Cambridge AS & A Level

CHEMISTRY

Paper 1

Topical Past Paper Questions

+ Answer Scheme

2015 - 2021

PapaCambridge

Chapter 9

The Periodic Table: chemical periodicity

9.1 Periodicity of physical properties of the elements in Period 3

452. 9701_m21_qp_12 Q: 13

Which row is correct?

	statement	reason
A	The first ionisation energy of phosphorus is greater than that of magnesium.	electron is lost from a 3p orbital in both cases
B	The melting point of phosphorus is greater than that of magnesium.	phosphorus has more valence electrons than magnesium
C	The atomic radius of phosphorus is smaller than that of magnesium.	phosphorus has greater nuclear charge than magnesium
D	The electrical conductivity of phosphorus is smaller than that of magnesium.	bonding changes from ionic in magnesium to covalent in phosphorus

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453. 9701_s19_qp_12 Q: 14

Elements D and E are both in Period 3. Element D has the smallest atomic radius in Period 3. There are only two elements in Period 3 which have a lower melting point than element E. Elements D and E react together to form compound L.

Which compound could be L?

A $MgCl_2$ **B** MgS **C** Na_2S **D** PCl_3

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454. 9701_s19_qp_13 Q: 12

Sodium and sulfur react together to form sodium sulfide, Na_2S.

How do the atomic radius and ionic radius of sodium compare with those of sulfur?

	atomic radius	ionic radius
A	sodium < sulfur	sodium > sulfur
B	sodium < sulfur	sodium < sulfur
C	sodium > sulfur	sodium > sulfur
D	sodium > sulfur	sodium < sulfur

---

455. 9701_w19_qp_11 Q: 13

X, Y and Z are consecutive elements in Period 3 of the Periodic Table. Element Y has the highest first ionisation energy and the lowest melting point of these three elements.

What are the identities of X, Y and Z?

	X	Y	Z
A	Na	Mg	Al
B	Mg	Al	Si
C	Al	Si	P
D	Si	P	S

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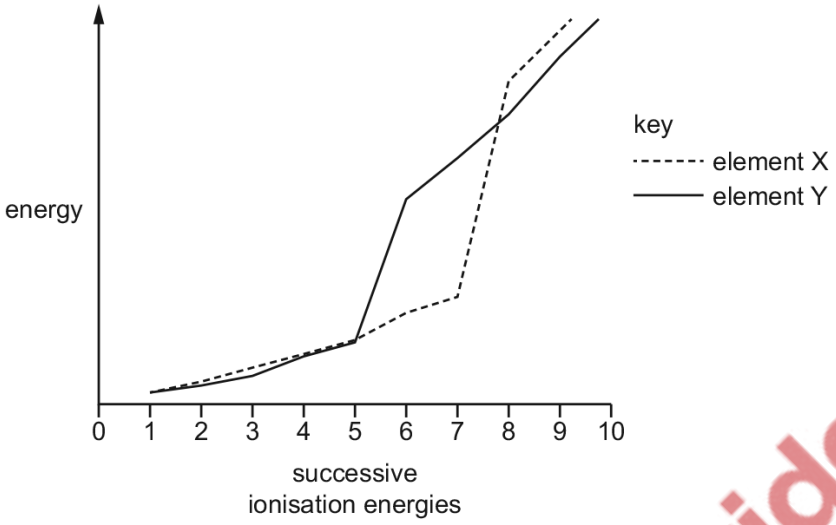
456. 9701_w19_qp_12 Q: 3

The graph shows the successive ionisation energies of element X and element Y.

Both elements are in Period 3.



Which statement is correct?

A An atom of element X needs one extra electron for a full outer shell; an atom of element Y needs three extra electrons for a full outer shell.

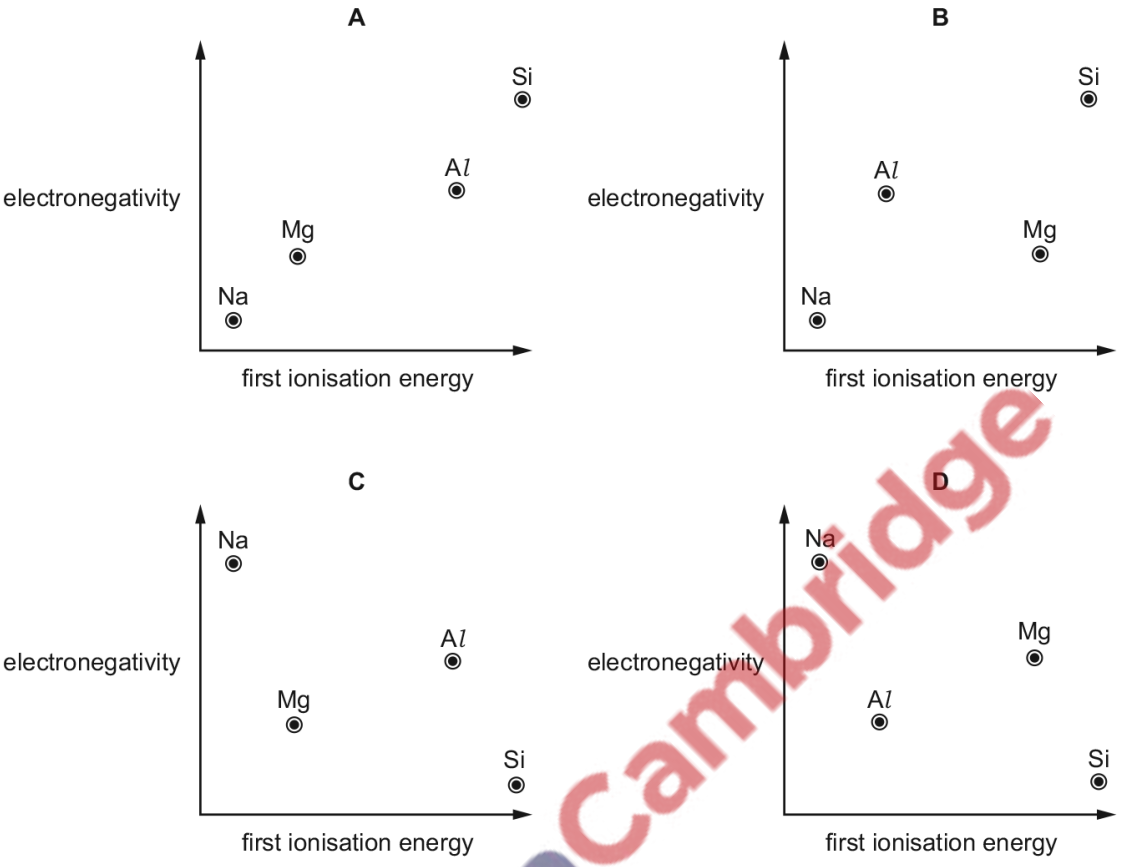
B An atom of element Y has five electrons in the 3p subshell.

C Element X has an oxidation number of +7 in most of its compounds.

D When element X combines with element Y, the bonding is ionic.

457. 9701_w19_qp_12 Q: 12

Which diagram correctly shows the electronegativity of the elements Na, Mg, Al and Si plotted against their first ionisation energies?



