

Life Cycle Assessment + Recycling

Mark Scheme 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Chemistry
Exam Board	AQA
Topic	5.10 Using Resources
Sub-Topic	Life Cycle Assessment + Recycling
Difficulty Level	Silver Level
Booklet	Mark Scheme 1

Time Allowed: 37 minutes

Score: /36

Percentage: /100

Grade Boundaries:

- M1.(a)** 4 (C₂H₄) 1
- (b) cracking involves a catalyst 1
- distillation does not
- or**
- distillation does not involve a chemical change
- but cracking does 1
- (c) Decomposition 1
- (d) **Level 3 (5–6 marks):**
A logically structured evaluation with links involving several comparisons. Nearly all points made are relevant and correct.
- Level 2 (3–4 marks):**
Some valid comparisons made between the two types of bag. There may be some incorrect or irrelevant points.
- Level 1 (1–2 marks):**
A vague response with few correct and relevant points and with no direct comparisons.
- 0 marks:**
No relevant content
- Indicative content**
- Accept converse in terms of plastic bags for all statements
- Paper bags are made from a renewable resource
 - Plastic bags are made from a finite resource
 - Paper bags require more energy to manufacture
 - Paper bags produce more waste
 - Paper bags are biodegradable
 - Paper bags create more CO₂
 - CO₂ created by paper bags offset by photosynthesis in growing wood

- Paper bag requires much more fresh water
- Paper bags cannot be recycled
- Agree because non-renewability less important than other factors **or** disagree because of converse **or** can't say because data inconclusive / incomplete

6

[10]

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) $\text{Fe} + \text{CO}_2$

correct formulae

1

$2\ldots + 3\ldots$

correct balancing
allow $\text{Fe}_2 + 3\text{CO}_2$ 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) 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]