



TOPIC 1 ASSESSED HOMEWORK MARK SCHEME

1. (i) $\frac{10x + 11y}{x + y} = 10.8$

OR ratio 10:11 = 1:4 **OR** 20:80 etc
Allow idea that there are 5 × 0.2 divisions between 10 and 11.

1

abundance of ^{10}B is 20(%)

OR

$$\frac{10x}{100} + \frac{11(100-x)}{100} = 10.8$$

$$\therefore 10x + 1100 - 11x = 1080$$

$$x = 1100 - 1080 = 20\%$$

Correct answer scores M1 and M2.

1

- (ii) Same number of electrons (in outer shell or orbital)
Ignore electrons determine chemical properties.

Same electronic configuration / arrangement
Ignore protons unless wrong.

1

[3]

2. (a) (Total number of protons and neutrons (in nucleus of atom)
(number of) nucleons
- 1

- (b) Zn -
Do not allow Zn⁺ or Zn⁻ or ZN
Ignore numbers
- 1

- (c) m / z
Allow mass / charge
- 1

(relative) abundance / (relative) intensity
 QoL
Allow M1 + M2 in any order

1



$$\frac{206 + 207 + (208 \times 2)}{4} = \frac{829}{4}$$

(d) (i)

$M1 = \text{topline}$

1

$M2 = \div 4$

1

$= \underline{207.3}$

Only

$207.3 = 3 \text{ marks}$

1

(ii) Lead / Pb

Not PB

1

(iii) Same number of electrons (in outer shell) / same electronic configuration

Ignore electrons determine chemical properties

Ignore reference to p and n if correct

Penalise if incorrect

1

[9]

3. (a) Average/mean mass of (1) atom(s) (of an element)
1/12 mass of one atom of ^{12}C

1

If moles and atoms mixes Max = 1

1

OR

(Average) mass of one mole of atoms
1/12 mass of one mole of ^{12}C

OR

(Weighted) average mass of all the isotopes
1/12 mass of one atom of ^{12}C

OR

Average mass of an atom/isotope compared to C-12 on a scale in which an atom of C-12 has a mass of 12

This expression = 2 marks



- (b) d block
- Allow 3d/D*
Other numbers lose M1
Ignore transition metals
- 1
- [Ar] 3d²4s²
- 1
- Can be written in full*
Allow subscripts
3d² and 4s² can be in either order
- 27
- 1
- $$\frac{(90 \times 9) + (91 \times 2) + (92 \times 3) + (94 \times 3)}{17}$$
- (c)
- (= ~~15~~50)
- 1
- (or their abundances)
- If one graph reading error lose M1 and allow consequential M2 and M3.*
If 2 GR errors penalise M1 and M2 but allow consequential M3
If not 17 or their abundances lose M2 and M3
- 1
- = 91.2
- 91.2 = 3 marks provided working shown.*
- 1
- Zr/Zirconium
- M4 -allow nearest consequential element from M3*
accept Zr in any circumstance
- 1
- (d) High voltage supply
- 1
- Removes electron(s) (to form ions)
- 1
- Z⁺ = 90 has shortest TOF
- If not 90 lose M3 and M4*
If charge is wrong on 90 isotope lose M3 only
Accept any symbol in place of Z
- 1



since lowest mass/lowest m/z

Allow lightest

1

- (e) (ions hit detector and) cause current/(ions) accept electrons/cause electron flow

QWC

1

bigger current = more of that isotope/current proportional to abundance

Implication that current depends on the number of ions

1

[15]

4. (a) 37

*These answers only.
Allow answers in words.*

1

48

Ignore any sum(s) shown to work out the answers.

1

- (b) Dissolved in volatile solvent/passed through hollow needle

1

Subjected to high voltage

1

- (c) (i) s / block s / group s

Only

1

- (ii) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^1$

Allow $3d^{10}$ before $4s^2$

Allow in any order.

1

- (d) $\frac{(85 \times 2.5) + 87 \times 1}{3.5}$

M1 is for top line

1

= 85.6

1

Only

1

OR

$\frac{(58 \times 5) + 87 \times 2}{7}$

M1⁸⁵Rb 71.4% and ⁸⁷Rb 28.6%

M2 divide by 100

1

1

85.6



$M3 = \underline{85.6}$

1

(e) Detector

*Mark independently
Allow detection (plate).*

1

Current / digital pulses / electrical signal related to abundance
Not electrical charge.