458. 9701_w18_qp_12 Q: 3

Rubidium and bromine form ions that are isoelectronic. Each ion has 36 electrons.

Which row is correct?

	rubidium radii	bromine / bromide radii
A	atomic < ionic	atomic < ionic
B	atomic < ionic	atomic > ionic
C	atomic > ionic	atomic < ionic
D	atomic > ionic	atomic > ionic

459. 9701_m17_qp_12 Q: 12

The electrical conductivities of two compounds, Y and Z, are shown in the table.

	Y	Z
conductivity of the compound in the liquid state	good	does not conduct
conductivity of the mixture obtained by adding the compound to water	good	good

What could compounds Y and Z be?

	Y	Z
A	Al_2O_3	$SiCl_4$
B	NaF	Al_2O_3
C	NaF	$SiCl_4$
D	$SiCl_4$	Al_2O_3

---

460. 9701_s17_qp_12 Q: 12

The elements magnesium and sulfur each form doubly charged ions.

How do the atomic radii and ionic radii of these elements compare?

	atomic radius		ionic radius	atomic radius		ionic radius
A	Mg	>	Mg^{2+}	S	>	S^{2-}
B	Mg	>	Mg^{2+}	S	<	S^{2-}
C	Mg	<	Mg^{2+}	S	>	S^{2-}
D	Mg	<	Mg^{2+}	S	<	S^{2-}

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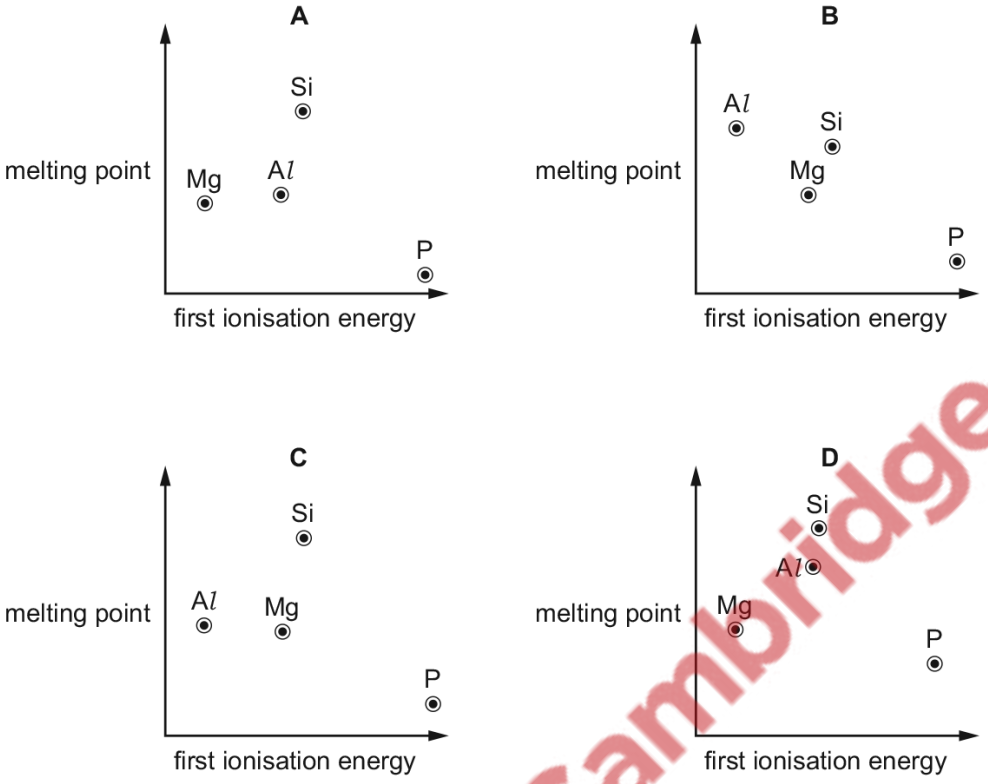
461. 9701_s17_qp_13 Q: 13

Which graph correctly shows the relative melting points of the elements Mg, Al, Si and P plotted against their relative first ionisation energies?



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462. 9701_w17_qp_11 Q: 12

The elements Cl, Mg, Si and S are all in Period 3.

What is the correct sequence of the melting points of these elements, from lowest to highest?

	lowest melting point → highest melting point			
A	Cl	S	Mg	Si
B	Cl	S	Si	Mg
C	Mg	Si	S	Cl
D	Si	Mg	S	Cl

---

463. 9701_m16_qp_12 Q: 12

Consecutive elements **X**, **Y** and **Z** are in Period 3 of the Periodic Table. Element **Y** has the highest first ionisation energy and the lowest melting point of these three elements.

What are the identities of **X**, **Y** and **Z**?

A sodium, magnesium, aluminium

B magnesium, aluminium, silicon

C aluminium, silicon, phosphorus

D silicon, phosphorus, sulfur

---

464. 9701_s16_qp_11 Q: 12

Why is the ionic radius of a chloride ion larger than the ionic radius of a sodium ion?

A A chloride ion has one more occupied electron shell than a sodium ion.

B Chlorine has a higher proton number than sodium.

C Ionic radius increases regularly across the third period.

D Sodium is a metal, chlorine is a non-metal.

---

465. 9701_s16_qp_11 Q: 13

Elements D and E are both in Period 3. Element D has the smallest atomic radius in Period 3. There are only two elements in Period 3 which have a lower melting point than element E. Elements D and E react together to form compound L.

Which compound could be L?

A $MgCl_2$ **B** MgS **C** Na_2S **D** PCl_3

---

466. 9701_s16_qp_12 Q: 12

Sodium and sulfur react together to form sodium sulfide, Na_2S.

How do the atomic radius and ionic radius of sodium compare with those of sulfur?

	atomic radius	ionic radius
A	sodium < sulfur	sodium > sulfur
B	sodium < sulfur	sodium < sulfur
C	sodium > sulfur	sodium > sulfur
D	sodium > sulfur	sodium < sulfur

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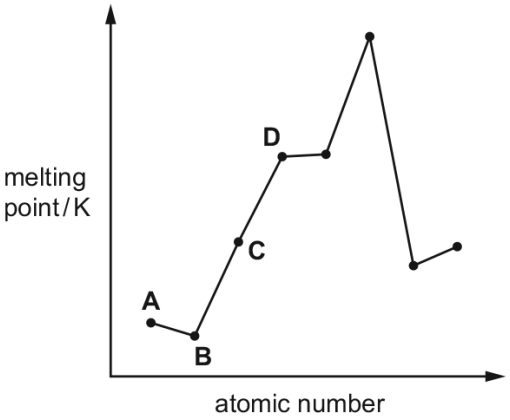
467. 9701_w16_qp_11 Q: 13

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

Which element could be sodium?



