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) 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 / <u>positive</u> ions

1

with delocalized / free electrons

1

so electrons can move / flow through the metal

accept so electrons can carry charge through the metal

accept so electrons can form a current

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 for 1 mark

1

[11]

M3.(a) (Chromium =) 20

in correct order

1

(Nickel =) 8

accept Chromium = 8 ***and*** *Nickel = 20 for* ***1*** *mark*

1

(b) (i) (because iron is made up of only) one type of atom

1

(ii) not strong

allow too soft ***or*** *too flexible*

accept it rusts / corrodes ***or*** *that it could wear away*

accept could change shape / bend

accept layers / atoms could slide (over each other)

1

(iii) structure is different / distorted / disrupted

accept not in layers ***or*** *not regular*

1

so it is difficult for layers / atoms / particles to slip / slide (over each other)

accept layers cannot slip / slide

1

[6]

M4.(a) (alloy) atoms / ions / particles not in layers

accept layers are distorted

accept different (size) particles / atoms

1

so, (alloy) layers / atoms / ions / particles can't slide

*if no other mark awarded allow (an alloy) is a mixture of metals for **1** mark*

1

(b) diamonds have a giant covalent structure

1

diamonds have strong bonds between carbon atoms

1

(c) (i) a compound

1

(ii) CH_4

1

(iii) covalent

1

(d) methane has a low boiling point
or boiling point less than 20°C molecules

1

because it has small molecules

accept it has forces between molecules

*accept weak forces between molecules for **2** marks*

1

[9]

M5. (a) 2,4

allow electrons in any position on correct shells

1

(b) (electron) 79

1

neutron

allow phonetic spelling

1

118

1

(c) (i) 16 **and** 9

in this order

1

(ii) any **two** from:

ignore reasons about colour / lustre / corrosion / rarity

- (100% / pure) gold is soft
  allow layers can slide in pure gold
- (alloyed) to make the metal hard(er)
  ignore just 'the ring is an alloy'
  allow (alloyed) to stop the layers sliding
  allow (alloyed) to make the metal strong
- gold is expensive **or** alloy is less expensive

2

[7]

M6. (a) 2.5

*correct answer with or without working gains **2** marks*
if answer incorrect
2.6 / 2.625 / 2.62 / 2.63
***or** recognise 3.0 as anomalous gains **1** mark*
accept answer in table
ignore units

2

(b) as the percentage of cement increases the mass needed to break the sleeper increases

*allow 50% cement is the strongest **or** 30% sand is the strongest **or** the highest amount of cement is the strongest*

or

as the percentage of sand increases the mass needed to break the sleeper decreases

1

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

- availability of materials
- cost (of materials)
- time needed (for the concrete mixture) to set/harden
- compression strength (of the concrete)
  accept weight of the train
- testing full size (concrete railway sleepers)
  accept any test on full size sleepers
  accept 'how well it would last / weather'

2

(ii) any **four** from:

*maximum of **3** marks if no comparison made*
ignore yes or no

<u>negative concrete:</u>

allow converse statements for wood

- more fossil fuel / energy / heat (needed to produce cement / concrete)
- cement / concrete resources / limestone not renewable whereas wood is renewable
- quarrying limestone destroys landscapes / habitats whereas growing wood improves landscapes / habitats

  allow quarrying causes noise pollution / dust / etc.
- making cement / concrete releases carbon dioxide / greenhouse gases whereas growing wood absorbs carbon dioxide / greenhouse gases / is carbon neutral

  allow making cement / concrete

  causes global warming / climate

  change whereas growing wood

  reduces global warming / climate change

  ignore loss of trees / deforestation (and resultant effects such as an increase in CO_2)

<u>positive concrete:</u>

- (less resources are needed because) cement / concrete sleepers last longer **or** wood rots / needs replacing

  ignore strength / ease of breaking

  ignore weathering / effects of acid rain

4

[9]