

4 This question is about compounds of sulfur.

(a) Sulfuric acid is manufactured in a four-stage process.

stage 1 Sulfur dioxide is produced from ores containing sulfur.

stage 2 Sulfur dioxide reacts with oxygen to form sulfur trioxide.

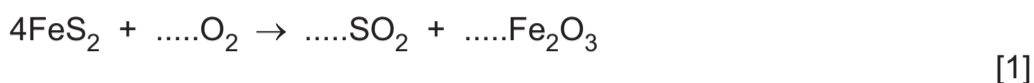
stage 3 Sulfur trioxide reacts with concentrated sulfuric acid to form oleum, $\text{H}_2\text{S}_2\text{O}_7$.

stage 4 Oleum reacts with water to form concentrated sulfuric acid.

(i) Iron pyrite is an ore containing sulfur. The ore contains a compound with the formula FeS_2 .

FeS_2 reacts with oxygen in the air to produce sulfur dioxide.

Balance the symbol equation for this reaction.



(b) (i) State **three** typical conditions for the reaction between sulfur dioxide and oxygen in **stage 2**.

1

2

3 [3]

(ii) Write a symbol equation for the reaction that occurs in **stage 2**.

..... [1]

(iii) Write the symbol equation for the reaction in **stage 3**.

..... [1]

(c) Sulfuric acid reacts with carbon. The equation for the reaction is shown.

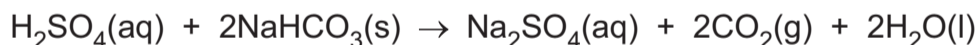


Give the oxidation number of carbon in:

• C

• CO_2 [2]

(d) Dilute sulfuric acid reacts with sodium hydrogencarbonate, NaHCO_3 , to produce carbon dioxide gas, CO_2 .



4.20 g of NaHCO_3 is added to excess dilute sulfuric acid.

Calculate the volume of $\text{CO}_2(\text{g})$, measured at r.t.p., produced using the following steps.

• Calculate the number of moles of NaHCO_3 in 4.20 g.

The M_r of NaHCO_3 is 84.

..... mol

• Deduce the number of moles of $\text{CO}_2(\text{g})$ that are produced.

..... mol

• Calculate the volume of $\text{CO}_2(\text{g})$ produced in cm^3 .

One mole of any gas occupies $24\,000\text{ cm}^3$ at r.t.p.

..... cm^3
[3]