| Candidate Name | Centre Number | Candidate Number |
|---|---|---|
| | | 0 |

WJEC CBAC

# GCSE

240/01

# ADDITIONAL SCIENCE
## FOUNDATION TIER
## CHEMISTRY 2

A.M. THURSDAY, 5 June 2008

45 minutes

| For Examiner's use only | | |
|---|---|---|
| **Question** | **Maximum Mark** | **Mark Awarded** |
| **1.** | **6** | |
| **2.** | **5** | |
| **3.** | **9** | |
| **4.** | **4** | |
| **5.** | **4** | |
| **6.** | **4** | |
| **7.** | **3** | |
| **8.** | **6** | |
| **9.** | **7** | |
| **10.** | **2** | |
| **Total** | **50** | |

**ADDITIONAL MATERIALS**

In addition to this paper you may require a calculator and a ruler.

**INSTRUCTIONS TO CANDIDATES**

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

**INFORMATION FOR CANDIDATES**

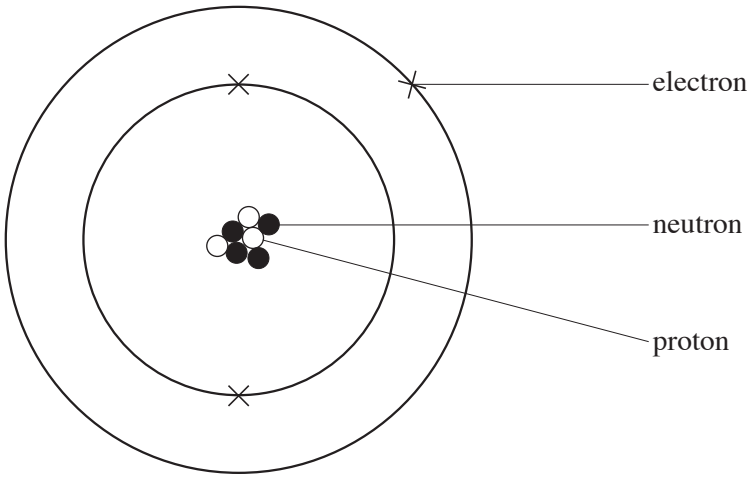
The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

The Periodic Table is printed on the back cover of the examination paper and the formulae for some common ions on the inside of the back cover.

*Answer* **all** *questions*.

**1.** *(a)* The diagram below shows an atom of lithium.




(i) Use the numbers in the box below to answer parts (i) I and II.

| | | | | |
|---|---|---|---|---|
| **1** | **2** | **3** | **4** | **7** |

Give the

I. atomic number of lithium, ..... [1]

II. mass number of lithium. ..... [1]

(ii) Use the words in the box below to complete the following sentences.

| | | |
|---|---|---|
| **electrons** | **neutrons** | **protons** |

I. Protons and ..... are always found in equal numbers in atoms. [1]

II. Protons and ..... have equal masses. [1]

*(b)* The calculation below shows how the relative molecular mass ($M_r$) of carbon dioxide, $CO_2$, is calculated.

$$A_r(C) = 12 \qquad A_r(O) = 16$$

$$M_r(CO_2) = 12 + 16 + 16 = 44$$

Calculate the relative molecular mass ($M_r$) of ammonia, $NH_3$. [2]

$$A_r(N) = 14 \qquad A_r(H) = 1$$

.....

**2.** (i) Read the information in the box below.

> PVC is widely used in everyday life. PVC is difficult to ignite, making it excellent for fire protection. Many window frames are now made of PVC because they withstand fires. PVC is also used in hospitals to seal floors and as wall coverings to prevent the spread of infections. PVC is used for many parts found in cars, e.g., dashboards, sun visors and gear levers. Unique uses of PVC include credit cards, phone cards and lifejackets.

