



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

www.PapaCambridge.com

CANDIDATE
NAME

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--



COMBINED SCIENCE

0653/03

Paper 3 (Extended)

October/November 2009

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 **20** printed pages.



- 1 Fig. 1.1 shows a transverse section of part of a leaf. The arrows show water movement

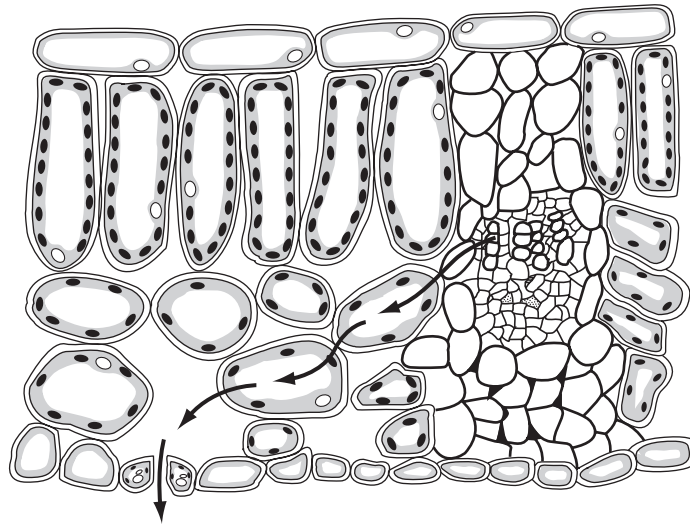


Fig. 1.1

- (a) (i) On Fig. 1.1, label a palisade cell, using a label line. [1]

- (ii) Explain why palisade cells need a good supply of water.

.....

 [2]

- (b) (i) Name the type of cell that transports water from the roots to a leaf.

..... [1]

- (ii) Name the process by which water moves from one plant cell to another, as it moves across the leaf.

..... [1]

(c) The loss of water vapour from the leaf to the air is called transpiration.

(i) Describe and explain how temperature affects the rate of transpiration.

.....

.....

.....

.....

..... [3]

(ii) Explain why temperature also affects the rate at which water is transported up to the leaves from the roots.

.....

.....

..... [2]

- 2 Radiation can be used to monitor the thickness of paper in a paper mill.

Fig. 2.1 shows a radiation detector connected to a control unit. This sends messages to machines that adjust the gap between the rollers.

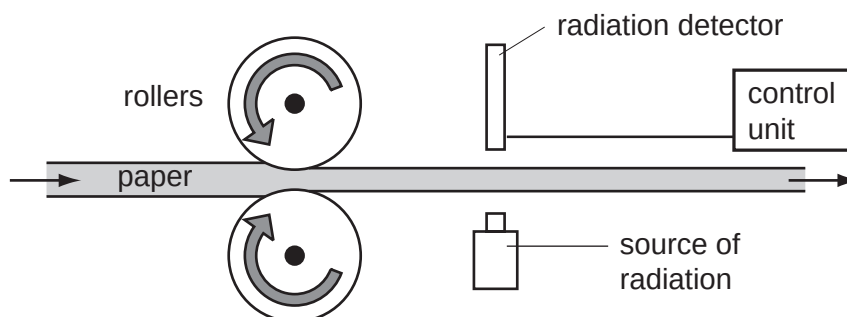


Fig. 2.1

- (a) The following sentences describe what happens if the paper sheet produced is too thin.

The sentences are in the wrong order.

- A The gap between the rollers is increased.
- B The paper sheet is now rolled a little thicker.
- C A signal goes from the detector to the control unit.
- D The paper sheet absorbs less beta radiation so more reaches the detector.

Arrange the sentences in the correct order.



[2]

- (b) Explain why an alpha radiation source **cannot** be used to monitor the thickness of the paper sheet.

.....
 [1]

- (c) Table 2.1 shows the half-life and type of radiation given out by four different radioactive isotopes.

Table 2.1

radioactive isotope	half-life / days	radiation given out
bismuth-210	5.0	beta
polonium-210	138.0	alpha and gamma
radon-222	3.8	alpha
iodine-131	8.0	beta and gamma

- (i) A sample of each isotope has the same count rate today. Which sample will have the highest count rate one month from today?

Explain your answer.

.....

 [2]

- (ii) Which isotopes in the table give out radiation that is the most ionising?

Explain your answer.

.....

 [2]

- 3 (a) Erupting volcanoes release a plume into the air, containing many gases.

