UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*0352851970*

**COMBINED SCIENCE** **0653/32**

Paper 3 (Extended) **May/June 2012**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
A copy of the Periodic Table is printed on page 20.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

| For Examiner's Use | |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| Total | |

This document consists of **19** printed pages and **1** blank page.

**1** **(a)** Most atoms of metallic elements found in the Earth's crust exist in compounds ores which are contained in rocks.

The chemical formulae of some metal compounds found in ores together with the names of the ores are shown below.

| | |
|---|---|
| argentite | $Ag_2S$ |
| chromite | $FeCr_2O_4$ |
| galena | $PbS$ |
| scheelite | $CaWO_4$ |

**(i)** A binary compound is one that contains only two different elements.

State which of the compounds in the list above are binary compounds.

..... [1]

**(ii)** State the ore from which the metallic element tungsten could be extracted.

..... [1]

**(b)** Fig. 1.1 shows an incomplete diagram of an atom of an element **Q** in which only the outer shell electrons are shown.

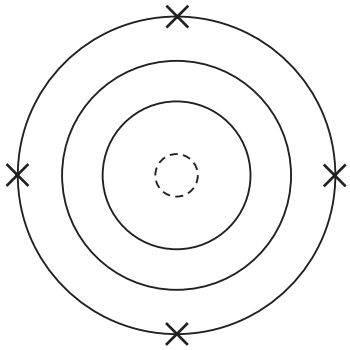


**Fig. 1.1**

**(i)** Name element **Q** and explain your answer.

name .....

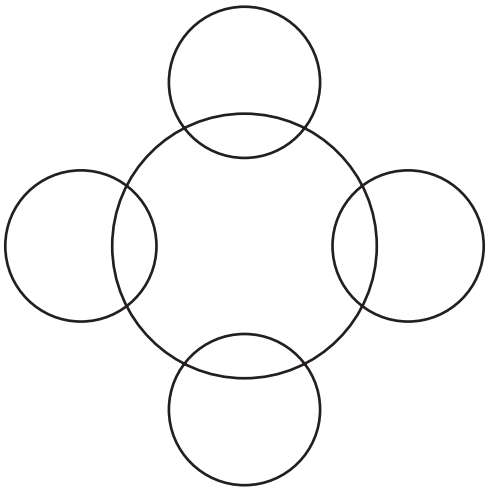
explanation .....

.....

..... [3]

**(ii)** Element **Q** combines with hydrogen to form covalent molecules which ha formula $QH_4$.

Complete the bonding diagram below to show how the bonding electrons are arranged.



[2]

**(iii)** Element **Q** may be extracted from its oxide, $QO_2$, in a reaction with carbon, C.

In this reaction, the compound carbon monoxide, CO, is formed in addition to the free element **Q**.

Suggest a balanced symbol equation for this reaction.

..... [2]

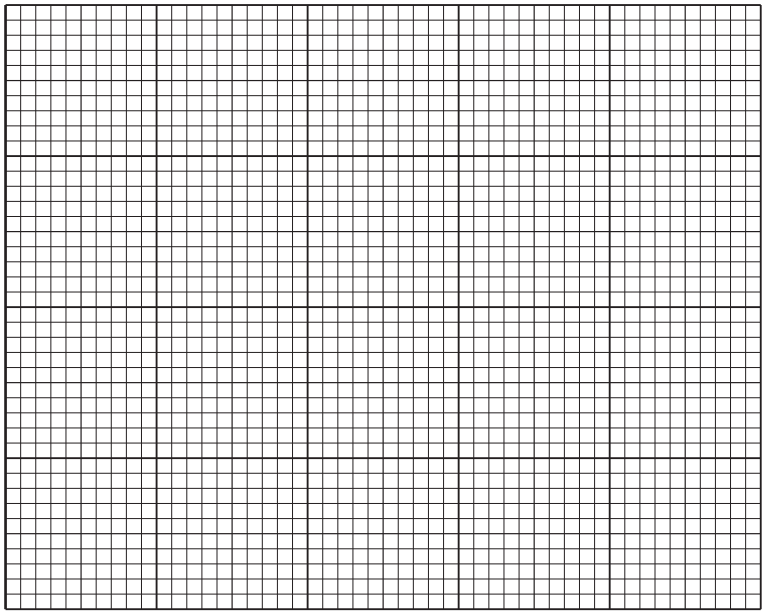
**2** An athlete warms up by running along a race track.

