



# THE PERIODIC TABLE

Period 1 2 3 4 5 6 7 0

Group

Period

4	He	Helium	2
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1	H	Hydrogen	1
---	---	----------	---

7	Li	Lithium	3	9	Be	Beryllium	4	11	B	Boron	5	12	C	Carbon	6	13	Al	Aluminium	13	14	N	Nitrogen	7	15	O	Oxygen	8	16	F	Fluorine	9	17	Ne	Neon	10
23	Na	Sodium	11	24	Mg	Magnesium	12	27	Al	Aluminium	13	28	Si	Silicon	14	31	P	Phosphorus	15	32	S	Sulphur	16	35.5	Cl	Chlorine	17	39	K	Potassium	19	40	Ca	Calcium	20
86	Rb	Rubidium	37	88	Sr	Strontium	38	91	Zr	Zirconium	40	93	Nb	Niobium	41	94	Mo	Molybdenum	42	96	Tc	Technetium	43	101	Ru	Ruthenium	44	103	Rh	Rhodium	45	106	Pd	Palladium	46
133	Cs	Caesium	55	137	Ba	Barium	56	179	Hf	Hafnium	72	181	Ta	Tantalum	73	184	W	Tungsten	74	186	Re	Rhenium	75	190	Os	Osmium	76	192	Ir	Iridium	77	195	Pt	Platinum	78
223	Fr	Francium	87	226	Ra	Radium	88	227	Ac	Actinium	89	201	Hg	Mercury	80	207	Pb	Lead	82	208	Tl	Thallium	81	209	Bi	Bismuth	83	210	Po	Polonium	84	210	At	Astatine	85
119	Ac	Actinium	89	112	Cd	Cadmium	48	115	In	Indium	49	119	Sn	Tin	50	122	Sb	Antimony	51	127	I	Iodine	53	128	Te	Tellurium	52	131	Xe	Xenon	54	132.9	Ba	Barium	56
65	Zn	Zinc	30	63.5	Cu	Copper	29	59	Ni	Nickel	28	59	Co	Cobalt	27	56	Fe	Iron	26	55	Mn	Manganese	25	59	Ni	Nickel	28	63.5	Cu	Copper	29	70	Ga	Gallium	31
79	Au	Gold	79	108	Ag	Silver	47	106	Pd	Palladium	46	108	Ag	Silver	47	112	Cd	Cadmium	48	119	Sn	Tin	50	122	Sb	Antimony	51	128	Te	Tellurium	52	132.9	Ba	Barium	56
76	Os	Osmium	76	190	Os	Osmium	76	192	Ir	Iridium	77	195	Pt	Platinum	78	201	Hg	Mercury	80	207	Pb	Lead	82	209	Bi	Bismuth	83	210	Po	Polonium	84	210	At	Astatine	85
79	Au	Gold	79	197	Au	Gold	79	197	Au	Gold	79	201	Hg	Mercury	80	207	Pb	Lead	82	208	Tl	Thallium	81	209	Bi	Bismuth	83	210	Po	Polonium	84	210	At	Astatine	85
80	Hg	Mercury	80	201	Hg	Mercury	80	201	Hg	Mercury	80	207	Pb	Lead	82	208	Tl	Thallium	81	209	Bi	Bismuth	83	210	Po	Polonium	84	210	At	Astatine	85	222	Rn	Radon	86
84	Po	Polonium	84	210	Po	Polonium	84	210	Po	Polonium	84	210	Po	Polonium	84	210	Po	Polonium	84	210	Po	Polonium	84	210	Po	Polonium	84	210	Po	Polonium	84	210	Po	Polonium	84
85	At	Astatine	85	210	At	Astatine	85	210	At	Astatine	85	210	At	Astatine	85	210	At	Astatine	85	210	At	Astatine	85	210	At	Astatine	85	210	At	Astatine	85	210	At	Astatine	85
86	Rn	Radon	86	222	Rn	Radon	86	222	Rn	Radon	86	222	Rn	Radon	86	222	Rn	Radon	86	222	Rn	Radon	86	222	Rn	Radon	86	222	Rn	Radon	86	222	Rn	Radon	86

Key

Relative atomic mass
Symbol
Name
Atomic number



**SECTION A**

1. (a) Complete the table of information about the three types of particle found in an atom.

