Question Number	Correct Answer	Reject	Mark
1	C		1

Question Number	Correct Answer	Reject	Mark
2	D		1

3)

Question Number	Correct Answer	Reject	Mark
(a)	B		1

Question Number	Correct Answer	Reject	Mark
(b)	A		1

Question Number	Correct Answer	Reject	Mark
(c)	D		1

4)

Question Number	Correct Answer	Reject	Mark
	B		1

5)

Question Number	Correct Answer	Reject	Mark
	D		1

6)

Question Number	Correct Answer	Reject	Mark
6	A		1

7)

Question Number	Correct Answer	Reject	Mark
7	C		1

8)

Question Number	Correct Answer	Reject	Mark
	C		1

9)

Question Number	Correct Answer	Reject	Mark
9	C		1

10)

Question Number	Correct Answer	Reject	Mark
10	C		1

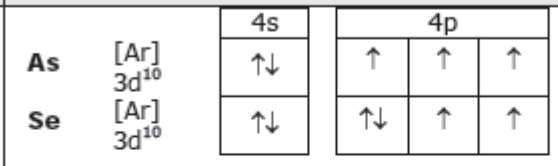
Question Number	Correct Answer	Reject	Mark
11	D		**1**

Question Number	Correct Answer	Reject	Mark
12	B		**1**

Question Number	Correct Answer	Reject	Mark
13	A		**1**

Question Number	Acceptable Answers	Reject	Mark
14 **(a)**	$As(g) - e^{(-)} \rightarrow As^{+}(g)$ OR $As(g) \rightarrow As^{+}(g) + e^{(-)}$ Entities **(1)** All species gaseous providing a reasonable attempt at an ionization energy **(1)** Examples: $As(g) + e^{(-)} \rightarrow As^{+}(g)$ $As(g) - e^{(-)} \rightarrow As^{-}(g)$ $As^{2+}(g) - e^{(-)} \rightarrow As^{3+}(g)$ IGNORE state symbol of electron ALLOW upper case / large S in arsenic ALLOW $As(g) + e^{(-)} \rightarrow As^{+}(g) + 2e^{(-)}$ **(2)**	$As(g)+e^{(-)} \rightarrow As^{-}(g)$ (electron affinity)	**2**

Question Number	Acceptable Answers	Reject	Mark
(b)	AsH_3 / H_3As **(1)** H_2Se / SeH_2 **(1)** IGNORE charges ALLOW upper case / large S in arsenic **NOTE:** If two or more answers given for one element mark that element on a plus minus basis	SE for Selenium	**2**

Question Number	Acceptable Answers	Reject	Mark
(c) (i)	 One mark for each row Arrows may be half-headed Arrows must be in same direction if in singly occupied boxes (can be down) ALLOW two arrows for Se in any 4p box Selenium two arrows must show opposite spins		**2**

Question Number	Acceptable Answers	Reject	Mark
(c) (ii)	**For parts c(ii),d and e it is important to keep in mind the two elements involved in each part** **As and Se** **First mark:** EITHER In Se, (spin) pairing has occurred (for the first time in that p sub-shell) OR electron removed from orbital containing two electrons **(1)** ALLOW sub-shell for orbital **Second mark:** EITHER (Increase in) repulsion (so electron lost more easily) OR Half-filled (sub-) shell/allow orbital (particularly) stable (in As) ALLOW orbital for sub-shell **(1)** Mark each point independently IGNORE reference to distance from nucleus and shielding		**2**

Question Number	Acceptable Answers	Reject	Mark
(d)	**Se and Kr** **First mark:** EITHER The nuclear charge is increasing (Nuclear must be stated or clearly implied) OR number of protons / atomic number is increasing **(1)** **Second mark:** (Outermost) electron closer to nucleus / electron is removed from the same (sub)shell / electron experiences similar shielding / (atomic) radius is smaller/ smaller **atom** **(1)** ALLOW reverse arguments for selenium IGNORE Kr has full outer shell	Ionic radius Molecule (unless monatomic)	**2**

Question Number	Acceptable Answers	Reject	Mark
(e)	**Kr and Rb** Any two from: The **electron** (in Rb) (removed) is further from the nucleus **(1)** The **electron** is in a higher / new / another / 5s (energy quantum) shell / energy level **(1)** **More** shielded **(1)** IGNORE any reference to stability of krypton or larger atomic radius of Rb / full outer shell of Kr It is possible that two answers may be offered together in one sentence e.g. Rb outer electron is in another shell further from nucleus (2)		**2**

Question Number	Acceptable Answers	Reject	Mark
(f)	Krypton / Kr	Anything else	**1**

Question Number	Acceptable Answers	Reject	Mark
15 **(a)**	All have the same number of electrons / all have one (s) electron / same electron configuration **(1)** All have the same number of protons / all have one proton **(1)** The first has no neutrons, the second one neutron and the third two neutrons Allow deuterium has one more neutron, tritium two more neutrons **(1)** Ignore references to same atomic number and different mass numbers	All have one p electron Different number of neutrons alone	**3**

