

1.

L and M are elements in Period 3 of the Periodic Table. Neither element is argon.

Information about the Pauling electronegativity values of L and M is given.

element	Pauling electronegativity value
L	the highest of the seven elements Na to Cl
M	the lowest of the seven elements Na to Cl

Three statements about elements L and M are given.

- 1 Element L contains covalent bonds.
- 2 Element L has a higher atomic number than element M.
- 3 A compound of L and M contains ionic bonds.

Which statements are correct?

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

Ans: A

2.

The elements magnesium and phosphorus are reacted separately with an excess of oxygen to form their oxides. Each oxide is then added separately to water and the pH values of the resulting solutions are measured.

The same two elements are reacted separately with an excess of chlorine to form their chlorides. Each chloride is then added separately to water and the pH values of the resulting solutions are measured.

Which row is correct?

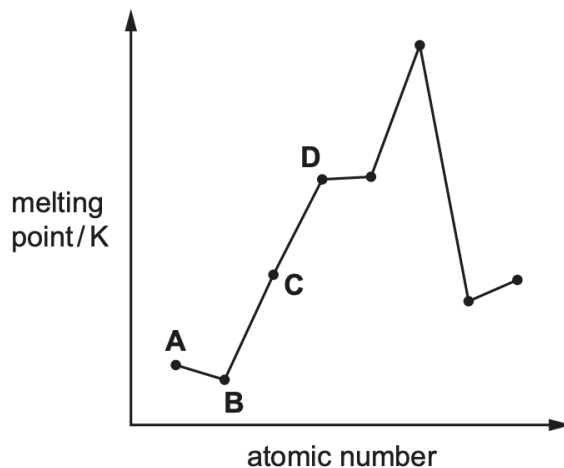
	oxide giving the higher pH	chloride giving the higher pH
A	magnesium	magnesium
B	magnesium	phosphorus
C	phosphorus	magnesium
D	phosphorus	phosphorus

Ans: A

3.

The diagram shows the melting points of eight elements with consecutive atomic numbers.

Which element could be sodium?



Ans: C

4.

X, Y and Z are elements all found within Groups 13, 14 and 15 of the Periodic Table.

X is in the same group in the Periodic Table as Y.

Y and Z are in Period 3.

The first ionisation energy of X is greater than the first ionisation energy of Y.

The melting point of Z is less than the melting point of Y.

Y and Z both form chlorides which are white solids. These white solids react with water to produce solutions with a pH of less than 4.

Which row of the table shows the possible identities of X and Y?

	X	Y
A	B	Al
B	Ge	Si
C	As	P
D	N	P

Ans: A

5.

Bromocresol green is an acid-base indicator. Below a pH of 3.8 it is yellow. Above a pH of 5.4 it is blue. Between these values it is green.

Bromocresol green is added to the aqueous solution formed when the chloride of element T is added to water. The colour becomes yellow.

When an excess of the solid oxide of element U is slowly added to this yellow solution, the indicator turns green then blue.

Which row could identify element T and element U?

	element T	element U
A	silicon	sodium
B	silicon	phosphorus
C	magnesium	sodium
D	magnesium	phosphorus

Ans: A

6.

Elements X, Y and Z are all in the first two periods of the Periodic Table.

Their Pauling electronegativity values, E_N , are shown.

element	E_N
X	1.0
Y	2.1
Z	4.0

Substances exist with formulae XZ, YZ and Z_2 .

Which row puts these substances in order of increasing melting point?

	lowest melting point	→	highest melting point
A	XZ	YZ	Z_2
B	XZ	Z_2	YZ
C	Z_2	YZ	XZ
D	Z_2	XZ	YZ

Ans: C

7.

A student investigated the chloride of a Period 3 element. This is what the student wrote down as a record.

The compound was a white crystalline solid. It dissolved easily in water to give a solution of pH 12. When placed in a test-tube and heated in a roaring Bunsen flame, the compound melted after several minutes heating.

What can be deduced from this record?

- A** At least one of the recorded observations is incorrect.
- B** The compound was magnesium chloride, $MgCl_2$.
- C** The compound was phosphorus pentachloride, PCl_5 .
- D** The compound was sodium chloride, $NaCl$.

Ans: A

REMEMBER: none of the options give a solution of pH 12 when dissolved!

- $NaCl = 7$
- $MgCl_2 = 6.5$
- $Al_2Cl_6 = 3$
- $SiCl_4 = 2$
- $PCl_5 = 2$

8.

Element X is in Period 3. Element X reacts with oxygen to produce a solid, Y.

When solid Y is added to water, a solution with a pH of less than 7 is produced.

What is the identity of element X?

- A** sodium
- B** silicon
- C** phosphorus
- D** sulfur

Ans: C

9.

