



Name _____ Class: _____

Start Time _____ End Time _____ Time Taken _____

Time allowed: 60 minutes

INSTRUCTIONS TO CANDIDATES

Write your name in the space above.
Fill in the time you start and the time you finish the test.
Answer all the questions.
Write your answers in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [] at the end of each question or part of a question.
The marks allocated and the spaces provided for your answers are a good indication of the length of answers required.

Success Criteria	Questions in Paper	Mark	%	Rank Order
Fundamental particles	1a, 1b, 2d, 4a	3, 2, 2		
Electron configurations	1c, 2b, 6a, 6b	2, 1, 2, 1		
Periodicity	1d, 2c, 6c	2, 1, 1		
Bonding	1ei, ii, iii,	6		
Equation writing	1eiv	1		
Isotopes	2a	5		
Mass Spectrometry	3, 5a-d	9, 8		
Relative Atomic Mass	3b, 53	2, 4		
Ionisation energies	3c, 3d, 3e	3		
Total		57		



Q1.

(a)

Particle	Relative charge	Relative mass	
Proton	+1 or 1+	1	(1)
Neutron	0 or no charge/neutral/zero	1 (<u>not</u> - 1)	(1)
Electron	-1 or 1-	1/1800 to 1/2000	(1)

or negligible

or zero

or 5.0×10^{-4} to 5.6×10^{-4}

*if 'g' in mass column - wrong
penalise once*

3

(b) ${}_{18}^{38}\text{Ar}$ **(1)(1)**

Allow numbers before or after Ar

2

(c) S: $1s^2 2s^2 2p^6 3s^2 3p^4$ **(1)**

Allow upper case letters

S^{2-} : $1s^2 2s^2 2p^6 3s^2 3p^6$ **(1)**

If use subscript penalise once

2

(d) *Block:* p **(1)**

Explanation: Highest energy or outer orbital is (3) p

OR outer electron, valency electron in (3) p

NOT 2p etc.

2

(e) (i) *Bonding in* Na_2S : ionic **(1)**

Bonding in CS_2 : covalent **(1)**

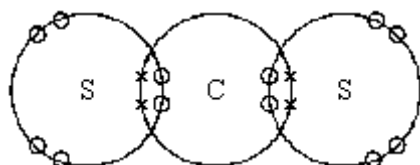
ignore other words such as dative / polar / co-ordinate

(ii) Clear indication of electron transfer from Na to S **(1)**

1 e⁻ from each (of 2) Na atoms or 2 e⁻ from 2 Na atoms **(1)**

QoL correct English

(iii)



Correct covalent bonds **(1)**

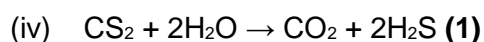
All correct including lone pairs **(1)**



Allow all •s or all ×s

M2 tied to M1

NOT separate e-s in S•- 2 l p



Ignore state symbols even if wrong

7

[16]

Q2.

- (a) (i) Atoms with the same number of protons / proton number (1)

NOT same atomic number

with different numbers of neutrons (1)

NOT different mass number / fewer neutrons

- (ii) Chemical properties depend on the number or amount of (outer) electrons (1) OR, isotopes have the same electron configuration / same number of e⁻

- (iii) $23/6.023 \times 10^{23}$ (1)

CE = 0 if inverted or multiplied

tied to M1 $3.8(2) \times 10^{-23}$ [2-5 sig figs] (1)

5

- (b) $1s^2 2s^2 2p^6 3s^1$ (1)

accept subscripted figures

1

- (c) Highest energy e⁻ / outer e-s / last e⁻ in (3)d sub-shell (1)

OR d sub-shell being filled / is incomplete

OR highest energy sub-shell is (3)d

NOT transition element / e⁻ configuration ends at 3d

Q of L

1

- (d) ${}^{15}_7\text{N}$ N correct symbol (1)

allow N^{15}_7

Mass number = 15 AND atomic number = 7 (1)

2

[9]

Q3.

