9.2 Periodic trends

01. 0620_s14_qp_31 Q: 4

In the Periodic Table, the elements are arranged in columns called Groups and in rows called Periods.

(a) (i) Complete the table for some of the elements in Period 3.

group number	I	II	III	IV	V	VI	VII
symbol	Na	Mg	A*l*	Si	P	S	C*l*
number of valency electrons							
valency							

[2]

(ii) What is the relationship between the group number and the number of valency electrons?

.....

..... [1]

(iii) Explain the relationship between the number of valency electrons and the valency

for the elements Na to A*l*,

.....

.....

.....

for the elements P to C*l*.

.....

.....

.....

[4]

(b) Across a period, the elements change from metallic to non-metallic.

(i) Describe how the type of oxide changes across this period.

.....

..... [2]

(ii) Describe how the type of bonding in the chlorides formed by these elements changes across this period.

.....

..... [2]

[Total: 11]

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An element, **M**, has the electron distribution 2 + 8 + 18 + 3.

(a) Which group in the Periodic Table is element **M** likely to be in?

..... [1]

(b) Predict whether element **M** is a poor or a good conductor of electricity.
Give a reason for your answer.

..... [1]

(c) Binary compounds contain two atoms per molecule, for example HCl.
Identify an element which could form a binary compound with element **M**.

..... [1]

(d) Predict the formula of the sulfate of **M**. The formula of the sulfate ion is SO_4^{2-}.

..... [1]

(e) The hydroxide of **M** is a white powder which is insoluble in water.
Describe how you could show that this hydroxide is amphoteric.

.....

.....

..... [2]

[Total: 6]

01. 0620_s14_ms_31 Q: 4

(a) (i)

Group number	I	II	III	IV	V	VI	VII
symbol	Na	Mg	A*l*	Si	P	S	C*l*
number of valency electrons	1	2	3	4	5	6	7
valency	1	2	3	4	3	2	1

(1) for each line [2]

(ii) number of valency electrons = the group number (1) [1]

(iii) for Na to A*l*
the valency is the same as the number of valency (outer) electrons (1)

(because) this is the number of electrons **lost** (for full energy level) (1)

for P to C*l*
the valency is 8 – [number of valency (outer) electrons]
or valency + valency electrons = 8 (1)

(because) this is number of electrons **needed** (or to be **gained**) (for full energy level) (1)

(b) (i) Assume change is from L to R unless clearly stated:
basic to amphoteric to acidic (2) [2]

(ii) ionic (metal) chlorides on the left (1)
covalent (non-metal) chlorides on the right (1) [2]

[Total: 11]

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(a) 3 or III [1]

(b) good conductor and it is a metal/has delocalised (free) electrons [1]

(c) N **or** P **or** As **or** Sb [1]
accept Bi

(d) $\mathbf{M}_2(SO_4)_3$ [1]
accept: $Ga_2(SO_4)_3$

(e) it would react with/dissolves in a named strong acid [1]
it would react with/dissolves in a named alkali [1]
it shows both basic and acid properties =1 [1]
it reacts with both acids and bases/alkalis =1 [1]
[max 2]

[Total: 6]