Do not write outside the box

Section B

Answer **all** questions in the spaces provided.

5 The following table gives the melting points of some elements in Period 3.

Element	Na	Al	Si	P	S
Melting point / K	371	933	1680	317	392

5 (a) State the type of structure shown by a crystal of silicon.
Explain why the melting point of silicon is very high.

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(3 marks)

(Extra space) .....

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5 (b) State the type of structure shown by crystals of sulfur and phosphorus.
Explain why the melting point of sulfur is higher than the melting point of phosphorus.

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(3 marks)

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5 (c) Draw a diagram to show how the particles are arranged in aluminium and explain why aluminium is malleable.
(You should show a minimum of six aluminium particles arranged in two dimensions.)

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(3 marks)

(Extra space) .....

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5 (d) Explain why the melting point of aluminium is higher than the melting point of sodium.

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(3 marks)

(Extra space) .....

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Question	Marking Guidance	Mark	Comments
5(a)	Macromolecular/giant covalent/ giant molecular / giant atomic	1	If IMF/H-bonds/Ionic/metallic CE =0/3 covalent bond between molecules CE = 0/3 If giant unqualified M1 = 0 but mark on
	Many/strong covalent bonds	1	M2 and M3 can only be scored if covalent mentioned in answer Ignore metalloid and carbon Ignore bp
	Bonds must be broken/overcome	1	Ignore numbers of bonds and references to energy
5(b)	(Simple) <u>molecular</u>	1	QoL Do not allow simple covalent for M1 Giant covalent/ionic/metallic, CE = 0 If breaking covalent bonds CE= 0/3
	S bigger <u>molecule</u> (than P) or S_8 and P_4 references	1	QoL Allow more electrons in sulfur <u>molecule</u> or S_8 Do not allow S is bigger then P Allow S <u>molecule</u> has a bigger M_r Do not allow contradictions
	So more/ stronger <u>van der Waals</u>' forces (to be broken or overcome)	1	Not just more energy to break

5(c)	Regular arrangement of minimum of 6 particles in minimum of 2 rows + charge in each one (of 6) <u>Rows/planes/sheets/layers</u> (of atoms/ions) can slide (owtte) over one another	1 1 1	Ignore e- Do not allow ring arrangements OR structures bonded with electrons Allow +, (1+, 2+ or 3+) in ions/or in words M3 independent If ionic bonding/molecules/IMF/vdw/covalent, penalise M3 Ignore layers of electrons sliding

5(d)	Bigger charge (3+ compared to 1+) ***OR*** smaller atom/ion in Al / more protons/bigger nuclear charge More free /<u>delocalised</u> electrons (in Al)/bigger sea of electrons in Al Stronger metallic bonding/ stronger (electrostatic) attraction between the (+) ions or nuclei and the (delocalised) electrons (or implied)	1 1 1	CE = 0 if molecules, ionic, covalent, IMF (Allow Al^{2+}) Accept 2 or 3 delocalised electrons compared to 1 in Na Must be implied that the electrons are the delocalised ones not the electrons in the shells. Accept converse arguments