

The Periodic Table*(Past Year Topical Questions 2010-2015)*May/June 2010 (31)

1 Choose an element which fits each of the following descriptions.

(i) It is a yellow solid which burns to form an acidic oxide.

..... [1]

(ii) This element is a black solid which, when heated, forms a purple vapour.

..... [1]

(iii) Most of its soluble salts are blue.

..... [1]

(iv) It has a basic oxide of the type MO which is used to treat acidic soils.

..... [1]

(v) It is an unreactive gas used to fill balloons.

..... [1]

[Total: 5]

May/June 2010 (32)

1 For each of the following unfamiliar elements predict one physical and one chemical property.

(a) caesium (Cs)

physical property

chemical property

..... [2]

(b) vanadium (V)

physical property

chemical property

..... [2]

(c) fluorine (F)

physical property

chemical property

..... [2]

[Total: 6]

Oct/Nov 2010 (31)

- 6 The table below shows the elements in the second period of the Periodic Table and some of their oxidation states in their most common compounds.

element	Li	Be	B	C	N	O	F	Ne
number of outer electrons	1	2	3	4	5	6	7	8
oxidation state	+1	+2	+3	+4	-3	-2	-1	0

- (a) (i) What does it mean when the only oxidation state of an element is zero?

.....
 [1]

- (ii) Explain why some elements have positive oxidation states but others have negative ones.

.....
 [2]

- (iii) Select **two** elements in the table which exist as diatomic molecules of the type X_2 .

..... [1]

Oct/Nov 2010 (32)

- 4 Chromium is a transition element.

- (a) (i) Predict **two** differences in the physical properties of chromium and sodium.

.....
 [2]

- (ii) Predict **two** differences in the chemical properties of chromium and sodium.

.....

 [2]

May/June 2011 (32)

1 Choose an element from the list below which best fits the description.

Rb Fe Si I P Sr

- (a) An element which reacts with cold water. [1]
- (b) It is a solid at room temperature and exists as diatomic molecules, X_2 [1]
- (c) It can form two oxides, XO and X_2O_3 [1]
- (d) This element has a hydride of the type XH_3 [1]
- (e) It has a macromolecular structure similar to that of carbon. [1]

[Total: 5]

Oct/Nov 2011 (33)

1 Use your copy of the Periodic Table to answer these questions.

- (a) Choose an element from the Periodic Table to match each description.
You may give either the name or the symbol.
- (i) It is the most reactive metal. [1]
- (ii) It is the only non-metal which is a liquid at r.t.p.. [1]
- (iii) An isotope of this element is used as a fuel in nuclear reactors. [1]
- (iv) This Group VII element is a solid at r.t.p.. [1]
- (v) This element is in Group V and Period 4. [1]
- (vi) This unreactive gas is used to fill lamps. [1]

May/June 2012 (31)

3 The Group I metals show trends in both their physical and chemical properties.

(a) (i) How do their melting points vary down the Group?

..... [1]

(ii) Which element in the Group has the highest density?

..... [1]

(iii) All Group I metals react with cold water. Complete the following equation.



Oct/Nov 2012 (31)

2 Three of the halogens in Group VII are listed below.

chlorine
bromine
iodine

(a) (i) How does their colour change down the Group?

..... [1]

(ii) How do their melting points and boiling points change down the Group?

..... [1]

(iii) Predict the colour and physical state (solid, liquid or gas) of astatine, At.

colour

physical state [2]

Oct/Nov 2012 (32)

1 This question is concerned with the elements in Period 5, Rb to Xe.

(a) The electron distributions of some of these elements are given in the following list.

element A $2 + 8 + 18 + 8 + 2$

element B $2 + 8 + 18 + 18 + 8$

element C $2 + 8 + 18 + 18 + 5$

element D $2 + 8 + 18 + 18 + 6$

element E $2 + 8 + 18 + 18 + 4$

element F $2 + 8 + 18 + 18 + 7$

(i) Identify element C. [1]

(ii) Which element in the list does not form any compounds?

..... [1]

(iii) Which element in the list forms a chloride of the type XCl_2 ?

..... [1]

(iv) Which **two** elements would react together to form a compound of the type XY_4 ?

..... [1]

- (v) Which element in the list would react with cold water to form an alkaline solution and hydrogen?

..... [1]

- (b) Predict **two** differences in physical properties and **two** differences in chemical properties between rubidium and the transition metal niobium.

physical

.....

.....

chemical

.....

..... [4]

[Total: 9]

Oct/Nov 2012 (33)

1 For each of the following, select an element from Period 4, potassium to krypton, which matches the description.

(a) A metal that reacts rapidly with cold water to form a compound of the type $M(OH)_2$ and hydrogen.