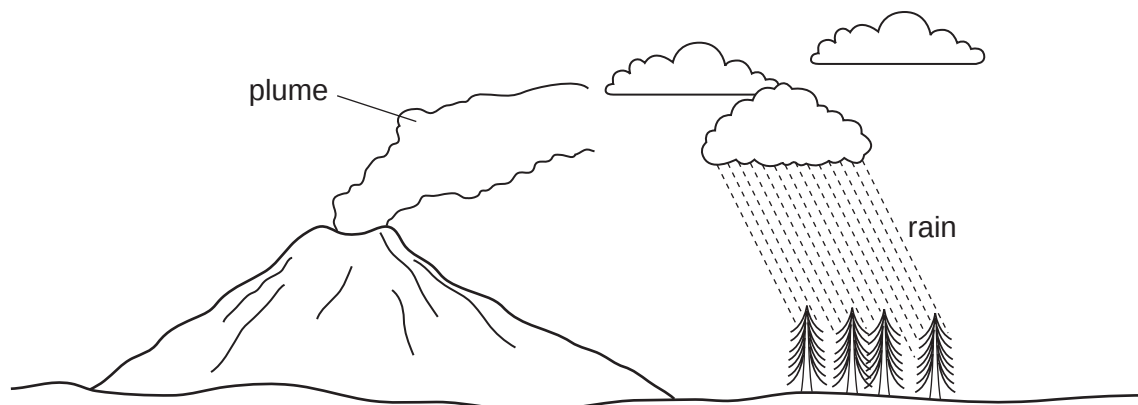


Table 3.1 shows some of the gases released by three volcanoes **A**, **B** and **C**.

Table 3.1

gas in plume	% of each gas in the plume		
	volcano A	volcano B	volcano C
H ₂ O	37.1	77.2	97.1
CO ₂	48.9	11.3	1.44
SO ₂	11.8	8.34	0.50
H ₂	0.49	1.39	0.70
CO	1.51	0.44	0.01

- (i) Explain why hydrogen is an element and the other gases are compounds.

.....

 [2]

- (ii) The plume from volcano **A** could be much more damaging to plant life than the plumes from the other volcanoes.

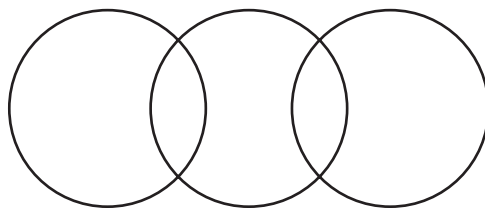
Use the information in Table 3.1 to explain why.

.....

 [3]

(b) (i) Complete the bonding diagram below to show

- the chemical symbols of the elements in a molecule of carbon dioxide,
- the arrangement of the outer electrons in each atom.



[2]

(ii) Use information in the Periodic Table on page 20 to calculate the relative molecular mass of sulfur dioxide.

Show your working.

..... [1]

(c) The air also contains noble gases, such as argon, which are very unreactive.

Draw a diagram of an argon atom showing how all of the electrons are arranged.

[2]

4 The enzyme amylase is present in saliva. It helps to digest starch in the mouth.

(a) (i) Name the substance that is produced when amylase digests starch.

..... [1]

(ii) State **one** part of the alimentary canal, other than the mouth, where amylase digests starch.

..... [1]

(b) There is a rare allele of the gene that is responsible for the production of amylase. A person with only one copy of this allele still produces amylase. However, a person with two copies of the allele does not produce amylase.

(i) State how this information shows that this allele is recessive.

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

(ii) Explain why a person with two copies of this allele would not be able to obtain energy from any starch in their diet.

.....
.....
.....
..... [3]

- (iii) Complete the genetic diagram to show how two people who both produce amylase can have a child who does not produce amylase.

Use the symbol **A** for the dominant allele and **a** for the recessive allele.

phenotypes of parents

produces amylase

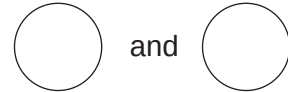
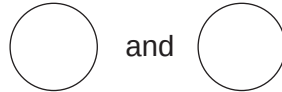
produces amylase

genotypes of parents

Aa

.....

gametes



gametes from one parent



gametes from
other parent



[4]

- 5 A student uses dilute hydrochloric acid to test four pieces of rock, **W**, **X**, **Y** and **Z**. She allows some of the acid to fall onto the samples and observes what happens.

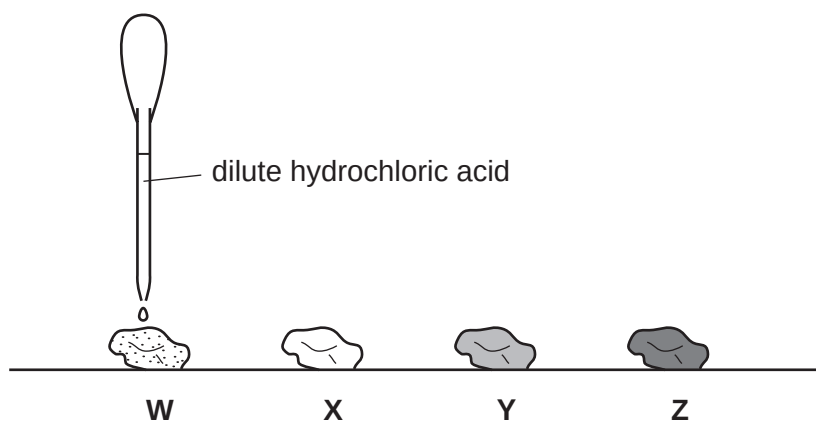


Fig. 5.1

The appearance of the rock samples before hydrochloric acid was added is shown in Table 5.1.