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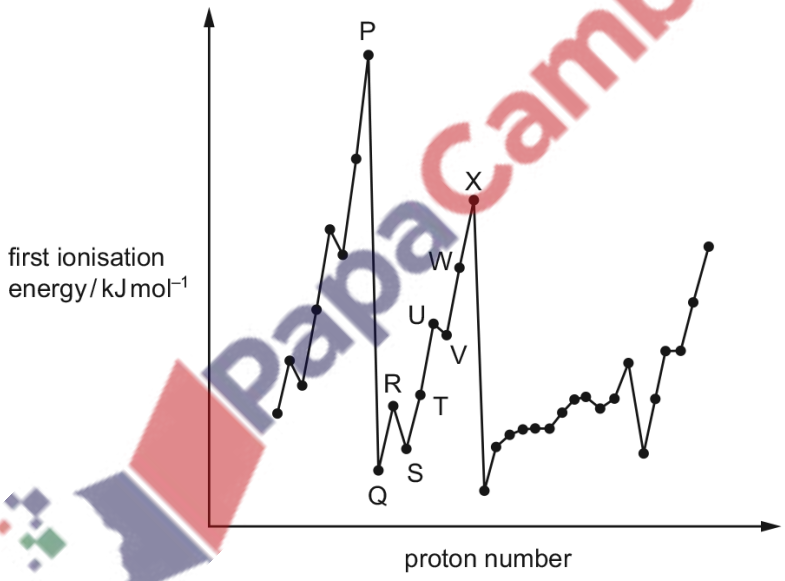
468. 9701_w16_qp_12 Q: 12

The graph below shows the variation of the first ionisation energy with proton number for some elements. The letters used are not the usual symbols for the elements.



Which statement about the elements is correct?

A P and X are in the same period in the Periodic Table.

B The general increase from Q to X is due to increasing atomic radius.

C The small decrease from R to S is due to decreased shielding.

D The small decrease from U to V is due to repulsion between paired electrons.

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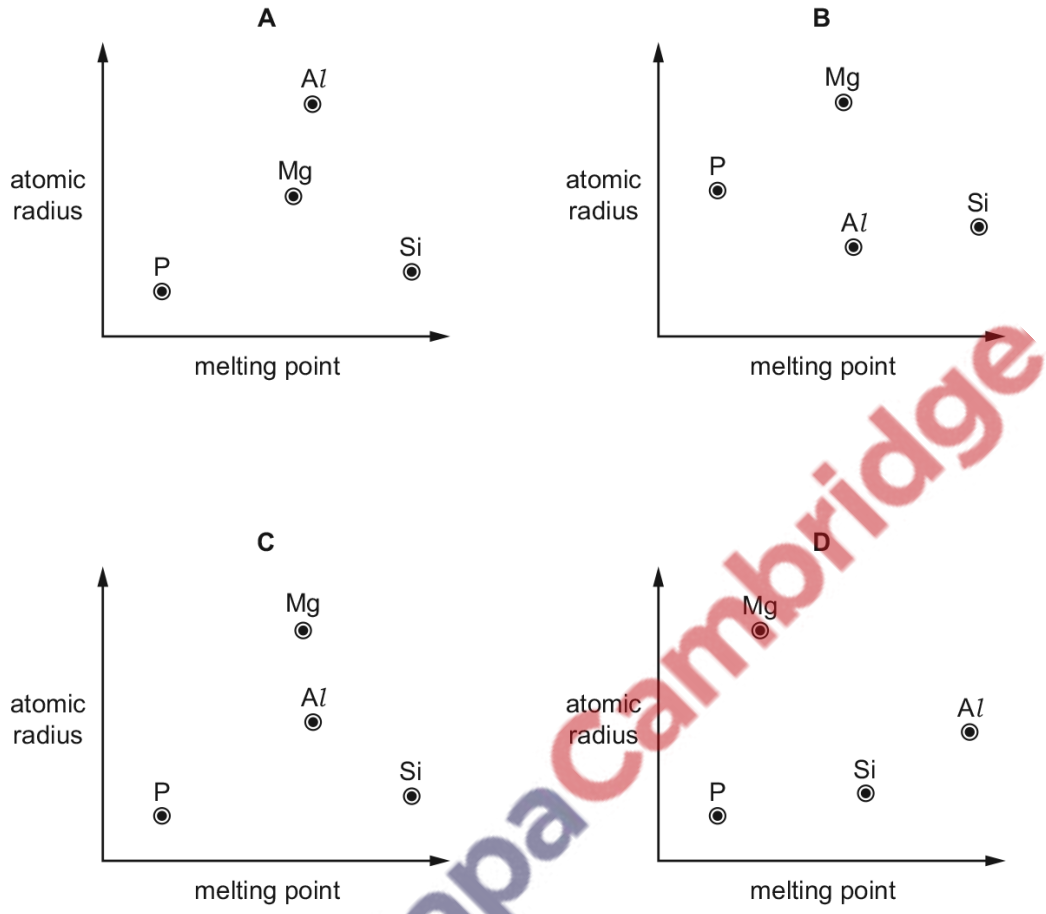
469. 9701_s15_qp_11 Q: 15

Use of the Data Booklet is relevant to this question.

Which diagram correctly shows the atomic radii of the elements Mg, Al, Si and P plotted against their melting points?



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470. 9701_s15_qp_13 Q: 17

This question refers to isolated gaseous species.

The species F^-, Ne and Na^+ are isoelectronic. This means they have the same number of electrons.

In which order do their radii increase?

	smallest ⟶		largest
A	Na^+	F^-	Ne
B	F^-	Ne	Na^+
C	Na^+	Ne	F^-
D	Ne	F^-	Na^+

---

471. 9701_w15_qp_11 Q: 14

Use of the Data Booklet is relevant to this question.

Which of the elements sodium, magnesium, aluminium, silicon, phosphorus, sulfur and chlorine

- has a lower first ionisation energy than the preceding element in the Periodic Table,
- conducts electricity and
- has a lower atomic radius than the preceding element in the Periodic Table?

A aluminium

B magnesium

C phosphorus

D sulfur

---

472. 9701_w15_qp_11 Q: 15

The melting points of the Period 3 elements sodium to aluminium are shown in the table.

element	Na	Mg	Al
mp/K	371	923	932

Which factor explains the **increase** in melting points from sodium to aluminium?

A the changes in first ionisation energy from sodium to aluminium

B the increase in electronegativity from sodium to aluminium

C the increase in the A_r of the elements from sodium to aluminium

D the increase in the number of outer electrons in each atom from sodium to aluminium

---

473. 9701_w15_qp_12 Q: 15

Use of the Data Booklet is relevant to this question.

Which row correctly compares the electrical conductivity and first ionisation energy of magnesium and aluminium?

	higher electrical conductivity	higher first ionisation energy
A	aluminium	aluminium
B	aluminium	magnesium
C	magnesium	aluminium
D	magnesium	magnesium

9.2 Periodicity of chemical properties of the elements in Period 3

474. 9701_m22_qp_12 Q: 17

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, $NaCl$.

---

475. 9701_m22_qp_12 Q: 18

The elements in Period 3 and their compounds show trends across the period from sodium to chlorine.

