Name:	Target Grade:	Actual Grade:

BRIGHT CULTURE

PERIODIC TABLE
MCQ and STRUCTURED QUESTIONS

READ THESE INSTRUCTIONS FIRST

INSTRUCTIONS TO CANDIDATES

1. Find a quiet, comfortable spot free place from distractions.

2. Spend one minute on each mark.

3. Time yourself for every single question.

4. Every chapter has their own question types. Ensure that you know the different question type for each chapter.

5. Make a conscientious effort to remember your mistakes, especially in terms of answering techniques. E.g Take a picture for the mistakes that you made, keep it in a photo album, and revise it over and over again.

6. Highlight question types that you tend to keep making mistakes and review them nearing exams.

7. Always review the common questions and question type that you tend to make mistakes nearing exams.

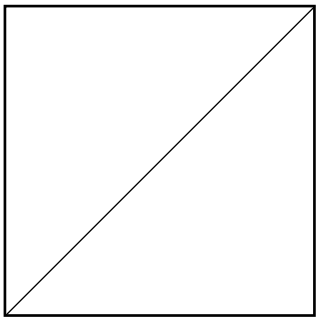
8. During exams, classify the question type and recall what you have learnt, how you need to analyse the questions for the different question type, what you need to take note of and answer with the correct answering techniques!

✨ **Wishing you all the best for this test!**

You've got this!

💡 **With lots of love,**
Bright Culture 💛

MARKS



If you are struggling in this paper, means you need to work harder!

If you need any professional guidance and further advice on how to advance, feel free to WhatsApp us at 91870820 or find us at www.bright-culture.com/. We are committed to connect you to your future to reach your goals.

PERIODIC TABLE MCQ

Paper 1

1 Caesium is an element in the same group of the Periodic Table as lithium, sodium and potassium.

Which statements about caesium are likely to be **false**?

I. It reacts explosively with cold water.
II. It forms a soluble carbonate salt.
III. It forms a carbonate with a formula of $CsCO_3$.
IV. It can be extracted via electrolysis of concentrated aqueous CsCl.

A I and II
B I and III
C II and III
D III and IV

2 The table below gives some information about element Y.

density / g/cm^3	6.2
melting point / °C	1280
formulae of oxides	YO (white) Y_2O_3 (brown)
chemical properties	reacts readily with O_2 or Cl_2

Which of the following statements about element Y is likely to be correct?

A It is a metal in Group III.
B It is a transition metal.
C It is an alkali metal.
D It forms oxides that are amphoteric in nature.

3 A new element, Hb, placed in Group VII of the Periodic Table, has a higher relative atomic mass than astatine.

Which statement about element Hb is **not** correct?

A Hb atom gains electrons less readily than a chlorine atom.
B Hb displaces astatine out from aqueous potassium astatide.
C Hb has a higher boiling point than bromine.
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4 Which statement is correct for the element of proton number 19?

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C It is a non-metal that burns quickly in air.
D It is a soft metal that is highly reactive with water.

5 In separate experiments conducted, a gaseous halogen was bubbled into an aqueous solution of a halide salt.

The following results were observed.

	Halides	
Halogen	**Y^-**	**Z^-**
X_2	No observable reaction	Displaced as Z_2
Y_2	No observable reaction	Displaced as Z_2
Z_2	No observable reaction	No observable reaction

What is the arrangement of halogens **X**, **Y** and **Z** in Group VII in order of decreasing reactivity?

A X, Y, Z
B Y, X, Z
C Z, X, Y
D Y, Z, X

6 Which of the following statements about Group VII is **false**?

A Colours of elements become darker down the Group.
B Densities of elements increase down the Group.
C Melting points of elements increase down the Group.
D Number of valence electrons of elements increases down the Group.

7 An element Q has x neutrons and y protons.

Which symbol can be used to represent the ion of Q if it belongs to Group VI?

A ${}^{x+y}_{y}Q^{2+}$

B ${}^{x}_{y}Q^{2+}$

C ${}^{x+y}_{y}Q^{2-}$

D ${}^{x}_{y}Q^{2-}$

8 The elements in a group of the Periodic Table show the following trends.

1 The element with the lowest proton number has the lowest reactivity.
2 All the elements in the group form basic oxides.
3 The density of the elements increases down the group.
4 The melting point of the elements decreases down the group.

In which group are the elements found?

A I
B IV
C VI
D VII

9 Elements X and Y are in the same period.

Which statement is correct?

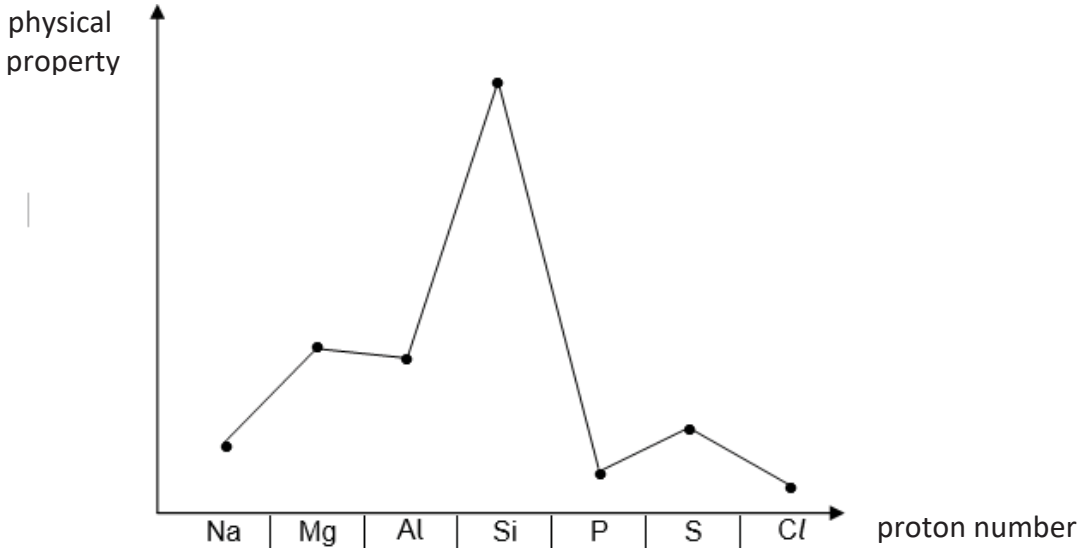
A Atoms of X and Y have the same electronic structure.
B Atoms of X and Y have the same number of electrons.
C If X is a metal, Y must be a non-metal.
D The number of shells containing electrons is the same in atoms X and Y.

10 Many properties of an element and its compounds can be predicted from the position of the element in the Periodic Table.

What property could **not** be predicted in this way?

A the formula of its oxide
B the nature of its oxide
C the number of isotopes it has
D the number of electron shells of its atom

11 The graph shows the variation of a physical property with proton number for the elements from sodium to chlorine in the Periodic Table.



What is the physical property that varies?

A atomic radius
B electrical conductivity
C melting point
D density

12 An element R forms compounds with the following chemical formulae:

MgR H_2R CR_2 Li_2R

In which group of the Periodic Table would element R be placed?

A Group II
B Group IV
C Group V
D Group VI

13 Transition metals are often used as catalysts in industries.

Which of the following is not an example of a transition metal acting as a catalyst?

