

M1.(a) all points correct

±1 small square

allow 1 mark for 6 or 7 plots

2

Year	Percentage (%) of bottles made from other materials
1975	5
1980	10
1985	22
1990	42
1995	70
2000	72
2005	90
2010	95

1

(b) **Level 3 (5–6 marks):**

A detailed and coherent argument is provided which considers a range of issues and comes to a conclusion consistent with the reasoning.

Level 2 (3–4 marks):

An attempt to describe the advantages and disadvantages of the production and uses is made, which comes to a conclusion. The logic may be inconsistent at times but builds towards a coherent argument.

Level 1 (1–2 marks):

Simple statements made. The logic may be unclear and the conclusion, if present, may not be consistent with the reasoning.

0 marks:

No relevant content.

Indicative content

- glass – 2 stages in production of soda-lime glass
- glass – second stage, heating sand, limestone and sodium carbonate
- HDPE – 3 stages in production
- HDPE – second stage, cracking of naphtha to obtain ethene
- HDPE – third stage, polymerisation of ethene
- fewer stages in glass production, may be quicker

- higher temperature in glass manufacture, therefore maybe higher energy requirement
- glass bottle can be reused
- consideration of collection / cleaning costs to reuse glass bottles
- other glass products can be made from recycled glass
- plastic has greater range of sizes
- both produced from limited raw materials
- higher percentage recycled materials in glass conserves raw materials

This indicative content is not exhaustive, other creditworthy responses should be awarded marks as appropriate.

6

[9]

- M2.** (a) (i) reduction
accept redox / smelting 1
- (ii) 3 4 3 1
- (b) (i) 55
ignore other units
- (ii) Water
accept sodium hydroxide
accept correct formulae H_2O or $NaOH$ 1
- (iii) any **one** from:
 - save energy / fuel for transporting the ore
accept less (cost of) transport allow transported quickly
 - (old) quarries nearby for waste/red mud 1
- (c) **Environmental**
any **one** from:
 - less mining / quarrying (of bauxite)
allow loss of habitat / less qualified noise pollution
 - less landfill space needed / used
allow less red mud / waste
 - less use of fossil fuels / energy
 - less carbon dioxide produced 1

Ethical or social

any **one** from:

- saves resources
allow using resources more than once
- creates (local) employment
if answers reversed and both correct award 1 mark
- more people aware of the need for recycling
allow less qualified noise pollution if not given in environmental

1

[7]

M3. (a) (i) low percentage / very little of metal (in the ore)

*accept only 0.5% metal in the ore **or** over 99% waste in the ore **or** nearly 100% waste in the ore*

*ignore reference to percentage of metal in the Earth's crust **or** energy used or pollution*

1

(ii) any **one** from

(it = iron)

- iron uses less energy / fuel for extraction

ignore electrolysis / uses electricity / reactivity

- iron has more uses

- more demand for iron

ignore high abundance in the Earth's crust / high percentage of metal in ore

- iron is stronger

ignore harder

- cheaper / costs less

- easier to extract

1

(b) (i) has melting point lower than 950°C

(it = aluminium)

allow has a low melting point

ignore boiling point

1

(ii) electrode(s) made of carbon

1

oxygen reacts with electrode(s) / carbon

accept $C + O_2 \rightarrow CO_2$

NB oxygen reacts with the carbon electrode(s) = 2 marks

1

*(iii) any **two** from:*

- saves resources / non-renewable
accept aluminium / ore will run out **or** conserves aluminium*
- landfill problem
accept aluminium does not corrode*
- saves energy / fuel / electricity
ignore global warming*
- less carbon dioxide / carbon emissions **or** reduces carbon footprint
ignore consequences of quarrying / mining*
- less quarrying / mining
ignore pollution / harms environment / costs / easy to recycle*

2

[7]

M4. (a) (i) C

must be correct symbol
*do **not** accept carbon*
any balancing must be correct

1

(ii) Fe + CO₂

correct formulae

1

2... + 3... .

correct balancing
allow Fe₂ + 3CO₂ for this mark

1

(iii) *layers / atoms in pure iron are able to slide over each other*

it = pure iron
accept ions for atoms
ignore molecules / particles

or

layers / atoms in cast iron are unable to slide over each other (easily)

1

(b) any **three** from:

mention of ozone = max 2

- *less iron ore used*
accept the idea that ores would be conserved but not unspecified conservation
- *less other metals extracted / used to make different steels*
accept the idea that ores would be conserved but not unspecified conservation
- less fuel used
accept the idea that fuels would be conserved

ignore reduces energy requirements

- *less specified pollution*
accept global warming / greenhouse effect / CO₂ / CO / carbon emissions / acid rain / SO₂ / global dimming /
*do **not** accept ozone layer*
- *less / no landfill space needed*
ignore reduces waste
- *less / no mining needed **or** fewer specified effects of mining*
accept effect such as eyesore / loss of habitat
*eg 'less mining iron ore' = **2** marks*

3

[7]

- M5.** (a) (i) polyethene / poly(ethene)
accept polythene / polyethylene 1
- (ii) needs heat / energy / high temperature / fuel (for cracking)
ignore other processes 1
- produces carbon dioxide / CO₂
ignore use of CO₂ **or** 'produces carbon' 1
- (b) any **three** from:
- use water from local sources **or** water from close to home
 - recycle bottles in the UK / close to home
accept do not recycle in other countries / Asia
 - (reduction in distance travelled) would reduce CO₂ emitted by transport
accept use of transport with low / no carbon dioxide emissions
 - use tap water
 - use glass bottles / waxed cartons / metal bottles
do **not** accept 'do not use plastic bottles' without an alternative material
 - do not put in landfill **or** recycle more
 - reuse / refill plastic bottles
 - tax imported water / plastic bottles (to offset carbon cost)
 - make more / all plastic bottles in UK
answers must be about the reduction of carbon cost 3

[6]

M6. (a) (i) reacts with carbon / C
accept burns / oxidises carbon 1

carbon dioxide / CO₂ / gas is formed / given off
accept carbon monoxide / CO
accept correctly balanced equation for **2** marks
ignore state symbols 1

(ii) change / improve properties
accept any specific property
accept to make alloys / special steels
ignore brittle 1

(b) any **two** from:

- 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

2

[5]

M7. (a) any **three** from:

- 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

3

(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

1

[5]

- M8.** (a) (i) contain enough metal to make it economical / worth while to extract 1
- (ii) reduction
accept displacement
accept redox 1
- (iii) $Fe + CO_2$
do **not** accept Fe_2 / Fe_4 1
- correct balancing
accept multiples and halves
- $2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$
allow Fe_2 / Fe_4 as ecf 1
- (b) **Pure Iron**
- (in pure metal all the atoms are the same size and) able to slip / slide over each other – (property soft)
OWTTE
ignore references to molecules / particles
if they say ‘move’ both times, allow **one** mark but ‘crack’ or ‘split’ is wrong.. 1
- Cast iron**
- (in cast iron) different sized atoms / larger atoms **or** structure is distorted / disrupted
OWTTE 1
- so it is difficult for layers of atoms to slip / slide over each other
OWTTE 1
- (c) any **three** from:
- conserves / saves resources / metal ores
 - saves energy resources (used for extraction / processing)
accept cheaper / saves money

- *decreases waste materials*
- *decreases a named pollution*
*do **not** accept acid rain*

3

[10]