Table 5.1

rock	appearance
W	light grey
X	white
Y	green
Z	dark grey

- (a) (i) Describe what the student will observe if the rock she is testing with acid contains a carbonate.

..... [1]

- (ii) Suggest and explain which of the rock samples, **W**, **X**, **Y** or **Z**, contains a compound of a transition metal.

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

- (b) Copper metal can be extracted from copper carbonate in two stages, as shown in Fig. 5.2.

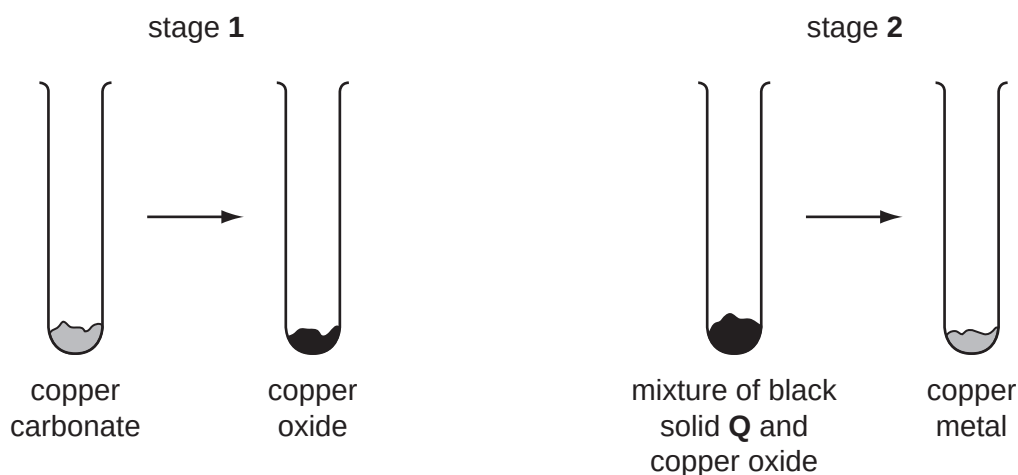


Fig. 5.2

- (i) The reaction in stage 1 occurs when copper carbonate is heated strongly.

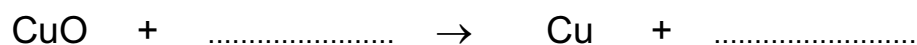
Suggest the word equation for the reaction.

..... [1]

- (ii) Solid Q is a non-metallic element.

Suggest the identity of this element. [1]

- (iii) Using your answer to (ii) complete and balance the symbolic equation for the reaction in stage 2.



[2]

- (iv) The compound copper oxide contains copper ions.

State whether copper ions must gain or lose electrons in order to be converted into copper atoms.

Explain your answer.

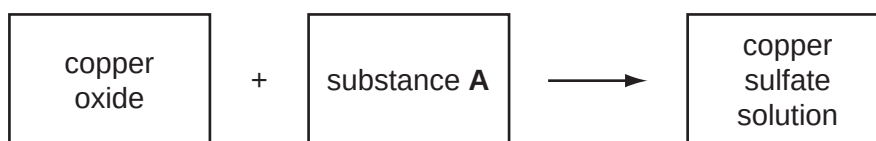
.....

 [2]

- (c) Copper metal can also be made from copper oxide by a different method.

Fig. 5.3 shows some of the reactants and products involved.

process 1



process 2

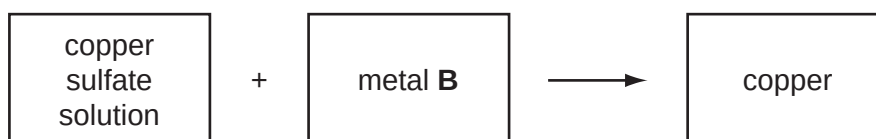


Fig. 5.3

- (i) Suggest the name of substance **A**. [1]
- (ii) Suggest the name of metal **B**. [1]
- (iii) Name the type of chemical change which occurs in process 2.
..... [1]
- (iv) Explain why copper is formed in process 2.
.....
..... [1]

- 6 A motorcyclist begins a journey on his motorcycle. The motorcycle starts from rest, stops at a road junction after 80 seconds. The motorcycle then moves off again and completes the journey.

(a) Fig 6.1 shows the motion of the motorcycle.

