M1.(a) because they are <u>gases</u>

ignore vapours / evaporate / (g)

allow it is a gas

1

(b) (i) 80 / 79.5

*correct answer with or without working = **2** marks*
ignore units

*if no answer **or** incorrect answer then evidence of 64 / 63.5 + 16 gains **1** mark*

2

(ii) 79.375 - 80

*correct answer with or without working = **2** marks*

*if no answer **or** incorrect answer then evidence of*

$\frac{64}{80}$ *or* $\frac{63.5}{79.5}$ *(×100) gains **1** mark*

accept (ecf) $\frac{64 \text{ or } 63.5}{\text{answer (b)(i)}}$ *× 100 for **2** marks*

if answer correctly calculated.

if incorrectly calculated evidence of $\frac{64 \text{ or } 63.5}{\text{answer (b)(i)}}$ *(× 100)gains **1** mark*

2

(iii) 3.2

*correct answer with or without working = **1** mark*

allow (ecf)
*4 x ((b)(ii)/100) for **1** mark if correctly calculated*

1

(c) (i) 3.3

accept 3.33……. ***or*** *3 1 / 3* ***or*** *3.3•*

or *3.3r*

1

(ii) (measure to) more decimal places **or** (use a) more sensitive balance / apparatus

*allow use smaller scale (division) **or** use a smaller unit*
ignore accurate / repeat

1

(iii) any **two** from:

ignore systematic / human / apparatus / zero / measurement / random / weighing / reading / recording errors unless qualified

different balances used **or** faulty balance

ignore dirty apparatus

reading / using the balance incorrectly

accept incorrect weighing of copper / copper oxide

spilling copper oxide / copper

allow some copper left in tube

copper oxide impure

allow impure copper (produced)

not all of the copper oxide was reduced / converted to copper **or** not enough / different amounts of methane used

accept not all copper oxide (fully) reacted

heated for different timesheated at different temperatures

if neither of these points awarded allow different amounts of heat used

accept Bunsen burner / flame at different temperatures

some of the copper produced is oxidised / forms copper oxide

some of the copper oxide / copper blown out / escapes (from tube)

ignore some copper oxide / copper lost

some water still in the test tube

2

[10]

M2.(a) electrons transferred from potassium to sulfur

1

two potassium atoms each lose one electron

1

forming K^+ / 1+ ions

1

sulfur atoms gain 2 electrons

1

forming S^{2-} / 2− ions

1

(b) there are no gaps / sticks between the potassium ions and sulfide ions

1

(c) (two) shared pairs between H and S

1

rest correct - no additional hydrogen electrons and two non-bonding pairs on sulfur

second mark dependent on first

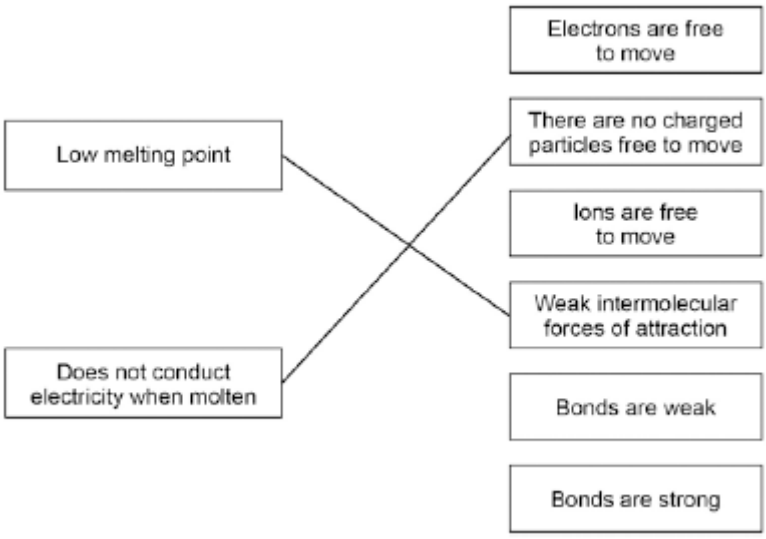
1

(d) 342

2

*allow **1** mark for evidence of (2 × 27) + 3[32 + (16 × 4)]*

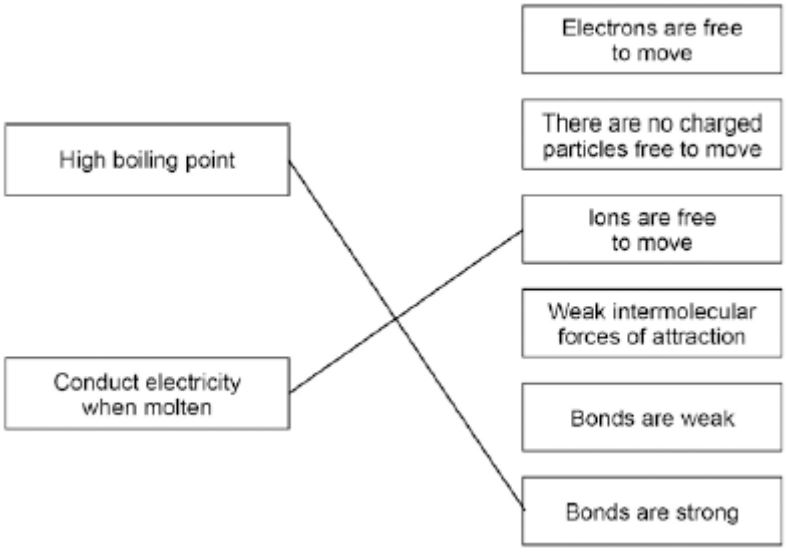
(e) **Property** **Explanation of property**



more than one line drawn from a variable negates the mark

2

(f) **Property** **Explanation of property**



more than one line drawn from a variable negates the mark

2

[14]

M3. (a) (i) 40

*correct answer with or without working **or** incorrect working*
*if the answer is incorrect then evidence of 24 + 16 gains **1** mark*
ignore units

2

(ii) 60

*correct answer with **or** without working or incorrect working*
*if the answer is incorrect then evidence of 24/40 **or** 24/(i) gains **1** mark*
ecf allowed from part(i)
ie 24/(i) ×100
ignore units

2

(iii) 15

ecf allowed from parts(i) and (ii)
24/(i) × 25 or (ii)/100 × 25
ignore units

1

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

ignore gas is lost

- error in weighing <u>magnesium</u> / <u>magnesium oxide</u>
  allow some magnesium oxide left in crucible
- loss of magnesium oxide / magnesium
  allow they lifted the lid <u>too much</u>
  allow loss of reactants / products
- not all of the magnesium has reacted
  allow not heated enough
  allow not enough oxygen / air

2

(ii) any **two** from:

ignore fair test

- check that the result is not anomalous
- to calculate a mean / average
  allow improve the accuracy of the mean / average
- improve the reliability
  allow make it reliable
- <u>reduce</u> the effect of errors

2

[9]

M4. (a) 1.86

ignore units / 1.9

1

(b) use a balance which weighs to more decimal places

accept (use a measuring cylinder with) smaller (scale) divisions / intervals

or use more sensitive balance

allow reference to more decimal places allow smaller units / scale

1

(c) (i) 45.8(3333333)

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

ignore units / 46

if the answer is not correct then evidence of:

(45.4 + 46.3 + 45.8) ÷ 3

***or** 137.5 ÷ 3*

***or** 47.25 / 47.3 / 47.2 gains **1** mark*

2

(ii) any **two** from:

ignore zero error / faulty equipmen

- loss of gas **or** leak
- error in measurement of volume of gas / gas in cylinder / 1 dm^3
- error in weighing the canister / gas at start
- error in weighing the canister / gas at end

  *error in weighing the canister / gas = **1** mark*
- change in temperature

  allow incorrect measurement of temperature
- change in pressure

  allow incorrect measurement of pressure

  *if no other mark awarded allow error in weighing for **1** mark*

2

(iii) any **one** from:

*ignore fair test / precise / valid **or** to check for errors / mistakes*

- check for anomalous results
- to find the mean / average

  allow improve (accuracy of) <u>mean</u> / <u>average</u>
- (improve) reliability / make reliable

1

(d) 44

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

ignore units

*if the answer is incorrect evidence of (3 × 12) / 36 **and** (8 × 1) / 8 gains **1** mark*

2

[9]

M5. (a) because they are gases

ignore vapours / evaporate / (g)

allow it is a gas

1

(b) (i) 80 / 79.5

correct answer with or without working = ***2*** *marks*

ignore units

if no answer ***or*** *incorrect answer then evidence of 64 / 63.5 + 16 gains* ***1*** *mark*

2

(ii) 80 / 79.87 / 79.9 / 79.375 / 79.38 / 79.4

correct answer with or without working = ***2*** *marks*

if no answer ***or*** *incorrect answer*

then

evidence of $\frac{64}{80}$ ***or*** $\frac{63.5}{79.5}$ *(x100) gains* ***1*** *mark*

accept (ecf)

$\frac{64 or 63.5}{answer (b)(i)} (\times 100)$ *for* ***2*** *marks if correctly calculated*

if incorrectly calculated

evidence of $\frac{64 or 63.5}{answer (b)(i)} (\times 100)$

gains ***1*** *mark*

2

(iii) 3.2

correct answer with or without working = ***1*** *mark*

allow (ecf)

4 x ((b)(ii)/100) for ***1*** *mark if correctly calculated*

1

(c) (i) 3.3

accept 3.33…….. or $3\frac{1}{3}$ *or 3.3˙ or 3.3 r*

1

(ii) measure to more decimal places
or *use a more sensitive balance / apparatus*
allow use smaller scale (division)
or *use a smaller unit*
ignore accurate / repeat

1

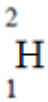
*(iii) any **two** from:*

- *ignore systematic / human / apparatus / zero / measurement / random / weighing / reading errors unless qualified*
- *different balances used **or** faulty balance*
  ignore dirty apparatus
- *reading / using the balance incorrectly **or** recording error*
  accept incorrect weighing of copper / copper oxide
- *spilling copper oxide / copper*
  allow some copper left in tube
- *copper oxide impure*
  allow impure copper (produced)
- *not all of the copper oxide was reduced / converted to copper*
  or *not enough / different amounts of methane used*
  accept not all copper oxide (fully) reacted
- *heated for different times*
- *heated at different temperatures*
  accept Bunsen burner / flame at different temperatures
- *some of the copper made is oxidised / forms copper oxide*
- *some of the copper oxide / copper blown out / escapes (from tube)*
  ignore some copper oxide / copper lost
- *some water still in the test tube*

2

[10]

M6. *(a)*



2 and 1 must be on the left

2 must be above half-way on the H and the 1 below half-way

accept diagram with 2 <u>different</u> particles in centre and 1 particle on circle

1

(b) *(i)* *18*

ignore working

ignore units

1

(ii) *forces (of attraction) between molecules **or***
*bonding between molecules **or***
intermolecular forces /intermolecular bonds

1

*are weak **or** not much energy needed to break them **or** easily overcome*

must be linked to first mark

*if no other mark awarded allow <u>small</u> molecules / small M_r for **1** mark*

*allow forces / bonds are weak for **1** mark*

*do **not** allow covalent bonding is weak*

1

(c) *any reference to <u>more</u> protons = **0** marks*

H-2 atoms have 1 proton and 1 neutron

*allow H-2 has more neutrons / particles for **1** mark*

1

H-1 atoms have one proton

*allow H-2 has two particles and H-1 has one particle for **1** mark*

or

H-2 atom has one neutron (1)

*allow H-2 atom has one more neutron for **2** marks*

H-1 atom has no neutrons (1)

***NB** heavy water (molecule) has 2 <u>more</u> neutrons = **2** marks*

*heavy water (molecule) has <u>more</u> neutrons / particles = **1** mark*

*if no other mark awarded then heavy water molecule has **M**, of 20 = **1** mark*

ignore reference to electrons

1

[6]