Question Number	Acceptable Answers	Reject	Mark
(b)	$(^{14}_{7}N + ^{1}_{0}n \rightarrow ^{3}_{1}H +) ^{12}_{6}C$ Numbers can be on either side or both sides		**1**

Question Number	Acceptable Answers	Reject	Mark
(c)(i)	**Molar mass / M(r) / 3+2 / 2+3** = 5 (g mol^{-1}) (1) Number of moles = 4/5 = 0.8 **(1)** O.8 with correct working, with wrong working, or with no working **(2)** Allow internal TE if Molar mass clearly indicated and incorrect eg Molar mass / M(r) = 6 (g mol^{-1}) **(0)** Number of moles = 4/6 = 0.67 **(1)**	Penalise incorrect units	**2**

Question Number	Acceptable Answers	Reject	Mark
(c)(ii)	24 000 x 0.8 = 19 200 (cm^3) Allow 19.2 **dm^3** Allow TE from (c)(i)	Incorrect units	**1**

Question Number	Acceptable Answers	Reject	Mark
(d)	$\frac{1.0078 \times 99.9850 + 2.0141 \times 0.0150}{100}$ OR $\frac{1.0078 \times 99.9850 + 2.0141 \times 0.0150}{99.9850 + 0.0150}$ **(1)** Notice this working must be shown in full to score first mark. (= 1.007951) = 1.0080 **(1)** 1.008 max 1 with or without working Correct answer no working **(2)** Only give second mark for correct answer to 4 decimal places Ignore g mol^{-1}	Incorrect units e.g. g	**2**

Question Number	Acceptable Answers	Reject	Mark
(e)(i)	Single arrow **upwards** from lowest line to infinity line (allow above or very close below) Allow double headed arrow	More than one line	**1**

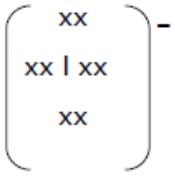
Question Number	Acceptable Answers	Reject	Mark
(e)(ii)	Hydrogen $1s^1$ **and** Sodium $1s^2\ 2s^2\ 2p^6\ 3s^1$ **(1)** Electron numbers may be on lines or subscript. Both have one (s) electron in the **outer** shell / orbital / sub shell OR same number of electrons / same electron(ic) configuration in **outer** shell / orbital / sub shell OR Both have an/one unpaired electron in their **outer** / **last** shell / orbital / sub shell **(1)** Second mark depends on one outer shell s electron shown for each electronic configuration	$1s^2\ 2s^1$ half filled s outer shell same electron(ic) configuration alone	**2**

Question Number	Acceptable Answers	Reject	Mark
(f)	Helium **(1)** Any two from the following points: Electron removed is closest / close to the nucleus **(1)** Little shielding, allow no shielding **(1)** More protons / higher nuclear charge than hydrogen. Allow higher effective nuclear charge **(1)** **NB** second and third marks can be gained if **hydrogen** is given: Electron removed is close / closest to the nucleus **(1)** No shielding **(1)**	Any other elements	3

Question Number	Acceptable Answers	Reject	Mark
16 (a)	**(i) Structure** Lattice /close-packed **(1)** (or a diagram with at least 3 rows) positive ions or cations (allow metal ions) **(1)** delocalized electrons / sea of electrons **(1)** **(ii) Bonding** (Electrostatic) **attraction** between positive ions / cations (allow metal ions) and delocalized electrons / sea of electrons **(1)**	layers protons 'free' electrons	**4**

Question Number	Acceptable Answers	Reject	Mark
(b)	Any three from 1. Magnesium ion / Mg^{2+} (allow magnesium) has a larger charge (density) than the sodium ion (allow sodium) / Na^+ some comparison of the ions is required **(1)** 2. magnesium ions / Mg^{2+} smaller than sodium ions **(1)** 3. Magnesium / Mg^{2+} contributes two / more electrons (per atom) to the "sea" of electrons **(1)** 4. magnesium ions / Mg^{2+} have greater attraction for the delocalized "sea" of electrons **(1)** Ignore reference to number of outer electrons in Mg / Na Any references to the bonding being ionic, covalent or intermolecular (max 2) Reverse argument can gain full marks	Just Mg^{2+} and Na^+ More bonds	**3**

Question Number	Acceptable Answers	Reject	Mark
(c)	The delocalized electrons / sea of electrons **(1)** Flow (allow move / free to move) **(1)** (When a potential difference/voltage is applied) 'Carry the current' is not sufficient for the mark	'free' electrons	**2**

Question Number	Acceptable Answers	Reject	Mark
17	$[:Li]^+$ (1)  (1) Accept all or mixture of dots and crosses **Check inner electrons present on lithium** If no element symbols but fully correct with Li first give **1 max** If no / incorrect charge(s) if the electrons are correct **1 max** If arrow drawn from third / outer shell electron on lithium to join electrons in iodine / iodide with correct charges scores **1 max** Brackets are not essential		**2**