Which row is correct?

	electronegativity of the elements	acid / base behaviour of the oxides of the elements
A	decreases	basic → amphoteric → acidic
B	decreases	acidic → amphoteric → basic
C	increases	basic → amphoteric → acidic
D	increases	acidic → amphoteric → basic

---

476. 9701_m22_qp_12 Q: 19

The table shows the melting points of SiO_2 and P_4O_6.

oxide	SiO_2	P_4O_6
melting point / K	1883	297

Which statement explains the difference between the melting points of SiO_2 and P_4O_6?

A The bonding of the oxides changes from ionic to covalent.

B The metallic character of the elements decreases across Period 3.

C The oxidation number of the element increases from Si to P.

D The structure changes from giant molecular to simple molecular.

---

477. 9701_m21_qp_12 Q: 12

Which observations are made when a sample of silicon chloride, $SiCl_4$, is added to a beaker of water?

A No visible change is observed.

B Steamy fumes and a precipitate are both observed.

C The appearance of a precipitate is the only observation.

D The appearance of steamy fumes is the only observation.

---

478. 9701_s21_qp_11 Q: 12

Element X is in Period 3. Element X forms a solid oxide Y.

Y reacts with hot concentrated hydrochloric acid. Y reacts with hot aqueous sodium hydroxide to form a compound in which X is part of an anion.

How many p electrons does one atom of X have in its outer shell?

A 0 **B** 1 **C** 2 **D** 3

---

479. 9701_s21_qp_11 Q: 19

R is an oxide of Period 3 element T. 5.00 g of R contains 2.50 g of T.

What is T?

A magnesium

B aluminium

C silicon

D sulfur

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480. 9701_s21_qp_12 Q: 12

A sample of $SiCl_4$ is added to cold water.

Which statement describes the mixture formed at the end of the reaction?

A acidic solution with no precipitate

B acidic solution with white precipitate

C neutral solution with no precipitate

D neutral solution with white precipitate

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481. 9701_s21_qp_12 Q: 13

L and M are elements in Period 3 of the Periodic Table.

- The oxide of L is a solid at room temperature. This oxide has a giant structure.
- The chloride of L does not react with water.
- Argon is the only element in Period 3 with a lower melting point than M.

Which formula represents a compound of elements L and M?

A Al_2S_3 **B** MgS **C** $NaCl$ **D** PCl_5

---

482. 9701_s21_qp_13 Q: 19

Two oxides of Period 3 elements are added separately to water. Both react to form colourless solutions. One solution is alkaline, the other is acidic.

What could be the two oxides?

A Al_2O_3 and SiO_2

B Al_2O_3 and P_4O_{10}

C Na_2O and P_4O_{10}

D Na_2O and SiO_2

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483. 9701_w21_qp_11 Q: 12

Which element requires the least number of moles of oxygen for the complete combustion of 1 mol of its atoms?

A aluminium

B magnesium

C phosphorus

D sodium

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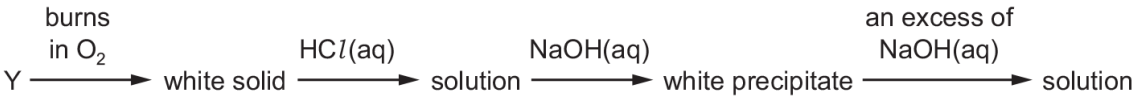
484. 9701_w21_qp_11 Q: 13

An element, Y, reacts according to the following sequence.



What could be element Y?

A Na **B** Mg **C** Al **D** P

---

485. 9701_w21_qp_12 Q: 12

A mixture of two Period 3 oxides are added to water. A solution forms with a pH of just below 7.

What could be the constituents of the mixture?

A Al_2O_3 and MgO

B Na_2O and MgO

C Na_2O and P_4O_{10}

D SO_3 and P_4O_{10}

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486. 9701_w21_qp_13 Q: 12

Which element requires the least number of moles of oxygen for the complete combustion of 1 mol of its atoms?

A aluminium

B magnesium

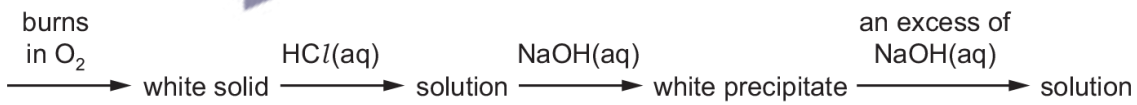
C phosphorus

D sodium

---

487. 9701_w21_qp_13 Q: 13

An element, Y, reacts according to the following sequence.



What could be element Y?

A Na **B** Mg **C** Al **D** P

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488. 9701_m20_qp_12 Q: 12

X and Y are oxides of different Period 3 elements.

If one mole of X is added to water, the solution formed is neutralised by exactly one mole of Y.

What could be the identities of X and Y?

	X	Y
A	P_4O_{10}	Al_2O_3
B	SO_3	Al_2O_3
C	P_4O_{10}	Na_2O
D	SO_3	Na_2O

---

489. 9701_m20_qp_12 Q: 16

Solid ammonium nitrate is put into a test-tube and solution X is added to it. The resulting mixture is warmed and the gas given off is tested with damp red litmus paper. The litmus paper changes colour from red to blue.

What could be the identity of X and its role in the reaction?

	identity of X	role of X
A	NaOH(aq)	proton donor
B	NaOH(aq)	proton acceptor
C	HCl(aq)	proton donor
D	HCl(aq)	proton acceptor

---

490. 9701_s20_qp_11 Q: 15

Element Z has a giant structure.

The chloride of Z reacts with water to give a solution with a pH less than 5.

Which pair shows two elements which could be Z?

A aluminium, magnesium

B aluminium, silicon

C phosphorus, magnesium

D phosphorus, silicon

---

491. 9701_s20_qp_11 Q: 16

Sodium, aluminium and silicon are three elements in Period 3. Each element forms an oxide.

Which row has three correct properties of these oxides?

	sodium oxide	aluminium oxide	silicon dioxide
A	basic	basic	amphoteric
B	giant ionic	giant ionic	simple molecular
C	high melting point	low melting point	high melting point
D	reacts with water	no reaction with water	no reaction with water

---

492. 9701_s20_qp_12 Q: 16

One molecule of an oxide of element Z reacts with six molecules of water to produce an acidic compound.

What is element Z?

A aluminium

B phosphorus

C silicon

D sulfur

---

493. 9701_s20_qp_13 Q: 15

Which element, when burned in oxygen, can form an oxide that is a reducing agent?

A Na **B** Mg **C** Al **D** S

---

494. 9701_s20_qp_13 Q: 19

Element X is in Period 3. It reacts rapidly with water to form an alkaline solution.

Which statement about the **chloride** of element X is correct?

A It conducts electricity when molten.

B It has a melting point of less than 100 °C.

C It has covalent bonding.

D It reacts rapidly with cold water.

---

495. 9701_w20_qp_11 Q: 12

X and Y are two elements in Period 3 of the Periodic Table. They combine to form compound Z.

X forms a soluble acidic oxide. The oxidation number of X in this oxide is +4.

Y forms an amphoteric oxide.

What is the formula of compound Z?

A $Al P$ **B** Al_2S_3 **C** Si_2P_5 **D** SiS_2

---

496. 9701_w20_qp_11 Q: 19

Sulfur dioxide, SO_2, reacts with calcium hydroxide in aqueous solution.