A platinum in catalytic converters
B iron in Haber Process
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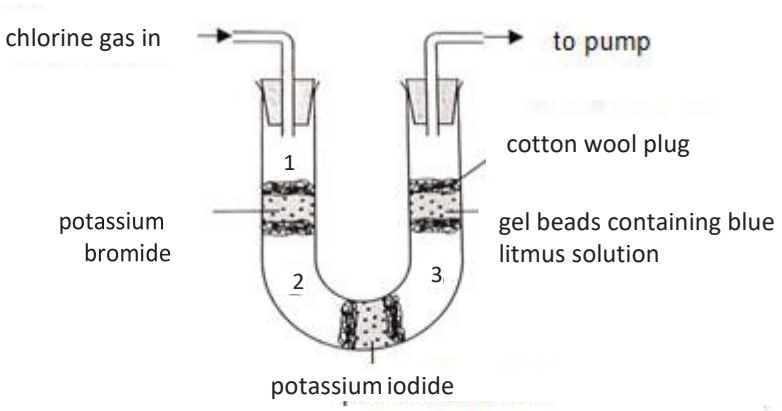
14 Gaseous chlorine was passed through the following apparatus. The apparatus was continuously heated and the observations were recorded below.



Which of the following observations would be made at regions 1, 2 and 3?

	region 1	region 2	region 3
A	red-brown gas	black solid	violet gas
B	violet gas	red-brown gas	black solid
C	yellow-green gas	red-brown gas	violet gas
D	yellow-green gas	violet gas	brown gas

15 The diagram shows the positions of elements L, M, Q, R and T in the Periodic Table. These letters are not the chemical symbols of the elements.

Which statement about the properties of these elements is correct?

A M reacts more vigorously with water than does L.
B Q, R and T are all metals.
C T is more reactive than R.
D T exists as diatomic molecules.

16 Which pair of elements would react together most vigorously?

A potassium and bromine
B potassium and iodine
C sodium and chlorine
D sodium and fluorine

17 Elements X and Y are in the same Group of the Periodic Table.

Which statement must be correct?

A Atoms X and Y have similar electronic structure.
B Atoms X and Y have the same physical properties.
C If X has a smaller proton number than Y, it is less metallic.
D The number of electronic shells in atoms X and Y must be the same.

18 The period 4 elements gallium (Ga), germanium (Ge), arsenic (As) and selenium (Se) are elements below aluminium, silicon, phosphorus and sulfur in the Periodic Table, a portion of which is shown below.

period 3 elements	Al	Si	P	S
period 4 elements	Ga	Ge	As	Se

The properties of each period 4 element resemble those of the period 3 element directly above it.

Which period 4 elements form oxides that dissolve in water to give an acid solution?

A As and Se

B Ga and Ge

C Ga and Se

D Se only

19 When a mineral was heated in a Bunsen flame to a constant mass, a colourless gas that produced a white precipitate in limewater, was given off. The remaining solid was cooled and then added to aqueous hydrochloric acid. Vigorous effervescence was seen. What was the mineral?

A aragonite, $CaCO_3$
B artinite, $MgCO_3.Mg(OH)_2.3H_2O$
C barytocalcite, $BaCO_3.CaCO_3$
D dolomite, $CaCO_3.MgCO_3$

20 Which property would all the hydrogen compounds of the Group VII elements possess?

A They form covalent compounds.
B They are solids at room temperature.
C They form alkaline aqueous solutions.
D They conduct electricity when molten.

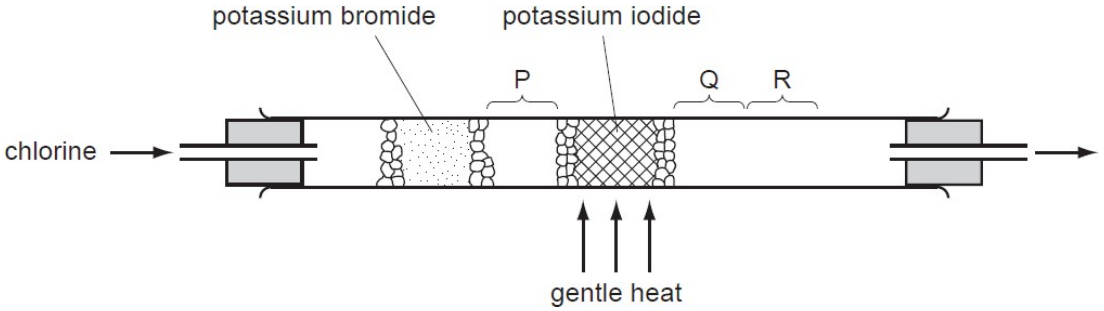
21 The properties of the oxides of four elements K, L, M and N in the third period of the Periodic Table are given below.

- The oxide of K is insoluble in water and dilute acid but soluble in concentrated alkali.
- The oxide of L reacts with both dilute acid and dilute alkali.
- The oxide of M reacts with dilute alkali at room temperature.
- The oxide of N dissolves in water to form an alkaline solution.

If K, L, M and N are placed in order of increasing atomic number, which order is correct?

A K, L, M, N
B N, M, K, L
C N, L, K, M
D L, K, N, M

22 Using the apparatus shown, chlorine is passed through the tube.



After a short time, coloured substances are seen at P, Q and R.
What are these coloured substances?

	at P	at Q	at R
A	green gas	red brown vapour	violet vapour
B	green gas	violet vapour	black solid
C	red brown vapour	violet vapour	black solid
D	violet vapour	red brown vapour	red brown vapour

23 Lithium and rubidium are both in Group I of the Periodic Table.

Which statement is correct?

A Lithium atoms and rubidium atoms have the same number of electrons in their outer shell.

B Lithium atoms are larger than rubidium ions.

C Lithium ions and rubidium ions have the same number of electrons in their outer shell.

D Rubidium ions are larger than rubidium atoms.

24 Which statement about both the Group I and Group VII elements is correct?

A They conduct electricity when molten.

B They form covalent compounds when bonded to non-metals.

C They exists as diatomic molecules.

D When Group I elements combine with Group VII elements, ionic compounds form.

PERIODIC TABLE STRUCTURED QUESTIONS

Paper 2 Section A

1 The table below shows some information about elements **A**-**F**. The letters are **not** the chemical symbols of the elements.

Element	Colour	Melting point / °C	Boiling point / °C	Conducts electricity	Density / g/cm^3
A	Dull grey	1415	2898	Yes	2.0300
B	Pale yellow	-219	-188	No	0.0017
C	Orange brown	-7	59	No	3.1000
D	Shiny brown	1074	2927	Yes	8.9200
E	Shiny grey	1540	2861	Yes	7.8700
F	Colourless	-157	-153	No	0.0033

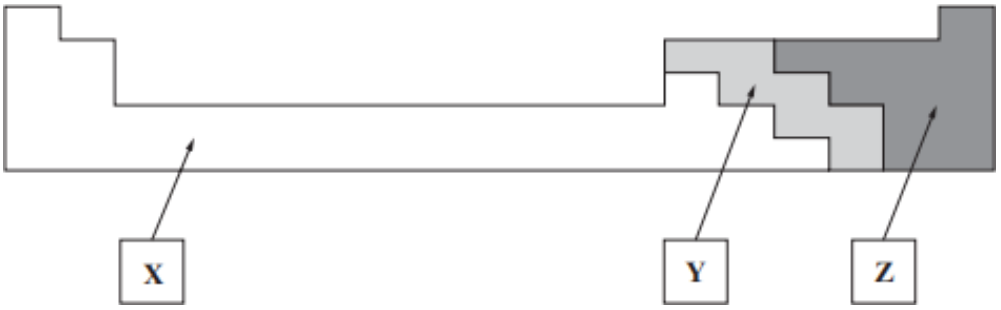
(a) **(i)** State which of the elements **A**-**F** are gases at room temperature. [1]

……..

(ii) Give the letter of the element **A**-**F** that has the biggest difference between melting point and boiling point. [1]

……..