Name of particle	Relative mass	Relative charge
electron		-1
neutron	1	
proton		

(4)

(b) An atom of chlorine can be represented by the symbol



(i) Explain the meaning of the term **mass number**. State the mass number of this chlorine atom.

.....

.....

.....

.....

(2)

(ii) How many neutrons are in this atom of chlorine?

.....

(1)

(c) There are two types of boron atoms. Some contain 5 protons and 5 neutrons while others contain 6 neutrons.

(i) How many protons do the second type of boron atoms contain?

.....

(1)

(ii) What name is given to atoms of the same element with different numbers of neutrons?

.....

(1)

(Total 9 marks)

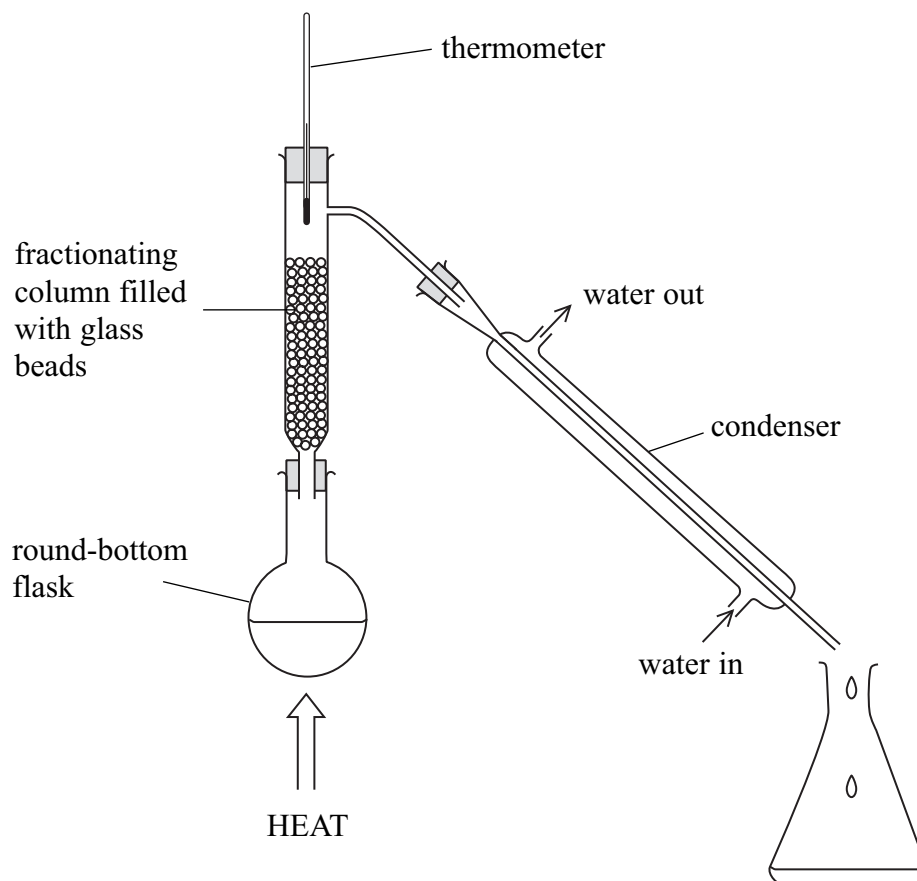
Q1



2. Propanone and water are both covalently bonded compounds. The table shows their boiling points.

Compound	Boiling point (°C)
propanone	56
water	100

(a) Propanone can be obtained from a mixture of propanone and water using the apparatus shown.



(i) Why can propanone and water be separated by this method?

..... (1)

(ii) Outline how a sample of pure propanone can be obtained from the mixture.

.....  
 .....  
 .....  
 .....  
 ..... (3)



(b) Propanone and water both have simple molecular structures. They have low boiling points. Place a cross (☒) in **one** box from **each** column of statements to explain why they have low boiling points.

the covalent bonds between their atoms are strong ☒

the covalent bonds between their atoms are weak ☒

the attractive forces between their molecules are strong ☒

the attractive forces between their molecules are weak ☒

AND

these require a lot of energy to be overcome ☒

these require little energy to be overcome ☒

these get weaker as the temperature increases ☒

(2)

Q2

(Total 6 marks)



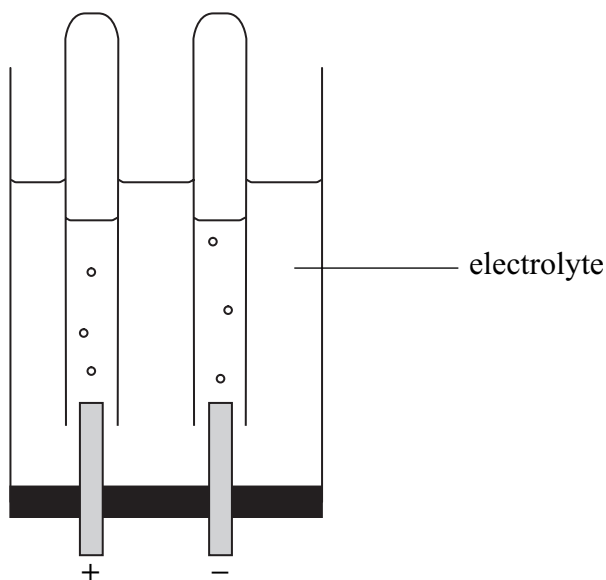
3. This question is about chlorine and other elements in Group 7 of the Periodic Table.

(a) Complete the table to show the colours and states of some elements in Group 7.

Name of element	Colour	State at room temperature
chlorine	green	gas
bromine	brown	
iodine		solid

(2)

(b) The diagram shows the electrolysis of an aqueous solution of a compound. The electrolysis produces chlorine and another gas.



(i) Add a label to the diagram to show the chlorine gas.

(1)

(ii) Identify the other gas produced during the electrolysis.

.....

(1)

(iii) What is the electrolyte used in the industrial production of chlorine?

.....

(1)



(c) When chlorine gas is bubbled into colourless sodium bromide solution a reaction takes place. The solution becomes brown.

Write a word equation for the reaction which takes place.

.....

(2)

Q3

(Total 7 marks)



4. The table shows the structures of some organic compounds.

$  \begin{array}{c}  \text{H} \quad \text{H} \\    \quad   \\  \text{H}-\text{C}-\text{C}-\text{H} \\    \quad   \\  \text{H} \quad \text{H}  \end{array}  $ <p style="text-align: center;"><b>A</b></p>	$  \begin{array}{c}  \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\    \quad   \quad   \quad   \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\    \quad   \quad   \quad   \\  \text{H} \quad \text{H} \quad \text{H} \quad \text{H}  \end{array}  $ <p style="text-align: center;"><b>B</b></p>
$  \begin{array}{c}  \text{H} \quad \quad \text{H} \\  \diagdown \quad / \\  \text{C}=\text{C} \\  / \quad \diagdown \\  \text{H} \quad \quad \text{H} \\  \quad \quad \quad \diagdown \quad / \\  \quad \quad \quad \text{C} \\  \quad \quad \quad / \quad \diagdown \\  \quad \quad \quad \text{H} \quad \quad \text{H}  \end{array}  $ <p style="text-align: center;"><b>C</b></p>	$  \begin{array}{c}  \text{H} \quad \text{H} \\    \quad   \\  \text{H}-\text{C}-\text{C}-\text{H} \\    \quad   \\  \text{Br} \quad \text{Br}  \end{array}  $ <p style="text-align: center;"><b>D</b></p>
$  \begin{array}{c}  \text{H} \\    \\  \text{H}-\text{C}-\text{H} \\    \\  \text{H} \quad \text{H} \quad \text{H} \\    \quad   \quad   \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\    \quad   \quad   \\  \text{H} \quad \text{H} \quad \text{H}  \end{array}  $ <p style="text-align: center;"><b>E</b></p>	$  \begin{array}{c}  \text{H} \quad \quad \text{H} \\  \diagdown \quad / \\  \text{C}=\text{C} \\  / \quad \diagdown \\  \text{H} \quad \quad \text{H}  \end{array}  $ <p style="text-align: center;"><b>F</b></p>

(a) Explain why compound **C** is not a saturated hydrocarbon.

.....  
 .....  
 (1)

(b) Explain why compound **D** is not a hydrocarbon.

.....  
 .....  
 (1)

(c) Give the letters of two compounds that are isomers of each other.

.....  
 (1)





(d) Give the letters of two compounds that are members of the same homologous series but have different molecular formulae.

.....  
(1)

(e) Name and give the general formula of the homologous series to which compound E belongs.

Name of homologous series .....

General formula .....  
(2)

(f) What colour change is seen when bromine water is added to compound F?

.....  
.....  
(2)

Q4

(Total 8 marks)

**TOTAL FOR SECTION A: 30 MARKS**



**SECTION B**

5. Lithium and sodium are metals in Group 1 of the Periodic Table. They react in a similar way with water, producing hydrogen gas and an alkaline solution.

(a) A student added a piece of lithium to a trough of water. A piece of platinum wire is dipped into the solution formed and then held in a hot Bunsen flame.

(i) What colour does the flame become?

.....  
**(1)**

(ii) What is the formula of the ion responsible for this colour?

.....  
**(1)**

(b) State the colour of methyl orange in the alkaline solution formed in (a) and give the formula of the ion which causes the solution to be alkaline.

Colour of methyl orange .....

Formula of ion .....

**(2)**

(c) A piece of sodium is added to another trough of water.

(i) Give two observations, other than the sodium floating, that you could make during the reaction.

1 .....

2 .....

**(2)**

(ii) Write a chemical equation for the reaction.

.....

.....

**(2)**



(d) Rubidium is another Group 1 metal. A piece of rubidium is added to a different trough of water.

(i) Predict one observation that would be different using rubidium instead of sodium.

.....

.....

**(1)**

(ii) Predict a possible pH value for the solution formed in the reaction between rubidium and water.

.....

**(1)**

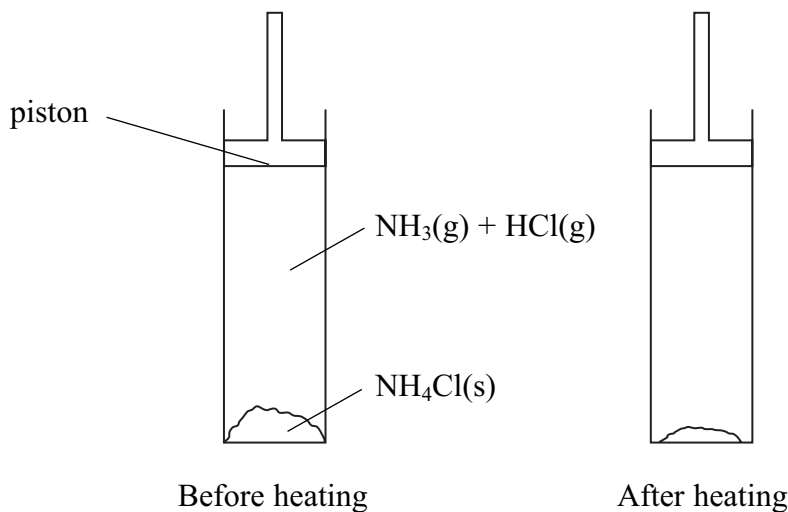
**Q5**

**(Total 10 marks)**

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6. A sample of solid ammonium chloride is placed in a tube fitted with a piston. The tube is heated in an oven to a constant temperature. The diagram shows the apparatus used.



- (a) The reaction inside the tube can be represented by the equation:



The value of  $\Delta H$  for the forward reaction is positive.

- (i) State the name of:

$\text{NH}_3(\text{g})$  .....

$\text{HCl}(\text{g})$  .....

(2)

- (ii) What does the  $\rightleftharpoons$  symbol indicate about the reaction?

.....

(1)

- (iii) What does the positive value of  $\Delta H$  indicate about the forward reaction?

.....

(1)

- (b) Describe the appearance of:

$\text{NH}_4\text{Cl(s)}$  .....

the mixture of  $\text{NH}_3(\text{g})$  and  $\text{HCl}(\text{g})$  .....

(2)



- (c) After leaving the tube in the oven at a constant temperature a dynamic equilibrium is established inside the tube.

Explain what is meant by the term **dynamic equilibrium**.

.....  
 .....  
 .....  
 .....

(2)

- (d) The temperature of the oven is increased by 30 °C and the tube is left at this temperature until a new dynamic equilibrium is established inside the tube. Predict what effect, if any, this temperature increase has on:

the speed of the forward reaction .....

the speed of the reverse reaction .....

the amount of NH<sub>4</sub>Cl(s) at equilibrium .....

(3)

- (e) The piston is pushed about halfway down the tube, without altering the temperature. This causes the concentrations of the gases inside the tube to increase.

State and explain, in terms of the particle collision theory, how this change affects the rate of the reaction between NH<sub>3</sub>(g) and HCl(g).

