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VCE Chemistry ¾
Introduction to Redox [1.6]
Test Solutions

20 Marks. 16 Minutes Writing.

Results:

Test Questions	_____ /15
Extension Questions	_____ /5

Section A: Test Questions (15 Marks)

Question 1 (3 marks)

Tick whether the following statements are true or false:

Statement	True	False
a. Reduction and oxidation occur simultaneously.	✓	
b. An oxidant's oxidation number increases.		✓
c. The oxidation number of N in N_2O is $+2$.		✓
d. A valid conjugate reductant of $CuSO_4$ is $CuCl_3$.		✓
e. Both the atoms and charges must balance in both half-equations and the overall equation.	✓	
f. In a balanced half-equation in an alkaline environment, H^+ is typically present.		✓

Space for Personal Notes

Question 2 (4 marks)

Liquid bromine (Br_2) is often converted into bromate ions (BrO_3^-) and added to foods such as breads and pastries to improve their texture and volume.

a. Write the balanced half-equation for this process in a low pH environment. (1 mark)

$Br_2(l) + 6H_2O(l) \rightarrow 2BrO_3^-(aq) + 12H^+(aq) + 10e^-$

b.

i. Explain whether this is an oxidation or reduction reaction, based on the **position of electrons** in the half equation you wrote in **part a**. (1 mark)

They are on the right/products, and they are being **lost**/removed, so **oxidation.**

ii. Explain whether this is an oxidation or reduction reaction, based on the **change in oxidation number** of Br. (1 mark)

Goes from **0 to +5**. As this is an **increase**, there must have been a **loss in negative charge (electrons),** and therefore **oxidation.**

c. State the conjugate redox pair for this process. (1 mark)

$BrO_3^-(aq)/Br_2(l)$

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Question 3 (7 marks)

For this question, you may assume everything takes place in an acidic environment, unless otherwise stated.

Given the following unbalanced equation:

$$Cl_2 + Fe_2O_3(s) \rightarrow ClO_4^- + Fe^{2+}$$

a.

i. Write the balanced half-equation for the reduction reaction. (1 mark)

$Fe_2O_3(s) + 6H^+(aq) + 2e^- \rightarrow 2Fe^{2+}(aq) + 3H_2O(l)$

ii. State the conjugate reducing agent. (1 mark)

$Fe^{2+}(aq)$

b.

i. Write the balanced half-equation for the oxidation reaction. (1 mark)

$Cl_2(g) + 8H_2O(l) \rightarrow 2ClO_4^-(aq) + 16H^+(aq) + 14e^-$

ii. State the change in oxidation number for the species being oxidised. (1 mark)

$Cl: 0 \rightarrow +7$ OR change of $+7$

c. Hence or otherwise, write the overall balanced equation. (2 marks)

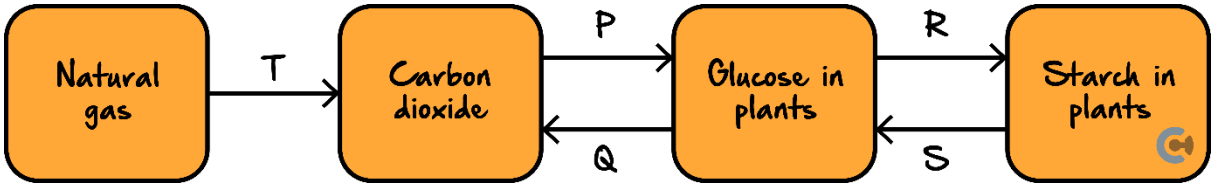
$7Fe_2O_3(s) + Cl_2(g) + 26H^+(aq) \rightarrow 14Fe^{2+}(aq) + 13H_2O(l) + 2ClO_4^-(aq)$

d. Had this reaction occurred in a **basic** environment, write what the overall balanced equation would have been. (1 mark)

$7Fe_2O_3(s) + Cl_2(g) + 13H_2O(l) \rightarrow 14Fe^{2+}(aq) + 2ClO_4^-(aq) + 26OH^-(aq)$

Question 4 (1 mark)

A simplified section of the carbon cycle is shown below.



Carbon atoms are oxidised in reaction(s):

A. Q only.

B. S and Q only.

C. Q and T only.

9	12	21	56	11	The oxidation of natural gas (methane) in process T and glucose in process Q both involved a change in the oxidation state of carbon. Yet over 30% of students chose option A or B, which did not include process T.

D. Q, R and T only.

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Section B: Extension Questions (5 Marks)

Question 5 (5 marks)

Use the **overall** equation below to answer the following questions:

$$2H_2O_2(aq) \longrightarrow 2H_2O(l) + O_2(g)$$

a. Describe how the oxidation number of oxygen varies from the reactants to the products in the above reaction. (2 marks)

It decreases from -1 in H_2O_2 to -2 in water (1), whereas it increases from -1 to 0 in O_2 (2)

b. Hence or otherwise, write the:

i. Balanced half-equation for oxidation. (1 mark)

$O_2(g) + 2H^+(aq) + 2e^- \rightleftarrows H_2O_2(aq)$

ii. Balanced half-equation for reduction. (1 mark)

$H_2O_2(aq) + 2H^+(aq) + 2e^- \rightleftarrows 2H_2O(l)$

c. Explain how your answer from **part a.** links to the **number of electrons** in your answer to **part b. ii**. (1 mark)

Change in oxidation number for O was -1.
As there are 2 O atoms in the balanced half equation, there are 2 electrons in the equation.

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