..... [1]

(b) Its only oxidation state is 0. [1]

(c) It has a macromolecular oxide, XO_2 , which has similar physical properties to those of diamond.

..... [1]

(d) This is one of the metals alloyed with iron in stainless steel. [1]

(e) It can be reduced to an ion of the type X^- [1]

(f) It can form a covalent hydride having the formula H_2X [1]

(g) Its soluble salts are blue and its oxide is black. [1]

(h) It is a liquid at room temperature. [1]

[Total: 8]

Oct/Nov 2013 (31)

1 For each of the following, name an element which matches the description.

(a) It is used as a fuel in nuclear reactors.

..... [1]

(b) It is the only non-metal which is a good conductor of electricity.

..... [1]

(c) Inert electrodes are made from this metal.

..... [1]

(d) This gaseous element is used to fill balloons in preference to hydrogen.

..... [1]

(e) An element which can form an ion of the type X^{3-} .

..... [1]

(f) It has the same electron distribution as the calcium ion, Ca^{2+} .

..... [1]

(g) The element is in Period 5 and Group VI.

..... [1]

[Total: 7]

Oct/Nov 2013 (32)

2 The halogens are a collection of diatomic non-metals in Group VII.

(a) (i) Define the term *diatomic*.

..... [1]

(ii) What do the electron distributions of the halogens have in common?

..... [1]

(iii) How do their electron distributions differ?

..... [1]

(iv) Complete the table.

halogen	solid, liquid or gas at room temperature	colour
chlorine
bromine
iodine

[2]

May/June 2014 (31)

- 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	Al	Si	P	S	Cl
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 Al,

.....

for the elements P to Cl.

.....

[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]

May/June 2014 (32)

1 The table below gives the electron distributions of atoms of different elements.

element	electron distribution
A	2 + 7
B	2 + 8 + 4
C	2 + 8 + 8 + 1
D	2 + 8 + 18 + 5
E	2 + 8 + 18 + 7
F	2 + 8 + 18 + 18 + 8

For each of the following, select an element or elements from the table that matches the description. Each element may be selected once, more than once or not at all.

(a) These two elements are in the same group.

..... [1]

(b) This element forms a fluoride with a formula of the type XF_3 .

..... [1]

(c) This element reacts violently with cold water.

..... [1]

(d) This element has a macromolecular structure similar to that of diamond.

..... [1]

(e) The only oxidation state of this element is 0.

..... [1]

(f) This element is bromine.

..... [1]

(g) This element is a good conductor of electricity.

..... [1]

[Total: 7]

6 Scandium, proton number 21, is not a typical transition element.

(a) Scandium is a low density metal which has only one oxidation state in its compounds. Scandium compounds are white solids which form colourless solutions. Titanium, the next metal in the period, is a far more typical transition element. How would the properties of titanium differ from those of scandium?

.....
.....
.....
..... [3]

May/June 2015 (31)

5 The halogens are a group of non-metals in Group VII of the Periodic Table.

(a) The reactivity of the halogens decreases down the group.

Describe an experiment which shows that chlorine is more reactive than iodine. Include an equation in your answer.

.....

.....

.....

..... [3]

(b) The halogens form interhalogen compounds. These are compounds which contain two different halogens.

Deduce the formula of the compound which has the composition 0.013 moles of iodine atoms and 0.065 moles of fluorine atoms.

.....

..... [2]

Oct/Nov 2015 (32)

1 Use your copy of the Periodic Table to help you answer some of these questions.

(a) Predict the formulae of the following compounds.

(i) nitrogen fluoride

(ii) phosphorus sulfide [2]

(b) Deduce the formulae of the following ions.

(i) selenide

(ii) gallium [2]

(c) Use the following ions to determine the formulae of the compounds.

ions OH^- Cr^{3+} Ba^{2+} SO_4^{2-}

compounds

(i) chromium(III) sulfate

(ii) barium hydroxide [2]

[Total: 6]

- 6 The table below shows the elements in the third period of the Periodic Table, the number of electrons in their outer energy level, their oxidation state in their common compounds and their melting points.

element	Na	Mg	Al	Si	P	S	Cl	Ar
number of outer electrons	1	2	3	4	5	6	7	8
oxidation state	+1	+2	+3	+4/-4	-3	-2	-1	0
melting point/ $^{\circ}$ C	98	650	660	1414	317	115	-101	-189

- (a) Describe and explain the variation in oxidation state across the period.

.....

.....

..... [3]