**Use only the information in the box above to answer parts I, II and III.**

I. Give the **property** of PVC which makes it a suitable material for fire protection. [1]

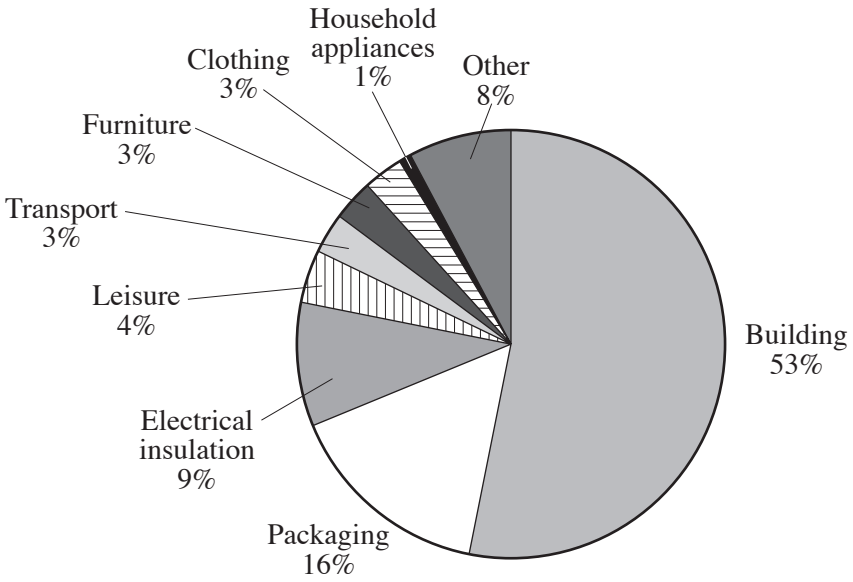
.....

II. Give **one use** of PVC which reduces the spread of infections in hospitals. [1]

.....

III. Give **one unique** use of PVC. ..... [1]

(ii) The pie chart below shows uses of PVC in everyday life.




**Areas of everyday life which use PVC**

**Use the pie chart to answer parts I and II.**

I. Give the percentage of PVC used to make packaging. ..... [1]

II. Give the area of everyday life which uses the **most** PVC. ..... [1]

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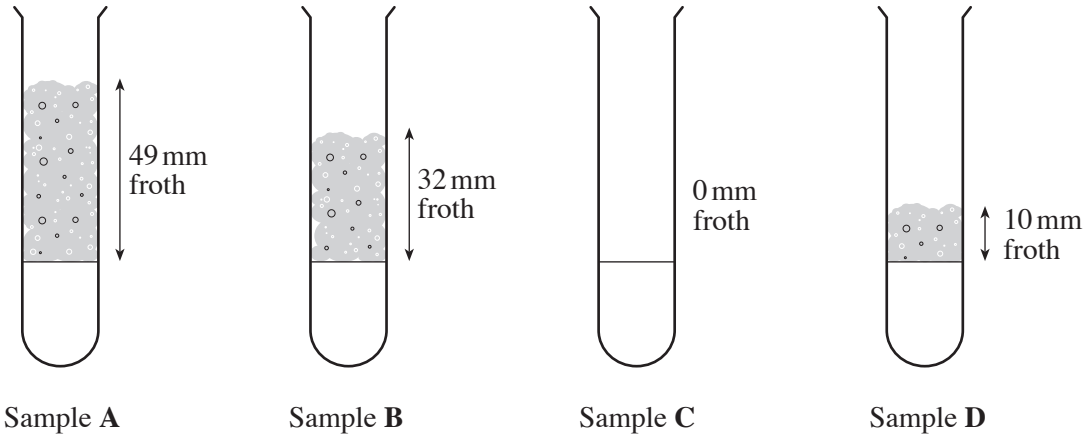
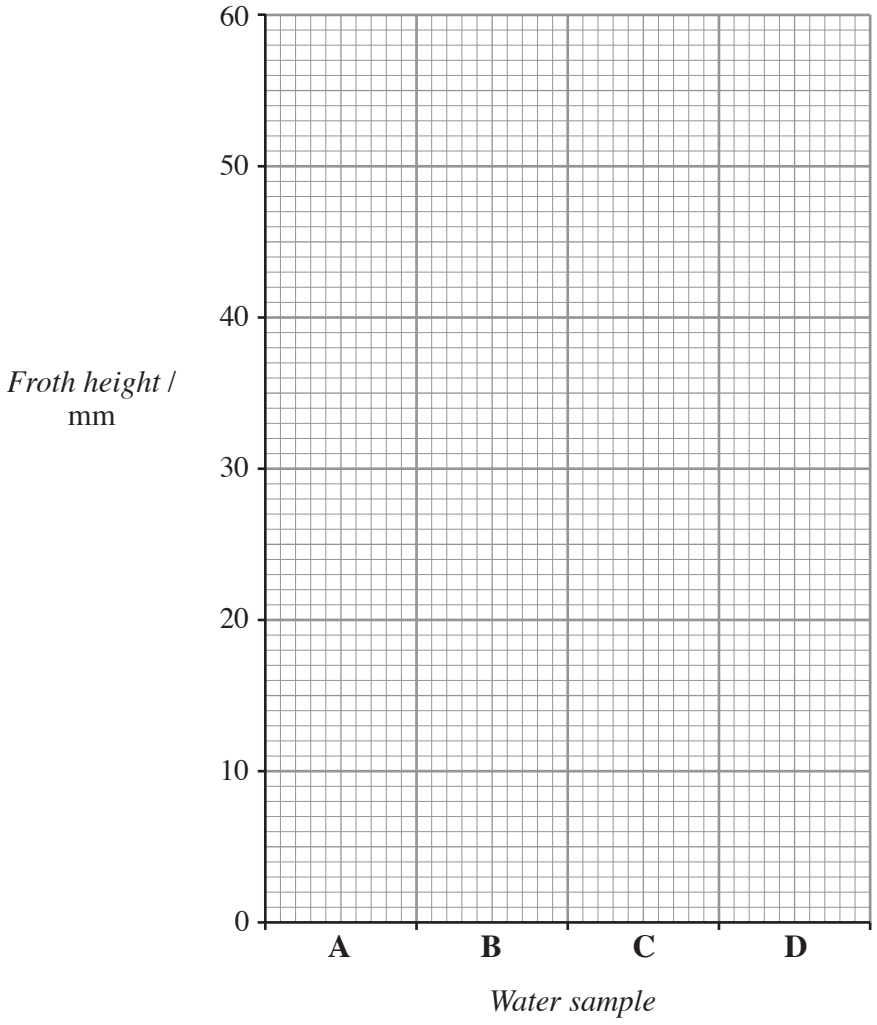
**3.** *(a)* Soap solution was shaken with four different water samples.
The results are shown in the diagram below.




(i) Complete the bar chart of the results on the grid below. [2]



(ii) Complete the following sentences.

I. The hardest water is in sample ..... . [1]

II. The softest water is in sample ..... . [1]

(iii) Describe **two** ways in which this investigation was made a fair test. [2]

1. .....

2. .....

*(b)* The box below contains some statements about hard water.

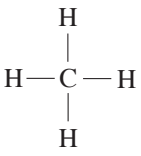
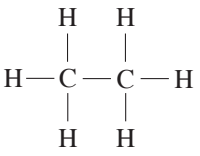
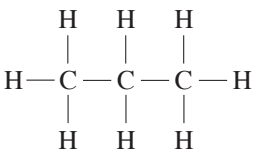
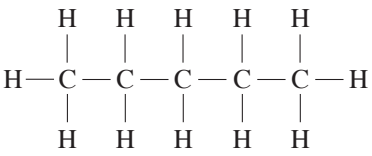
| **forms fur in kettles** | **reduces heart disease** | **strengthens bones and teeth** |
|---|---|---|
| **forms a scum with soap** | **wastes soap** | |

Put **each** statement in the correct column below. [3]

| *Advantages of hard water* | *Disadvantages of hard water* |
|---|---|
| | |
| | |
| | |

Examiner only

**4.** *(a)* The table below shows the structural formulae of some hydrocarbons. One structural formula is missing from the table.

| | | | | | |
|---|---|---|---|---|---|
| *Structural formula* |  |  |  | ..... |  |
| *Name* | methane | ethane | propane | butane | pentane |

(i) Name the **two** elements present in all hydrocarbons. [1]

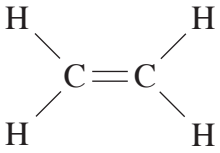
..... and .....

(ii) Give the **name** of the hydrocarbon in the table above which is represented by the molecular formula $C_2H_6$. [1]

.....

(iii) Butane contains four carbon atoms and ten hydrogen atoms. Complete the table above by drawing the **structural formula** for butane. [1]

*(b)* **Name** the alkene which has the structural formula shown below. [1]



.....

4

**5.** (i) The word equation for a reaction in an industrial process is shown below.

nitrogen + hydrogen $\rightleftharpoons$ ammonia

I. Name **one reactant** at the start of the process. ..... [1]

II. Name the useful **product** in the process. ..... [1]

(ii) I. The nitrogenous fertiliser ammonium sulphate is made by reacting ammonia with an acid.

| | | |
|---|---|---|
| **hydrochloric acid** | **nitric acid** | **sulphuric acid** |

Choose, from the box above, the acid used to make ammonium sulphate from ammonia. [1]

.....

II. Give **one** problem caused when nitrogenous fertiliser is washed from fields into canals, streams and rivers. [1]

.....

.....

**6.** (i) The box below shows some smart materials.

| | | |
|---|---|---|
| **thermochromic materials** | **photochromic material** | **shape memory alloys** |
| **hydrogels** | **shape memory polymers** | |

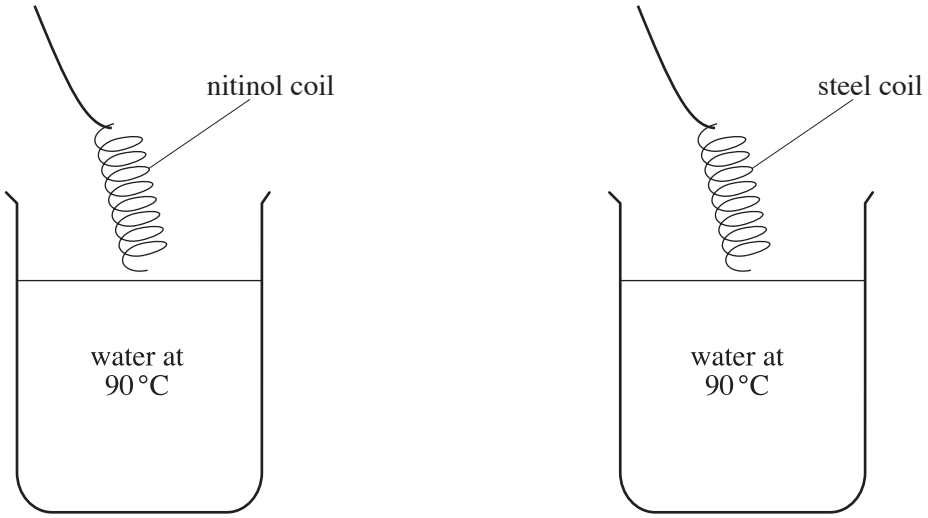
Choose from the box above the type of smart material that

I. is used to make **lenses** for sunglasses, ..... [1]

II. swells up to 1000 times in volume when added to water. ..... [1]

(ii) Nitinol and steel are both alloys. Nitinol is a shape memory alloy but steel is not.


A student made coils from straight nitinol and steel wires. Each coil was then put into water at 90 °C. State what happens to each coil when it is lowered into the hot water.




*Nitinol coil* ..... [1]

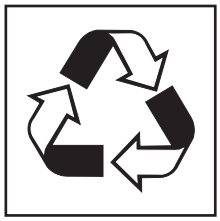
*Steel coil* ..... [1]

**7.** Steel is the most recycled metal in Britain. In Britain we use 13 billion steel cans every year.

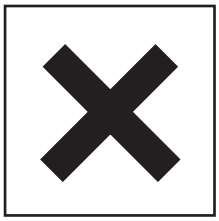
(i)

**A**

**B**



**C**



**D**

Give the **letter** of the symbol above which you would expect to see on a household container showing that it is suitable for recycling.

..... [1]

(ii) One advantage of recycling steel is the conservation of raw materials. Choose, from the box below, the raw material which would be conserved by recycling steel cans.

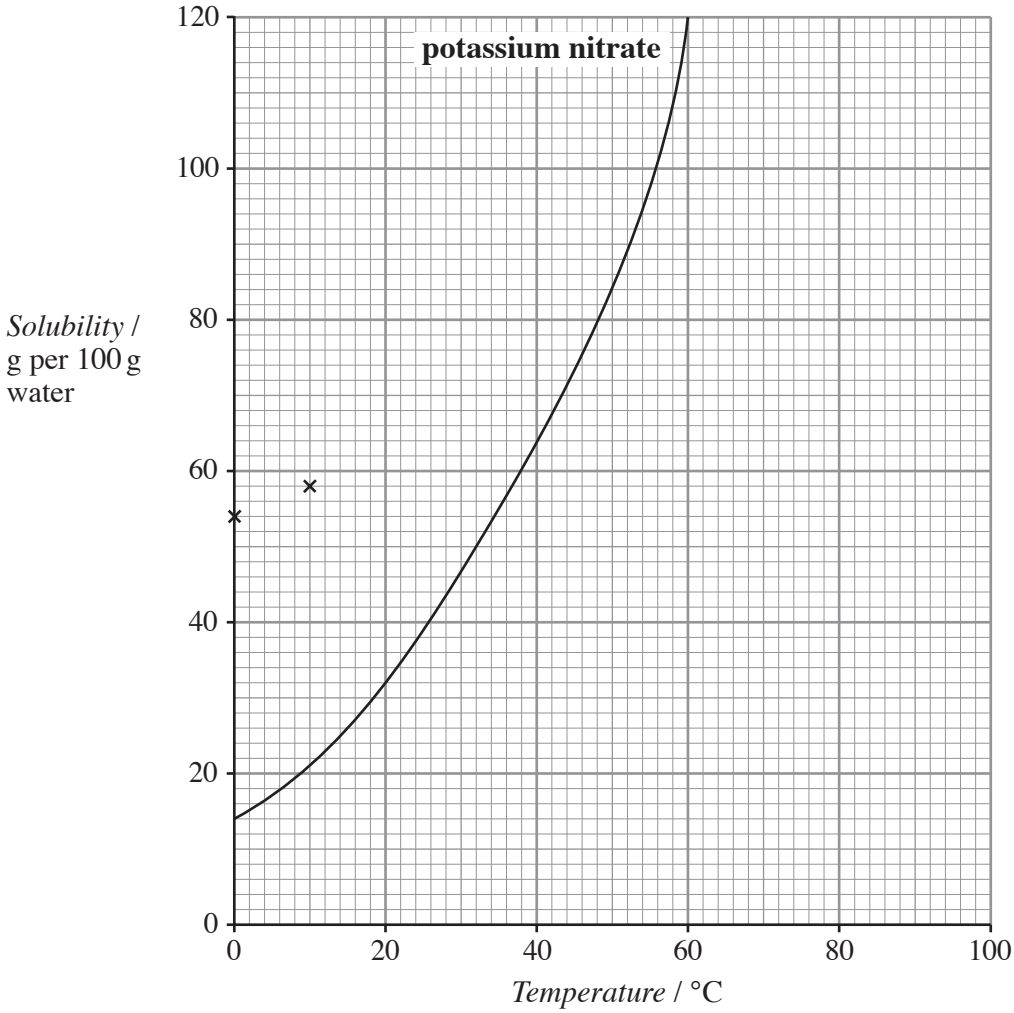
| | | | |
|---|---|---|---|
| **aluminium ore** | **iron ore** | **copper ore** | **titanium ore** |

..... [1]

(iii) Every household uses approximately 600 steel cans a year. State **one** way in which households are helped by local councils to recycle steel cans. [1]

.....

**8.** The graph below shows the solubility of potassium nitrate in water at different temperatures.




(i) The table below shows the solubility of potassium bromide in water at different temperatures. The solubility at 60 °C is missing from the table.

| *Temperature* / °C | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 |
|---|---|---|---|---|---|---|---|---|---|
| *Solubility* / g per 100 g water | 54 | 58 | 64 | 70 | 76 | 82 | | 92 | 98 |

I. Draw the graph of the solubility of potassium bromide on the grid on page 12. Two points have been plotted for you. [3]

II. Use the graph to give the solubility of potassium bromide at 60 °C.

..... g per 100 g water. [1]

