Question 36 **(19 marks)**

Australia is a significant producer of antimony. Antimony, Sb, and its compounds have a wide range of uses. The metal is used to form alloys with other metals, such as lead, to increase their hardness, while compounds of antimony can be used in the manufacture of many substances such as plastics, pigments and match heads.

High-grade antimony ores are converted to the metal through the use of a blast furnace.

- Antimony sulfide ore is first heated to convert it to an oxide.
- Antimony oxide is then heated with carbon to convert it to a metal.

The following equations represent these two reactions.

Reaction one: $2\ Sb_2S_3(s) + 9\ O_2(g) \leftrightharpoons 2\ Sb_2O_3(s) + 6\ SO_2(g)$

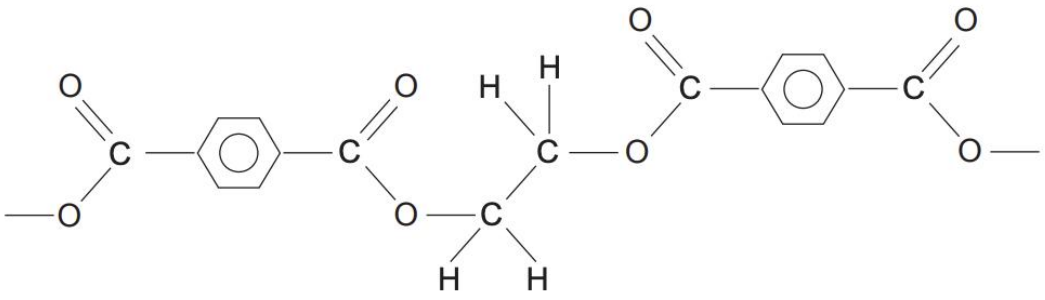
Reaction two: $2\ Sb_2O_3(s) + 3\ C(s) \leftrightharpoons 4\ Sb(s) + 3\ CO_2(g)$

(a) What mass of ore would be required to produce 6.00 tonnes of antimony, assuming the ore contains 25.6% by mass of antimony(III) sulfide and the reactions go to completion?
(6 marks)

(b) Calculate the maximum volume of sulfur dioxide that could be produced in Reaction one at 525.0 °C and 105 kPa. Give the answer to the correct number of significant figures.

(4 marks)

Pure antimony(III) oxide is used as a catalyst in the production of polyethylene terephthalate (PET).



A section of a PET polymer

(c) Draw the monomers required to produce this polymer. (4 marks)

(d) State **one** common use for PET and state **two** properties that enable it to be used for this purpose. (3 marks)

Use: _____

Properties:

One: _____

Two: _____

PET is produced through condensation polymerisation; another type of polymer is produced through addition polymerisation. Each of these types of polymerisation uses different types of monomers.

(e) Distinguish between the types of monomers used for each type of polymerisation.

(2 marks)