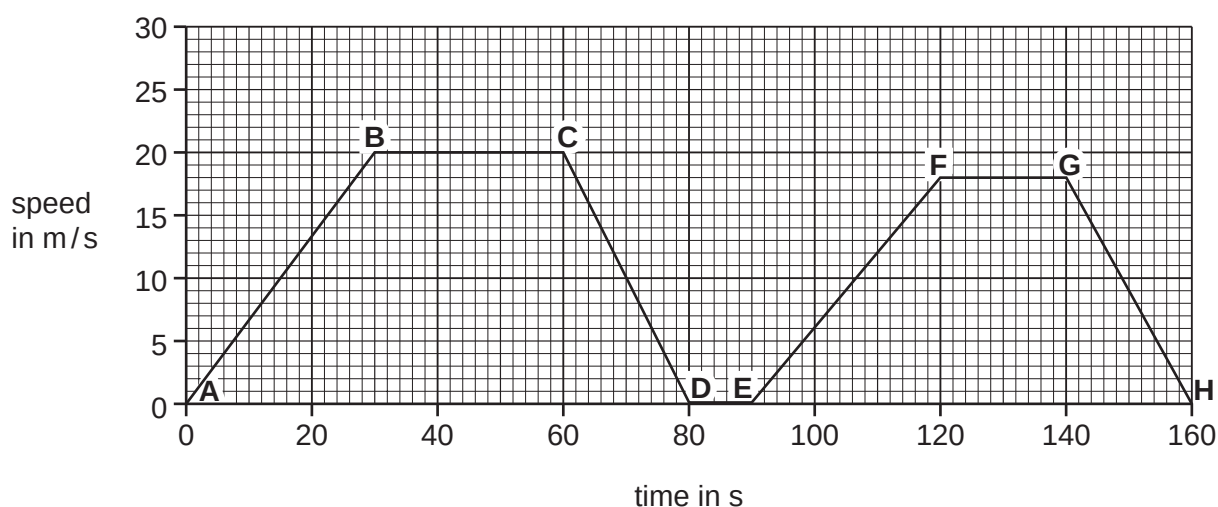


Fig. 6.1

- (i) From the start of the journey, how long did it take the motorcyclist to reach a speed of 10 m/s?

..... [1]

- (ii) For how long was the motorcyclist travelling at a steady speed of 20 m/s?

..... [1]

- (iii) During which two parts of the journey was the motorcyclist slowing down?

from to

and from to [1]

- (iv) Use Fig. 6.1 to show how far the motorcyclist travelled between 0 seconds and 80 seconds.

Show your working.

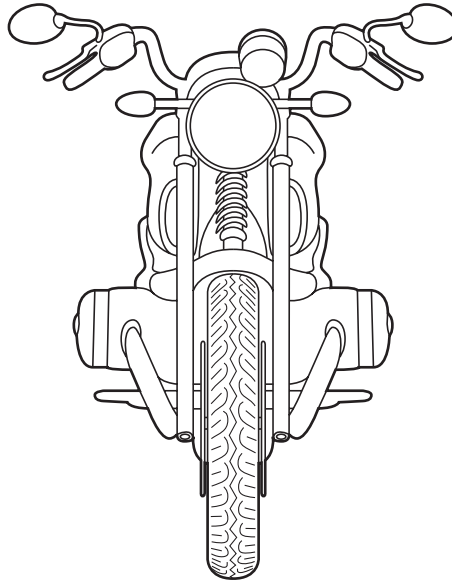
..... [2]

- (b) Describe the motion of the moving motorcycle if the total frictional force it experiences is the same as the force produced by the engine.

Explain your answer.

.....
..... [2]

- (c) Explain in terms of centre of mass why a stationary motorcycle is very unstable.



.....
.....
.....
.....
.....
..... [3]

- (d) The motorcycle has two lamps connected in a parallel circuit shown in Fig. 6.2.

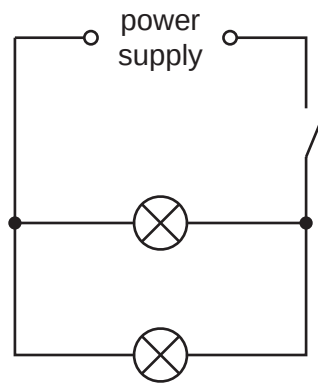


Fig. 6.2

One lamp when lit has a resistance of $1\ \Omega$. The other lamp when lit has a resistance of $2\ \Omega$.

Calculate the combined resistance of the two lamps.

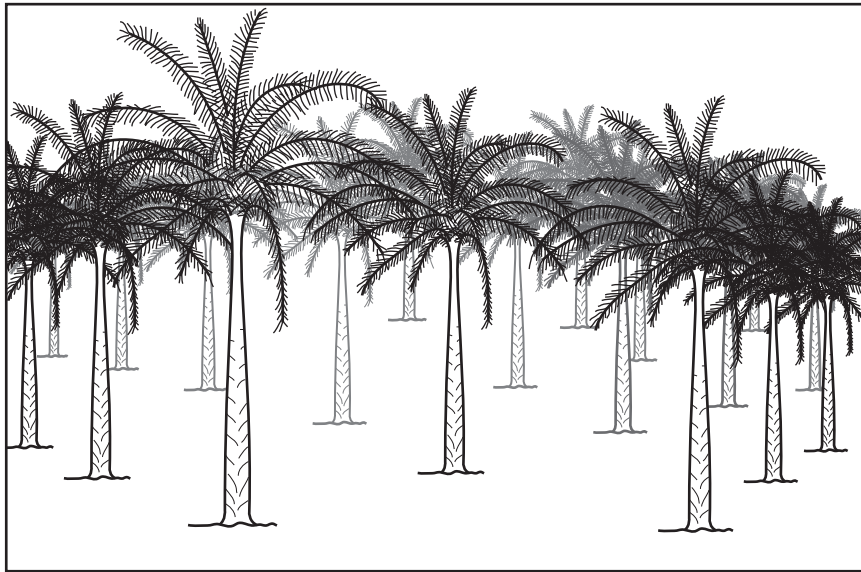
State the formula that you use and show your working.

formula

working

[3]

- 7 In some countries in south-east Asia, large areas of tropical rainforest have been cut down to clear the land. The land has then been planted with oil-palm trees.