What is the main product that is first formed?

A $Ca(HSO_4)_2$ **B** CaS **C** $CaSO_3$ **D** $CaSO_4$

---

497. 9701_w20_qp_12 Q: 12

Element X, in Period 3, has the following properties.

- Its oxide has a giant structure.
- It forms covalent bonds with chlorine.
- Its oxide will neutralise $HCl(aq)$.

What is element X?

A Mg **B** Al **C** Si **D** P

---

498. 9701_w20_qp_12 Q: 19

Compound X is the oxide of a Period 3 element. Compound X reacts with water to give an acidic solution.

A solution is prepared by reacting 0.100 g of compound X with an excess of water. This solution is neutralised by exactly 25.0 cm^3 of 0.100 mol dm^{-3} sodium hydroxide solution.

What could be the identity of compound X?

A Al_2O_3 **B** MgO **C** P_4O_{10} **D** SO_3

---

499. 9701_m19_qp_12 Q: 12

X, Y and Z are elements in Period 3 of the Periodic Table. The results of some experiments carried out with compounds of these elements are shown.

element	result of adding the oxide of the element to $H_2O(l)$	result of adding the chloride of the element to $H_2O(l)$	result of adding the oxide of the element to $HCl(aq)$
X	no reaction	hydrolyses	forms chloride salt
Y	forms hydroxide	dissolves	forms chloride salt
Z	forms acid	hydrolyses	hydrolyses

Which statement could be correct?

A X is Al and Y is Mg.

B X is Si and Y is Na.

C Y is Al and Z is P.

D Y is Na and Z is Al.

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500. 9701_m19_qp_12 Q: 13

A solid Period 3 element, Q, is reacted with oxygen gas. Compound R is formed.

When R is added to water the pH decreases.

What could be the empirical formula of R?

A Q_2O_4 **B** Q_2O_5 **C** Q_4O_{10} **D** Q_5O_2

---

501. 9701_s19_qp_12 Q: 12

Element Q readily oxidises in air. The oxide produced reacts with water to form a solution of very low pH.

Where could element Q be found in the Periodic Table?

	period	group
A	2	1
B	2	14
C	3	14
D	3	15

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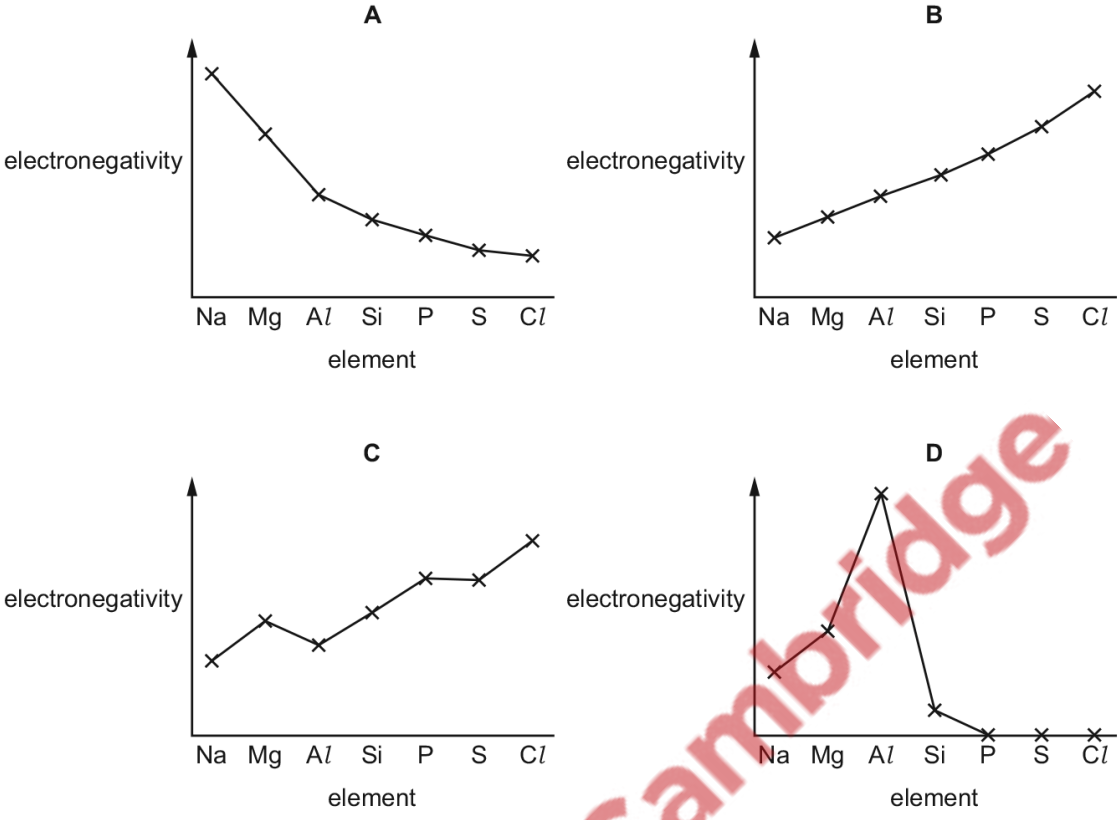
502. 9701_s19_qp_13 Q: 13

Which graph represents the variation in electronegativity for Period 3 elements?



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503. 9701_w19_qp_11 Q: 12

Which oxide will cause an increase in pH when added to water?

A MgO **B** Al_2O_3 **C** SiO_2 **D** SO_2

---

504. 9701_m18_qp_12 Q: 16

The volatility of the Group 17 elements, chlorine, bromine and iodine, decreases down the group.

What is responsible for this?

A bond length in the halogen molecule

B bond strength in the halogen molecule

C electronegativity of the halogen

D number of electrons in the halogen molecule

---

505. 9701_m18_qp_12 Q: 17

Bromine is extracted from sea-water.

In the final stages of the process two redox reactions take place.

$$Br_2(aq) + SO_2(g) + 2H_2O(l) \rightarrow 2HBr(aq) + H_2SO_4(aq)$$

$$2HBr(aq) + Cl_2(g) \rightarrow Br_2(g) + 2HCl(aq)$$

Which row is correct?

	strongest oxidising agent	→	weakest oxidising agent
A	Br_2	SO_2	Cl_2
B	Cl_2	Br_2	SO_2
C	Cl_2	SO_2	Br_2
D	SO_2	Br_2	Cl_2

---

506. 9701_m18_qp_12 Q: 18

When burned, sulfur forms a gaseous product X which can be oxidised to produce a gas Y.

Gas Y reacts with water to produce a product Z.

Which row correctly shows the oxidation states of sulfur in X, Y and Z?

	X	Y	Z
A	–2	+4	+4
B	–2	+4	+6
C	+4	+6	+4
D	+4	+6	+6

---

507. 9701_s18_qp_11 Q: 12

Silicon is heated in an excess of chlorine, producing compound J.

Excess water is added to the sample of J produced.