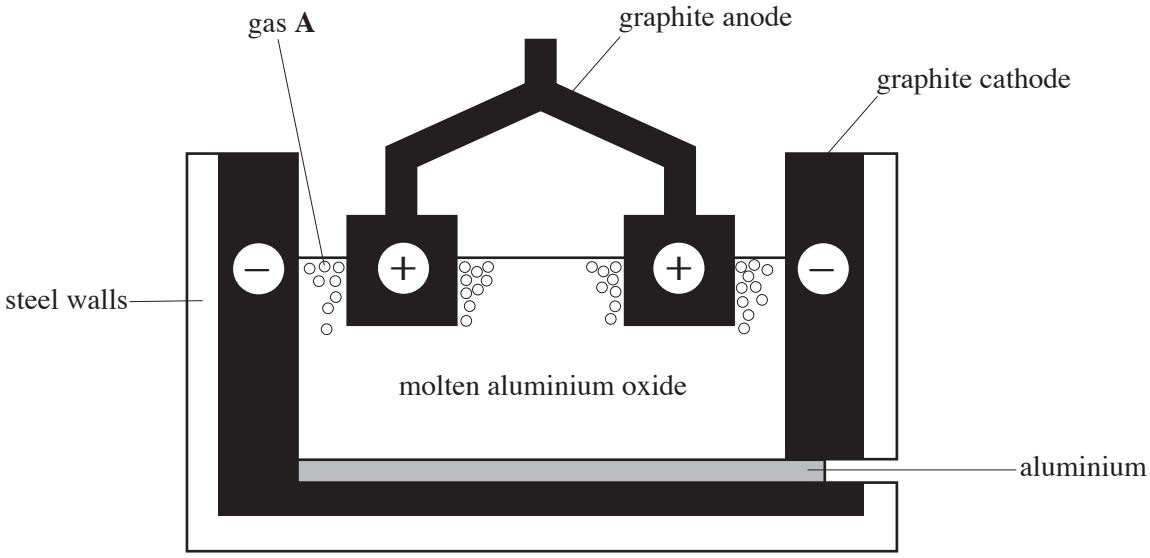
III. Give the temperature at which the two compounds have the **same** solubility.

..... °C [1]

(ii) State why the temperature scale on solubility graphs ranges between 0 °C and 100 °C. [1]

.....

**9.** (i) The diagram below shows the industrial extraction of aluminium by the electrolysis of aluminium oxide.




I. Give the reason why electrolysis is used to extract aluminium from its oxide. [1]

.....

II. Write the **word** equation for the overall reaction that takes place during the electrolysis of aluminium oxide. [2]

..... ⟶ ..... + .....

III. Give the **formula** of the **ion** attracted to the cathode during the electrolysis process. Use the table of formulae for common ions on the inside of the back cover of this examination paper to help in answering this question. [1]

.....

(ii) Many factors, such as available work force, road and rail links and distance from built up areas are considered when locating any **new** chemical plant.

Give **one** other factor that is important when locating a new **aluminium** extraction plant. [1]

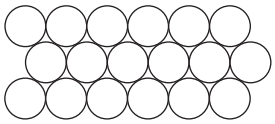
.....

(iii) Aluminium has the property of being a good electrical conductor and is therefore used to make overhead power cables.
Give a **different** property of aluminium and **one** use which relies on this property. [2]

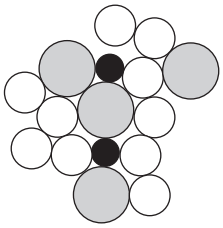
*Property* .....

*Use* .....

**10.** The diagrams below show how the atoms are arranged in a metal and in a metallic glass.



atoms in a metal



atoms in a metallic glass

Give **two** differences between the **structures** shown above. [2]

*Difference 1* .....

.....

*Difference 2* .....

.....

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## FORMULAE FOR SOME COMMON IONS

| POSITIVE IONS | | NEGATIVE IONS | |
|---|---|---|---|
| **Name** | **Formula** | **Name** | **Formula** |
| Aluminium | $Al^{3+}$ | Bromide | $Br^{-}$ |
| Ammonium | $NH_4^{+}$ | Carbonate | $CO_3^{2-}$ |
| Barium | $Ba^{2+}$ | Chloride | $Cl^{-}$ |
| Calcium | $Ca^{2+}$ | Fluoride | $F^{-}$ |
| Copper(II) | $Cu^{2+}$ | Hydroxide | $OH^{-}$ |
| Hydrogen | $H^{+}$ | Iodide | $I^{-}$ |
| Iron(II) | $Fe^{2+}$ | Nitrate | $NO_3^{-}$ |
| Iron(III) | $Fe^{3+}$ | Oxide | $O^{2-}$ |
| Lithium | $Li^{+}$ | Sulphate | $SO_4^{2-}$ |
| Magnesium | $Mg^{2+}$ | | |
| Nickel | $Ni^{2+}$ | | |
| Potassium | $K^{+}$ | | |
| Silver | $Ag^{+}$ | | |
| Sodium | $Na^{+}$ | | |