(iii) The diagram shows an outline of the Periodic Table.



[2]

Element **A** is found in area **Y** of the Periodic Table shown above. Explain how the information in the table above supports this statement.

……..

……..

……..

(b) Methane reacts violently with fluroine according to the following equation.

$$CH_4\,(g) + 4F_2\,(g) \rightarrow CF_4\,(g) + 4HF\,(g) \qquad \rightarrow H = -1904\ kJ/mol$$

Mean bond energies are given in the table shown below.

Bond	C-H	C-F	H-F
Mean bond energy / kJ/mol	412	484	562

A student suggested that one reason for the high reactivity of fluorine is a weak F-F bond.

Is the student correct? Justify your answer with calculations using the above data. [4]

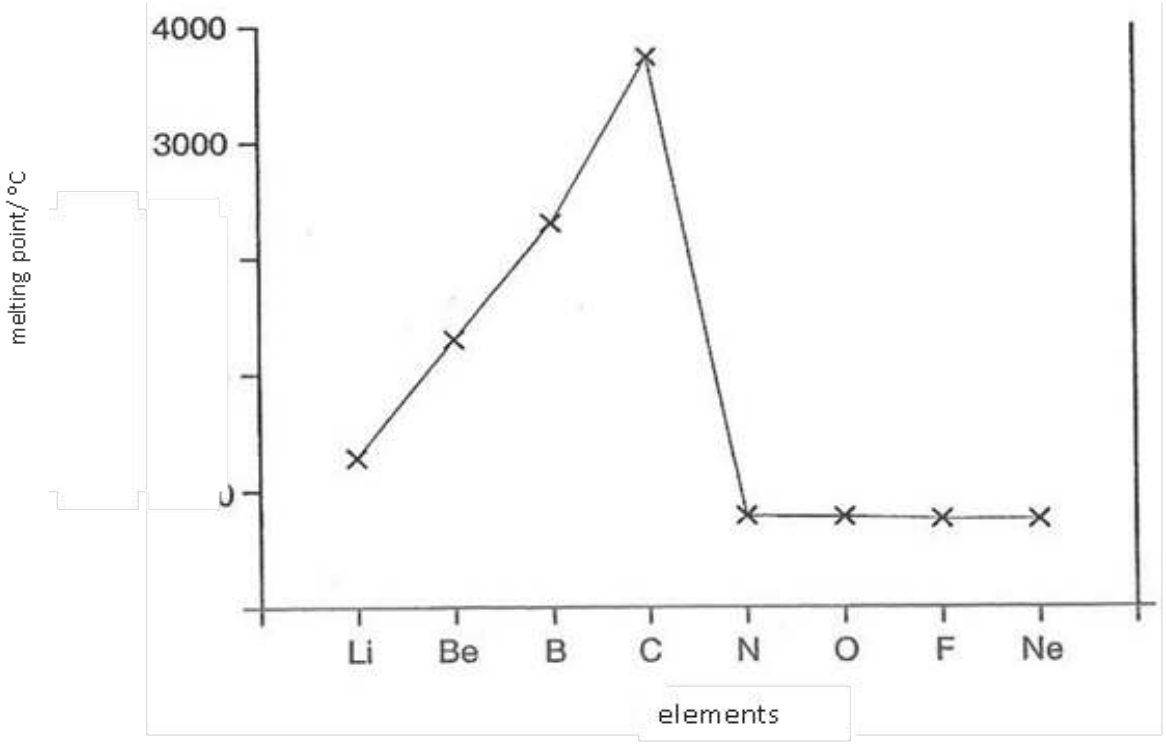
(c) Write an ionic equation for the reaction between potassium and cold water. [1]

……

[Total: 9]

Paper 2 Section B

1 This information is about the elements in **Period 2** of the Periodic Table.



element	electrical conductivity (at room temperature and pressure)
Li	good
Be	good
B	poor
C	good
N	does not conduct
O	does not conduct
F	does not conduct
Ne	does not conduct

(a) (i) Use the information to describe the trends in melting point and electrical conductivity across Period 2.

……

……

…… [2]

(ii) How does the data show that the first four elements in Period 2 are solids at room temperature and pressure?

……

…… [1]

(b) (i) Does the electrical conductivity of carbon fit the general pattern across the period? Justify your answer.

……

……

……

…… [2]

(ii) There are two forms of carbon: diamond and graphite.

Which form of carbon does the data refer to?
Explain your answer with reference to the structure of the substance you have chosen.

……

……

……

…… [2]

(c) Draw a sketch graph to show how atomic number changes across the period.

(d) An element in **Period 3** has the following properties.

melting point/ °C	98
conductivity	good

Use the information given in the question to suggest the element that this data is most likely to refer to.

Explain your answer.

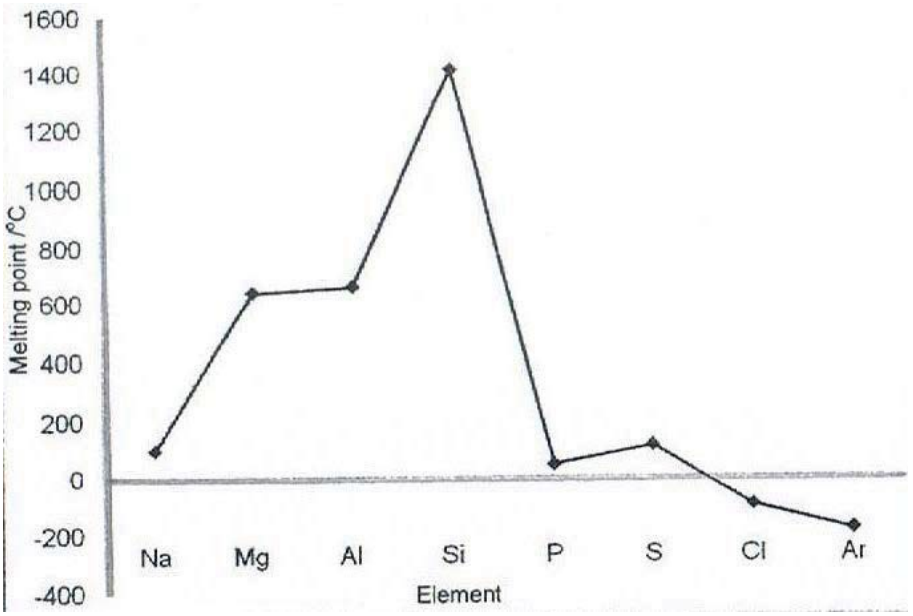
.....

.....

.....[2]

[Total: 10]

2 **(a)** The information in Fig 11.3 is about the elements in Period **3** of the Periodic Table.



1 Fig 11.3

(i) Describe the general trends in melting point across Period **3**.

……...

……...

……...

……...

……..[3]

(ii) How does the data show that the first four elements in Period **3** are solids at room temperature and pressure?

……...

……..[1]

(b) Silicon has a structure similar to that of diamond. Explain in terms of structure and bonding why silicon has such a high melting point in Period **3**.

……...

……...

……...

……..[2]

(c) Sketch a graph to show how proton number changes across Period **3**.

[1]

(d) Fluorine, chlorine, bromine and iodine are halogens found in Group VII of the Periodic Table. Table 11.4 lists the bond lengths and average bond energies of the halogens.

Table 11.4

covalent bond	bond length/ nm ($1nm = 10^{-9}m$)	average bond energy (kJ/mol)
F – F	0.142	158
Cl – Cl	0.199	242
Br – Br	0.228	193
I – I	0.267	151

(i) Describe the **general** relationship between bond length and the average bond energy within Group VII molecules.

……...

