Electrochemistry

(Past Year Topical Questions 2010-2015)

Oct/Nov 2010 (23)/Q2

(d) Most of the sulfur that is used in the Contact process is recovered from sulfur compounds present in crude oil and natural gas by using the Claus process.

(i) In this process, about one third of the hydrogen sulfide, H_2S, present in the oil or gas, is converted into sulfur dioxide, SO_2.

Balance the equation for this reaction.

$$.....H_2S + ...O_2 \rightarrow .....SO_2 + ...H_2O$$

(ii) The SO_2 formed is then reacted catalytically with the remaining H_2S, producing sulfur and water.

$$2H_2S + SO_2 \rightarrow 3S + 2H_2O$$

What are the oxidation numbers of each of the sulfur-containing substances in this reaction?

H_2S..... SO_2 ..... S .....

Which substance is reduced? Explain your answer.

substance .....

explanation ..... [3]

May/June 2011 (22)

4 Chlorine is manufactured by electrolysis from brine, concentrated aqueous sodium chloride.

(a) (i) Describe, with the aid of a fully labelled diagram, the industrial electrolysis of brine in a diaphragm cell. State what each electrode is made of and show clearly the inlet for the brine and the outlets for the products.

(ii) Write a half-equation, with state symbols, for the reaction at **each** electrode.

anode .....

cathode .....

(iii) Name the chemical that is produced in solution in this electrolytic process.

..... [7]

May/June 2013 (23)/Q1

(d) Carbon disulfide reacts with nitrogen monoxide, NO, in a 1:2 molar ratio. A yellow solid and two colourless gases are produced.

(i) Construct a balanced equation for the reaction.

.....

(ii) What is the change in the oxidation number of sulfur in this reaction?

from ..... to .....

[3]

Oct/Nov 2013 (21)

3 Chlorine gas is manufactured by the electrolysis of brine using a diaphragm cell.

(a) (i) Write half-equations, including state symbols, for the reactions occurring at **each** of the electrodes of a diaphragm cell.

anode .....

cathode .....

(ii) In the diaphragm cell, the anode is made of titanium and the cathode is made of steel.

Suggest why steel is never used for the anode.

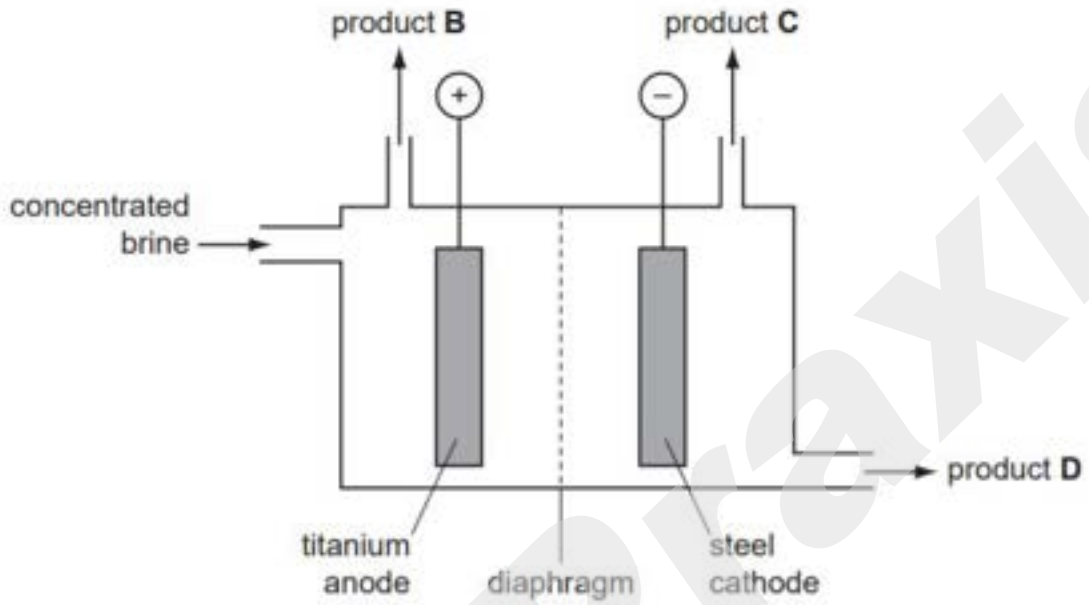
.....

.....

[3]

May/June 2014 (21)/Q3

(b) The diagram below is a simplified representation of a diaphragm cell.



(i) Identify each of the products.

B .....

C .....

D .....

[3]

(ii) Give the equations for the two electrode reactions.

anode .....

cathode .....

[2]

+6018 – 375 2833

May/June 2015 (22)/Q1

(c) Magnesium can be produced by electrolysis of magnesium chloride in a molten mixture of salts.

(i) Give equations for the anode and cathode reactions during the electrolysis of molten magnesium chloride, $MgCl_2$.

anode .....

cathode .....

[2]

The electrolysis is carried out under an atmosphere of hydrogen chloride gas to convert any magnesium oxide impurity into magnesium chloride.

(ii) An investigation of the reaction between magnesium oxide and hydrogen chloride gas showed that an intermediate product was formed with the composition by mass Mg, 31.65%; O, 20.84%; H, 1.31% and Cl, 46.20%.

Calculate the empirical formula of this intermediate compound.

empirical formula ..... [2]