.....  
 .....  
 .....  
 .....  
 .....  
 .....

(3)

**(Total 14 marks)**

**Q6**

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7. Iron is extracted from iron ore in a blast furnace using three raw materials, **J**, **K** and **L**.

**J** is a black solid, **K** is a white solid composed mostly of calcium carbonate, and **L** is a colourless mixture of gases.

(a) Give the names of these raw materials.

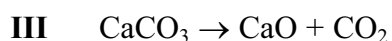
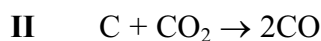
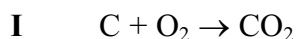
**J** .....

**K** .....

**L** .....

(3)

(b) The chemical equations for three reactions that occur in the blast furnace are:



(i) Explain why reaction **I** is important in the blast furnace.

.....

(1)

(ii) State the function of the product of reaction **II**.

.....

(1)

(iii) The function of the CaO formed in reaction **III** is to remove impurities in the iron ore. Write a chemical equation to show the reaction that occurs.

.....

(2)

(c) Two molten substances, **M** and iron, collect at the bottom of the blast furnace.

Give the name of **M** and suggest why it floats on top of the molten iron.

.....

.....

.....

(2)



(d) Iron has many uses.

Suggest one property of iron, different in each case, that makes it suitable for:

making railway lines .....

.....

using in the Haber process .....

.....

(2)

(e) One problem with using iron to make objects is rusting.

Galvanising is a method of preventing rusting that involves coating iron with zinc.

(i) Give the chemical name of rust.

.....

(1)

(ii) Explain how zinc is able to prevent iron from rusting even when the coating is scratched.

.....

.....

.....

.....

(2)

Q7

(Total 14 marks)

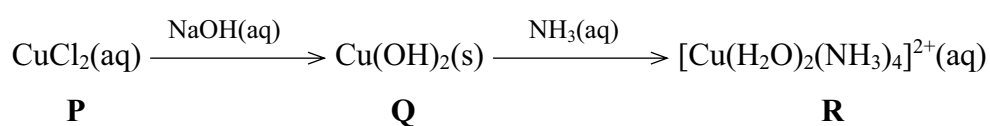
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8. (a) An oxide of copper contains 88.8% by mass of copper.  
Calculate the empirical formula of this oxide.

(3)

- (b) The following sequence shows two reactions of copper(II) compounds.



- (i) State the colour of **Q**.

..... (1)

- (ii) State two observations you would make when **Q** is converted into **R**.

1 .....

2 .....

(2)

- (iii) What type of cation is **R**?

..... (1)





(c) A solution contains  $\text{NH}_4^+$ ,  $\text{Cu}^{2+}$  and  $\text{SO}_4^{2-}$  ions.

(i) Describe how you could test for the presence of  $\text{NH}_4^+$  ions in this solution. Give the result of this test.

.....  
.....  
.....  
.....

**(4)**

(ii) Describe a test, and its result, to show that the solution contains  $\text{SO}_4^{2-}$  ions.

.....  
.....  
.....

**(3)**

**Q8**

**(Total 14 marks)**

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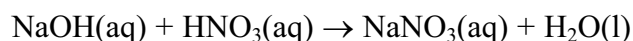


9. A student wanted to make some crystals of sodium nitrate.

She did a titration to find the volumes of sodium hydroxide solution and dilute nitric acid needed to react together completely.

She placed a 25.0 cm<sup>3</sup> sample of the nitric acid solution in a conical flask and titrated it with sodium hydroxide solution, using phenolphthalein as an indicator. The phenolphthalein changed colour after she added a total of 20.00 cm<sup>3</sup> of the sodium hydroxide solution.

The equation for the reaction is:



(a) State the colour change of the phenolphthalein.

.....  
 .....

**(2)**

(b) In this titration the amount of sodium hydroxide used was 0.020 mol.

(i) Calculate the relative formula mass of sodium nitrate.

**(1)**

(ii) Calculate the mass of sodium nitrate formed in the titration.

**(2)**



(c) A solution of sodium nitrate was formed by neutralising some dilute nitric acid with aqueous sodium hydroxide.

Outline how you could obtain a dry sample of sodium nitrate crystals from the solution formed.

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.....

(3)

Q9

(Total 8 marks)

**TOTAL FOR SECTION B: 60 MARKS**

**TOTAL FOR PAPER: 90 MARKS**

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