……..[1]

(ii) A student made the following comment about the reaction of gaseous propane, gaseous chlorine and gaseous bromine.

"When the same number of moles of gaseous propane is reacted with both gaseous bromine and gaseous chlorine, the rates for the two reactions will be the same."

Do you agree with the student's comment? Explain your reasoning.

……...

……...

……..[2]

[Total: 10 marks]

3 This question refers to the elements shown in the section of the Periodic Table below.

							H										He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr

From this list of elements, identify in each case one element that has the property described. Give the symbol of the element.

(a) An element that sinks in cold water and reacts readily with it.

……. [1]

(b) An element that forms an oxide that is a reducing agent.

……. [1]

(c) An element in Period 3 that forms the smallest cation.

……. [1]

(d) 2 elements that react the most violently together to form a solid.

……. [1]

(e) An element that produces a reddish-brown solution with potassium iodide.

……. [1]

[Total: 5]

4 **(a)** The grid below represents part of a blank periodic table, the numbers being the proton number of the elements.

In the grid below, write

(i) **P** in a space which could be occupied by a noble gas which is used to fill weather balloons. [1]

(ii) **Q** in a space which the most reactive non-metal would occupy. [1]

(iii) **R** in a space which could be occupied by a metal with the lowest density. [1]

(iv) **S** in a space which could be occupied by an element forming an amphoteric hydroxide. [1]

(v) **T** in a space which could be occupied by an element with an isotope that can be represented by $^{14}_{6}X$. [1]

1							2
3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18

(b) **(i)** Describe how the metallic character of the elements in Period 3 changes across the period from left to right.

……[1]

(ii) State how the metallic character of an element is related to its electronic structure.

…… [1]

(c) Explain what is meant by the term *periodicity*.

……

……[1]

[Total: 8]

5 A laboratory assistant has six elements that are **consecutively** arranged in the Periodic Table. He randomly assigns each element a letter, T, V, W, X, Y and Z. The letters do not represent the atomic symbols and the order of the elements.

He carried out some experiments on the elements and found the following properties.

- V2 reacts with X_2 to form a compound VX_3.
- Y forms a carbonate that decomposes to carbon dioxide and an oxide on heating.
- W reacts with T_2 to form W_2T. W_2T dissolves in water to form a solution that turns purple with addition of Universal Indicator.
- Z is a gaseous element. It is used in advertising strip lights.

(a) Identify the following elements

(i) T, ……[1]

(ii) W, ……[1]

(iii) Z. ……[1]

(b) Write down the product(s) formed from the reaction between

(i) Y and Cl_2, [1]

(ii) X_2 and NaCl [1]

(c) State the industrial conditions required to produce VH_3. (H is hydrogen).

……

…… [2]

[Total: 7]

6 The diagram shows part of the Periodic Table. Only some of the elements are shown.

							H										
												C	N	O			
Na	Mg											Al	Si	P			
K	Ca						Fe			Cu	Zn						
Rb																	

Answer each of the following questions using only those elements shown in the diagram. Each element may be used once, more than once or not at all.

Give one element which

(a) has a giant molecular structure,

.....[1]

(b) combines with oxygen to form a gas which contributes to acid rain,

.....[1]

(c) forms an ion of type X^+ which has only three completely filled shells of electrons,

.....[1]

(d) has an atom with fourteen protons,

.....[1]

(e) can exist as two different allotropes in gaseous state,

.....[1]

(f) is the most reactive metal among the listed elements,

.....[1]

(g) has a chloride of type XCl_2, whose aqueous solution forms a green precipitate on addition of sodium hydroxide.

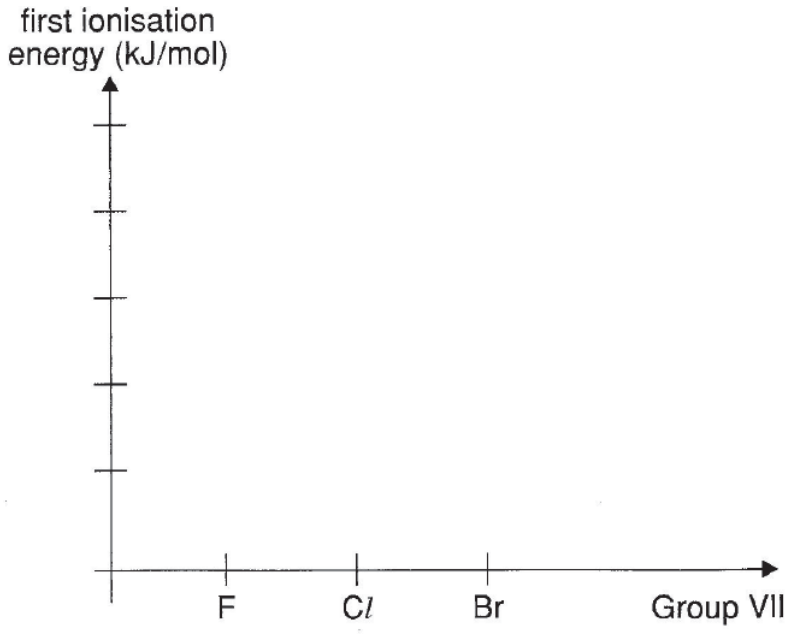
.....[1]

[Total: 7]

7 First ionisation energy is the energy required to convert one mole of gaseous atoms into one mole of gaseous ions with a charge of +1.

The magnitude of the first ionisation energy increases in general as the number of electron shells decreases.

(a) **(i)** Draw, in the following graph, the trend in which the first ionisation energy changes down Group VII elements from fluorine to bromine.



[1]

(ii) Based on the trend of the change in first ionisation energy, suggest the relationship between the first ionisation energy and the reactivities of elements in Group VII.

.....[1]

(b) **(i)** What is observed if aqueous sodium iodide is reacted with aqueous chlorine?

.....[1]

(ii) Write an ionic equation, with state symbols, for the reaction in **(i)** above.

.....[2]

[Total: 5]

8 Fig. 1.1 shows part of the Periodic Table.

										He
					B	C	N	O	F	Ne
					Al	Si	P	S	Cl	Ar
Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
									I	Xe

a) *Fig. 1.1*

Answer the following questions using **only** the elements shown in Fig. 1.1.

Each element can be used once, more than once or not at all.

Write the **symbol** for

(a) an element which is used as a gas in balloons, …….. [1]

(b) an element which forms an ion of type X^{3-}, …….. [1]

(c) an element which is a catalyst for the production of ammonia, …….. [1]

(d) two elements which combine to form a compound that causes acid rain, ……. and ……. [1]

(e) an element which forms ions in aqueous solution which gives a white precipitate on reaction with acidified silver nitrate. …….. [1]

[Total: 5]

ANSWER FOR PERIODIC TABLE MCQ

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The following results were observed.

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In which group are the elements found?