Which row is correct?

	structure of J	Is HCl produced when water is added to J?
A	giant molecular	no
B	giant molecular	yes
C	simple molecular	no
D	simple molecular	yes

---

508. 9701_s18_qp_12 Q: 12

Which oxide does **not** react with cold, dilute sodium hydroxide to produce a salt?

A Al_2O_3 **B** P_4O_{10} **C** SO_2 **D** SiO_2

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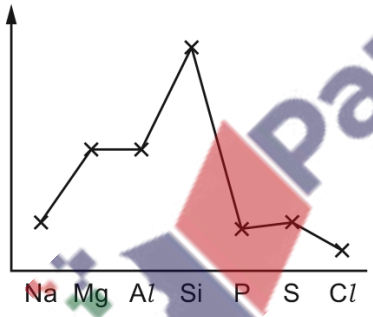
509. 9701_s18_qp_12 Q: 13

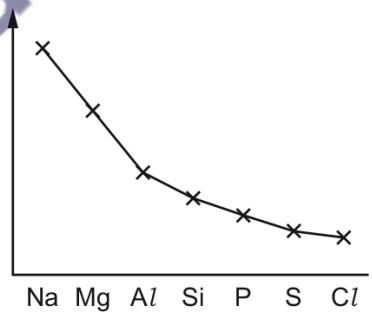
The graphs show trends in four physical properties of elements in Period 3, excluding argon.

Which graph has electronegativity on the *y*-axis?

A



B



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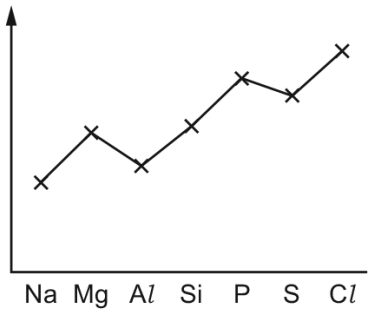
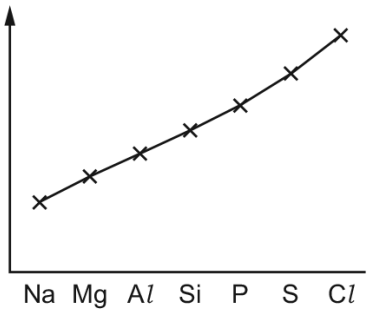


D



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510. 9701_s18_qp_13 Q: 12

Which description of the bonding and acid / base nature of aluminium oxide is correct?

	bonding	acid / base nature
A	simple covalent	amphoteric
B	giant covalent	basic only
C	ionic	amphoteric
D	ionic	basic only

---

511. 9701_s18_qp_13 Q: 13

X and Y are elements of the third period.

X and Y are individually heated in excess chlorine. Each product is purified and then separately added to water, producing two solutions. Both solutions have a pH of less than 5.

What could be X and Y?

A Na and P **B** Mg and Al **C** Mg and Si **D** Si and P

---

512. 9701_w18_qp_11 Q: 12

Sodium and sulfur are burned separately in oxygen.

Each reaction has a distinctive coloured flame.

Which row is correct?

	$Na + O_2$	$S + O_2$
A	white	blue
B	white	yellow
C	yellow	blue
D	yellow	yellow

---

513. 9701_w18_qp_11 Q: 13

X and Y are elements in Period 3 of the Periodic Table.

- The oxide of X is a solid at room temperature. This oxide has a giant structure.
- The chloride of X does not react with water.
- Argon is the only element in Period 3 with a lower melting point than Y.

What could be the formula of a compound formed between elements X and Y?

A Al_2S_3 **B** MgS **C** NaCl **D** PCl_5

---

514. 9701_w18_qp_12 Q: 12

The melting points of the Period 3 elements phosphorus to argon are shown in the table.

element	P	S	Cl	Ar
mp/K	317	392	172	84

Which factor explains the changes in melting points from phosphorus to argon?

A the changes in electronegativity from phosphorus to argon

B the changes in first ionisation energy from phosphorus to argon

C the increase in the number of electrons in each atom from phosphorus to argon

D the number of atoms in each molecule of the element from phosphorus to argon

---

515. 9701_w18_qp_12 Q: 13

Which observations are made when a sample of silicon chloride, $SiCl_4$, is added to a beaker of water?

A No visible change is observed.

B Steamy fumes and a precipitate are both observed.

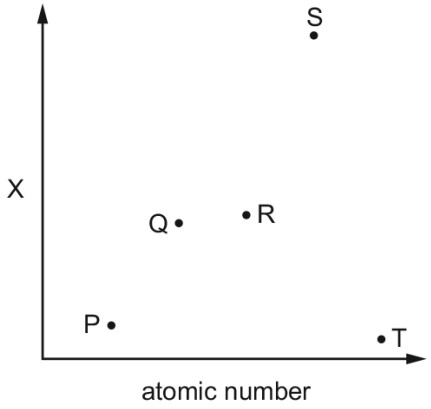
C The appearance of a precipitate is the only observation.

D The appearance of steamy fumes is the only observation.

---

516. 9701_m17_qp_12 Q: 15

The magnitude of property X of five elements from the third period of the Periodic Table, P, Q, R, S and T is shown. P, Q, R, S and T have consecutive atomic numbers. The letters do not represent the symbols of the elements.

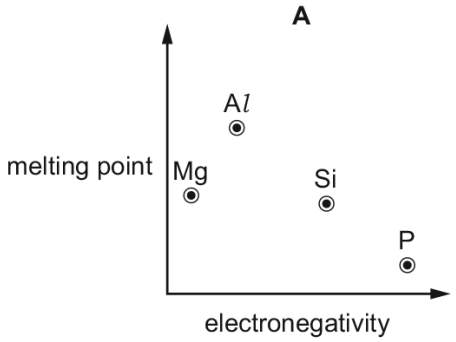


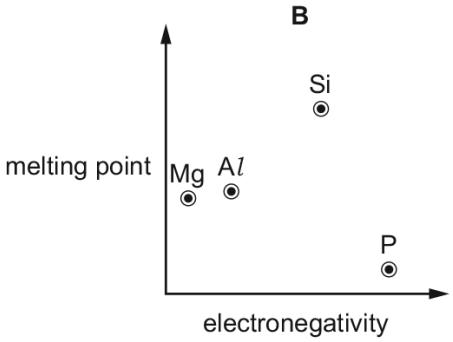
Which row correctly identifies property X and element R?

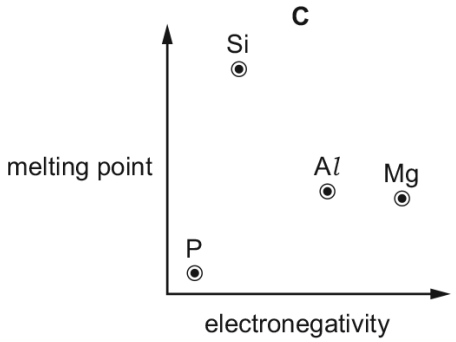
	property X	element R
A	electrical conductivity	Al
B	electronegativity	Si
C	melting point	Al
D	melting point	Si

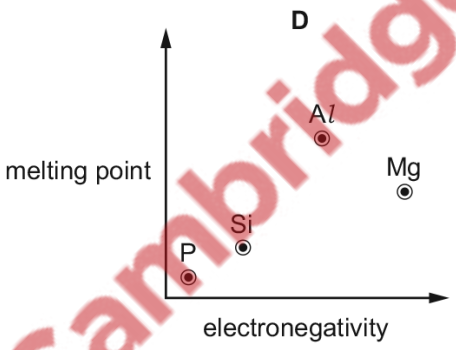
517. 9701_s17_qp_11 Q: 13

Which graph correctly shows the relative melting points of the elements Mg, Al, Si and P plotted against their relative electronegativities?