(a)
$$\frac{(82 \times 2) + (83 \times 2) + (84 \times 10) + (86 \times 3)}{17} \quad \frac{(1428)}{(17)}$$

M1 for the top line



M2 is for division by 17

1

= 84.0

Not 84

No consequential marking from M1 or M2

Ignore units

1

The A_r in the Periodic table takes account of the other isotopes / different amounts of isotopes (or words to that effect regarding isotopes)

Award independently

Comparison implied

Isotope(s) alone, M4 = 0

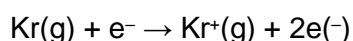
1

(b) (Beam of electrons from) an electron gun / high speed / high energy electrons

1

Knocks out electron(s) (to form a positive ion)

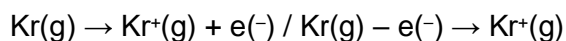
1



State symbols must clearly be (g)

1

OR



The ^{84}Kr isotope

One mark for identifying the 84 isotope

1

Has 2 electrons knocked out / gets a 2+ charge

One mark for the idea of losing 2 electrons (from this isotope)

1

[9]

Q4.

(a) (i) 1.6734×10^{-24} (g)

Only.

1.6734×10^{-27} kg

Not 1.67×10^{-24} (g).

1

(ii) **B**

1

(b) (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

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

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

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

Correct answer scores M1 and M2.

1

(c) Range between 3500 and 10 000 kJ mol^{-1}

1

(d) $\text{B}^+(\text{g}) \longrightarrow \text{B}^{2+}(\text{g}) + \text{e}^{-}$

$\text{B}^+(\text{g}) - \text{e}^{-} \longrightarrow \text{B}^{2+}(\text{g})$

$\text{B}^+(\text{g}) + \text{e}^{-} \longrightarrow \text{B}^{2+}(\text{g}) + 2\text{e}^{-}$

Ignore state symbol on electron even if wrong.

1

(e) Electron being removed from a positive ion (therefore needs more energy) / electron being removed is closer to the nucleus

Must imply removal of an electron.

Allow electron removed from a + particle / species or from a 2+ ion.

Not electron removed from a higher / lower energy level / shell.

Not electron removed from a higher energy sub-level / orbital.

Ignore electron removed from a lower energy sub-level / orbital.

Ignore 'more protons than electrons'.

Not 'greater nuclear charge'.

Ignore 'greater effective nuclear charge'.

Ignore shielding.

1

[8]

Q5.

(a) (Ions accelerated by) attraction to negatively charged plate / electric field

Mark independently

1

Ions detected by gaining electrons

Allow the transfer of electrons

1

Abundance determined by (size) of current flowing



- (or amount of electrons gained) in the detector
Allow current is proportional to abundance 1
- (b) Mass = $\frac{52/1000}{6.022 \times 10^{23}}$
Mass = $8.6(4) \times 10^{-26}$ 1
- (c) $V^2 = (2 \times 1.269 \times 10^{-13}) / 8.64 \times 10^{-26}$
Allow correct rearrangement for V or V² 1
- $V = 1.71 \times 10^6 \text{ ms}^{-1}$
Allow ecf from (b) (note if 8.6×10^{-23} in (b) leads to approx. $5.4 \times 10^4 \text{ ms}^{-1}$) 1
- (d) Sketch with peaks at 158, 160, 162
Mark independently 1
- In ratio 25%:50%:25%
Allow approx. ratio 1:2:1 1
- (e) % abundance $^m\text{Xe} = 20(\%)$
Working must be shown 1
- $131.31 = (0.28 \times 129) + (0.25 \times 131) + (0.27 \times 132) + (0.20 \times m)$ 1
- $131.31 - 104.51 = 0.2m$ 1
- Mass number = 134
Answer must be an integer 1
- [12]

Q6.

- (a) $1s^2 2s^2 2p^6 3s^2 3p^1$ 1
- $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3$ 1
- If noble gas core used correctly in both then scores 1*
Allow subscripts and capitals
Ignore $4s^0$
- (b) Sr^{2+}
Ignore name and correct proton/mass number



Allow Sr⁺²

1

(c) Ca₃P₂

Allow reversed or ionic formula

Ignore name

1