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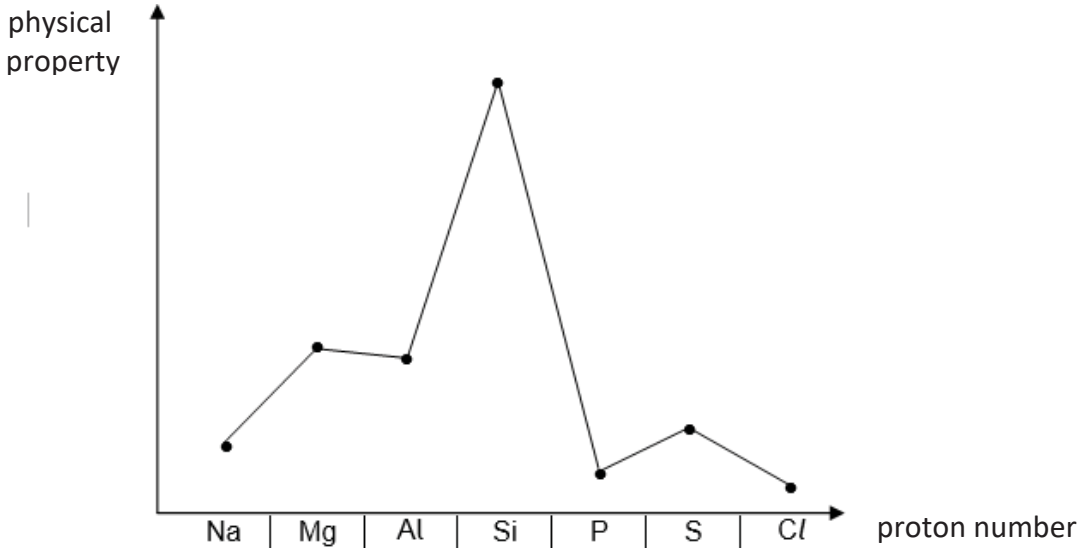

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Which of the following is not an example of a transition metal acting as a catalyst?

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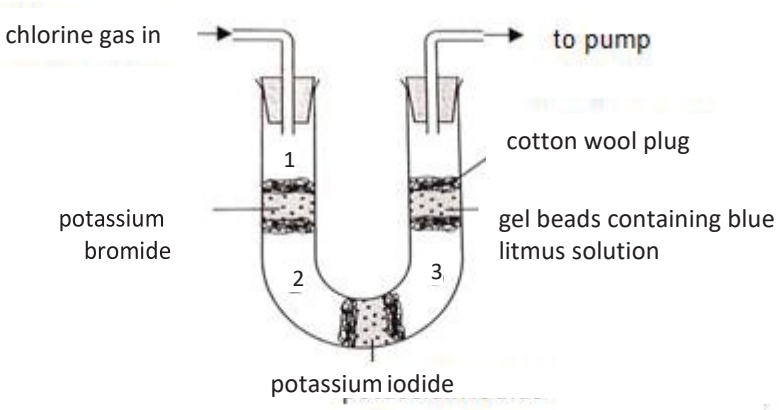
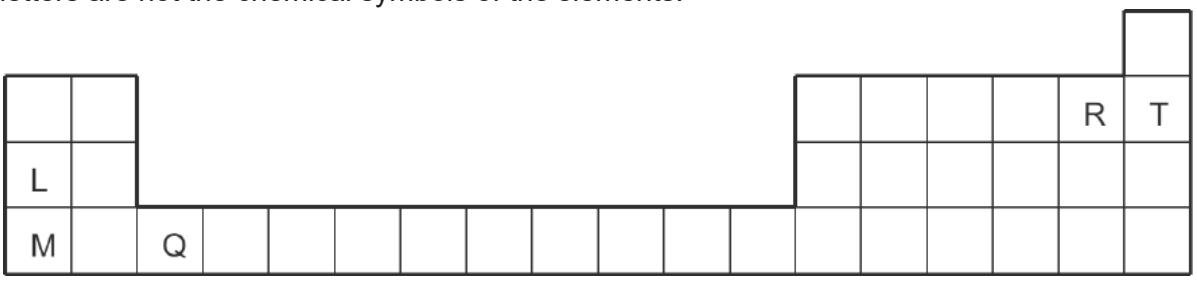


Which of the following observations would be made at regions 1, 2 and 3?

	region 1	region 2	region 3
A	red-brown gas	black solid	violet gas
B	violet gas	red-brown gas	black solid
C	yellow-green gas	red-brown gas	violet gas
D	yellow-green gas	violet gas	brown gas

15 The diagram shows the positions of elements L, M, Q, R and T in the Periodic Table. These letters are not the chemical symbols of the elements.



Which statement about the properties of these elements is correct?

A M reacts more vigorously with water than does L.
B Q, R and T are all metals.
C T is more reactive than R.
D T exists as diatomic molecules.

16 Which pair of elements would react together most vigorously?

A potassium and bromine
B potassium and iodine
C sodium and chlorine
D sodium and fluorine

17 Elements X and Y are in the same Group of the Periodic Table.

Which statement must be correct?

A Atoms X and Y have similar electronic structure.
B Atoms X and Y have the same physical properties.
C If X has a smaller proton number than Y, it is less metallic.
D The number of electronic shells in atoms X and Y must be the same.

18 The period 4 elements gallium (Ga), germanium (Ge), arsenic (As) and selenium (Se) are elements below aluminium, silicon, phosphorus and sulfur in the Periodic Table, a portion of which is shown below.

period 3 elements	Al	Si	P	S
period 4 elements	Ga	Ge	As	Se

The properties of each period 4 element resemble those of the period 3 element directly above it.

Which period 4 elements form oxides that dissolve in water to give an acid solution?

A As and Se
B Ga and Ge
C Ga and Se
D Se only

19 When a mineral was heated in a Bunsen flame to a constant mass, a colourless gas that produced a white precipitate in limewater, was given off. The remaining solid was cooled and then added to aqueous hydrochloric acid. Vigorous effervescence was seen. What was the mineral?

A aragonite, $CaCO_3$
B artinite, $MgCO_3.Mg(OH)_2.3H_2O$
C barytocalcite, $BaCO_3.CaCO_3$
D dolomite, $CaCO_3.MgCO_3$

20 Which property would all the hydrogen compounds of the Group VII elements possess?

A They form covalent compounds.
B They are solids at room temperature.
C They form alkaline aqueous solutions.
D They conduct electricity when molten.

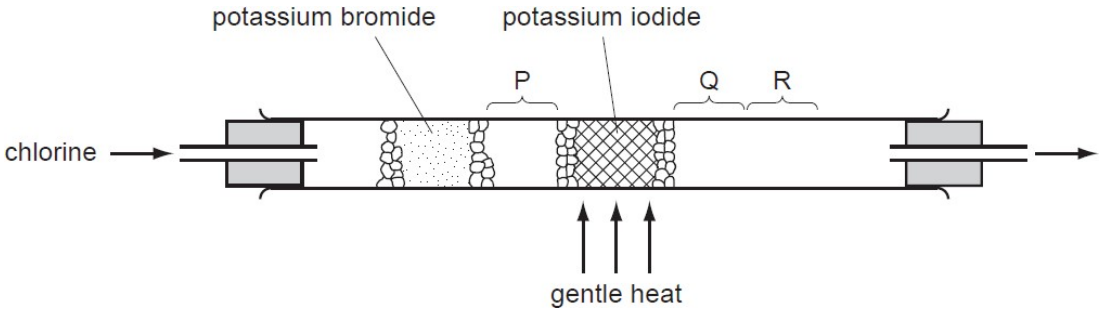
21 The properties of the oxides of four elements K, L, M and N in the third period of the Periodic Table are given below.

- The oxide of K is insoluble in water and dilute acid but soluble in concentrated alkali.
- The oxide of L reacts with both dilute acid and dilute alkali.
- The oxide of M reacts with dilute alkali at room temperature.
- The oxide of N dissolves in water to form an alkaline solution.

If K, L, M and N are placed in order of increasing atomic number, which order is correct?

A K, L, M, N
B N, M, K, L
C N, L, K, M
D L, K, N, M

22 Using the apparatus shown, chlorine is passed through the tube.



After a short time, coloured substances are seen at P, Q and R. What are these coloured substances?

	at P	at Q	at R
A	green gas	red brown vapour	violet vapour
B	green gas	violet vapour	black solid
C	red brown vapour	violet vapour	black solid
D	violet vapour	red brown vapour	red brown vapour

23 Lithium and rubidium are both in Group I of the Periodic Table.

Which statement is correct?

