

### Extracting metals

1. Impure iron is produced in a blast furnace by reducing the iron compound found in one of its ores. Match substances, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

- A** carbon  
**B** cast iron  
**C** iron  
**D** iron oxide

The main ore from which iron is extracted contains the compound . . . **1** . . . .

This is reduced in the blast furnace by reacting it with . . . **2** . . . .

The metal produced from the blast furnace contains about 96 % . . . **3** . . . .

The product is brittle and is known as . . . **4** . . . .

2. In each part choose only **one** answer.

### Jobs for bacteria – metal miners

Copper is found in the Earth's crust as the ore copper sulfide.

Traditionally, copper-rich ores are roasted and smelted to extract the metal.

Copper compounds can now be extracted from low-grade ores by bioleaching. In one type of bioleaching, the copper compounds are extracted from heaps of the crushed ore using bacteria.

- The bacteria live in the ore and gain their energy by slowly breaking down the copper compounds.
- The bacteria produce acidic solutions in which the copper compounds dissolve from the rocks and can be collected.
- The bacteria usually live at 35 °C to 40 °C. This means that breakdown of the compounds takes place only very slowly in the heaps of crushed ore.
- If these bacteria could work at a temperature 10 °C higher, then it is estimated that the rate of breakdown of the compounds would be twice as fast.

- A** Which of the following is a disadvantage of extracting copper by bioleaching rather than by the traditional method?
- 1 Bioleaching allows us to use low-grade ores.
  - 2 Bioleaching is more economical.
  - 3 Bioleaching is slower.
  - 4 Bioleaching uses less energy.

- B** Copper compounds can be extracted more quickly from the ore in tanks at a temperature of 75 °C.

Where might bacteria able to work at this temperature be found?

- 1 in rivers running through rainforests
  - 2 in polluted rivers
  - 3 in streams on the sides of active volcanoes
  - 4 in tropical seas
- C** About 20% of the world's copper is now extracted from low-grade ores by bioleaching. Some scientists think that this figure will steadily increase in the next few years. An increase in the use of bioleaching may **not** happen if . . .
- 1 the price of copper increases dramatically.
  - 2 large new deposits of high-grade ore are discovered.
  - 3 the cost of energy rises quickly.
  - 4 sulfur dioxide levels in the atmosphere reach dangerous levels.
- D** Copper can be obtained from solutions containing copper compounds by . . .
- 1 electrolysis.
  - 2 oxidation.
  - 3 fractionation.
  - 4 combustion.