(a) Explain how cutting down tropical rainforest may affect each of the following.

(i) soil erosion

.....
.....
..... [2]

(ii) species diversity

.....
.....
..... [2]

- (b) Rats can become serious pests in oil-palm plantations. The rats damage the fruit obtained from the oil-palms.

- (i) The rats can be controlled by putting down poison for them to eat.

Suggest two disadvantages, other than the cost of the poison, of this method of control.

1

.....

2

..... [2]

- (ii) An alternative method of controlling the rats is to encourage owls to nest in the oil-palms by providing them with nest boxes. Owls are predators of rats.

Suggest **one** disadvantage of this method of control.

.....

..... [1]

- 8 (a) Fig. 8.1 shows an aluminium saucepan on a cooker. Vegetables are being cooked in boiling water in the pan.

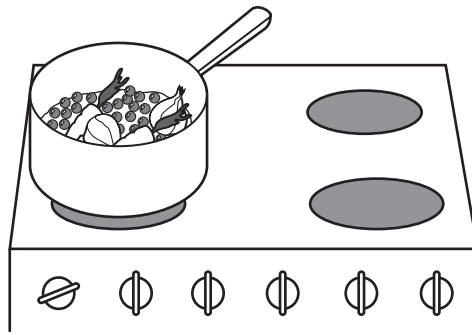


Fig. 8.1

State how the energy passes from the hot cooker through the base of the saucepan in to the water inside.

.....

[1]

- (b) Fig. 8.2 shows a block of aluminium which has a mass of 540 g.

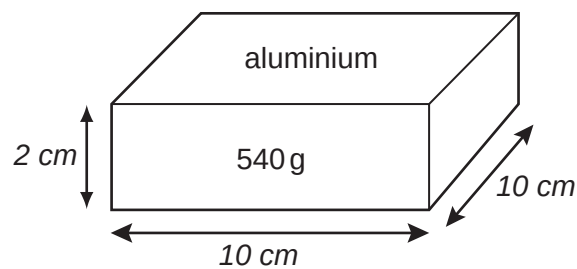


Fig. 8.2

Calculate the density of the block.

Show your working.

..... [3]

- (c) Describe how you would find the volume of an irregularly shaped object such as a carrot. You may draw a diagram if it helps your answer.

.....
..... [2]

- 9 Poly(ethene) is a compound used in making plastics. Poly(ethene) is a polymer made from the monomer, ethene (C_2H_4).

- (a) Describe how ethene molecules react to form poly(ethene). In your answer include a diagram showing the displayed (graphical) formulae of **two** ethene molecules and how these are changed during the reaction.

.....
.....
..... [3]

- (b) Describe and explain what is observed when gaseous ethene is bubbled through a solution of bromine.

.....
.....
..... [2]