Two Period 3 elements, X and Y, burn separately in oxygen to form solid oxides.

The oxide of X is insoluble in water.

The oxide of Y dissolves in water to form a solution which dissolves the oxide of X.

What could X and Y be?

	X	Y
A	aluminium	sodium
B	magnesium	sodium
C	silicon	phosphorus
D	silicon	sulfur

Ans: A

- Al_2O_3 is insoluble in water
- NaOH dissolves Al_2O_3 , as it is an amphoteric oxide

10.

V and Z are both elements in Period 3 of the Periodic Table. Each element forms one stable ion that does not contain another element.

The atomic radius of each element and the ionic radius of the ion described above is shown.

element	atomic radius / nm	ionic radius / nm
V	0.186	0.095
Z	0.099	0.181

Which statement is correct?

- A** Ions of V and Z have the same number of full electron shells.
- B** Ions of Z are positively charged.
- C** Z has a greater electronegativity than V.
- D** V has more outer electrons than Z.

Ans: C

- V forms cation and Z forms anion
- Thus Z is more electronegative

11.

In this question Q is used to represent a halogen atom.

Magnesium and calcium each form a compound with chlorine and a compound with bromine.

One of these compounds contains:

- the element in Group 2 with the higher first ionisation energy **and**
- the element in Group 17 with the higher Q–Q bond energy.

What is the formula of this compound?

A $MgCl_2$ **B** $MgBr_2$ **C** $CaCl_2$ **D** $CaBr_2$

Ans: A

12.

Compound X contains two elements, Y and Z.

Element Y is in Period 2 of the Periodic Table. In one atom of element Y, the p sub-shell has all three orbitals occupied; only one of these three orbitals is fully occupied.

Element Z is in Period 3 of the Periodic Table. In one atom of element Z, the p sub-shell has only two orbitals occupied.

What is the formula of compound X?

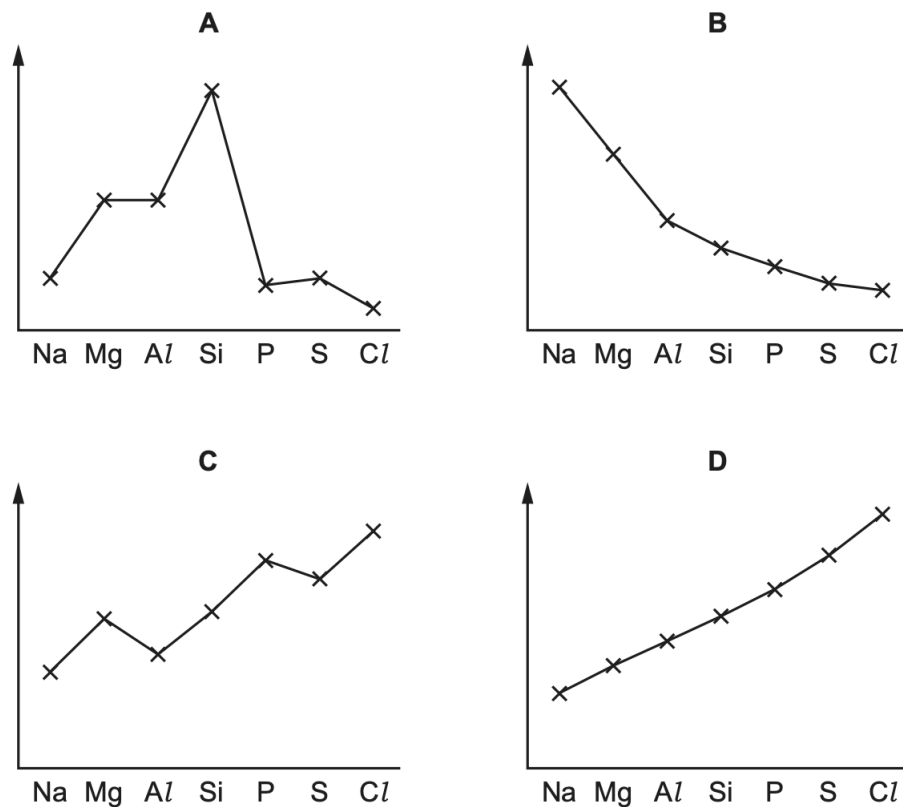
A CCl_4 **B** $SiCl_4$ **C** SiO_2 **D** SO_2

Ans: C

13.

The graphs show trends in four physical properties of elements in Period 3, excluding argon.

Which graph has electronegativity on the y-axis?



Ans: D

14.

Q is a semi-conductor. The chloride of Q reacts with water to form white fumes and an acidic solution.

Which Period 3 element is Q?

- A magnesium
- B aluminium
- C silicon
- D phosphorus

Ans: C

- Silicon is semi-conductor; phosphorus is not