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SMART EXAM RESOURCES
9701 CAMBRIDGE AS CHEMISTRY
TOPIC QUESTIONS AND MARK SCHEMES
TOPIC : ATOMIC STRUCTURE

SUB-TOPIC: VARIATION IN ATOMIC AND IONIC RADIUS

SET-2-QP-MS

- 1 (a) Table 1 gives physical data for some of the Period 3 elements.

Table 1

atomic number, Z	11	12	13	14	15	16	17
bonding present in element	M						C
first ionisation energy/kJ mol ⁻¹	494	736	577	786	1060	1000	1260
maximum oxidation number							+7
anionic radius/nm	–	–	–	0.271	0.212	0.184	0.181

Explain the variation in anionic radius for the elements with atomic numbers 14 to 17.

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..... [2]

Mark Scheme:

M1 (anions have) same number of electrons (but increasing proton number)	2
M2 increasing proton number / nuclear charge AND increasing attraction of nucleus for (outer) electrons OR (outer) electrons attracted more (strongly) to the nucleus AND because of increasing proton number / nuclear charge	

2 Suggest why ionic radius increases down Group 1.

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..... [1]

Mark Scheme:

Ions/elements have more shells / energy levels (as the group is descended)	1
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- 3 (i) The first ionisation energies of the elements Na to Ar show a variation. Some physical properties show similar variations.

The atomic radius of the elements decreases from Na to Cl.

Give a brief explanation of this variation.

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- (ii) The cations formed by the elements Na to Al are smaller than the corresponding atoms.

Give a brief explanation of this change.

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[3]

Mark Scheme:

- (i) **from Na to Cl**
increased nuclear charge/nuclear attraction (1)
- (ii) cation has fewer electrons than atom **or**
cation has lost outer electrons **or**
cation has fewer shells (1)
- but cation has same nuclear charge as atom **or**
proton number is the same (1) [3]

The first six ionisation energies of an element **X** are given below.

ionisation energy / kJ mol ⁻¹					
first	second	third	fourth	fifth	sixth
950	1800	2700	4800	6000	12300

(a) Define the term *first ionisation energy*.

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..... [3]

Mark Scheme: