SECTION A

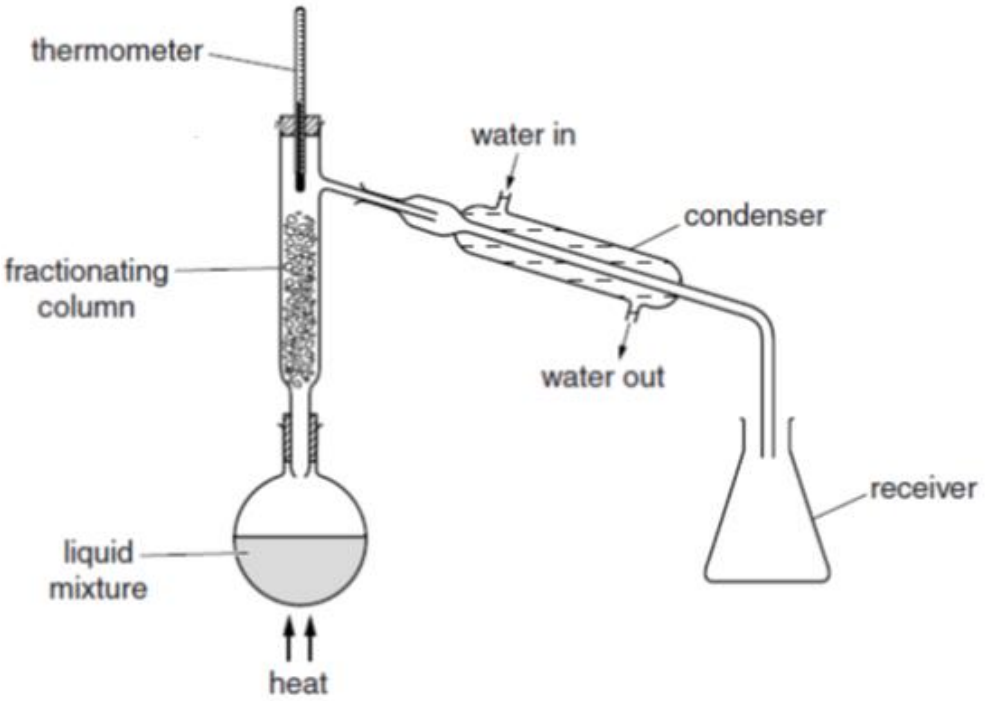
1 Which statements are correct?

1 The volume of a gas at constant pressure increases as the temperature increases.
2 The rate of diffusion of a gas increases as the temperature increases.
3 The pressure of a gas at constant volume decreases as the temperature increases.

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

C 1 and 3 only **D** 2 and 3 only

2 A student sets up the apparatus for fractional distillation as shown below.



What error is the student making in setting up the apparatus?

A The thermometer is in the wrong position.

B There should not be a bung in the top of the fractionating column.

C Water enters and leaves the condenser in the wrong place.

D There should be a bung in the top of the receiver.

3 Calcium carbonate reacts with hydrochloric acid, producing carbon dioxide gas.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

The rate of this reaction can be measured using the apparatus shown.

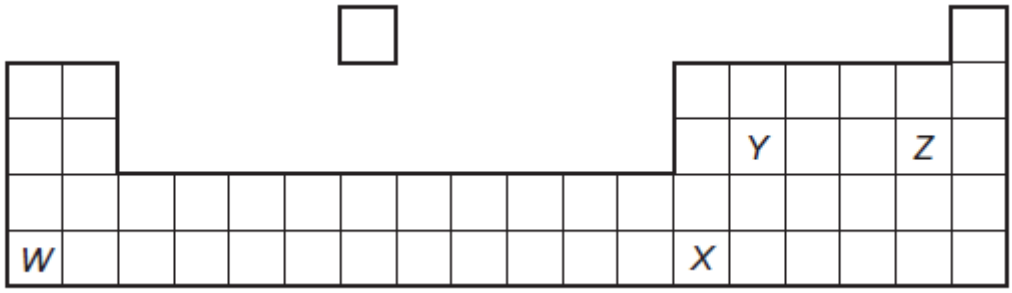
Which additional piece of apparatus is also required?
A a burette
B a stop watch
C a gas syringe
D a thermometer

4 What is the correct sequence for obtaining pure sodium chloride from a mixture of sand and sodium chloride?
A add water, evaporate
B add water, filter
C add water, filter, evaporate
D filter, add water, evaporate

5 Which statement describes ionic bonding?
A a lattice of ions in a sea of electrons
B electrostatic attraction between oppositely charged ions
C the sharing of electrons between atoms to gain a noble gas configuration
D the transfer of electrons from atoms of a non-metal to the atoms of a metal

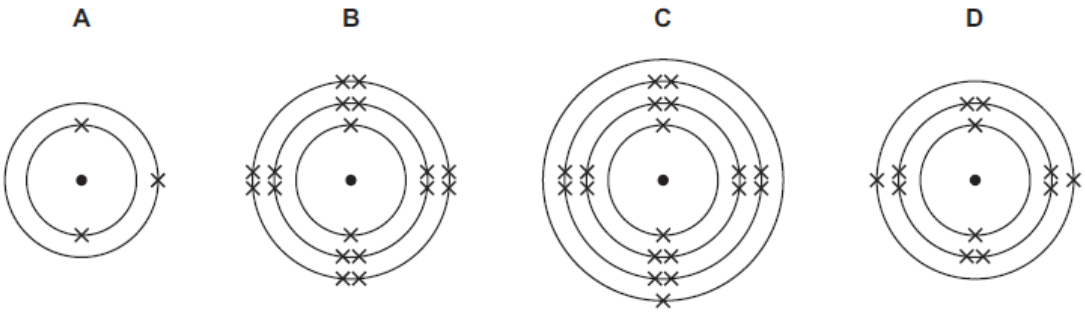
6 Why does ammonia gas diffuse faster than hydrogen chloride gas?
A Ammonia has a higher boiling point than hydrogen chloride.
B Ammonia is a base, hydrogen chloride is an acid.
C The ammonia molecule contains more atoms than a hydrogen chloride molecule.
D The relative molecular mass of ammonia is smaller than that of hydrogen chloride.

7 The diagram shows an outline of part of the Periodic Table



Which statement is not correct?
A The melting point of W is lower than that of Z.
B W and Z could react together and form a compound, WZ.
C X could form an oxide, X_2O_3.
D Y could form an oxide, YO_2.

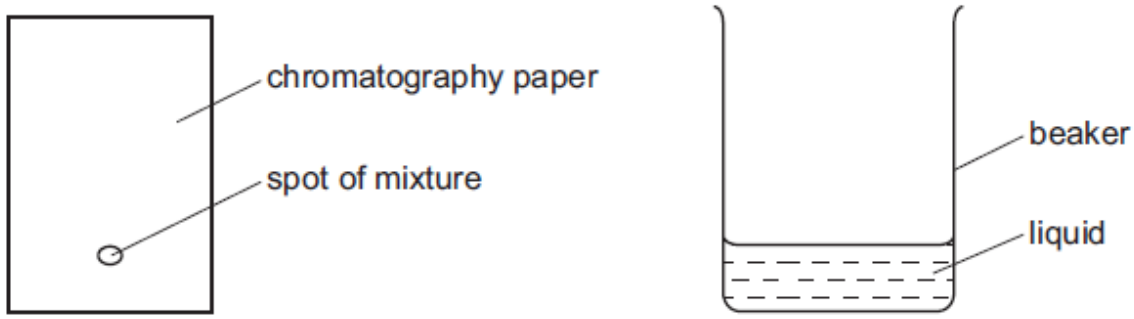
8 The diagram shows the arrangement of electrons in the atoms of four different elements.
Which is the least reactive of the four elements?



9 A gas cylinder is placed in each of the four corners of a square room. Each cylinder contains adifferent gas stored under the same pressure. The gases are released at exactly the same time.
Which gas will reach the centre of the room first?
A ammonia, NH_3
B argon, Ar
C carbon monoxide, CO
D chlorine, Cl_2

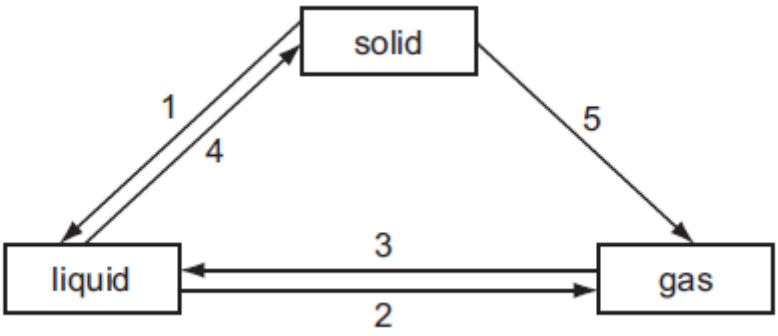
10 Which gas is not obtained industrially by fractional distillation?
A ammonia
B argon
C nitrogen
D oxygen

11 Mixture of two substances is spotted onto a piece of chromatography paper. The paper is inserted into a beaker containing a liquid.



For separation of the substances to occur the spot of mixture must
A be placed so that the spot is just below the level of the liquid.
B be soluble in the liquid.
C contain substances of the same R_f values.
D contain substances that are coloured.

12 The diagram shows some of the changes of state.

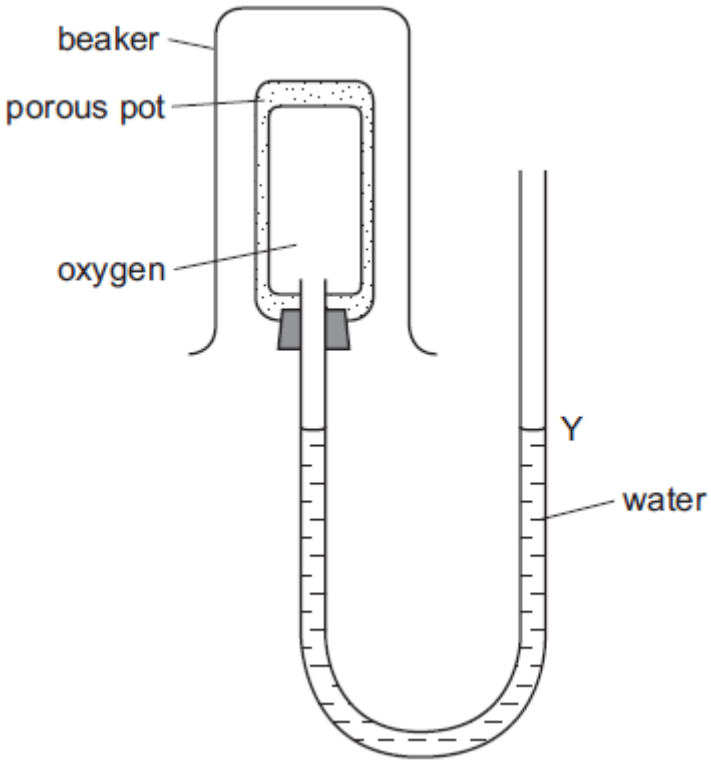


Which statement is correct?
A Although the change is not shown on the diagram, a gas can change directly to a solid.
B The changes 1 and 3 involve particles moving closer together.
C The changes 2 and 4 involve particles moving further apart.
D The changes 3, 4 and 5 all involve the release of energy.

13 Radium (Ra) is in the same group of the Periodic Table as magnesium.
What is the charge on a radium ion?
A 2– B 1– C 1+ D 2+

14 A researcher notices that atoms of an element are releasing energy.
Why are the atoms releasing energy?
A The atoms are absorbing light.
B The atoms are evaporating.
C The atoms are radioactive.
D The atoms react with argon in the air.

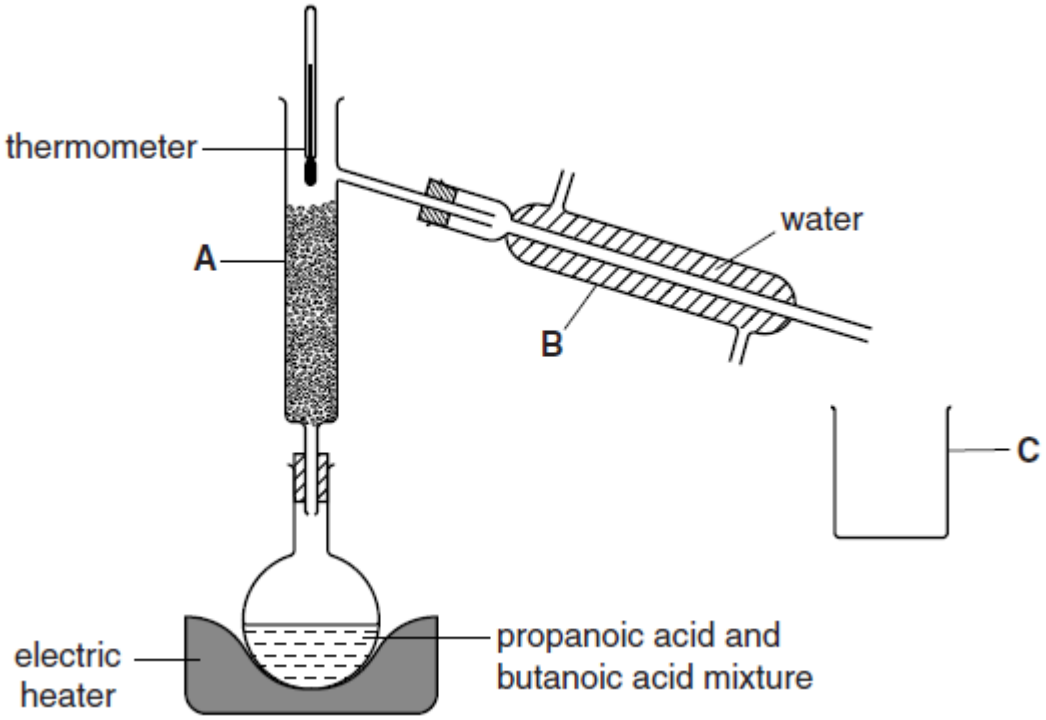
15 The diagram shows a diffusion experiment.



