



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

* 9 1 4 7 5 4 0 8 6 5 *

COMBINED SCIENCE

0653/23

Paper 2 (Core)

October/November 2011

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 24.

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 **21** printed pages and **3** blank pages.



- 1 Coral reefs are found in shallow seawater. Limestone is a common type of rock found in Earth's crust. Both coral reefs and limestone are made mainly of the ionic compound calcium carbonate.

(a) A student used the apparatus shown in Fig. 1.1 to test a rock sample to discover whether or not it is limestone.

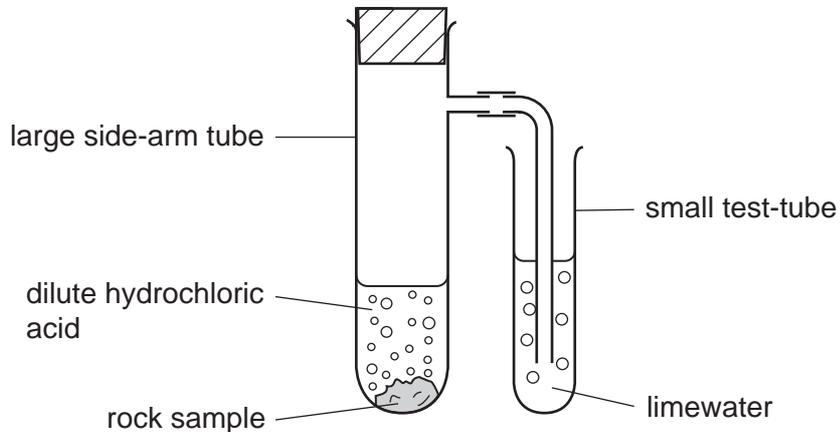


Fig. 1.1

The student observed that a gas was given off and that the limewater in the small test-tube became cloudy.

(i) Name the gas that was given off. [1]

(ii) State the chemical formula of hydrochloric acid.
..... [1]

(iii) After some time, the student observed that the gas stopped forming, but a small piece of the rock sample remained in the large side-arm tube.

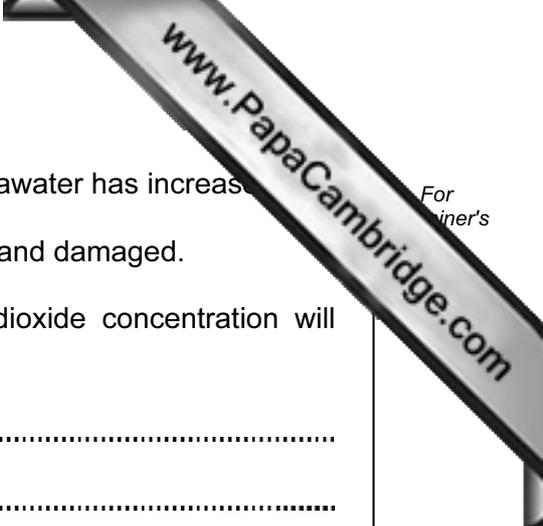
Explain why gas stopped forming.

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

(iv) The student carried out a flame test on the solution that remained in the large side-arm tube. This test produced an orange-red colour.

Name the element that this observation suggests is contained in the rock sample.

..... [1]



(b) In recent years, the amount of carbon dioxide dissolving in seawater has increased.

During this period, many coral reefs have become weakened and damaged.

(i) State and explain briefly how an increase in carbon dioxide concentration will affect the pH of seawater.

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

(ii) Suggest a reason why an increase in carbon dioxide concentration might be responsible for damage to coral reefs.

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

- 2 (a) Fig. 2.1 shows the horizontal forces acting on an aircraft moving along the runway. These forces are balanced.

