

Mark schemes



1.

(a) FeS_2

do not accept equations

1

(b) 26

1

30

1

26

1

must be this order

(c) any **two** from:

- iron has a high(er) melting / boiling point
- iron is dense(r)
- iron is hard(er)

allow iron is less malleable / ductile

- iron is strong(er)
- iron is less reactive

allow specific reactions showing difference in reactivity

- iron has ions with different charges
- iron forms coloured compounds
- iron can be a catalyst

allow iron is magnetic

allow the converse statements for sodium

allow transition metal for iron

allow Group 1 metal for sodium

ignore references to atomic structure

ignore iron rusts

2

(d) carbon is more reactive (than nickel)

allow converse

1

(so) carbon will displace / replace nickel (from nickel oxide)

allow (so) nickel ions gain electrons

or

(so) carbon will remove oxygen (from nickel oxide)

allow (so) carbon transfers electrons to nickel (ions)

1



(e) (total M_r of reactants =) 87

1

(percentage atom economy)

$$= \frac{59}{87} \times 100$$

allow (percentage atom economy)

$$= \frac{59}{\text{incorrectly calculated } M_r} \times 100$$

1

= 67.8 (%)

allow an answer from an incorrect calculation to 3 sig figs

1

an answer of 67.8 (%) scores 3 marks

an answer of 67.8160919 (%) or correctly rounded answer to 2, 4 or more sig figs scores 2 marks

an incorrect answer for one step does not prevent allocation of marks for subsequent steps

[11]

2.

(a) heat with a water bath

or

heat with an electric heater

or

allow to evaporate / crystallise at room temperature

1

(b) to make sure that all the iodine reacts

allow so can see the reaction is complete

1

(as) excess iodine would remain in solution

1

(so) iodine could not be filtered off

allow (whereas) excess zinc could be filtered off

or

(so) the zinc iodide would not be pure

allow (so) would have to separate iodine from zinc iodide

1



(c) $\text{moles } I_2 = \frac{0.5(00)}{254} = (0.00197)$
allow moles $I_2 = 0.00197$
allow 65 g Zn: 254 g I_2

1

mass Zn = 0.00197×65 (g)

1

mass = 0.128 (g)

1

allow an expression $\frac{0.5(00) \times 65}{254}$ (g) for the first 2 marks

(d) $92.0 = \frac{12.5}{\text{maximum mass}} \times 100$

1

(maximum mass) = $\frac{100}{92.0} \times 12.5$

1

= 13.6 (g)

allow 13.5869... (g)

1

(e) some product lost on separation
allow incomplete reaction

1

(f) $M_r \text{ZnI}_2 = 319$

1

moles needed

$\left(= 0.1 \times \frac{250}{1000} \right) = 0.025$

or

mass per $\text{dm}^3 = 31.9$ (g)

1

(mass) = 7.98 (g)

allow 7.975 / 8.0 (g)

1

an answer of 7.975, 7.98 or 8.0 (g) scores 3 marks

[14]

3.

(a) (i) lit splint **or** ignite the gas

1

(squeaky) pop / explosion

1

(ii) because it provides energy (for the reaction)

1



to break bonds (in the reactants) **or** so the particles collide successfully

ignore reference to frequency or rate of collisions

because it provides the activation energy gains 2 marks

1

(b) (i) 1.67(g)

allow 1.66-1.68

correct answer (to 3 significant figures) with or without working gains 3 marks

if answer incorrect allow up to 2 marks for the following steps:

24 → 40

1.00 → 40 / 24

or

*moles magnesium = 1 / 24 **or** 0.04(17)*

multiply by 40

*allow ecf from incorrect ratio **or** incorrect number of moles*

3

(ii) **if correct answer from part (b)(i) used**

allow ecf from part (b)(i)

89.8 or 90

if 1.82 g used

82.4 or 82

correct answer with or without working gains 2 marks

if answer incorrect, allow the following for 1 mark:

1.50 / 1.67 (or their answer from part (b)(i))

if 1.82 g used: 1.50 / 1.82

2

(iii) any **one** from:

ignore measurement errors

- not all the magnesium reacted
allow the reaction may be reversible
- some of the magnesium oxide / product may have been left in the tube **or** may have been lost
ignore magnesium lost
- different / unexpected reaction
- magnesium not pure

1

[10]



4.

(a) 2.61 / range 2.5 to 2.7

correct answer with **or** without **or** with wrong working gains **2** marks

(accept answers between 2.5 and 2.7)

if answer incorrect moles of salicylic acid = $2/138 = 0.0145$ moles

ie $2/138$ **or** 0.0145 gains **1** mark

or

$(180/138) \times 2$ gains **1** mark

or

$1 \text{ g} \rightarrow 180/138 = (1.304 \text{ g})$ gains **1** mark

(**not** 1.304g alone)

2

(b) 42.1 range 40.7 to 42.3

accept correct answer with **or** without **or** with wrong working for **2** marks

ecf ie $(1.1 / \text{their answer from (a)}) \times 100$ correctly calculated gains **2** marks

if answer incorrect percentage yield = $1.1 / 2.61 \times 100$ gains **1** mark

if they do not have an answer to part (a)

or

they choose not to use their answer then:

- yield = $(1.1 / 2.5) \times 100$ (1)

- = 44

accept 44 for **2** marks with no working

2

(c) any **one** from:

- errors in weighing
- some (of the aspirin) lost
do not allow 'lost as a gas'
- not all of the reactant may have been converted to product
eg reaction didn't go to completion
allow loss of some reactants
- the reaction is reversible
accept other products / chemicals
- side reactions
ignore waste products
- reactants impure
- not heated for long enough
- not hot enough for reaction to take place

1



- (d) any **one** from:
- use lower temperature
 - use less fuel / energy
ignore references to use of catalyst
 - produce product faster **or** speed up reaction
 - more product produced in a given time (owtte)
 - increased productivity
 - lowers activation energy

1

[6]

5.

(a) lithium (atom) loses (one) electron(s)

1

chlorine (atom) gains (one) electron(s)

1

reference to transfer of one electron

1

to form positive and negative ions

allow to form noble gas electronic structures

or

allow to form stable electron arrangements

or

allow to form full outer shells

or

allow reference to ionic bonding

1

(b) $\frac{161}{81 + 98} \times 100$

1

= 89.944134

1

= 89.9 (%)

1

an answer of 89.9 (%) scores 3 marks

(c) more sustainable **or** less waste

allow any sensible economic or environmental reason but not 'cheaper' without qualification

1



- (d) $50 / 1000 \text{ (dm}^3\text{) or } 0.05 \text{ dm}^3$
or
 $80 / 1000 \text{ (g / cm}^3\text{) or } 0.08 \text{ g / cm}^3$

= 4(.00) (g)

an answer of 4(.00) (g) scores 2 marks

1

1

[10]