A Lithium atoms and rubidium atoms have the same number of electrons in their outer shell.

B Lithium atoms are larger than rubidium ions.

C Lithium ions and rubidium ions have the same number of electrons in their outer shell.

D Rubidium ions are larger than rubidium atoms.

24 Which statement about both the Group I and Group VII elements is correct?

A They conduct electricity when molten.

B They form covalent compounds when bonded to non-metals.

C They exists as diatomic molecules.

D When Group I elements combine with Group VII elements, ionic compounds form.

ANSWER FOR PERIODIC TABLE STRUCTURED QUESTIONS

Paper 2 Section A

1 The table below shows some information about elements **A**-**F**. The letters are **not** the chemical symbols of the elements.

Element	Colour	Melting point / °C	Boiling point / °C	Conducts electricity	Density / g/cm^3
A	Dull grey	1415	2898	Yes	2.0300
B	Pale yellow	-219	-188	No	0.0017
C	Orange brown	-7	59	No	3.1000
D	Shiny brown	1074	2927	Yes	8.9200
E	Shiny grey	1540	2861	Yes	7.8700
F	Colourless	-157	-153	No	0.0033

(a) **(i)** State which of the elements **A**-**F** are gases at room temperature. [1]

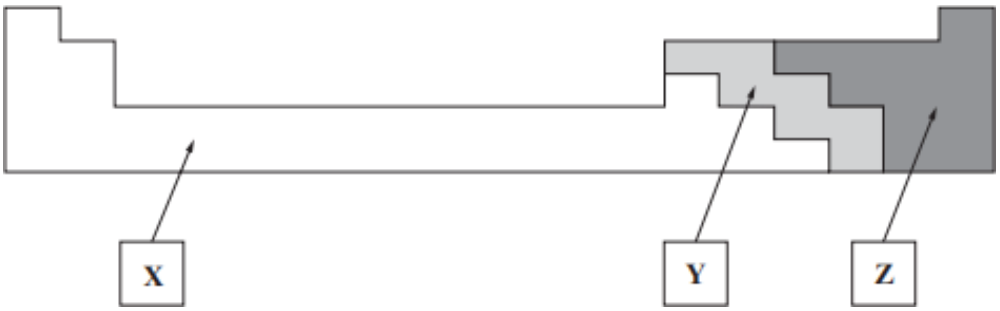
B and F

[1]

(ii) Give the letter of the element **A**-**F** that has the biggest difference between melting point and boiling point.

D

(iii) The diagram shows an outline of the Periodic Table.



[2]

Element **A** is found in area **Y** of the Periodic Table shown above. Explain how the information in the table above supports this statement.

It is a metalloid/shows property of both metal and non-metal. [1]

(Provide one property of a metal and one of a non-metal e.g. conducts electricity but low density, dull colour accepted) – [1] [2]

(b) Methane reacts violently with fluroine according to the following equation.

$$CH_4\ (g) + 4F_2\ (g) \rightarrow CF_4\ (g) + 4HF\ (g) \quad \rightarrow H = -1904\ kJ/mol$$

Mean bond energies are given in the table shown below.

Bond	C-H	C-F	H-F
Mean bond energy / kJ/mol	412	484	562

A student suggested that one reason for the high reactivity of fluorine is a weak F-F bond.

Is the student correct? Justify your answer with calculations using the above data. [4]

Bonds broken

4(C–H) + 4(F–F) = 4 × 412 + 4 × F–F - [1]

Bonds formed

4(C–F) + 4(H–F) = 4 × 484 + 4 × 562 – [1]

[Enthapy change = bond break – bond make]

–190 = [4 × 412 + 4(F–F)] – [4 × 484 + 4 × 562] [1]

4(F–F) = –1904 – 4 × 412 + [4 × 484 + 4 x 562] = 632

F–F 632 / 4 = **158 kJ/mol , The student is correct**. [1]

because the F–F bond energy is much less than the C–H or other covalent bonds, therefore the F–F bond is weak / easily broken.

(c) Write an ionic equation for the reaction between potassium and cold water. [1]

Chemical eqn

$2K\ (s) + 2H_2O\ (l) \rightarrow 2KOH\ (aq) + H_2\ (g)$

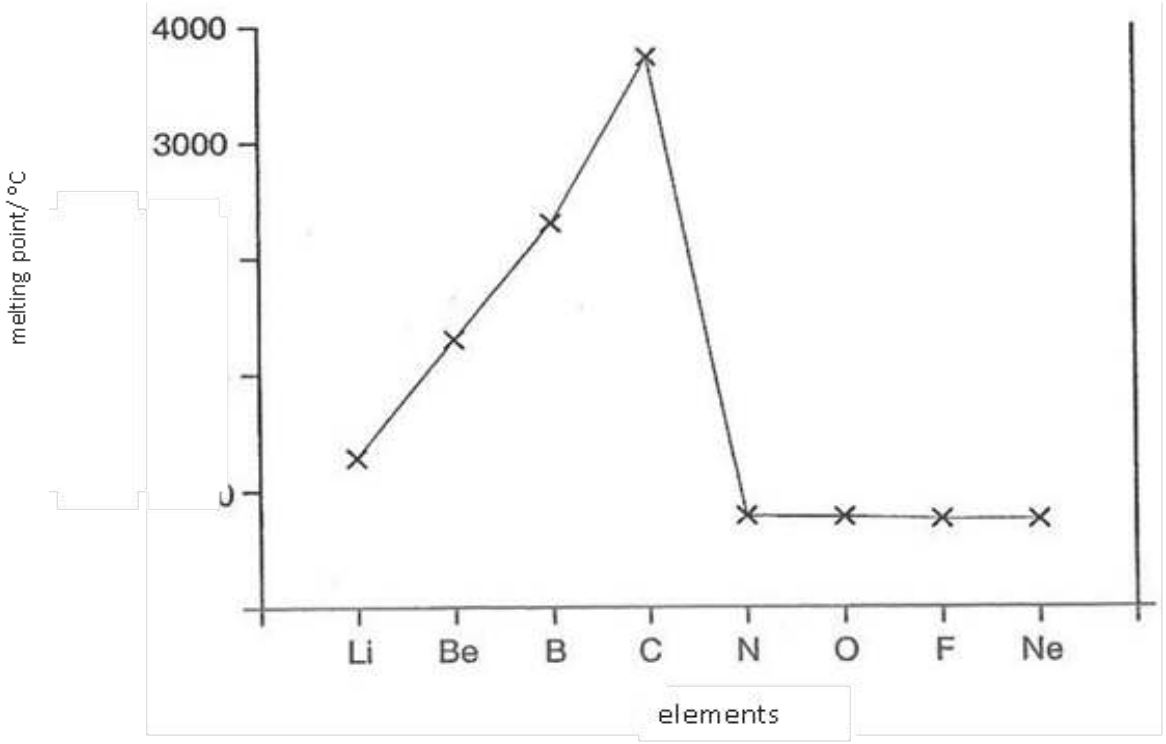
Ionic eqn

$2K\ (s) + 2H_2O\ (l) \rightarrow 2K^+\ (aq) + 2OH^-\ (aq) + H_2\ (g)$ [1]

[Total: 9]

Paper 2 Section B

1 This information is about the elements in **Period 2** of the Periodic Table.



element	electrical conductivity (at room temperature and pressure)
Li	good
Be	good
B	poor
C	good
N	does not conduct
O	does not conduct
F	does not conduct
Ne	does not conduct

(a) (i) Use the information to describe the trends in melting point and electrical conductivity across Period 2.