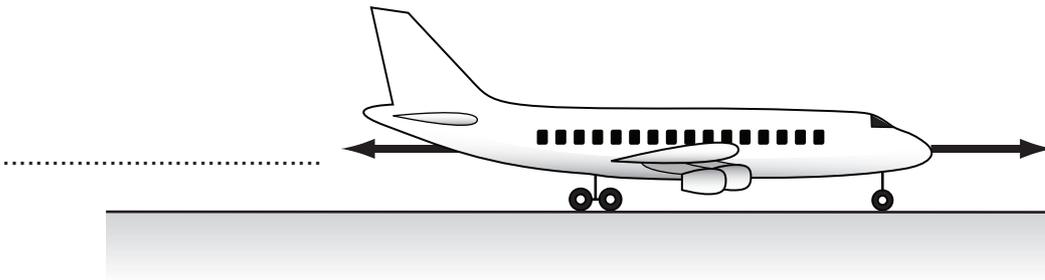


Fig. 2.1

- (i) The arrow to the right represents the driving force produced by the engines.

On the diagram, name the other force.

[1]

- (ii) Explain what is meant by the phrase *forces are balanced*.

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

- (iii) Describe the movement of the aircraft when these forces are balanced.

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

- (b) In the air, the aircraft travels at 80 m/s for one hour.

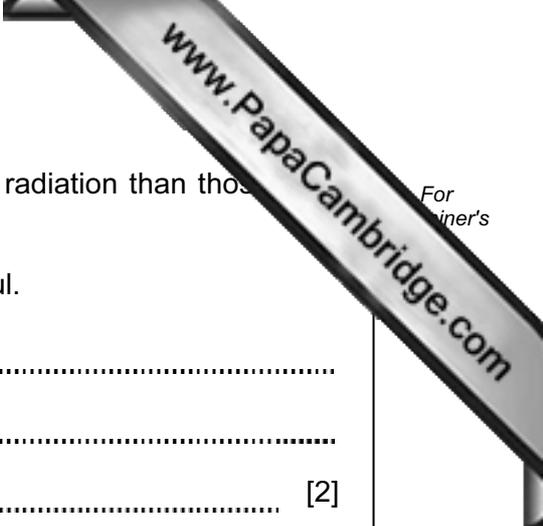
Calculate the distance travelled.

State the formula that you use and show your working.

formula used

working

..... m [2]



(c) People who fly frequently have greater exposure to ionising radiation than those who do not fly.

(i) Explain why exposure to ionising radiation may be harmful.

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

(ii) This ionising radiation is cosmic radiation from outer space. This is one source of background radiation.

State **one** other natural source of background radiation.

..... [1]

(d) The aircraft is able to navigate using radar. This involves using microwaves. These are part of the electromagnetic spectrum.

Name **one** other wave which is part of the electromagnetic spectrum and give a use for this radiation.

name

use [2]

3 (a) Complete the word equation for aerobic respiration.



(b) Describe how oxygen is transported from the lungs to a cell in a human muscle.

.....

 [2]

(c) An athlete ran on a treadmill at a slow speed for 5 minutes. She then ran on the same treadmill at a faster speed for 5 minutes.

Fig. 3.1 shows the volume of oxygen she used per minute during both runs.



Fig. 3.1

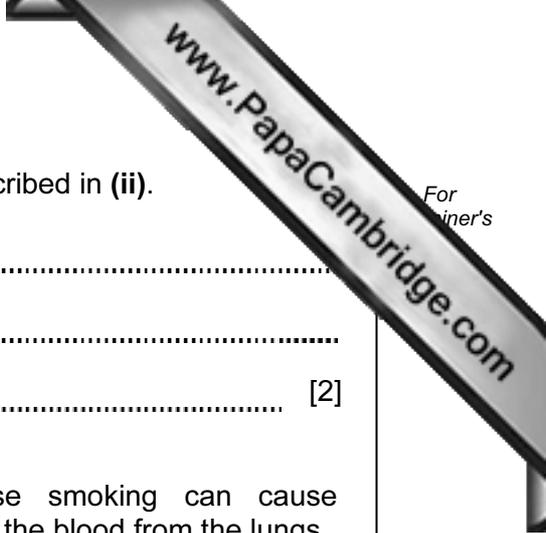
(i) State the volume of oxygen used per minute by the athlete before she began to run.

..... dm³ [1]

(ii) Describe how the volume of oxygen used per minute during the fast run differs from the slow run.

