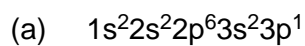
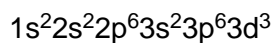


Mark schemes

1



1

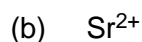


1

If noble gas core used correctly in both then scores 1

Allow subscripts and capitals

Ignore $4s^0$



Ignore name and correct proton/mass number

Allow Sr^{+2}

1



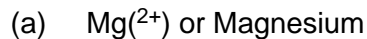
Allow reversed or ionic formula

Ignore name

1

[4]

2



Na⁺ CE=0

1

Because Mg^{2+} has more protons

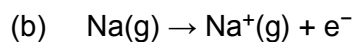
AND

With the same shielding/screening/electron arrangement/number of electrons (or isoelectronic)

Allow larger/stronger nuclear charge

Ignore atomic radius

1



1 for correct species and gas phase

Allow e without charge

Allow $Na(g) - e^- \rightarrow Na^+(g)$

$Na(g) + e^- \rightarrow Na^+(g) + 2e^-$

1

(c) Mg between 600-800 1

S between 800-1040

If S not lower than P on graph then M1 only

If no plots on graph must state S below P to access M3 & M4

1

e^- paired in (3)p orbital in S (owtte)

Allow (3)p subshell/sublevel provided pair mentioned

1

Paired e^- repel (so less energy needed to remove)

1

[7]

3

(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 V^2

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]

4 D

[1]

5 C

[1]

6

- (a) General increase
If not increase then CE 1
- Greater nuclear charge / more protons 1
- Same shielding / electrons added to same shell
Allow similar 1
- Stronger attraction (from nucleus) for outer electron(s)
Allow electron in outer shell 1
- (b) Aluminium / Al (lower than Mg)
CE if not Al or S 1
- (Outer) electron in (3)p orbital / sub-shell (level)
If 2p or 4p orbital lose M2 and M3 1
- (3p) higher in energy
Allow more shielded or weaker nuclear attraction
M3 is dependent on M2 1
- or
- Sulfur / S (lower than P)
 (Outer) electrons in (3)p orbital begin to pair
 Repel
If 2p or 4p orbital lose M2 and M3
Allow 2 electrons in (3)p
M3 is dependent on M2 1

- (c) Sulfur / S
CE if not S 1
 Large jump after 6th or between 6th and 7th
Do not allow M2 if atom/ion is removed 1
- (d) Silicon
CE if not Si 1
 Giant covalent structure / macromolecule 1
 Covalent (bonds)
Giant covalent scores M2 and M3 1
 Many / strong (covalent bonds) or
 (covalent bonds) need lots of energy to break
CE for M2-M4 if molecules / metallic / ionic / IMFs mentioned 1
- [13]

- 7** (a) $1s^22s^22p^63s^23p^64s^2$
Allow correct numbers that are not superscripted 1
- (b) $Ca(s) + 2H_2O(l) \longrightarrow Ca^{2+}(aq) + 2OH^-(aq) + H_2(g)$
State symbols essential 1
- (c) Oxidising agent 1
- (d) $Ca(g) \longrightarrow Ca^+(g) + e^-$
State symbols essential
Allow 'e' without the negative sign 1
- (e) Decrease
If answer to 'trend' is not 'decrease', then chemical error = 0 / 3 1
 Ions get bigger / more (energy) shells
Allow atoms instead of ions 1
 Weaker attraction of ion to lost electron 1
- [7]

- 8** (a) Abundance of third isotope = $100 - 91.0 - 1.8 = 7.2\%$ 1

$$\frac{(32 \times 91) + (33 \times 1.8) + (y \times 7.2)}{100} = 32.16$$

1

$$7.2y = 32.16 \times 100 - 32 \times 91 - 33 \times 1.8 = 244.6$$

1

$$y = 244.6 / 7.2 = 33.97$$

$$y = 34$$

Answer must be rounded to the nearest integer

1

(b) (for electrospray ionisation)

A high voltage is applied to a sample in a polar solvent

1

the sample molecule, M, gains a proton forming MH^+

1

OR

(for electron impact ionisation)

the sample is bombarded by high energy electrons

1

the sample molecule loses an electron forming M^+

1

(c) Ions, not molecules, will interact with and be accelerated by an electric field

1

Only ions will create a current when hitting the detector

1

[8]

9

D

[1]

10

D

[1]