

Name of the Student: _____

Max. Marks : 23 Marks

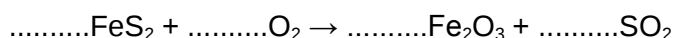
Time : 23 Minutes

Q1.

Sulfuric acid is made from SO_3 which can be manufactured in a series of stages from iron(II) disulfide (FeS_2), found in the mineral iron pyrites.

(a) In the first stage, FeS_2 is roasted in air to form iron(III) oxide and sulfur dioxide.

(i) Balance the following equation for this reaction.



(1)

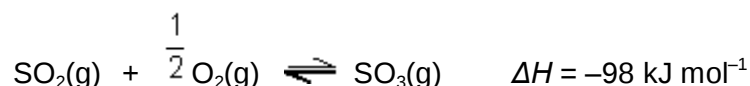
(ii) Deduce the oxidation state of sulfur in each of the following compounds.

SO_2 _____

FeS_2 _____

(2)

(b) In the second stage of the manufacture of sulfuric acid, sulfur dioxide reacts with oxygen. The equation for the equilibrium that is established is shown below.



State and explain the effect of an increase in temperature on the equilibrium yield of SO_3

Effect of increase in temperature on yield _____

Explanation _____

(3)

(c) In the extraction of iron, carbon monoxide reacts with iron(III) oxide. Write an equation for this reaction and state the role of the carbon monoxide.

Equation _____

Role of the carbon monoxide _____

(2)

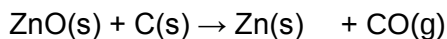
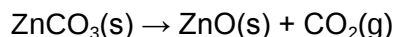
(Total 8 marks)

Q2.

The method of extraction of zinc has changed as different ores containing the element have been discovered and as technology has improved.

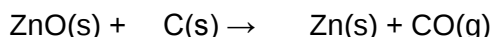
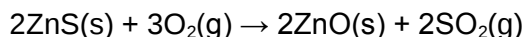
Extraction process 1

In the earliest process, calamine (impure zinc carbonate) was heated with charcoal in earthenware pots. This two-stage process gave a low yield of zinc.



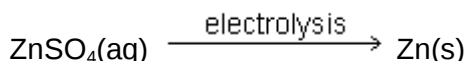
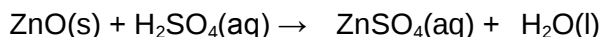
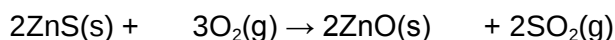
Extraction process 2

Deposits of calamine were being used up and a new two-stage process was developed using zinc sulfide ores. All of the waste gases from this process were released into the atmosphere.

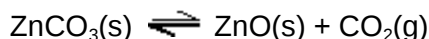


Extraction process 3

The modern process uses the electrolysis of aqueous solutions of very pure zinc sulfate. The first step in this process is the same as the first step in Extraction process 2. The second step uses sulfuric acid made from the SO_2 collected in the first step. The third step involves the electrolysis of zinc sulfate solution to form pure zinc.



- (a) In the first stage of Extraction process 1 the following equilibrium is established when zinc carbonate is heated in a closed container.



Use Le Chatelier's principle to suggest and explain the effect on the yield of zinc oxide of allowing the carbon dioxide to escape from the container.

(3)

- (b) State and explain **one** environmental reason why Extraction process **3** is an improvement over Extraction process **2**.

(3)

- (c) Give **one** reason why Extraction process **3** is an expensive method of making zinc but one which is justified in terms of the product formed.

(2)

- (d) Deduce the half-equation for the formation of zinc from zinc ions during the electrolysis of zinc sulfate solution and identify the electrode at which this reaction occurs.

(2)

- (e) Identify **one** reaction from the three extraction processes that is **not** a redox reaction and state the type of reaction that it is. In terms of redox, state what happens to the carbon in Extraction process **2**.

(3)

- (f) Zinc and magnesium both react with steam in a similar way. Write an equation for the reaction of zinc with steam and name the products of this reaction.

(2)

(Total 15 marks)