Metals and their uses

1. (a) atoms 1

(b) mixture 1

metal 1

structure 1

smart 1

(c) (i) any **two** from: 2

- saves raw materials / iron ore
- saves energy / fuels *accept cheaper / saves money*
- make new / useful items
- make money / it is economic
- reduces pollution *allow less harmful for the environment*
- decreases cost of steel cans
- reduces carbon dioxide emissions
- decreases waste materials / use of landfill

(ii) any **one** from: 1

- provide information / education of the need to recycle
- legislate against / charge for waste
- reward / pay people to recycle *accept fine people for not recycling*
- put labels on the cans
- provide recycling bags / bins / areas

[8]

2. conducts heat *list principle applies after 4 ticks* 1

forms coloured compounds 1

high melting point 1

strong 1

[4]

3. (a) (i) reacts with carbon / C 1

accept burns / oxidises carbon

carbon dioxide / CO_2 / gas is formed / given off 1

accept carbon monoxide / CO
*accept correctly balanced equation for **2** marks*
ignore state symbols

(ii) change / improve properties 1

accept any specific property
accept to make alloys / special steels; ignore brittle

(b) any **two** from: 2

- to conserve ores / iron

accept ores / iron are non-renewable / non-sustainable allow less quarrying / mining

- to prevent the use of landfills

  allow reduce waste
- to conserve energy / fuel

  accept fossil fuels are non-renewable
- to reduce carbon / carbon dioxide emissions
- to meet EU / International targets

  ignore costs / demand

[5]

4. (a) any **one** from: 1

- light(er) / less dense *ignore stronger*
- resistant to acids / alkalis / chemical *accept resistant to corrosion*

(b) any **two** from: 2

it must be clear; list principle applies
allow reverse argument; ignore reference to temperature

- magnesium is more reactive than titanium

  magnesium is above titanium in the reactivity series
- titanium is more reactive than carbon
- magnesium is more reactive than carbon
- magnesium is most reactive
- carbon is least reactive

(c) any **three** from: 3

- takes a long time to process
- low abundance (of ore)
- small amount produced
- batch process used **or** blast furnace is continuous
- more stages used to manufacture titanium *allow ≥ 3 / many / several*
- more energy used (per tonne of titanium)

  allow high energy requirement; ignore references to temperature
- magnesium / chlorine is expensive
- labour intensive

  it = titanium; ignore references to cost / easier / usefulness alone ***or*** *references to incorrect processes*

[6]

5. (a) any **three** from: 3

- resources / aluminium / ores are conserved *accept converse argument*
- less / no mining **or** less associated environmental problems
  eg quarrying / eyesore / dust / traffic / noise / loss of land / habitat

  ignore just pollution
- less / no waste (rock) / landfill *do **not** accept 'wastes 50% of the ore'*
- no purification / separation (of aluminium oxide)

- (aluminium extraction / production) has high energy / electricity / heat / temperature requirements
- less carbon dioxide produced

accept no carbon dioxide produced; ignore references to cost

(b) statement *ignore density* 1

linked reason

eg (pure) Al / it is weak / soft (1)
as layers / rows can slide (over each other) (1)
or
alloy / other metals / they make it stronger / harder (1)
stops layers / rows sliding over each other (1)
accept disrupts the structure owtte if no other mark awarded
*accept to form an alloy **or** to change properties for **1** mark*

[5]

6. (a) unreactive / near bottom of reactivity series 1

(b) carbon more reactive / higher up reactivity series 1

(c) very reactive / near top of reactivity series 1

cannot use displacement methods / can only be extracted by electrolysis/ had to wait discovery of electricity 1

[4]

7. (a) (i) large amounts of energy would be needed to extract the copper 1

accept labour-intensive to extract copper from this land
accept copper would have to be extracted from a large area of land (owtte)

(ii) any **one** from: 1
- produces large amounts of solid waste
- atmospheric pollution from carbon dioxide/sulfur dioxide
- more lorries/traffic

(b) (i) copper is expensive/iron is cheap 1

accept iron is much more abundant than copper

(ii) any **one** from: 1
- iron displaces copper from solutions of its salts
- iron is more reactive than copper

(c) (i) any **two** from: 2
- less expensive/energy to extract the small amounts of copper
- plants will remove carbon dioxide from the atmosphere as they grow
- can produce heat/electrical energy when plants are burned

(ii) any **one** from: 1
- takes a long time for plants to grow
- supply problem as plants only harvested once/twice a year
- still need to heat the plant ash in a furnace to extract the copper

[7]