_2/Br^- half cell when each of the two cells (described in parts (a) and (b)) are run. Give reasons for any differences AND include comments on the direction of the electron flow.

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QUESTION THREE

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(a) When a piece of iron metal is added to a solution of copper sulfate, the metal decreases in size and a pink-brown solid forms.

Use the $E°$ data to determine which of Fe^{2+} or Fe^{3+} is present in the resulting solution. Justify your answer.

$E^o(Fe^{2+}/Fe) = -0.44$ V

$E^o(Fe^{3+}/Fe^{2+}) = +0.77$ V

$E^o(Cu^{2+}/Cu) = +0.34$ V

Ion present in solution is: _____

Justification: _____

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(b) Three reactions are represented by the unbalanced equations below:

$$HOCl + SO_2 \rightarrow SO_4^{2-} + Cl_2$$
$$Br_2 + SO_4^{2-} \rightarrow \text{no reaction}$$
$$HOCl + Br_2 \rightarrow Cl_2 + BrO_3^-$$

Use the information from the equations to arrange the standard reduction potentials $E^o(HOCl/Cl_2)$, $E^o(SO_4^{2-}/SO_2)$ and $E^o(BrO_3^-/Br_2)$ from highest to lowest, and identify the strongest reductant. Justify your answer.

Order: _____ > _____ > _____

Strongest reductant: _____

Justification: _____

Extra paper for continuation of answers if required.
Clearly number the question.

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Question number	

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