.....

 [2]



(iii) Suggest an explanation for the differences you have described in (ii).

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

(d) Professional athletes do not smoke cigarettes because smoking can cause emphysema. This reduces the ability of oxygen to diffuse into the blood from the lungs.

Explain what is meant by *emphysema*.

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

4 Fig. 4.1 shows an electric hairdryer.

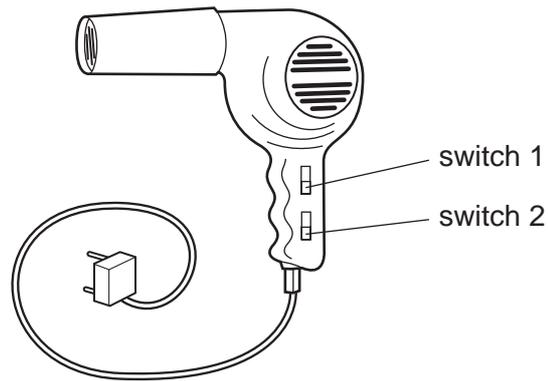


Fig. 4.1

(a) Fig. 4.2 shows the circuit diagram for the hairdryer.

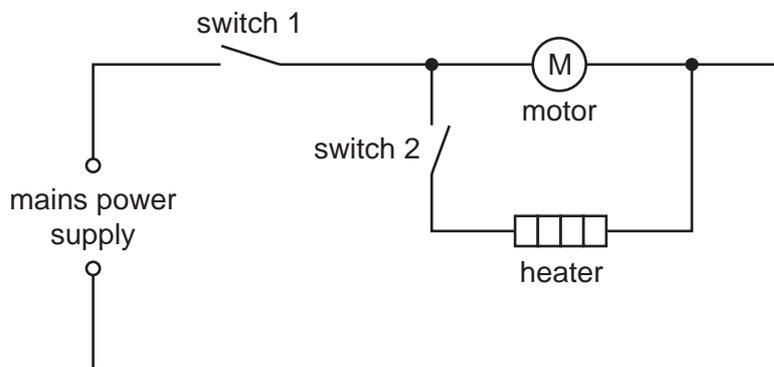


Fig. 4.2

(i) State which of the switches must be closed (on) for the heater in the hairdryer to work.

..... [1]

(ii) A student wanted to determine the resistance of the heater.

Fig. 4.3 shows the circuit he built to measure the current passing through the heater and the potential difference across the heater.

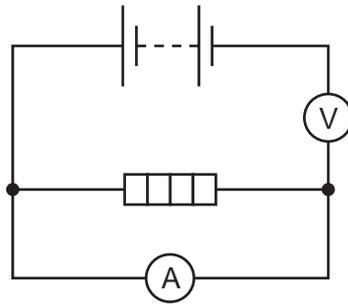


Fig. 4.3

His experiment did not work because his circuit was incorrect.

Draw the correct circuit in the space below.

[2]

(b) The electricity used in the hairdryer was generated at a power station.

(i) Name a fossil fuel that can be used in power stations.

..... [1]

(ii) Power is transmitted from the power station over large distances.

A high voltage is always used. Explain why.

.....
 [1]

The high voltage is produced by a transformer.

Fig. 4.4 shows a simple transformer.

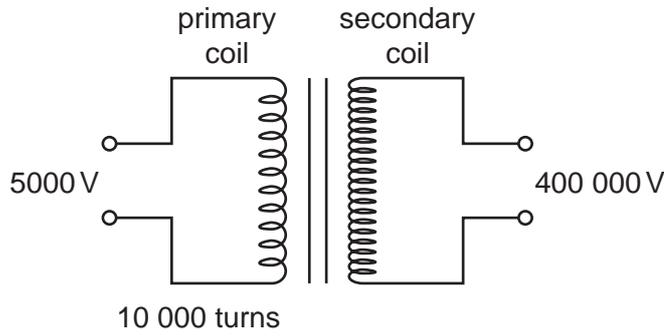


Fig. 4.4

(iii) Use the equation

$$V_p/V_s = N_p/N_s$$

to calculate the number of turns in the secondary coil.

Show your working.

number of turns = [1]

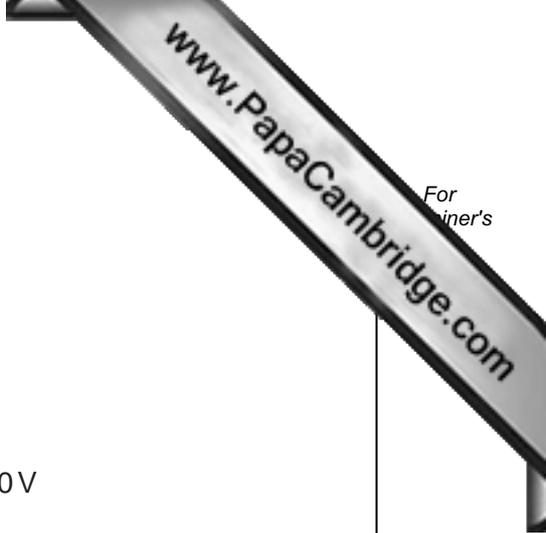
(iv) Transformers are also used between power lines and people's houses.

Explain why.

.....

.....

..... [2]



5 Fig. 5.1 shows a section through a flower.

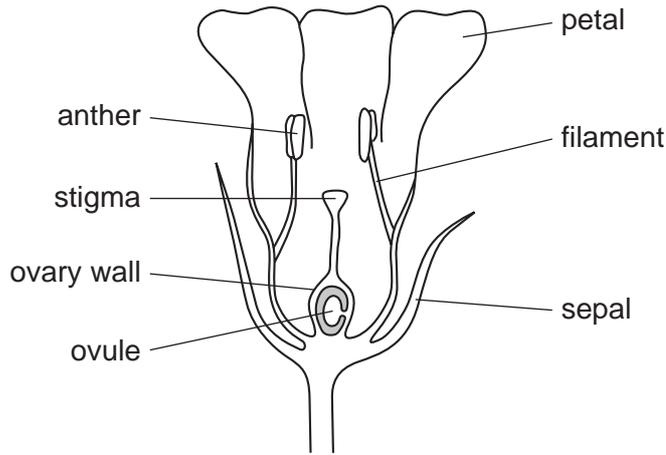


Fig. 5.1

(a) (i) State the function of each of the following parts of the flower.

petal

anther [2]

(ii) Name the part of the flower that

develops into a seed,

develops into a fruit. [2]

(b) Flowers are involved in sexual reproduction.

Complete the table to show whether each statement is true for asexual reproduction, sexual reproduction, both or neither.

Use a tick (✓) for a correct statement and a cross (✗) for an incorrect statement. You must write either a tick or cross in each space in the table.

The first statement has been completed for you.

statement	asexual reproduction	sexual reproduction
gametes are involved	✗	✓
new individuals are produced		
a zygote is produced		
offspring are always genetically identical		

- 6 Nordic gold is an alloy of four metals used to make coins.



Table 6.1 shows information about the metals contained in Nordic gold.

Table 6.1

metal	% by mass in Nordic gold	compound from which the metal is extracted
aluminium	5	Al_2O_3
copper		$CuFeS_2$
tin	1	SnO_2
zinc	5	ZnS

- (a) (i) Complete Table 6.1 by stating the percentage of copper in Nordic gold. [1]

- (ii) Suggest how Nordic gold could be made.

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

- (iii) In the right hand column, the elements present in compounds can be identified by their symbols.

Name a metallic element present in one of the compounds in Table 6.1 which is **not** present in Nordic gold.