**(a)** He accelerates from rest and after 10 seconds reaches a maximum speed of 7 m / s.

He continues at this speed for another 10 seconds.

During the next 5 seconds, he steadily slows down and stops.

Draw a speed-time graph to show the motion of the athlete.



[3]

**(b)** He then competes in a 200 m running race.

**(i)** He completes the race in 25 seconds.

Calculate his average speed.

State the formula that you use and show your working.

formula used

working

..... [2]

**(ii)** The mass of the athlete is 70 kg.

Calculate the kinetic energy of the athlete when he is travelling at 6 m / s.

State the formula that you use and show your working.

formula used

working

..... [2]

**(c)** During a race the athlete cools down by sweating.

**(i)** Describe and explain, in terms of the movement of water molecules, how evaporation cools down the athlete.

.....

.....

.....

.....

..... [3]

**(ii)** State **two** factors which would increase the rate of evaporation.

..... and ..... [1]

3 **(a)** Define the term *respiration*.

.....

.....

..... [2]

**(b)** State the balanced symbolic equation for aerobic respiration.

..... [2]

**(c)** Outline how oxygen is transported to a respiring cell in a muscle.

.....

.....

..... [2]

**4** **(a)** Radio waves are electromagnetic waves. Sound waves are not.

State **two** other ways in which radio waves differ from sound waves.

1 .....

.....

2 .....

.....

[2]

**(b)** Draw lines to connect each type of radiation to its use.

| **radiation** | **use** |
|---|---|
| gamma | examining bones and teeth |
| microwave | remote controls for television sets |
| infra-red | satellite communications |
| X-rays | sterilising surgical instruments |

[2]

**(c)** Visible light is another type of electromagnetic wave.

The frequency of green light is $5 \times 10^{14}$ Hz.
The wavelength of green light is $6 \times 10^{-7}$ m.

Calculate the speed of green light.

State the formula that you use and show your working.

formula used

working

..... [2]

**(d)** Describe how to find the density of a small irregular object such as a tooth.

.....

.....

.....

.....

.....

..... [3]

**5** Water supplies are often impure and have to be purified to make them safe for hum
drink.

**(a)** State **one** way that harmful bacteria may be removed from water during purification.

.....

[1]

**(b)** Water is a compound which contains the elements hydrogen and oxygen.

Describe **one** difference, other than physical state, between the **compound** water and a **mixture** of the elements hydrogen and oxygen.

.....

.....

.....

[2]

**(c)** Table 5.1 shows information about water and three compounds that can form mixtures with water.

**Table 5.1**

| compound | melting point / °C | boiling point / °C | solubility in water |
|---|---|---|---|
| water | 0 | 100 | – |
| sodium chloride | 801 | 1413 | soluble |
| silicon dioxide | 1650 | 2230 | insoluble |
| hexane | –95 | 69 | insoluble |

**(i)** State which compound in Table 5.1 could be separated from a mixture with water by filtration.

.....

[1]

**(ii)** Explain why the other two compounds **cannot** be separated from a mixture with water by filtration.

.....

.....

.....

.....

[2]

**(d) (i)** A student was asked to use the reaction between the insoluble compou carbonate and dilute sulfuric acid to make a solution that contained only the zinc sulfate.

Describe the main steps of a method the student should use to carry out this task.

You may draw labelled diagrams if it helps you to answer this question.

.....

.....

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.....

..... [3]

**(ii)** Suggest the word chemical equation for the reaction between zinc carbonate and dilute sulfuric acid.

..... [2]

**6** **(a)** A car tyre is inflated with air using a footpump. The mechanic using the foo notices that the pump gets hot.

The air going into the tyre is warmed up by the pumping. Describe what happens to the motion of the air molecules as the air warms up.

.....

..... [1]

**(b)** Many forces act on a car tyre during a car journey.

State **three** effects that forces can have on an object.

1 .....

2 .....

3 .....

[2]

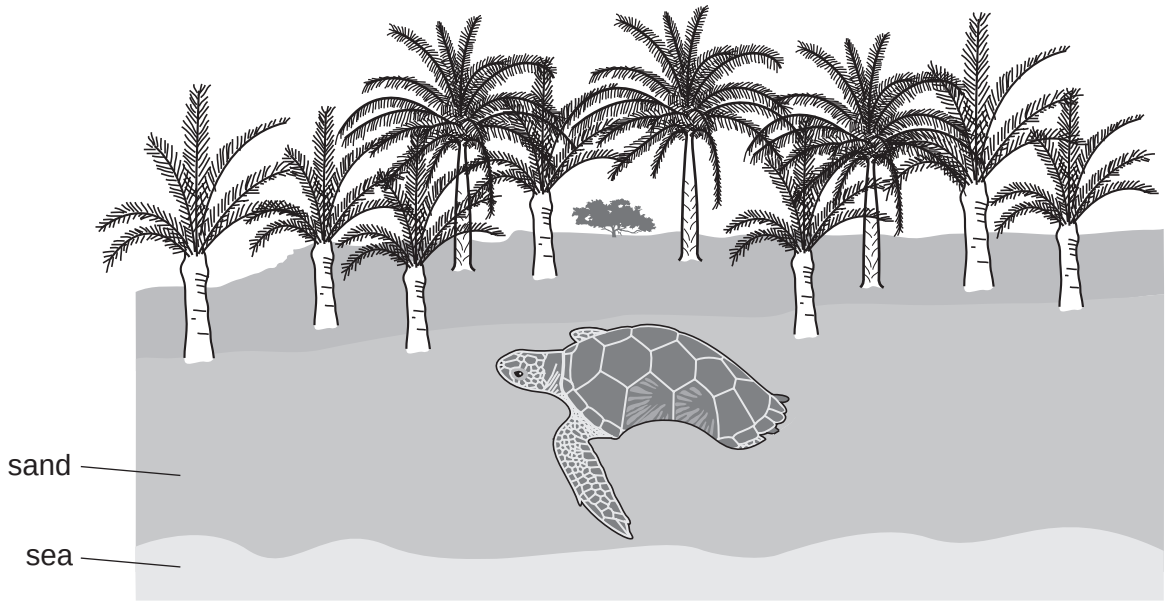
**(c)** Car brake lights (stop lights) light up when the driver presses on the footbrake pedal. The pedal acts as a switch.

Draw a circuit diagram including a battery to show how this works.

Design your circuit so that, if one brake light fails, the other still lights up.

[4]

**7** Hawksbill turtles are an endangered species. Adults spend most of their lives at se
the females come ashore to lay their eggs. They bury their eggs in nests in the sand, e
on a beach or in the vegetation that grows just behind the beach.




The sex of hawksbill turtles is determined by the temperature of the sand in which the eggs develop.

- At 29 °C, equal numbers of males and females develop.
- Higher temperatures produce more females.
- Lower temperatures produce more males.

There is concern that in recent years too many female turtles have been produced, and not enough males.

**(a)** Researchers measured the temperature, at a depth of 30 cm, in four different parts of a beach, on Antigua, where hawksbill turtles lay their eggs. The results are shown in Fig. 7.1. The tops of the bars represent the mean temperature.

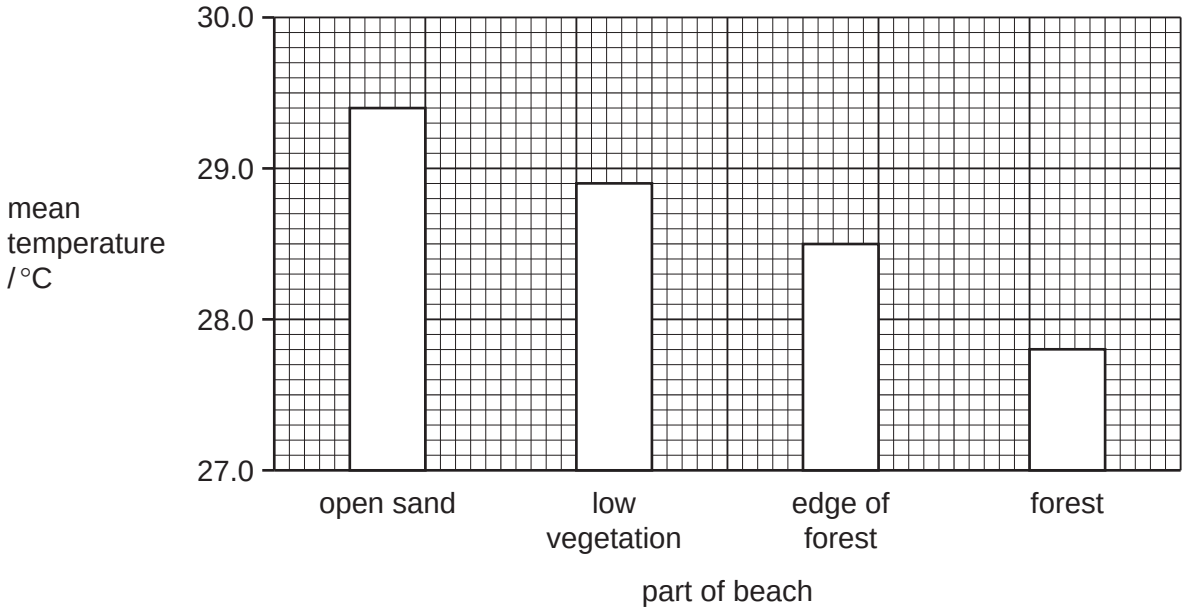



**Fig. 7.1**

With reference to Fig. 7.1, describe the effect of the presence of trees on the temp of the sand.

.....

.....

..... [2]

**(b)** The researchers counted the proportion of male and female turtles hatching from nests in the four different parts of the beach. The results are shown in Table 7.1.

**Table 7.1**

| part of beach | nests producing more males than females | nests producing more females than males | nests producing equal numbers of females and males |
|---|---|---|---|
| open sand | 0 | 16 | 0 |
| low vegetation | 31 | 24 | 6 |
| edge of forest | 61 | 0 | 11 |
| in forest | 36 | 0 | 0 |

**(i)** State the part of the beach in which most female hawksbill turtles chose to lay their eggs.

..... [1]

**(ii)** Use the information in Fig. 7.1 to explain the results for nests in open sand and in forest, shown in Table 7.1.

.....

.....

..... [2]

**(c)** Tourism is an important industry in Antigua. The vegetation on many beaches has been cut down to make the beaches more attractive to tourists.

With reference to the results of this research, suggest how deforestation of beaches could affect hawksbill turtle populations.

.....

.....

..... [2]

**(d)** Describe **two** harmful effects to the environment, other than extinction of species, that may result from deforestation.

1 .....

.....

.....

2 .....

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.....

[4]

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**Please turn over for Question 8.**