3. In each part choose only **one** answer.

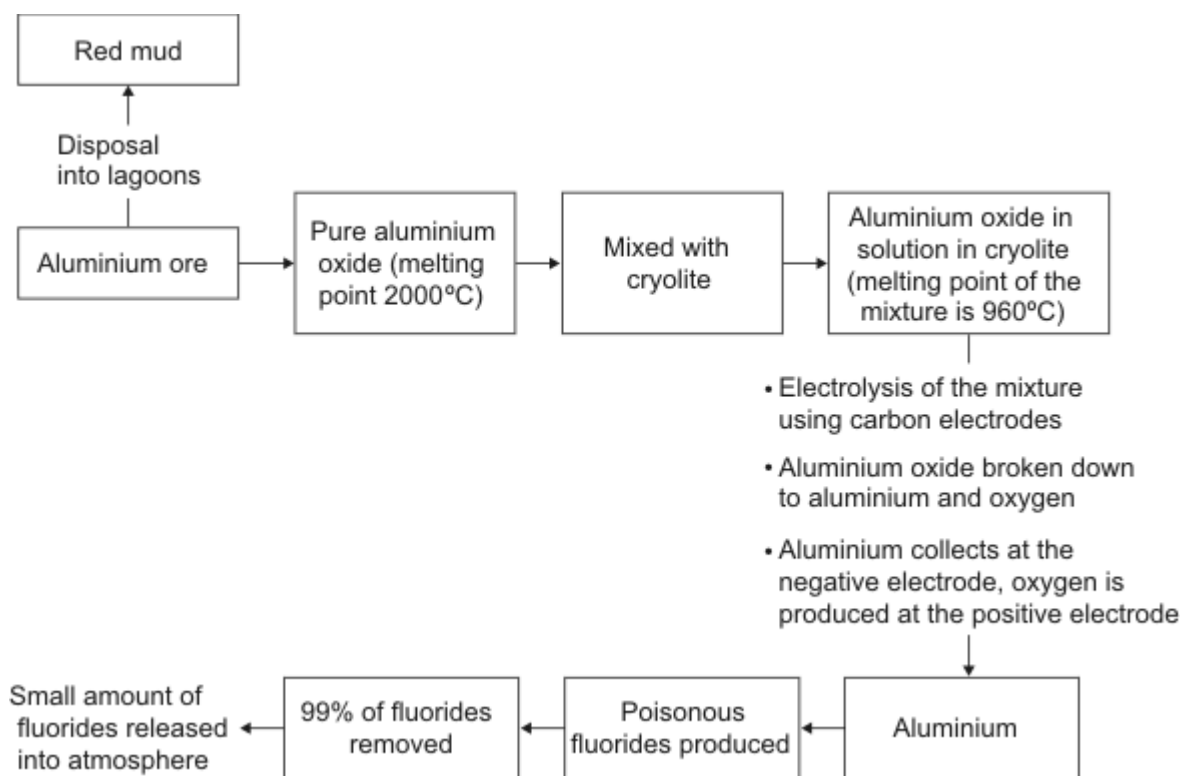
Aluminium can be obtained by extracting it from aluminium ore, and by recycling used objects made from aluminium.

- A** One disadvantage of extracting aluminium from aluminium ore is that . . .
- 1 aluminium ore contains very small amounts of aluminium.
  - 2 aluminium ore is a limited resource.
  - 3 the aluminium obtained corrodes easily.
  - 4 the aluminium obtained has a high density.
- B** It is better to recycle aluminium than to extract it from aluminium ore because . . .
- 1 aluminium ore contains few impurities.
  - 2 aluminium ore produces low grade aluminium.
  - 3 digging up aluminium ore destroys the local environment.
  - 4 recycling produces 'smart' aluminium alloys.

Unit C1, C1.3.1

- C It makes economic sense to recycle aluminium because extracting it from its ore . . .
- 1 is a cheap process.
  - 2 takes too long.
  - 3 employs more people.
  - 4 uses large amounts of energy.
- D If aluminium cans are not recycled, they can affect the environment by . . .
- 1 causing acid rain.
  - 2 filling up landfill rubbish tips.
  - 3 producing poisonous gases.
  - 4 rapidly corroding in lakes and rivers.

4. The flow chart shows the stages in the extraction of aluminium.



(a) The red mud from the aluminium ore is disposed of by dumping in lagoons. The red mud contains iron oxide.

The most likely reason why iron is **not** extracted from the red mud is that . . .

- 1 the iron oxide evaporates too quickly.
- 2 there is no transportation system nearby.
- 3 it is **not** economic compared to other sources of iron.
- 4 iron oxide from the lagoons cannot be reduced by carbon.

- (b) Why is pure aluminium oxide mixed with cryolite before electrolysis?
- 1 to produce an aluminium alloy
  - 2 to reduce the breakdown of aluminium oxide
  - 3 to lower the melting point so less energy is used during electrolysis
  - 4 to react with impurities in the aluminium oxide
- (c) During electrolysis, the positive carbon electrode is rapidly used up causing emissions. The main component of these emissions contributes to . . .
- 1 global dimming.
  - 2 global warming.
  - 3 acid rain.
  - 4 red mud lagoons.
- (d) It is important to monitor the amount of poisonous fluorides released into the atmosphere. Plants absorb these fluorides. The amounts of fluorides in plants can be found by chemical analysis. The best information would be found by chemical analysis of plants that are growing . . .
- 1 in all the workers' homes.
  - 2 at exactly one kilometre in all directions from the factory.
  - 3 at various distances in all directions from the factory.
  - 4 at various distances in an easterly direction from the factory.