Which gas, when present in the beaker over the porous pot, will cause the water level at Y torise?
A carbon dioxide, CO_2
B chlorine, Cl_2
C methane, CH_4
D nitrogen dioxide, NO_2

SECTION B

1 A student separates propanoic acid (b.p. 141 °C) and butanoic acid (b.p. 164 °C) using theapparatus shown below.



(a) **(i)** The student has left out one item in setting up the apparatus. Name the missing item. [1]

The item is added and the apparatus is made ready for the separation of thetwo acids.

(ii) Name apparatus **A**. [1]

(iii) What is the purpose of apparatus **A**? [1]

(iv) Apparatus**B** is a condenser. What is the purpose of the apparatus. [1]

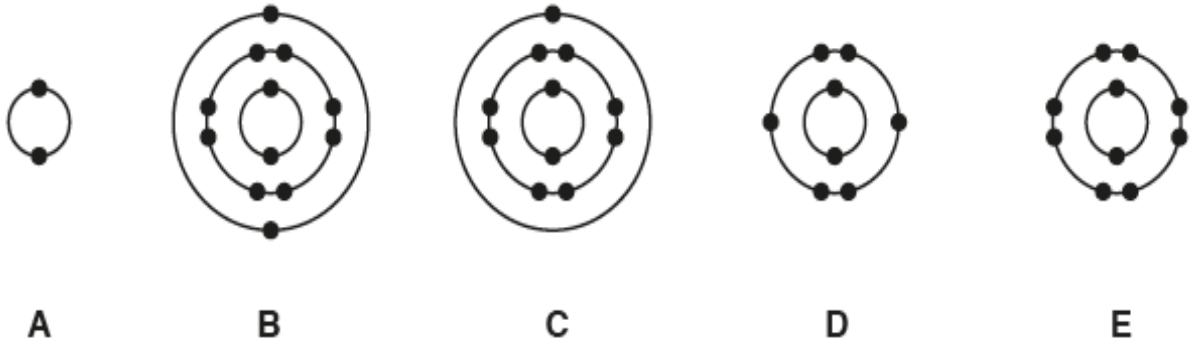
(b) **(i)** What is the reading on the thermometer when the first few drops of distillate appearin **C**? [1]

(ii) Name this distillate. [1]

(iii) How does the student know when all of this compound has distilled over? [1]

[Total: 7]

2 The electronic configurations of five atoms are shown.



(a) Which electronic configuration represents each of the following descriptions? Each electronic configuration may be used once, more than once or not at all.

(i) a sodium atom [1]

(ii) an atom of a reactive non-metallic element [1]

(iii) an atom with a proton (atomic) number of 12 [1]

(iv) an atom of a noble gas which is used to fill balloons [1]

(v) an atom which forms a noble gas electronic configuration when it gains two electrons [1]

(b) Chlorine has two naturally occurring isotopes.
One isotope of chlorine is represented by the symbol shown.

$^{17}_{37}Cl$

(i) Deduce the number of neutrons in one atom of this isotope of chlorine. [1]

(ii) Chlorine has diatomic molecules.