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
												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	73 Ge Germanium 32	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	101 Ru Ruthenium 44	101 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	127 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	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															
58-71 Lanthanoid series																	
90-103 Actinoid series																	
158-164 Lanthanoid series																	
165-172 Actinoid series																	
173-178 Lanthanoid series																	
179-186 Actinoid series																	
187-194 Lanthanoid series																	
195-202 Actinoid series																	
203-210 Lanthanoid series																	
211-218 Actinoid series																	
219-226 Lanthanoid series																	
227-234 Actinoid series																	
235-242 Lanthanoid series																	
243-250 Actinoid series																	
251-258 Lanthanoid series																	
259-266 Actinoid series																	
267-274 Lanthanoid series																	
275-282 Actinoid series																	
283-290 Lanthanoid series																	
291-298 Actinoid series																	
299-306 Lanthanoid series																	
307-314 Actinoid series																	
315-322 Lanthanoid series																	
323-330 Actinoid series																	
331-338 Lanthanoid series																	
339-346 Actinoid series																	
347-354 Lanthanoid series																	
355-362 Actinoid series																	
363-370 Lanthanoid series																	
371-378 Actinoid series																	
379-386 Lanthanoid series																	
387-394 Actinoid series																	
395-402 Lanthanoid series																	
403-410 Actinoid series																	
411-418 Lanthanoid series																	
419-426 Actinoid series																	
427-434 Lanthanoid series																	
435-442 Actinoid series																	
443-450 Lanthanoid series																	
451-458 Actinoid series																	
459-466 Lanthanoid series																	
467-474 Actinoid series																	
475-482 Lanthanoid series																	
483-490 Actinoid series																	
491-498 Lanthanoid series																	
499-506 Actinoid series																	
507-514 Lanthanoid series																	
515-522 Actinoid series																	
523-530 Lanthanoid series																	
531-538 Actinoid series																	
539-546 Lanthanoid series																	
547-554 Actinoid series																	
555-562 Lanthanoid series																	
563-570 Actinoid series																	
571-578 Lanthanoid series																	
579-586 Actinoid series																	
587-594 Lanthanoid series																	
595-602 Actinoid series																	
603-610 Lanthanoid series																	
611-618 Actinoid series																	
619-626 Lanthanoid series																	
627-634 Actinoid series																	
635-642 Lanthanoid series																	
643-650 Actinoid series																	
651-658 Lanthanoid series																	
659-666 Actinoid series																	
667-674 Lanthanoid series																	
675-682 Actinoid series																	
683-690 Lanthanoid series																	
691-698 Actinoid series																	
699-706 Lanthanoid series																	
707-714 Actinoid series																	
715-722 Lanthanoid series																	
723-730 Actinoid series																	
731-738 Lanthanoid series																	
739-746 Actinoid series																	
747-754 Lanthanoid series																	
755-762 Actinoid series																	
763-770 Lanthanoid series																	
771-778 Actinoid series																	
779-786 Lanthanoid series																	
787-794 Actinoid series																	
795-802 Lanthanoid series																	
803-810 Actinoid series																	
811-818 Lanthanoid series																	
819-826 Actinoid series																	
827-834 Lanthanoid series																	
835-842 Actinoid series																	
843-850 Lanthanoid series																	
851-858 Actinoid series																	
859-866 Lanthanoid series																	
867-874 Actinoid series																	
875-882 Lanthanoid series																	
883-890 Actinoid series																	
891-898 Lanthanoid series																	
899-906 Actinoid series																	
907-914 Lanthanoid series																	
915-922 Actinoid series																	
923-930 Lanthanoid series																	
931-938 Actinoid series																	
939-946 Lanthanoid series																	
947-954 Actinoid series																	
955-962 Lanthanoid series																	
963-970 Actinoid series																	
971-978 Lanthanoid series																	
979-986 Actinoid series																	
987-994 Lanthanoid series																	
995-1002 Actinoid series																	
1003-1010 Lanthanoid series																	
1011-1018 Actinoid series																	
1019-1026 Lanthanoid series																	
1027-1034 Actinoid series																	
1035-1042 Lanthanoid series																	
1043-1050 Actinoid series																	
1051-1058 Lanthanoid series																	
1059-1066 Actinoid series																	
1067-1074 Lanthanoid series																	
1075-1082 Actinoid series																	
1083-1090 Lanthanoid series																	
1091-1098 Actinoid series																	
1099-1106 Lanthanoid series																	
1107-1114 Actinoid series																	
1115-1122 Lanthanoid series																	
1123-1130 Actinoid series																	
1131-1138 Lanthanoid series																	
1139-1146 Actinoid series																	
1147-1154 Lanthanoid series																	
1155-1162 Actinoid series																	
1163-1170 Lanthanoid series																	
1171-1178 Actinoid series																	
1179-1186 Lanthanoid series																	
1187-1194 Actinoid series																	
1195-1202 Lanthanoid series																	
1203-1210 Actinoid series																	
1211-1218 Lanthanoid series																	
1219-1226 Actinoid series																	
1227-1234 Lanthanoid series																	
1235-1242 Actinoid series																	
1243-1250 Lanthanoid series																	
1251-1258 Actinoid series																	
1259-1266 Lanthanoid series																	
1267-1274 Actinoid series																	
1275-1282 Lanthanoid series																	
1283-1290 Actinoid series																	
1291-1298 Lanthanoid series																	
1299-1306 Actinoid series																	
1307-1314 Lanthanoid series																	
1315-1322 Actinoid series																	
1323-1330 Lanthanoid series																	
1331-1338 Actinoid series																	
1339-1346 Lanthanoid series																	
1347-1354 Actinoid series																	
1355-1362 Lanthanoid series																	
1363-1370 Actinoid series																	
1371-1378 Lanthanoid series																	
1379-1386 Actinoid series																	
1387-1394 Lanthanoid series																	
1395-1402 Actinoid series																	
1403-1410 Lanthanoid series																	
1411-1418 Actinoid series																	
1419-1426 Lanthanoid series																	
1427-1434 Actinoid series																	
1435-1442 Lanthanoid series																	
1443-1450 Actinoid series																	
1451-1458 Lanthanoid series																	
1459-1466 Actinoid series																	
1467-1474 Lanthanoid series																	
1475-1482 Actinoid series																	
1483-1490 Lanthanoid series																	
1491-1498 Actinoid series																	
1499-1506 Lanthanoid series																	
1507-1514 Actinoid series																	
1515-1522 Lanthanoid series																	
1523-1530 Actinoid series																	
1531-1538 Lanthanoid series																	
1539-1546 Actinoid series																	
1547-1554 Lanthanoid series																	
1555-1562 Actinoid series																	
1563-1570 Lanthanoid series																	
1571-1578 Actinoid series																	
1579-1586 Lanthanoid series																	
1587-1594 Actinoid series																	
1595-1602 Lanthanoid series																	
1603-1610 Actinoid series																	
1611-1618 Lanthanoid series																	
1619-1626 Actinoid series																	
1627-1634 Lanthanoid series																	
1635-1642 Actinoid series																	
1643-1650 Lanthanoid series																	
1651-1658 Actinoid series																	
1659-1666 Lanthanoid series																	
1667-1674 Actinoid series																	
1675-1682 Lanthanoid series																	
1683-1690 Actinoid series																	
1691-1698 Lanthanoid series																	
1699-1706 Actinoid series																	
1707-1714 Lanthanoid series																	
1715-1722 Actinoid series																	
1723-1730 Lanthanoid series																	
1731-1738 Actinoid series																	
1739-1746 Lanthanoid series																	
1747-1754 Actinoid series																	
1755-1762 Lanthanoid series																	
1763-1770 Actinoid series																	
1771-1778 Lanthanoid series																	
1779-1786 Actinoid series																	
1787-1794 Lanthanoid series																	
1795-1802 Actinoid series																	
1803-1810 Lanthanoid series																	
1811-1818 Actinoid series																	
1819-1826 Lanthanoid series																	
1827-1834 Actinoid series																	
1835-1842 Lanthanoid series																	
1843-1850 Actinoid series																	
1851-1858 Lanthanoid series																	
1859-1866 Actinoid series																	
1867-1874 Lanthanoid series																	
1875-1882 Actinoid series																	
1883-1890 Lanthanoid series																	
1891-1898 Actinoid series																	
1899-1906 Lanthanoid series																	
1907-1914 Actinoid series																	
1915-1922 Lanthanoid series																	
1923-1930 Actinoid series																	
1931-1938 Lanthanoid series																	
1939-1946 Actinoid series																	
1947-1954 Lanthanoid series																	
1955-1962 Actinoid series																	
1963-1970 Lanthanoid series																	
1971-1978 Actinoid series																	
1979-1986 Lanthanoid series																	
1987-1994 Actinoid series																	
1995-2002 Lanthanoid series																	
2003-2010 Actinoid series																	
2011-2018 Lanthanoid series																	
2019-2026 Actinoid series																	
2027-2034 Lanthanoid series																	
2035-2042 Actinoid series																	
2043-2050 Lanthanoid series																	
2051-2058 Actinoid series																	
2059-2066 Lanthanoid series																	
2067-2074 Actinoid series																	
2075-2082 Lanthanoid series																	
2083-2090 Actinoid series																	
2091-2098 Lanthanoid series																	
2099-2106 Actinoid series																	
2107-2114 Lanthanoid series																	
2115-2122 Actinoid series																	
2123-2130 Lanthanoid series																	
2131-2138 Actinoid series																	
2139-2146 Lanthanoid series																	
2147-2154 Actinoid series																	
2155-2162 Lanthanoid series																	
2163-2170 Actinoid series																	
2171-2178 Lanthanoid series																	
2179-2186 Actinoid series																	
2187-2194 Lanthanoid series																	
2195-2202 Actinoid series																	
2203-2210 Lanthanoid series																	
2211-2218 Actinoid series																	
2219-2226 Lanthanoid series																	
2227-2234 Actinoid series																	
2235-2242 Lanthanoid series																	
2243-2250 Actinoid series																	
2251-2258 Lanthanoid series																	
2259-2266 Actinoid series																	
2267-2274 Lanthanoid series																	
2275-2282 Actinoid series																	
2283-2290 Lanthanoid series																	
2291-2298 Actinoid series																	
2299-2306 Lanthanoid series																	
2307-2314 Actinoid series																	
2315-2322 Lanthanoid series																	
2323-2330 Actinoid series																	
2331-2338 Lanthanoid series																	
2339-2346 Actinoid series																	
2347-2354 Lanthanoid series																	
2355-2362 Actinoid series																	
2363-2370 Lanthanoid series																	
2371-2378 Actinoid series																	