The melting points increase across Period 2 from Li to C, then decrease sharply from C to N. The melting points decreases gradually from N to Ne [1]

The electrical conductivity is high for the first elements in the period and is for the last four elements. Boron is the exception as it one of the first few elements yet it has poor electrical conductivity [1]

NB
X Wrong: merely restating the table information in sentence form,
for example, "lithium, beryllium and carbon are good conductors, boron is poor and the other elements do not conduct.

Right: answers that identified a general trend, "the conductivity is high for the first elements in the period and is low for the last four elements and then highlighted the exception 'except for boron' or 'except for carbon [2]

(ii) How does the data show that the first four elements in Period 2 are solids at room temperature and pressure?

They have high melting points that are above room temperature. [1]

(b) (i) Does the electrical conductivity of carbon fit the general pattern across the period? Justify your answer.

No. Electrical conductivity generally decreases across Period 2. [1] (specific mention of a trend)

However, carbon is a good electrical conductor despite the preceding element, boron, being a poor conductor, and the following element, nitrogen, being a non-conductor. [1]

NB: Only ans that presents the idea of a general pattern will be accepted. [2]

(ii) There are two forms of carbon: diamond and graphite.

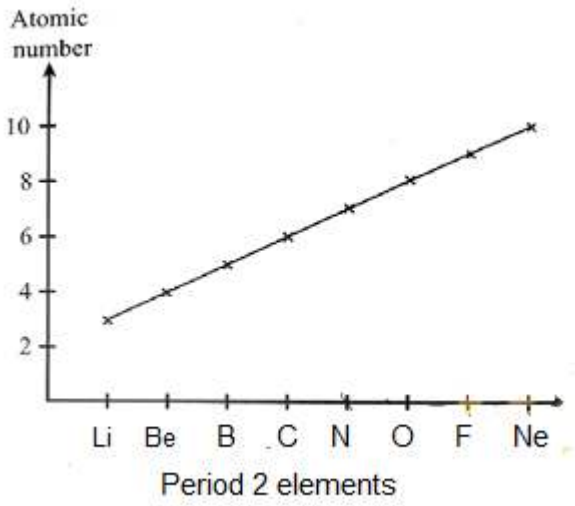
Which form of carbon does the data refer to?
Explain your answer with reference to the structure of the substance you have chosen.

Graphite. [no marks]

Graphite has a giant molecular structure consisting of layers of carbon atoms. Each carbon atom is covalently bonded to three other carbon atoms.
This leaves each carbon atom with one valence electron not involved in bonding. [1] This electron becomes delocalised and can move freely along the layers of carbon atoms, [1] thus conducting electricity.

NB: Reject if students write each atom is bonded to 3 other electrons. [2]

(c) Draw a sketch graph to show how atomic number changes across the period.



NB: reject if axes are unlabeled.

(d) An element in **Period 3** has the following properties.

melting point/ →C	98
conductivity	good

Use the information given in the question to suggest the element that this data is most likely to refer to.

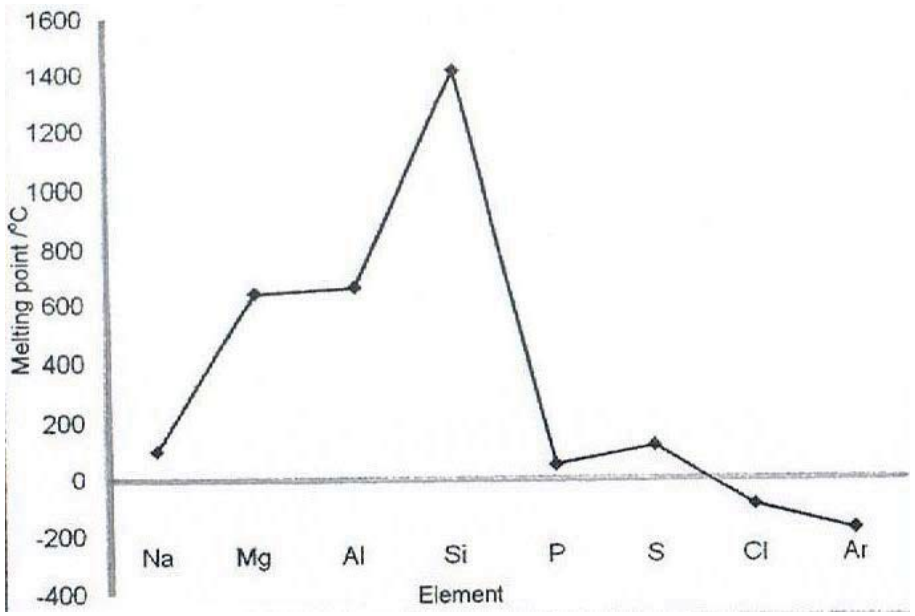
Explain your answer.

Sodium. [no mark]

A relatively low melting point (compared to other metals) [1] and good electrical conductivity are properties of Group I/alkali metals.[1] [2]

[Total: 10]

2 **(a)** The information in Fig 11.3 is about the elements in Period **3** of the Periodic Table.



2 Fig 11.3

(i) Describe the general trends in melting point across Period **3**.

1: Melting point increases from Na to Si
2. It drops drastically from-Si to P.
3. There· is a gradual drop in melting point from S to Cl [3]

(ii) How does the data show that the first four elements in Period **3** are solids at room temperature and pressure?

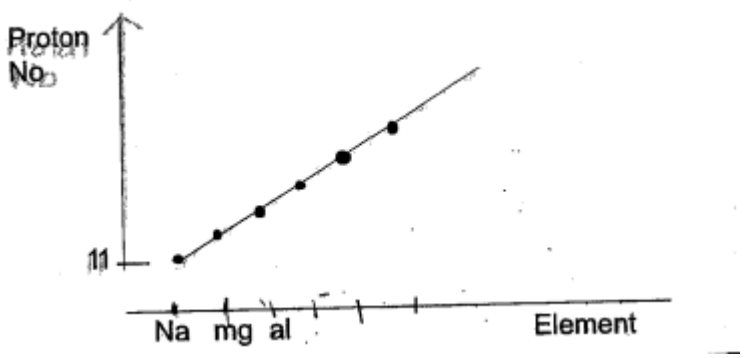
Their melting points are above room temperature [1]

(b) Silicon has a structure similar to that of diamond. Explain in terms of structure and bonding why silicon has such a high melting point in Period **3**.

Silicon has a giant molecular structure with all the silicon atoms joined together with strong covalent bonds.
A lot of heat energy is needed to break the strong covalent bonds between the silicon atoms.

.[2]

(c) Sketch a graph to show how proton number changes across Period **3**.



[1]

(d) Fluorine, chlorine, bromine and iodine are halogens found in Group VII of the Periodic Table. Table 11.4 lists the bond lengths and average bond energies of the halogens.

Table 11.4

covalent bond	bond length/ nm ($1nm = 10^{-9}m$)	average bond energy (kJ/mol)
F – F	0.142	158
Cl – Cl	0.199	242
Br – Br	0.228	193
I – I	0.267	151

(i) Describe the **general** relationship between bond length and the average bond energy within Group VII molecules.

as bond length increases, the bond energy decreases; (with the exception of fluorine). [1]

(ii) A student made the following comment about the reaction of gaseous propane, gaseous chlorine and gaseous bromine.

"When the same number of moles of gaseous propane is reacted with both gaseous bromine and gaseous chlorine, the rates for the two reactions will be the same."

Do you agree with the student's comment? Explain your reasoning.

No. Chlorine is more reactive than bromine;
the reactivity decreases down Group VII
[2]

[Total: 10 marks]

3 This question refers to the elements shown in the section of the Periodic Table below.

							H										He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr

From this list of elements, identify in each case one element that has the property described. Give the symbol of the element.

(a) An element that sinks in cold water and reacts readily with it.

Ca [1]

(b) An element that forms an oxide that is a reducing agent.

C/S/N/H [1]

(c) An element in Period 3 that forms the smallest cation.

Na [1]

(d) 2 elements that react the most violently together to form a solid.

KF [1]

(e) An element that produces a reddish-brown solution with potassium iodide.

Cl/F. [1]

[Total: 5]

4 (a) The grid below represents part of a blank periodic table, the numbers being the proton number of the elements.

In the grid below, write

(i) P in a space which could be occupied by a noble gas which is used to fill weather balloons. [1]

P- box 2

(ii) Q in a space which the most reactive non-metal would occupy. [1]

Q -box 9

(iii) R in a space which could be occupied by a metal with the lowest density. [1]

R-box 3

(iv) S in a space which could be occupied by an element forming an amphoteric hydroxide. [1]

S-box 13

(v) T in a space which could be occupied by an element with an isotope that can be represented by $^{14}_{6}X$. [1]

T – box 6

1							2
3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18

(b) (i) Describe how the metallic character of the elements in Period 3 changes across the period from left to right.

elements become less metallic [1]

(ii) State how the metallic character of an element is related to its electronic structure.

As the number of valence electrons increases, the metallic character of the element decreases.[1]

(c) Explain what is meant by the term *periodicity*.

Periodicity is a repeating pattern (across different periods) [1]

[Total: 8]

5 A laboratory assistant has six elements that are **consecutively** arranged in the Periodic Table. He randomly assigns each element a letter, T, V, W, X, Y and Z. The letters do not represent the atomic symbols and the order of the elements.

He carried out some experiments on the elements and found the following properties.

- V_2 reacts with X_2 to form a compound VX_3.
- Y forms a carbonate that decomposes to carbon dioxide and an oxide on heating.
- W reacts with T_2 to form W_2T. W_2T dissolves in water to form a solution that turns purple with addition of Universal Indicator.
- Z is a gaseous element. It is used in advertising strip lights.

(a) Identify the following elements

(i) T, Oxygen [1]

(ii) W, Sodium [1]

(iii) Z. Neon [1]

(b) Write down the product(s) formed from the reaction between

(i) Y and Cl_2, YCl_2
Accept: magnesium chloride [1]

(ii) X_2 and NaCl NaX and Cl_2
Accept sodium fluoride and chlorine [1]

(c) State the industrial conditions required to produce VH_3. (H is hydrogen).

200-250atm 400-500^{o}C

Iron catalyst

Note: 2 marks for 3 correct answers; 1 mark for 2 correct answer [2]

[Total: 7]

6 The diagram shows part of the Periodic Table. Only some of the elements are shown.

							H										
													C	N	O		
Na	Mg											Al	Si	P			
K	Ca						Fe			Cu	Zn						
Rb																	

Answer each of the following questions using only those elements shown in the diagram. Each element may be used once, more than once or not at all.

Give one element which

(a) has a giant molecular structure,

C / Si [1]

(b) combines with oxygen to form a gas which contributes to acid rain,

N [1]

(c) forms an ion of type X^+ which has only three completely filled shells of electrons,

K [1]

(d) has an atom with fourteen protons,

Si [1]

(e) can exist as two different allotropes in gaseous state,

O [1]

(f) is the most reactive metal among the listed elements,

Rb [1]

(g) has a chloride of type XCl_2, whose aqueous solution forms a green precipitate on addition of sodium hydroxide.

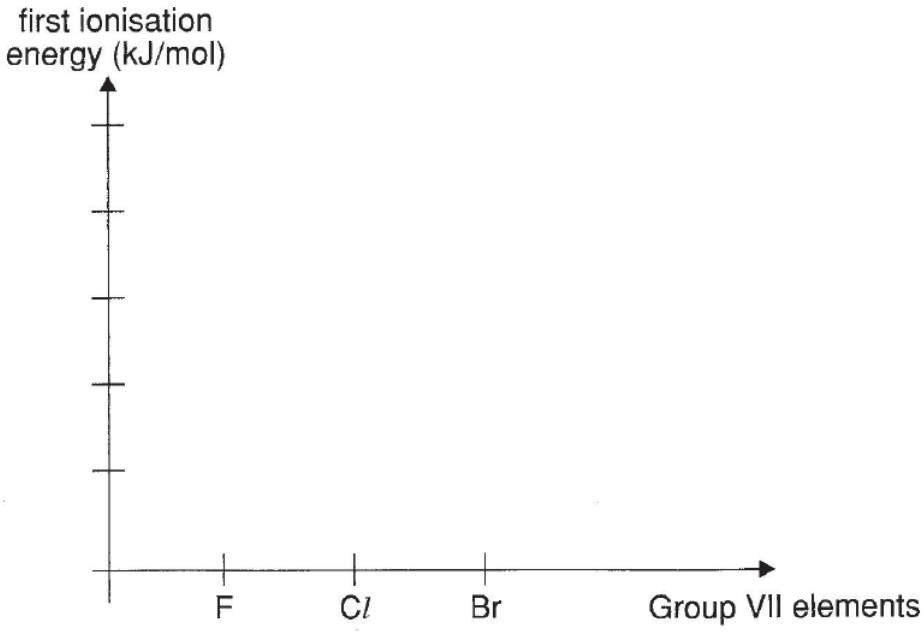
Fe [1]

[Total: 7]

7 First ionisation energy is the
energy required to convert one mole of gaseous atoms into one mole of gaseous ions with a charge of +1.

The magnitude of the first ionisation energy increases in general as the number of electron shells decreases.

(a) (i) Draw, in the following graph, the trend in which the first ionisation energy changes down Group VII elements from fluorine to bromine.



[1]

(ii) Based on the trend of the change in first ionisation energy, suggest the relationship between the first ionisation energy and the reactivities of elements in Group VII.

.....[1]

(b) (i) What is observed if aqueous sodium iodide is reacted with aqueous chlorine?

.....[1]

(ii) Write an ionic equation, with state symbols, for the reaction in **(i)** above.

.....[2]

[Total: 5]

Answer:

7	**(ai)**	Downward trend;
	(aii)	The higher the first ionisation energy, the higher the reactivity of the halogen
	(bi)	The solution turns from colorless to reddish brown
	(bii)	$Cl_2(aq) + 2Do - (aq) \rightarrow 2C - (aq) + Do_2(s)$ (balanced equation; state symbols;)

8 Fig. 1.1 shows part of the Periodic Table.

										He
					B	C	N	O	F	Ne
					Al	Si	P	S	Cl	Ar
Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
									I	Xe

a) *Fig. 1.1*

Answer the following questions using **only** the elements shown in Fig. 1.1. Each element can be used once, more than once or not at all.

Write the **symbol** for

(a) an element which is used as a gas in balloons, …….. [1]

(b) an element which forms an ion of type X^{3-}, …….. [1]

(c) an element which is a catalyst for the production of ammonia, …….. [1]

(d) two elements which combine to form a compound that causes acid rain, ……. and ……. [1]

(e) an element which forms ions in aqueous solution which gives a white precipitate on reaction with acidified silver nitrate. …….. [1]

[Total: 5]

Answer:

8	**(a)**	He	[1]
	(b)	N/P/As	[1]
	(c)	Fe	[1]
	(d)	S and O/ N and O/ C and O	[1]
	(e)	C [Overall, of 1 m will be deducted if candidates never follow the instruction to write chemical symbol.]	[1]