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	Gold Level
Booklet	Mark Scheme 1

Time Allowed: **44 minutes**

Score: **/42**

Percentage: **/100**

Grade Boundaries:

M1.(a) Fe_2O_3 + 3 CO → 2Fe + 3 CO_2

correct formulae of reactants **1**

correct formulae of products **1**

correct balancing **1**

(b) iron loses oxygen – reduction **1**

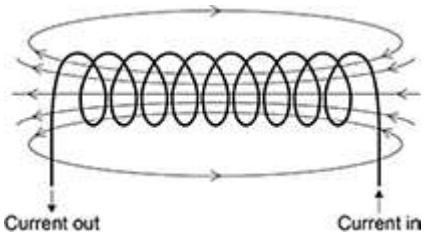
carbon gains oxygen – oxidation **1**

(c) any **four** from:

- resources for manufacture are limited
- recycling reduces the use of resources
- reduces energy consumption in extraction / manufacture
- reduces waste from processing and extraction
- reduces environmental impact of extraction

4

(d)



field lines going through and around coil **1**

correct directional arrows **1**

(e) any **two** from:

1 *mark for suggestion,* ***1*** *mark for correctly linked explanation*

- use many coils **or** tight coils **or** long wire (1)
- to give a strong magnetic field for lifting heavy objects (1)

explanation must be correctly linked to the suggestion to gain the mark

or

- add an iron core
- to increase field circuit for lifting

or

- include a switch in circuit
- so can drop / pick up cars

max. 4

[15]

M2.(a) gravity (of moon and sun)

1

(b) any **two** from:

1 *mark for statement,* ***1*** *mark for correctly linked reason*

- tidal energy is renewable (1)
- so won't run out like fossil fuels (1)

or

- doesn't emit carbon dioxide
- so won't contribute to global warming / climate change

or

- doesn't emit oxides of sulfur or nitrogen
- so doesn't cause acid rain

or

- doesn't use fossil fuels
- so less impact on environment of extraction / transport

or

- doesn't produce particulates
- so less effect on health / environment

Max. 4

(c) coal consumption per year = 29.25 × 1000 × 6 million = 175 500 000 000 MJ

1

1 hectare of willow will produce 9 × 13 × 1000 = 117 000 MJ per year

1

so need 175 500 000 000 ÷ 117 000 = 1 500 000 (hectares)

1

*allow 1 500 000 with no working shown for **3** marks*

(d) although has higher direct emissions than other fuels

1

it has much lower lifetime emissions

1

[10]

M3.Level 3 (5–6 marks):
A detailed, coherent and logical justification of the scientist's statement, with relevant links made between statements in the question, phytomining and the effects of other methods of metal production on the environment.

Level 2 (3–4 marks):
An attempt to justify the scientist's statement is made, with some attempt at linking statements. The logic may be inconsistent at times but builds towards a coherent argument.

Level 1 (1–2 marks):
Discrete relevant points made. The logic may be unclear and may not be consistent with the reasoning. Links are not made.

0 marks:
No relevant content

Indicative content

- phytomining conserves supplies of ores
- copper will be available for longer as at present rate of use copper ores will run out in about 35 years
- phytomining conserves supplies of fossil fuels or energy
- less fuel used at a lower cost
- mining scars landscape or produces noise pollution

- mining destroys wildlife habitats
- with more phytomining less need to mine ores
- with phytomining less habitat destroyed or less scarring of landscape
- with phytomining less need to use landfill for waste
- burning fossil fuels produces carbon dioxide / greenhouse gas
- burning fossil fuels causes global warming or climate change
- extraction from ores produces sulfur dioxide which causes acid rain

[6]

M4. (a) *allow answers referring specifically to the naphtha fraction*

crude oil is evaporated/vaporised (by heating)

1

the vapours are condensed (by cooling)

1

(fractions condense) / boil at different temperatures

allow fractions have different boiling points

1

(b) any **four** from:

answer yes or no does not gain credit

ignore references to volume of milk held / number of bottles used / biodegradability / habitats / pollution / mining / dust

each marking point must be a comparison

milk bag points

- uses (75%) less **crude oil** to make (than a plastic milk bottle)

  allow eg uses 75% less

  poly(ethene) which is made from crude oil

- uses less **energy** / fuel to make (than a plastic / glass milk bottle)

- produces less **carbon dioxide** to manufacture (than a plastic / glass milk bottle)

  allow produces less greenhouse gases / causes less global warming

  allow produces less CO_2 on burning

- produces less **waste** (than a plastic / glass milk bottle)

allow takes up less landfill (space)

allow an argued case for more waste eg milk bags are discarded / cannot be reused

- less fuel used for **transport** than glass milk bottles
- (produces waste because) milk bags are only used once whereas glass bottles can be **re-used**

  allow milk bags are discarded but glass bottles can be reused (24 / many times)

  allow glass bottles can be reused but milk bags can't

poly(ethene) points

- uses a limited **raw material** / crude oil whereas the raw materials for glass are almost unlimited
- **less** (5%) poly(ethene) is **recycled** (compared to glass (35%))

  allow (35%) glass is recycled or (5%) poly(ethene) (bottles) recycled BUT milk bags aren't / are discarded

  or

  recycled poly(ethene) is not used to make new bags whereas recycled glass is used to make new bottles

4

[7]

M5. Reused

- saves raw materials / crude oil
  - *unable to reuse many times*
  - *bags easily split*
- saves energy / fuel / transport
- fewer bags needed / made
- reduces carbon / CO_2 emissions
- reduces use of landfill
- saves cost of a new bag
- no waste

1

Recycled

- saves raw materials / crude oil
  - *has to be collected / transported / washed / separated / melted*
- saves energy / use of fuel
- reduces carbon / CO_2 emissions
- reduces use of landfill
- can be used for new products

ignore uses energy

1

Burned

- heat / energy released can be used (for heating / generating electricity)
  - *has to be collected / transported*
- reduces use of landfill
  - *wastes the resource / plastic*
  - *releases harmful gases / toxic gases / CO_2*

1

Dumped

- collected / transported with household waste
  - *wastes the resource*
  - *plastic uses landfill*
- (slowly) biodegrades **or** produces methane which can be used as a fuel
  - *produces methane which is a greenhouse gas / could cause explosions*
- (not biodegradable so) does not release CO_2 / green house gas into the air
  - *not biodegradable / take years to decompose*

ignore cost / litter / waste / global warming / habitats unless mentioned above

1

[4]