PROPERTIES OF PERIOD 3 ELEMENTS

1. The elements from sodium to argon make up Period 3 of the Periodic Table. The properties of the elements show important variations which are related to the structure and bonding of the elements.

a) The atomic radii of the elements from sodium to aluminium are shown below

Element	Na	Mg	Al
Atomic radius/nm	0.186	0.160	0.143

What happens to the atomic radius as the atomic number increases?

_____ (1)

b) Explain the variation.

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_____

_____ (3)

2. The melting-points of three of the Period 3 elements are shown below.

Element	Na	Mg	Si
M. pt./°C	98	660	1410

a) Name the type of bonding present in sodium.

_____ (1)

b) Explain how the sodium atoms are bonded together by describing the structure of the metal.

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_____

_____ (3)

c) Explain why the melting point of magnesium is higher than that of sodium.

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_____ (4)

d) The element silicon is quite different in its properties to sodium and magnesium because it has a different type of structure. Name the type of structure found in silicon and use it to account for the very high melting-point of the element.

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_____ (4)

3. a) Define the term *first ionisation energy of an element*.

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_____ (3)

b) The first ionisation energies (I.E.) of sodium and magnesium are 494 and 736 kJ mol^{-1} respectively. Explain why the first I.E. of magnesium is higher than that of sodium.

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_____ (3)

c) The first I.E. of aluminium is 577 kJ mol^{-1}, which is a lower value than that of magnesium. Explain why aluminium's first I.E. is lower than magnesium's.

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_____ (3)

d) The first I.E.s of phosphorus and sulphur are 1060 and 1000 kJ mol^{-1} respectively. Account for the difference by reference to the electronic configurations of the two elements.

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_____ (2)

Total = 27 marks