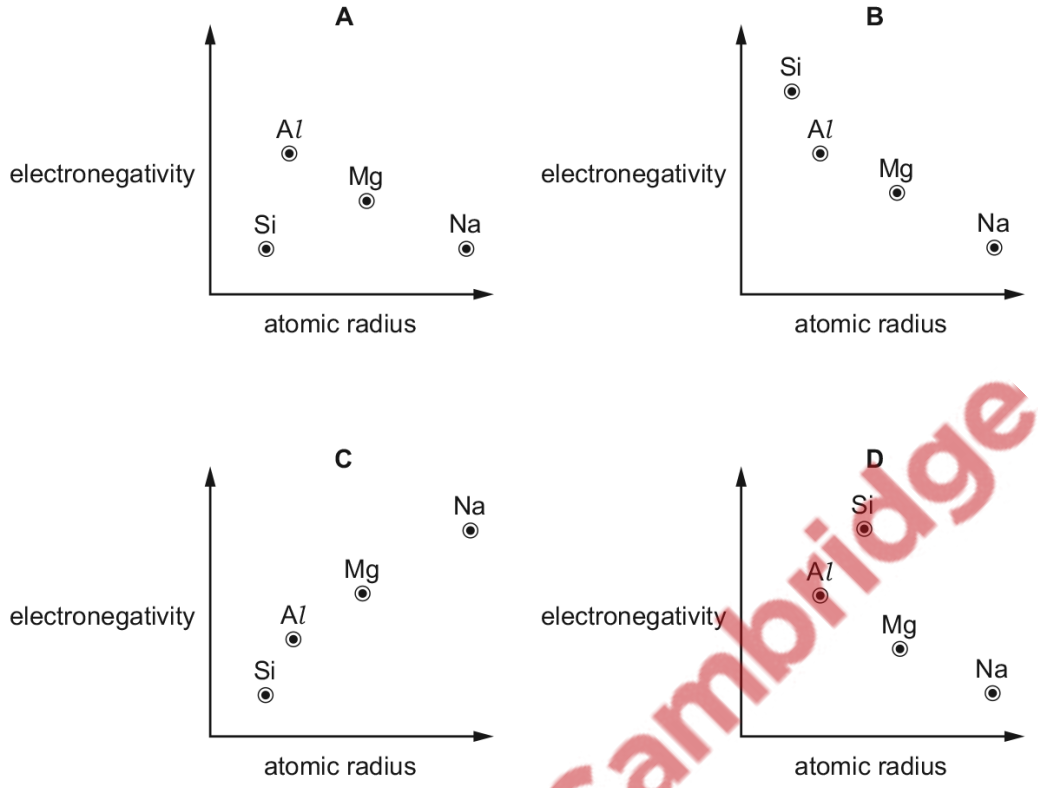






518. 9701_s17_qp_12 Q: 13

Which graph correctly shows relative electronegativity plotted against relative atomic radius for the elements Na, Mg, Al and Si?



519. 9701_s17_qp_13 Q: 12

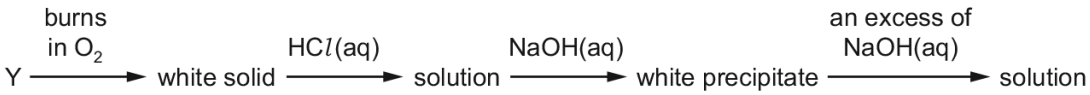
Magnesium chloride, $MgCl_2$, and silicon tetrachloride, $SiCl_4$, are separately added to water.

What are the approximate pH values of the solutions formed?

	$MgCl_2$	$SiCl_4$
A	0–3	0–3
B	0–3	6–7
C	6–7	0–3
D	6–7	6–7

520. 9701_w17_qp_11 Q: 13

An element Y reacts according to the following sequence.



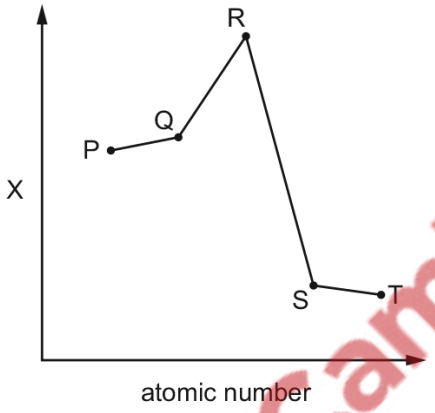
What could be element Y?

A Al **B** Ca **C** Mg **D** P

---

521. 9701_w17_qp_12 Q: 12

The relative magnitude of the property X of five elements is shown. P, Q, R, S and T are all in Period 3 and have consecutive atomic numbers.



Which row shows a correct pairing of property X and element R?

	property X	element R
A	electrical conductivity	Al
B	electronegativity	Si
C	melting point	Al
D	second ionisation energy	Si

---

522. 9701_w17_qp_12 Q: 13

Element Z has a giant structure.

The chloride of Z reacts with water to give a solution with a pH less than 5.

Which row shows two elements which could be Z?

A aluminium, magnesium

B aluminium, silicon

C phosphorus, magnesium

D phosphorus, silicon

---

523. 9701_m16_qp_12 Q: 13

When dealing with a spillage of metallic sodium it is important that no toxic or flammable products are formed.

Which material should be used if there is a spillage of metallic sodium?

A dilute hydrochloric acid

B ethanol

C sand

D water spray

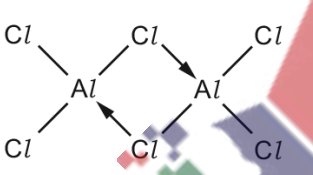
---

524. 9701_s16_qp_12 Q: 13

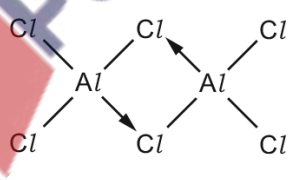
Solid aluminium chloride sublimes at 178 °C.

Which structure best represents the species in the vapour at this temperature?

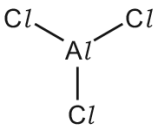
A



B



C



D

$Al^{3+}(Cl^{-})_3$

---

525. 9701_s16_qp_13 Q: 12

The oxide and chloride of an element **X** are separately mixed with water. The two resulting solutions have the same effect on litmus.

What could element **X** be?

A Al **B** Ca **C** Na **D** P

---

526. 9701_s16_qp_13 Q: 13

Each pair below consists of a sample of two separate elements. Each element is in its standard state at room temperature and pressure.

