Mark schemes

Q1.

(a) (thermal) energy is transferred

allow heat is transferred

1

by delocalised electrons

1

(b) (the alloy / mixture has) different sized atoms

1

(so the) layers are distorted

1

(so the) layers cannot easily slide

allow (positive / metal) ions for atoms throughout

allow (so the) atoms cannot slide over each other

1

(c) $2\ Fe + 3\ Cl_2 \rightarrow 2\ FeCl_3$

1

(d) $1\ Fe^{2+} : 2\ Fe^{3+} : 4\ O^{2-}$

1

(e) ($M_r\ Fe_3O_4$ =) 232

1

$(\%\ Fe =) \frac{3 \times 56}{232} \times 100$

allow $\frac{168}{232} \times 100$

allow correct use of an incorrectly determined M_r using the values of A_r given in the question

1

= 72.4 (%)

allow 72.41379 correctly rounded to at least 2 significant figures

1

(f) (40.0 kg =) 40 000 (g)

*a maximum of **4** marks can be awarded for a method which determines and uses the volume of iron oxide as a gas*

1

(moles $Fe_2O_3 = \frac{40\,000}{160}$ =) 250

allow correct use of an incorrectly converted or unconverted mass

1

(moles $CO_2 = 250 \times \frac{3}{2}$ =) 375

allow correct use of an incorrectly determined number of moles of Fe_2O_3

1

(volume of CO_2 =) 375 × 24

allow correct use of an incorrectly determined number of moles of CO_2

1

= 9000 (dm^3)

1

[15]

Q2.

(a) **Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

3-4

Level 1: Relevant points are made. They are not logically linked.

1-2

No relevant content

0

Indicative content

relevant points

- silver is the best electrical conductor
- aluminium is the least dense
- aluminium is the least expensive
- copper is a better conductor than aluminium
  or
  copper is almost as good a conductor as silver
- copper is much less expensive than silver
- overhead power cables need a low density metal
- wiring in homes needs to be affordable
- printed circuit boards only require small amounts of material

judgements

- use aluminium for overhead wires because of aluminium's low density and/or lower cost
- use copper for domestic wiring because copper is a very good conductor and not too expensive
- use silver only for small uses such as circuit boards due to high cost
- copper is a good compromise between electrical conductivity and cost

(b) (metals have) delocalised electrons

1

the electrons carry (electrical) charge

ignore current / electricity for charge

1

the electrons move through the structure / metal

ignore throughout for through

1

(c) in alloys different sized atoms distort the layers / structure

1

(so) the movement of (delocalised) electrons is restricted

1

[9]