2379-2386 Lanthanoid series																	
2387-2394 Actinoid series																	
2395-2402 Lanthanoid series																	
2403-2410 Actinoid series																	
2411-2418 Lanthanoid series																	
2419-2426 Actinoid series																	
2427-2434 Lanthanoid series																	
2435-2442 Actinoid series																	
2443-2450 Lanthanoid series																	
2451-2458 Actinoid series																	
2459-2466 Lanthanoid series																	
2467-2474 Actinoid series																	
2475-2482 Lanthanoid series																	
2483-2490 Actinoid series																	
2491-2498 Lanthanoid series																	
2499-2506 Actinoid series																	
2507-2514 Lanthanoid series																	
2515-2522 Actinoid series																	
2523-2530 Lanthanoid series																	
2531-2538 Actinoid series																	
2539-2546 Lanthanoid series																	
2547-2554 Actinoid series																	
2555-2562 Lanthanoid series																	
2563-2570 Actinoid series																	
2571-2578 Lanthanoid series																	
2579-2586 Actinoid series																	
2587-2594 Lanthanoid series																	
2595-2602 Actinoid series																	
2603-2610 Lanthanoid series																	
2611-2618 Actinoid series																	
2619-2626 Lanthanoid series																	
2627-2634 Actinoid series																	
2635-2642 Lanthanoid series																	
2643-2650 Actinoid series																	
2651-2658 Lanthanoid series																	
2659-2666 Actinoid series																	
2667-2674 Lanthanoid series																	
2675-2682 Actinoid series																	
2683-2690 Lanthanoid series																	
2691-2698 Actinoid series																	
2699-2706 Lanthanoid series																	
2707-2714 Actinoid series																	
2715-2722 Lanthanoid series																	
2723-2730 Actinoid series																	
2731-2738 Lanthanoid series																	
2739-2746 Actinoid series																	
2747-2754 Lanthanoid series																	
2755-2762 Actinoid series																	
2763-2770 Lanthanoid series																	
2771-2778 Actinoid series																	
2779-2786 Lanthanoid series																	
2787-2794 Actinoid series																	
2795-2802 Lanthanoid series																	
2803-2810 Actinoid series																	
2811-2818 Lanthanoid series																	
2819-2826 Actinoid series																	
2827-2834 Lanthanoid series																	
2835-2842 Actinoid series																	
2843-2850 Lanthanoid series																	
2851-2858 Actinoid series																	
2859-2866 Lanthanoid series																	
2867-2874 Actinoid series																	
2875-2882 Lanthanoid series																	
2883-2890 Actinoid series																	
2891-2898 Lanthanoid series																	
2899-2906 Lanthanoid series																	
2907-2914 Lanthanoid series																	
2915-2922 Lanthanoid series																	
2923-2930 Lanthanoid series																	
2931-2938 Lanthanoid series																	
2939-2946 Lanthanoid series																	
2947-2954 Lanthanoid series																	
2955-2962 Lanthanoid series																	
2963-2970 Lanthanoid series																	
2971-2978 Lanthanoid series																	
2979-2986 Lanthanoid series																	
2987-2994 Lanthanoid series																	
2995-3002 Lanthanoid series																	
3003-3010 Lanthanoid series																	
3011-3018 Lanthanoid series																	
3019-3026 Lanthanoid series																	
3027-3034 Lanthanoid series																	
3035-3042 Lanthanoid series																	
3043-3050 Lanthanoid series																	
3051-3058 Lanthanoid series																	
3059-3066 Lanthanoid series																	
3067-3074 Lanthanoid series																	
3075-3082 Lanthanoid series																	
3083-3090 Lanthanoid series																	
3091-3098 Lanthanoid series																	
3099-3106 Lanthanoid series																	
3107-3114 Lanthanoid series																	
3115-3122 Lanthanoid series																	
3123-3130 Lanthanoid series																	
3131-3138 Lanthanoid series																	
3139-3146 Lanthanoid series																	
3147-3154 Lanthanoid series																	
3155-3162 Lanthanoid series																	
3163-3170 Lanthanoid series																	
3171-3178 Lanthanoid series																	
3179-3186 Lanthanoid series																	
3187-3194 Lanthanoid series																	
3195-3202 Lanthanoid series																	
3203-3210 Lanthanoid series																	
3211-3218 Lanthanoid series																	
3219-3226 Lanthanoid series																	
3227-3234 Lanthanoid series																	
3235-3242 Lanthanoid series																	
3243-3250 Lanthanoid series																	
3251-3258 Lanthanoid series																	
3259-3266 Lanthanoid series																	
3267-3274 Lanthanoid series																	
3275-3282 Lanthanoid series																	
3283-3290 Lanthanoid series																	
3291-3298 Lanthanoid series																	
3299-3306 Lanthanoid series																	
3307-3314 Lanthanoid series																	
3315-3322 Lanthanoid series																	
3323-3330 Lanthanoid series																	
3331-3338 Lanthanoid series																	
3339-3346 Lanthanoid series																	
3347-3354 Lanthanoid series																	
3355-3362 Lanthanoid series																	
3363-3370 Lanthanoid series																	
3371-3378 Lanthanoid series																	
3379-3386 Lanthanoid series																	
3387-3394 Lanthanoid series																	
3395-3402 Lanthanoid series																	
3403-3410 Lanthanoid series																	
3411-3418 Lanthanoid series																	
3419-3426 Lanthanoid series																	
3427-3434 Lanthanoid series																	
3435-3442 Lanthanoid series																	
3443-3450 Lanthanoid series																	
3451-3458 Lanthanoid series																	
3459-3466 Lanthanoid series																	
3467-3474 Lanthanoid series																	

a	X	b
Key		

a = relative atomic mass

X = atomic symbol

b = proton (atomic) number

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).