**Turn over.**

(240-01)

# PERIODIC TABLE OF ELEMENTS

| 1 | 2 | Group | | | | | | | | | | 3 | 4 | 5 | 6 | 7 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | $^{1}_{1}$H Hydrogen | | | | | | | | | $^{4}_{2}$He Helium |
| $^{7}_{3}$Li Lithium | $^{9}_{4}$Be Beryllium | | | | | | | | | | | $^{11}_{5}$B Boron | $^{12}_{6}$C Carbon | $^{14}_{7}$N Nitrogen | $^{16}_{8}$O Oxygen | $^{19}_{9}$F Fluorine | $^{20}_{10}$Ne Neon |
| $^{23}_{11}$Na Sodium | $^{24}_{12}$Mg Magnesium | | | | | | | | | | | $^{27}_{13}$Al Aluminium | $^{28}_{14}$Si Silicon | $^{31}_{15}$P Phosphorus | $^{32}_{16}$S Sulphur | $^{35}_{17}$Cl Chlorine | $^{40}_{18}$Ar Argon |
| $^{39}_{19}$K Potassium | $^{40}_{20}$Ca Calcium | $^{45}_{21}$Sc Scandium | $^{48}_{22}$Ti Titanium | $^{51}_{23}$V Vanadium | $^{52}_{24}$Cr Chromium | $^{55}_{25}$Mn Manganese | $^{56}_{26}$Fe Iron | $^{59}_{27}$Co Cobalt | $^{59}_{28}$Ni Nickel | $^{64}_{29}$Cu Copper | $^{65}_{30}$Zn Zinc | $^{70}_{31}$Ga Gallium | $^{73}_{32}$Ge Germanium | $^{75}_{33}$As Arsenic | $^{79}_{34}$Se Selenium | $^{80}_{35}$Br Bromine | $^{84}_{36}$Kr Krypton |
| $^{86}_{37}$Rb Rubidium | $^{88}_{38}$Sr Strontium | $^{89}_{39}$Y Yttrium | $^{91}_{40}$Zr Zirconium | $^{93}_{41}$Nb Niobium | $^{96}_{42}$Mo Molybdenum | $^{99}_{43}$Tc Technetium | $^{101}_{44}$Ru Ruthenium | $^{103}_{45}$Rh Rhodium | $^{106}_{46}$Pd Palladium | $^{108}_{47}$Ag Silver | $^{112}_{48}$Cd Cadmium | $^{115}_{49}$In Indium | $^{119}_{50}$Sn Tin | $^{122}_{51}$Sb Antimony | $^{128}_{52}$Te Tellurium | $^{127}_{53}$I Iodine | $^{131}_{54}$Xe Xenon |
| $^{133}_{55}$Cs Caesium | $^{137}_{56}$Ba Barium | $^{139}_{57}$La Lanthanum | $^{179}_{72}$Hf Hafnium | $^{181}_{73}$Ta Tantalum | $^{184}_{74}$W Tungsten | $^{186}_{75}$Re Rhenium | $^{190}_{76}$Os Osmium | $^{192}_{77}$Ir Iridium | $^{195}_{78}$Pt Platinum | $^{197}_{79}$Au Gold | $^{201}_{80}$Hg Mercury | $^{204}_{81}$Tl Thallium | $^{207}_{82}$Pb Lead | $^{209}_{83}$Bi Bismuth | $^{210}_{84}$Po Polonium | $^{210}_{85}$At Astatine | $^{222}_{86}$Rn Radon |
| $^{223}_{87}$Fr Francium | $^{226}_{88}$Ra Radium | $^{227}_{89}$Ac Actinium | | | | | | | | | | | | | | | |

Key: