

- M1.** (a) Proton mass = 1 charge = +1
 Electron mass $\leq 1/1800$ Or $\leq 5.6 \times 10^{-4}$ charge = -1
 (Do not accept +1 for proton mass or 'g' units) 2
- (b) (i) 13 1
- (ii) Si 1
- Mass number = 28 **and** atomic number = 14
 (Do not accept 28.1 or 28.0 or 'Silicon') 5
- (c) Mean (average) mass of an atom / all the isotopes
 1/12th mass of atom of ^{12}C
 Or Mass of 1 mole of atoms of an element (1)
 1/12th mass of 1 mole of ^{12}C (1)
 Or Average mass of an atom / all the isotopes (1)
 relative to the mass of a ^{12}C atom taken as exactly 12 / 12.000 (1)
 (Penalise 'weight' once only) (Ignore 'average' mass of ^{12}C)
 (Do not allow 'mass of average atom') 2
- (d) $A_r = (24 \times 0.735) + (25 \times 0.101) + (26 \times 0.164) = 24.41$
 (mark M2 conseq on transcription error or incorrect addition of %)
- (e) $M_r =$ highest m/z value 1
 (NOT 'highest/largest/right-hand' peak) 3
- [10]

M2. (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)

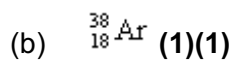
or negligible

or zero

or 5.0×10^{-4} to 5.6×10^{-4}

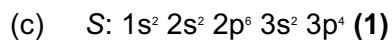
*if 'g' in mass column - wrong
penalise once*

3

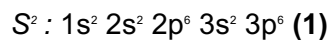


Allow numbers before or after Ar

2



Allow upper case letters



If use subscript penalise once

2



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

OR outer electron, valency electron in (3) p

NOT 2p etc.

2



Bonding in CS₂: covalent **(1)**

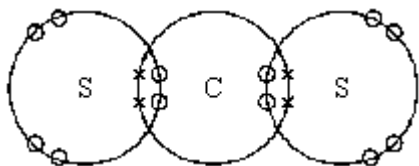
ignore other words such as dative / polar / co-ordinate



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

(iv) $\text{CS}_2 + 2\text{H}_2\text{O} \rightarrow \text{CO}_2 + 2\text{H}_2\text{S}$ (1)

Ignore state symbols even if wrong

7

[16]

M3. (a) Proton: mass 1, charge + 1 (1)

Neutron: mass 1, charge 0 (1)

Electron mass 1/1840, charge -1 (1)

Allow mass = 0, or negligible, or 1/1800 to 1/2000

Isotopes have the same number of protons (1)

OR atomic number

different number of neutrons (1)

Isotopes have the same electronic configuration (1)

OR same number of electrons

Chemical properties depend on electrons (1)

7

average(1) mass of an atom/isotopes

(b) $\frac{\text{mass of 1 atom of } ^{12}\text{C}}{\text{average(1) mass of an atom/isotopes}} \times 12$ (1)

$\frac{\text{mass of 1 mol of atoms}}{\text{OR mass of 1 atom of } ^{12}\text{C}} \times 12 \text{ or in words}$

Spectrum gives (relative) abundance **(1)**

OR % or amount

And m/z **(1)**

Multiply m/z by relative abundance for each isotope **(1)**

Allow instead of m/z mass no, A_r or actual value from example

Sum these values **(1)**

Divide by the sum of the relative abundances **(1)**

only award this mark if previous 2 given

Max 2 if e.g. has only 2 isotopes

7

[14]

M4.C

[1]