1

[11]



5. (a) N^{3-} / N^{-3} 1
- (b) F-/ fluoride
Ignore fluorine/F
Penalise FI 1 [2]
6. $H^- = 1s^2$ or $1s_2$ 1 [1]
- →
7. (a) $Na(g) \rightarrow Na^+(g) + e^-$
OR $Na(g) + e^- \rightarrow Na^-(g) + 2e^-$
(-) on electron not essential
equation (1)
state symbols (1)
Ignore state symbols on electrons 2
- (b) Trend : Increases (1)
Explanation : Increased nuclear charge or proton number (1)
Stronger attraction (between nucleus and (outer) e^-) (1)
Trend wrong
Allow M2 only if M3 correct (con) 3
- (c) How values deviate from trend: (both values) too low (1)
Explanation for Al: e^- removed from (3) p (1)
 e^- or orbital is higher in energy or better shielded than (3)s
or p electron is shielded by 3s electrons (1)
Allow e^- is further away
- Mark independently
- Explanation for S*: e^- removed from (3)p electron pair (1)
repulsion between paired e^- (reduces energy required) (1)
Mark separately
If deviation *wrong* allow M2 and M4
If M3 and / or M5 right (con)
If used 'd' rather than 'p' orbital - lose M2 + M4
but may get M3, M5 (explanation marks) 5



[10]

8. (a) Heat / enthalpy / energy for removal of one electron (1)

from a gaseous atom (1)
can score in an equation

must have first mark to score the second

2

(b) (i) 2 (1)

(ii) Two elements (or Na / Mg) before the drop (in energy)
to Al (1)

(iii) ionisation energy of Al < that for Mg (1)

(iv) fall in energy from P to S (1)
or discontinuity in trend

From Al to P there are 3 additional electrons (1)
or three elements

For second mark idea of block of 3 elements

5

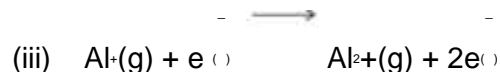
[7]

9. (a) (i) Higher than P

1

(ii) $1s^2 2s^2 2p^6 3s^1$
Allow any order

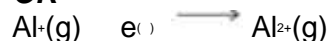
1



OR



OR



1

(iv) Electron in Si (removed from) (3)p orbital /

8

MEGA LECTURE

electron (removed)
from higher energy orbital or sub-shell / electron
in silicon is more shielded

Accept converse arguments relating to Al
Penalise incorrect p-orbital

1

(b) Sodium / Na

Allow Na⁺

1

Electron (removed) from the 2nd shell / 2p (orbital)

M2 is dependent on M1

*Allow electron from shell nearer the nucleus (so
more attraction)*

1

(c) Silicon / Si

Not Si

1

(d) Heat or energy needed to overcome the attraction between the
(negative) electron and the (positive) nucleus or protons

Not breaking bonds

QoL

Or words to that effect eg electron promoted to higher energy
level (infinity) so energy must be supplied

1

[8]

10. (a) 2s² 2p⁶;

*If ignored the 1s² given and written 1s²2s²2p⁶
mark as correct*

Allow capitals and subscripts

1

(b) (i) Na⁺(g) Na²⁺(g) + e⁻;

*One mark for equation and one mark for state
symbols*



M2 dependent on M1

Allow Na⁺(g) - e⁻ Na(g)

Allow X⁺(g) X²⁺(g) + e = 1 mark

2

(ii) Na⁽²⁺⁾ requires loss of e⁻ from a 2(p) orbital or 2nd energy level or
2nd shell and Mg⁽²⁺⁾ requires loss of e⁻ from a 3(s) orbital or 3rd
energy level or 3rd shell / Na⁽²⁺⁾ loses e from a lower (energy)



orbital/ or vice versa;

Not from 3p

1

Less shielding (in Na);

Or vice versa for Mg

1

e⁻ closer to nucleus/ more attraction (of electron to nucleus) (in Na);

M3 needs to be comparative

1

(iii) Aluminium /Al;

1

(c) Decreases;

If not decreases CE = 0

If blank, mark on

1

Increasing nuclear charge/ increasing number of protons;

1

Electrons in same shell or level/ same shielding/ similar shielding;

1

[10]



- | | | |
|-----|---|-----|
| 11. | D | [1] |
| 12. | D | [1] |
| 13. | D | [1] |
| 14. | A | [1] |

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