Which pair of elements has chemical bonds of the same type between their atoms?

A aluminium and phosphorus

B chlorine and argon

C magnesium and silicon

D sulfur and chlorine

---

527. 9701_w16_qp_12 Q: 14

Elements Y and Z are both in Period 3.

When the chloride of Y is added to water, it reacts and a solution of pH 2 is produced.

When the chloride of Z is added to water, it dissolves and a solution of pH 7 is produced.

Which statement explains these observations?

A Both chlorides hydrolyse in water.

B Y is magnesium and Z is sodium.

C Y is phosphorus and Z is aluminium.

D Y is silicon and Z is sodium.

---

528. 9701_s15_qp_11 Q: 14

Which observations are made when a sample of silicon chloride, $SiCl_4$, is added to a beaker of water?

A No visible changes are observed.

B Steamy fumes and a white precipitate are both observed.

C The appearance of a white precipitate is the only observation.

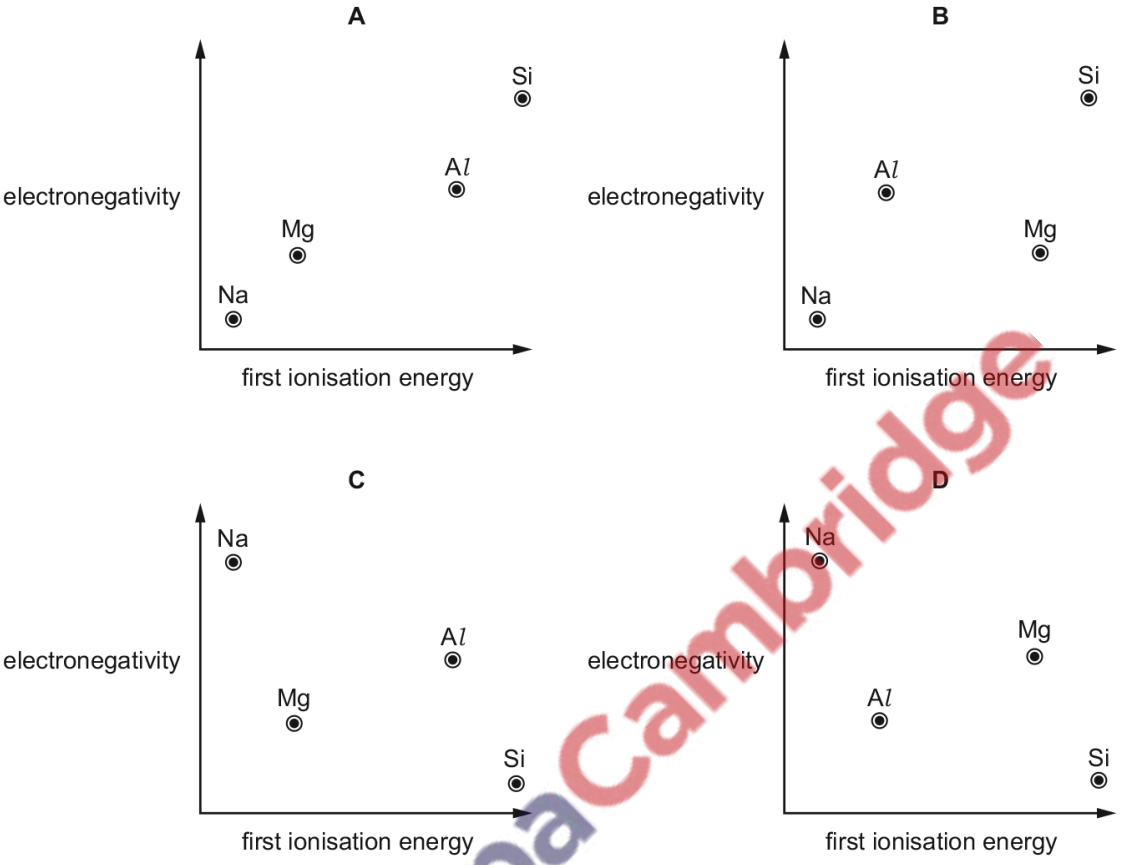
D The appearance of steamy fumes is the only observation.

---

529. 9701_s15_qp_12 Q: 15

Use of the Data Booklet is relevant to this question.

Which diagram correctly shows the electronegativity of the elements Na, Mg, Al and Si plotted against their first ionisation energies?



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530. 9701_s15_qp_13 Q: 12

Which oxide will produce the solution with the highest pH when it is mixed with water?

A Al_2O_3 **B** CO_2 **C** Na_2O **D** SO_2

---

531. 9701_s15_qp_13 Q: 15

The labels had become detached from four bottles in the laboratory. A student realised that the contents of one of them could easily be identified, because on addition of water it would **not** give fumes of hydrogen chloride.

Which did **not** give the HCl fumes?

A Al_2Cl_6 **B** $MgCl_2$ **C** PCl_5 **D** $SiCl_4$

---

532. 9701_w15_qp_11 Q: 16

X is the oxide of a Period 3 element. **X** reacts with water to give an acidic solution.

A solution is prepared by reacting 0.100 g of **X** with excess water. This solution was neutralised by exactly 25.0 cm^3 of 0.100 mol dm^{-3} sodium hydroxide solution.

What could be the identity of **X**?

A Al_2O_3 **B** MgO **C** P_4O_{10} **D** SO_3

---

533. 9701_w15_qp_12 Q: 14

Which chloride of a Period 3 element dissolves in water to form a solution with a pH of 7?

A aluminium chloride

B phosphorus(V) chloride

C silicon(IV) chloride

D sodium chloride

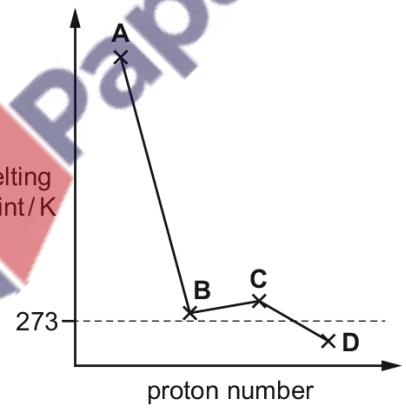
9.3 Chemical periodicity of other elements

534. 9701_s19_qp_11 Q: 13

The relative melting points of four consecutive elements in the Periodic Table are shown in the graph.

The elements all have proton numbers less than 20.

Which element is in Group 16?



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535. 9701_s18_qp_11 Q: 10

Element X has a higher first ionisation energy than element Y.

Two students state what they believe is one factor that helps to explain this.

student 1 "X has a higher first ionisation energy than Y because an atom of X has more protons in its nucleus than an atom of Y."

student 2 "X has a higher first ionisation energy than Y because X has a smaller atomic radius than Y."

Only **one** of the two students is correct.

What could X and Y be?

	X	Y
A	carbon	boron
B	magnesium	aluminium
C	oxygen	nitrogen
D	oxygen	sulfur

---

536. 9701_s18_qp_11 Q: 13

Which element has the **second** smallest atomic radius in its group and the **third** lowest first ionisation energy in its period?

A boron

B calcium

C magnesium

D sodium