**8** Fig. 8.1 shows apparatus a student used to investigate temperature changes that oc
during chemical reactions.

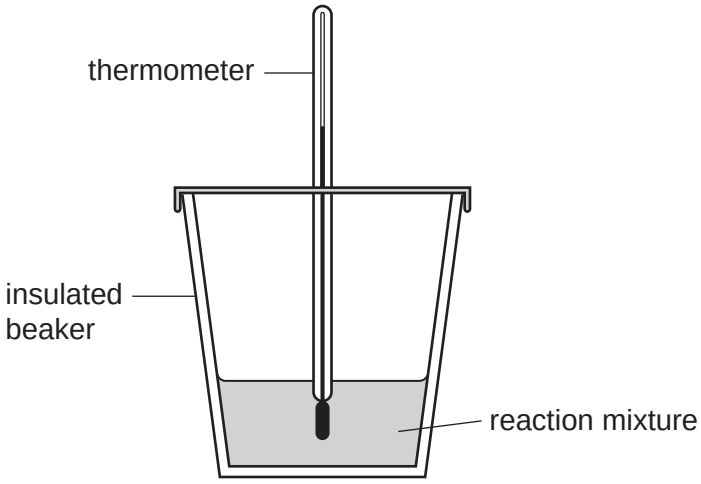


**Fig. 8.1**

The student added reactants to the insulated beaker and stirred the mixture. She recorded the final temperature of each mixture.

At the start of each experiment, the temperature of the reactants was 22 °C.

Table 8.1 contains the results the student obtained.

**Table 8.1**

| experiment | reactant A | reactant B | final temperature / °C |
|---|---|---|---|
| **1** | dilute hydrochloric acid | sodium hydrogencarbonate | 16 |
| **2** | dilute hydrochloric acid | potassium hydroxide solution | 26 |
| **3** | magnesium | copper sulfate solution | 43 |
| **4** | copper | magnesium sulfate solution | 22 |

**(a)** Explain which experiment, **1**, **2**, **3** or **4**, was a neutralisation reaction between an acid and an alkali.

experiment .....

explanation .....

..... [1]

**(b)** State and explain which experiment, **1**, **2**, **3** or **4**, was an endothermic reaction.

experiment .....

explanation .....

..... [1]

**(c)** Apart from the change in temperature, state **one** other observation the student could make when she carried out experiment **3**.

.....

..... [1]

**(d)** Explain, in terms of reactivity, why a reaction occurred in experiment **3**.

.....

..... [1]

**(e)** Suggest and explain a reason for the result obtained in experiment **4**.

.....

..... [2]

**9** **(a)** Fig. 9.1 shows the effect of pH on the activity of an enzyme.

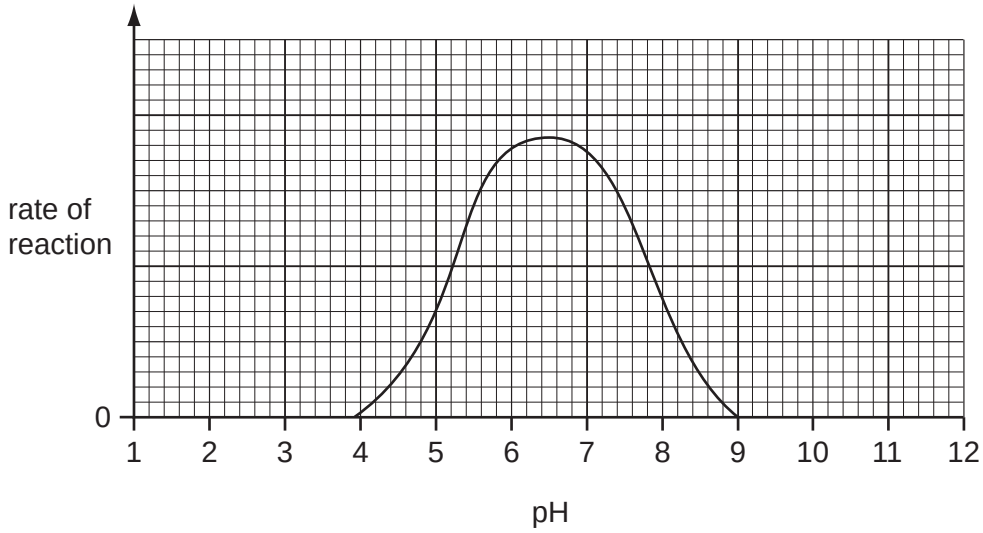


**Fig. 9.1**

**(i)** Describe the effect of pH on the activity of this enzyme.

.....

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..... [2]

**(ii)** Explain why pH affects the enzyme in this way.

.....