What is the meaning of the term *diatomic*? [1]

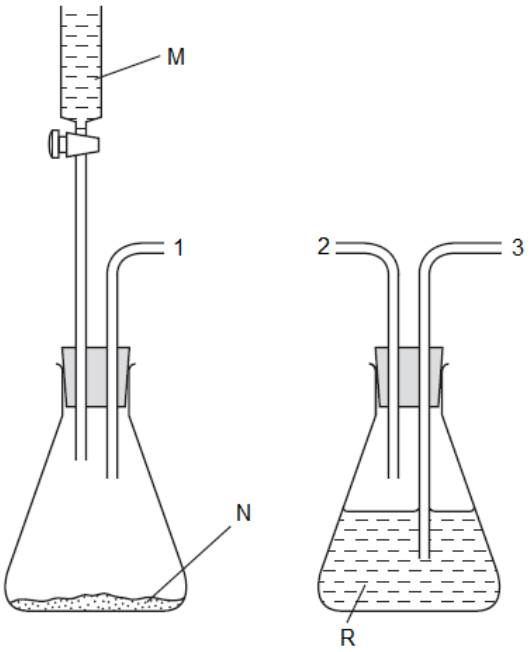
(iii) What is the meaning of the term *isotopes*? [2]

(c) The table shows some information about six particles.
Copy and Complete the table.

particle	proton (atomic) number	number of neutrons in particle	number of electrons in particle
^{35}Cl	17	18	.....
.....	17	20	17
$^{39}K^{+}$	19	.....	18
$^{79}Br^{-}$	.....	44	36
^{81}Br	35	.....	35
.....	37	48	36

[6]
[Total: 15]

3 Chlorineis produced when hot concentrated hydrochloric acid reacts with manganese (IV) oxide. The diagrams below show some of the apparatus used by a student to prepare dry chlorine.



(a) Name the substances **M**, **N** and **R**. [3]

(b) Which of the tubes, **2** or **3** should be connected to tube **1**? [2]

(c) Chlorine is denser than air and moderately soluble in water.

Draw a diagram to show how chlorine can be collected. [2]

[Total: 7]

4 The Periodic Table is an arrangement of elements in groups and periods.

(a) Describe how the position of an element in the Periodic Table is related to its electronicconfiguration. [2]

(b) Aluminium is an element in Group III of the Periodic Table.
Deduce the electronic configuration of the aluminium ion. [1]

(c) (i) Draw a 'dot-and-cross' diagram of a molecule of oxygen.
Only draw the outer shell electrons. [2]

(ii) Describe and explain the difference in the rate of diffusion of the gases oxygen andnitrogen. [1]

[Total: 6]

5 Sodium oxide, Na_2O, is an ionic compound.

(a) Draw the dot and cross diagram to show the bonding in Na_2O. Show all electrons. [3]

(b) Explain how molten sodium oxide conducts electricity whereas solid sodium chloride does not. [2]

(c) Explain why magnesium oxide has a higher melting point than sodium oxide. [2]

(d) **(i)** What is meant by the term *diffusion*? [2]

(ii) Explain why propane diffuses faster at 100 °C than at 60 °C. [1]

(iii) Explain why diffusion could be used to separate a mixture of oxygen and carbon dioxide. [2]

[Total: 12]

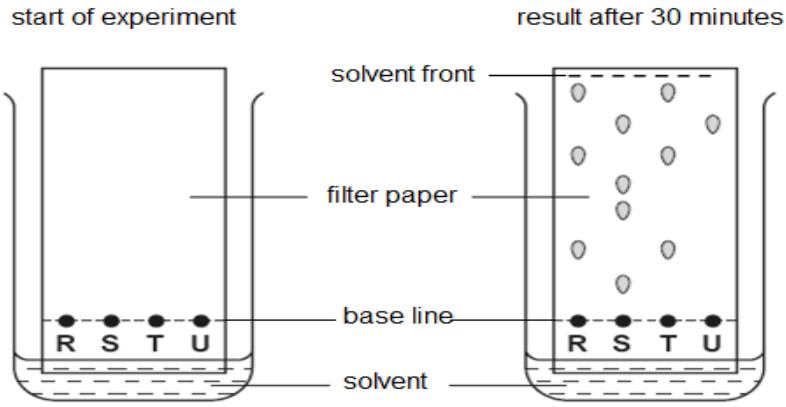
6 Plants make a variety of coloured pigments.

A student extracted red colouring from four different plants, **R**, **S**, **T** and **U**.

The student put a spot of each colouring on a piece of filter paper.

The filter paper was dipped into a solvent and left for 30 minutes.

The results are shown below.



(a) What is name given to the process shown in the diagram? [1]

(b) Suggest why the base line is above the solvent level before the start of the experiment? [2]

(c) A pencil was used to draw the start line. Why was a pen **not** used for this purpose? [2]

(d) Which plant contained the greatest number of different pigments? [1]

(e) Which **two** plants contained the same pigments? [2]

(f) What do you understand about the term R_f value? [1]

(g) What is the R_f value of coloured pigment **U**? [2]

(h) Why would no locating agent be necessary for the above experiment? [2]

[Total: 13]