

Mark schemes



1.

(a)

property	J	K
density in g/cm ³		
melting point in °C		✓
flame resistance		✓
water absorption	✓	

three correct = 2 marks

one or two correct = 1 mark

2

(b)
$$\frac{1.4 \times 6.0}{0.90}$$

= 9.3 (kg)

allow 9.3(333...)(kg)

an answer of 9.3(333...)(kg) score 2 marks

1

1

(c) polymer L will not melt

1

(d) polymers are more hard-wearing

1

(e) any **two** from:

- (wool / sheep) renewable
allow wool grows back, etc.
- (wool) will not run out
ignore (wool is) readily available
- (crude oil) non-renewable
allow finite
- (crude oil) will run out
ignore references to cost
ignore prope

2

[8]

2.

(a) bar to 0.3 g

1

bar labelled copper

allow Cu

1

(b) (£) 57

allow (£) 57.00

1

(c) $\frac{22}{9} \times 1.9$

= 4.6 (g)

allow an answer of 4.6(4444) (g)

1

an answer of 4.6(4444) (g) scores 2 marks

1

(d) (9 carat gold is)

any **two** from:

- harder

allow stronger or more durable or less malleable

- less expensive

allow cheaper

- aesthetic reasons

allow references to colour

allow converse arguments about 24 carat or pure gold

ignore references to finite resources

2

(e) any **three** from:

- copper ores will run out

allow copper ores scarce

- landfill sites running out

allow reduces waste

- less energy used

allow produces less carbon dioxide or an implication

e.g. global warming

- mining causes pollution

allow a specific pollution resulting from mining, e.g.

noise, eyesore, damage to environment

- copper from copper

allow recycled

3



3.

(a) 1×10^{-2} g

1



(b) $\frac{0.46}{8.45} \times 100$

1

(test tube 1) 5.44 %

and

(test tube 2) 0.854 %

1

4.586

1

4.59

1

allow ecf answer correctly calculated to 3 significant figures

allow 4.59 with no working for 4 marks

allow 4.586 with no working for 3 marks



(c) **Level 3 (5–6 marks):**

Detailed and coherent conclusions based on the evidence together with an evaluation are given in a response that is coherent and well-structured. A range of relevant points is made demonstrating a broad understanding of the key scientific ideas.

Level 2 (3–4 marks):

An attempt to relate relevant points and draw conclusions or to make an evaluation. The logic may be inconsistent at times but builds towards a coherent argument.

Level 1 (1–2 marks):

Simple descriptive statements are made. The logic may be unclear and any conclusions, if present, may not be consistent with the reasoning.

0 marks:

No relevant content.

Indicative content

Simple statements

- nail rusted in test tubes 1 and 5
- test tubes 1 and 4 contained air / oxygen and water
- nail did not rust in test tubes 2, 3 and 4
- test tube 2 no water present
- test tube 3 no air / oxygen present
- test tube 4 paint stopped rusting
- test tube 6 scratched galvanised iron did not rust
- test tube 6 galvanising stopped rusting

Conclusions

- both water and oxygen are required for rusting
- coatings that prevent water and oxygen reaching the metal prevent rusting
- when paint is scratched, iron comes into contact with water and oxygen and the iron rusts
- in test tube 5 less iron exposed so less rusting than in test tube 1
- galvanising is better at resisting rusting than paint when scratched
- zinc is more reactive than iron, so when galvanised metal is scratched, zinc reacts with water and oxygen first / sacrificially

Evaluation

- oil and paint are effective at preventing rusting when the coating is intact
- galvanising is the most effective coating because it prevents rusting even when scratched.



- (d) iron + oxygen + water
all three needed for 2 marks
2 correct = 1 mark
ignore air

2

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- 4.** (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]

5.

(a) giant structure / lattice / layers / close packed

first 3 marks can be obtained from a suitably labelled diagram

incorrect structure or bonding or particle = max 3

1

made up of atoms / positive ions

1

with delocalized / free electrons

1

so electrons can move / flow through the metal

accept so elec

he metal

accept so elec

1



- (b) an alloy (is a metal which) has different types / sizes of atoms
accept converse for pure metal throughout
both marks can be obtained from suitable diagrams
allow made of different metals
allow mixture of metals / atoms / elements
ignore particles
ignore properties
*do **not** accept compound*

1

alloy has distorted layers
allow layers are unable to slide

1

- (c) (i) can return to its original shape
accept shape memory alloy
accept smart alloy
ignore other properties

1

- (ii) (pure copper is too) soft
accept converse
accept malleable or bends
accept copper is running out
ignore references to strength and weakness

1

- (iii) aluminium oxide
accept alumina
accept Al_2O_3
ignore bauxite / aluminium ore

1

- (iv) any **one** from:
- different conditions
 - different catalyst
 - different pressure
- allow different concentration*
- different temperature.
- do **not** accept different monomers*

1

- (d) any **two** from:
- accurate
 - sensitive
 - rapid
 - small sample.
- both needed f*

1



6. (a) (i) many ethene / molecules / monomers
accept double bonds open / break
accept addition polymerisation 1
- join to form a long hydrocarbon / chain / large molecule
ignore references to ethane
correct equation gains 2 marks 1
- (ii) (can be deformed but) return to their original shape (when heated or cooled)
ignore 'it remembers its shape' 1
- (iii) cross links / extra bonds in PEX
it = PEX throughout
accept inter-molecular bonds
ignore inter-molecular forces 1
- molecules / chains in PEX are held in position
accept rigid structure 1
- molecules / chains in PEX unable to slide past each other / move 1



(b) any **four** from:

ignore costs / sustainability / non-renewable

- less (hydrocarbon) fuels used
allow less energy
- less / no electrical energy used
allow no electrolysis
- reduce carbon / carbon dioxide emissions
allow less global warming
- reduce / no pollution by sulfur dioxide / acid rain
allow less / no transportation
- continuous process
- conserve copper which is running out or only low-grade ores available
allow less waste
- reduce the amount of solid waste rock that needs to be disposed
allow less mining
- reduce the need to dig large holes (to extract copper ores)

4

[10]