.....

..... [2]

**(iii)** An enzyme digests food in the human stomach, where hydrochloric acid is secreted. This enzyme is adapted to work best in these conditions.

**On Fig. 9.1**, sketch a curve to show how pH affects the activity of this stomach enzyme. [1]

**(iv)** After the food has been in the stomach for a while, it passes into the duodenum. Pancreatic juice, which contains sodium hydrogencarbonate, is mixed with the food in the duodenum.

Explain why this stomach enzyme stops working when it enters the duodenum.

.....

.....

..... [2]

**(b)** Explain how chemical digestion enables body cells to obtain nutrients.

*For iner's*

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..... [3]

**DATA SHEET**
**The Periodic Table of the Elements**

| Group | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I | II | | | | | | | | | | III | IV | V | VI | VII | 0 |
| | | | | | | | | | | | | | | | | 4 He Helium 2 |
| | | | | | 1 H Hydrogen 1 | | | | | | | | | | | |
| 7 Li Lithium 3 | 9 Be Beryllium 4 | | | | | | | | | | 11 B Boron 5 | 12 C Carbon 6 | 14 N Nitrogen 7 | 16 O Oxygen 8 | 19 F Fluorine 9 | 20 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 Sulfur 16 | 35.5 Cl Chlorine 17 | 40 Ar Argon 18 |
| 39 K Potassium 19 | 40 Ca Calcium 20 | 45 Sc Scandium 21 | 48 Ti Titanium 22 | 51 V Vanadium 23 | 52 Cr Chromium 24 | 55 Mn Manganese 25 | 56 Fe Iron 26 | 59 Co Cobalt 27 | 59 Ni Nickel 28 | 64 Cu Copper 29 | 65 Zn Zinc 30 | 70 Ga Gallium 31 | 75 As Arsenic 33 | 79 Se Selenium 34 | 80 Br Bromine 35 | 84 Kr Krypton 36 |
| 85 Rb Rubidium 37 | 88 Sr Strontium 38 | 89 Y Yttrium 39 | 91 Zr Zirconium 40 | 93 Nb Niobium 41 | 96 Mo Molybdenum 42 | Tc Technetium 43 | 101 Ru Ruthenium 44 | 103 Rh Rhodium 45 | 106 Pd Palladium 46 | 108 Ag Silver 47 | 112 Cd Cadmium 48 | 115 In Indium 49 | 122 Sb Antimony 51 | 128 Te Tellurium 52 | 127 I Iodine 53 | 131 Xe Xenon 54 |
| 133 Cs Caesium 55 | 137 Ba Barium 56 | 139 La Lanthanum 57 * | 178 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 | 197 Au Gold 79 | 201 Hg Mercury 80 | 204 Tl Thallium 81 | 207 Pb Lead 82 | 209 Bi Bismuth 83 | Po Polonium 84 | At Astatine 85 | Rn Radon 86 |
| Fr Francium 87 | 226 Ra Radium 88 | 227 Ac Actinium 89 † | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 140 Ce Cerium 58 | 141 Pr Praseodymium 59 | 144 Nd Neodymium 60 | Pm Promethium 61 | 150 Sm Samarium 62 | 152 Eu Europium 63 | 157 Gd Gadolinium 64 | 159 Tb Terbium 65 | 162 Dy Dysprosium 66 | 165 Ho Holmium 67 | 167 Er Erbium 68 | 169 Tm Thulium 69 | 173 Yb Ytterbium 70 | 175 Lu Lutetium 71 |
| 232 Th Thorium 90 | Pa Protactinium 91 | 238 U Uranium 92 | Np Neptunium 93 | Pu Plutonium 94 | Am Americium 95 | Cm Curium 96 | Bk Berkelium 97 | Cf Californium 98 | Es Einsteinium 99 | Fm Fermium 100 | Md Mendelevium 101 | No Nobelium 102 | Lr Lawrencium 103 |

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

The volume of one mole of any gas is 24 dm$^3$ at room temperature and pressure (r.t.p.).