GCSE Chemistry

Relative Formula Mass

Mark Scheme

Time available: 51 minutes
Marks available: 48 marks

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1.

(a) **C**

1

(b) **D**

1

(c) 4 / four

1

(d) very hard

1

(e) C_2H_6

1

(f) H^+

1

(g) (M_r =) (1 × 2) + 12 + (16 × 3)

allow (M_r) = 2 + 12 + 48

= 62

2

[8]

2.

(a) any **one** from:

- more vigorous bubbling (for rubidium)
- bigger / brighter flame (for rubidium)

allow converse statements for potassium

allow (rubidium) catches fire more quickly

allow (rubidium) moves around more quickly

allow (rubidium) explodes

allow (rubidium) disappears more quickly

allow (rubidium) melts more quickly

1

(b) (rubidium's) outer shell / electron is further from the nucleus

allow the (rubidium) atom is larger

allow (rubidium) has more shells

1

(so) there is less (electrostatic) attraction between the nucleus and the outer electron (in rubidium)

allow (so) there is more shielding between the outer electron and the nucleus (in rubidium)

1

(so) the outer electron (in rubidium) is more easily lost

allow (so) less energy is needed to remove the (outer) electron (in rubidium)

1

allow energy level for shell throughout

allow converse argument in terms of potassium

(c) $2\ Rb + 2\ H_2O \rightarrow 2\ RbOH + H_2$

ignore state symbols

allow multiples

*allow **1** mark for H_2*

*allow **1** mark for RbOH*

3

(d) the noble gases have boiling points that increase going down the group

1

(e) (relative atomic mass =) $\frac{(90.48 \times 20)+(0.27 \times 21)+(9.25 \times 22)}{100}$

allow (relative atomic mass =) $\frac{1809.6 + 5.67 + 203.5}{100}$

allow (relative atomic mass =) 18.096 + 0.0567 + 2.035

1

= 20.1877

1

= 20.2

allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses all of the values in the table

ignore units

1

[11]

3.

(a) ($3 \times M_r$ H_2O = 3 × (2 + 16) =) 54

(A_r **R** = 150 – 54 =) 96

ignore units

1

alternative approach:
(M_r **R**O_3 = 150 – 6 =) 144 (1)

(A_r **R** = 144 – (3 × 16) =) 96 (1)

ignore units

1

(b) **(R** =) molybdenum / Mo

*allow ecf from question **(a)***

1

(c) (total M_r of reactants) = 163

1

(% atom economy =) $\frac{119}{163}(\times 100)$

allow correct use of an incorrectly calculated value of total M_r

1

= 73 (%)

allow 73.00613 (%) correctly rounded to at least 2 significant figures

1

(d) **Level 2:** Some logically linked reasons are given. There may also be a simple judgement.

3–4

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

1–2

No relevant content

0

Indicative content

- carbon and iron are the cheapest reactants
- hydrogen is the most expensive reactant

- separating solid products is expensive
- separating solid products is time consuming

- in method 1, tungsten needs to be separated from tungsten carbide
- in method 1, some tungsten is lost as tungsten carbide
- in method 1, the carbon dioxide produced will escape

- in method 2, the water vapour produced will escape
- in method 2, no separation of solids is needed

- in method 3, tungsten needs to be separated from iron oxide

[10]

4. (a) precipitate / solid formed

allow colour change

1

(b) total mass before = 257.68 g
total mass after = 257.68 g

1

so the mass of products equals
the mass of the reactants

1

(c) 0.01 g

1

(d) 207 + (2 × 14) + (6 × 16)
or
207 + 2 × [14 + (3 × 16)]

1

= 331

1

*an answer of 331 scores **2** marks*

(e) CrO_4^{2-}

1

(f) carbon dioxide is a gas

allow a gas is produced

1

the gas escapes during the reaction

1

(so) the mass at the end is less than expected

1

[10]

5. (a) C_5H_{12}

1

(b) 2:5

1

(c) **A**

1

(d) **A**

1

(e) carbon dioxide

1

water

1

(f) propane

1

(g) (8 × 1) + (3 × 12)

1

= 44

1

*an answer of 44 scores **2** marks*

[9]