..... [1]

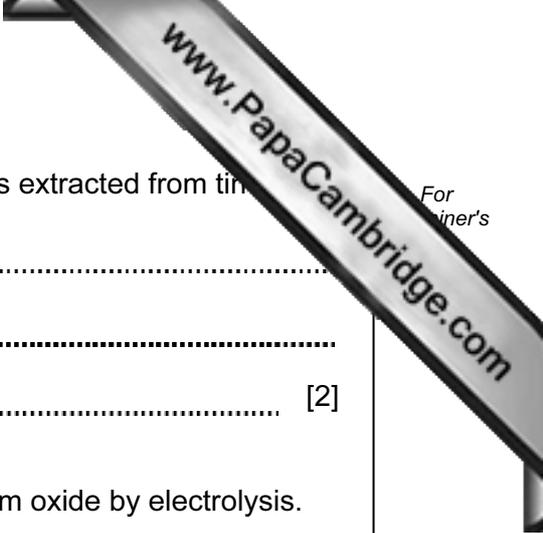
- (iv) Suggest **two** properties of Nordic gold, other than its appearance, that make it a suitable material from which to make coins.

1
2 [2]

- (b) (i) Tin may be extracted from tin oxide by heating a mixture of tin oxide and carbon. The other product of this reaction is carbon monoxide.

Write a **word** chemical equation for this reaction.

..... [1]



(ii) State and explain which substance is **oxidised** when tin is extracted from tin
substance which is oxidised
explanation
..... [2]

(c) (i) Aluminium is extracted from the ionic compound aluminium oxide by electrolysis.
Explain the meanings of the following terms that are important in electrolysis.
cathode
electrolyte
..... [3]

(ii) State how the position of aluminium in the Periodic Table shows that aluminium
atoms have three electrons in their outer shell.
.....
..... [1]

7 (a) Fig. 7.1 shows a mother pushing her child in a baby buggy. She uses a force of 100 N.



Fig. 7.1

The baby buggy is pushed 2000 m.

Calculate how much work has been done.

State the formula that you use and show your working.

formula used

working

..... J [2]

(b) A child is playing on a swing. This is shown in Fig. 7.2.

At the top of the oscillation, the child and swing are momentarily at rest.

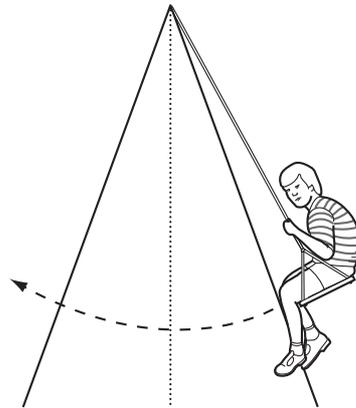


Fig. 7.2

(i) Write the correct energy type in the space to complete the box.

gravitational potential energy at the top of the oscillation	=	gravitational potential energy at the bottom of the oscillation	+ energy at the bottom of the oscillation	+	energy losses
---	---	--	---	--	---	---------------

[1]

(ii) Suggest a form of energy which is lost from the system.

..... [1]

(iii) Suggest where the lost energy goes.

..... [1]

(c) The child weighs 400 N.

The Earth's gravitational field strength is 10 N/kg.

(i) State the mass of the child.

..... kg [2]

- (ii) The average density of the human body is 1020 kg/m^3 .

Calculate the volume of the child.

State the formula that you use and show your working.

formula used

working

..... m^3 [1]

8 Fig. 8.1 shows a tree frog that lives in a tropical rain forest.

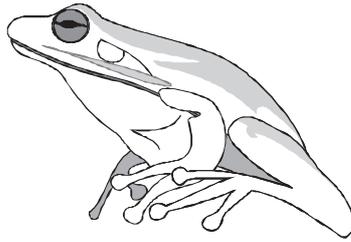


Fig. 8.1

(a) Tree frogs feed on insects. Enzymes in their alimentary canal break down large molecules in the insects into small ones.

(i) State the correct biological term for this process. [1]

(ii) Explain why this process is necessary for the frog's survival.

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

(iii) Use words from the list to complete the sentences about enzymes.

- | | | | |
|----------------------|---------------|------------------|------------------|
| carbohydrates | cells | denatured | dissolved |
| hydrogen | killed | oxygen | proteins |

Enzymes are that catalyse chemical reactions in living organisms. One example of an enzyme is catalase, which breaks down hydrogen peroxide to water and Enzymes are by high temperatures. [3]

(b) Tropical rain forests have a high species diversity.

(i) Explain what is meant by *species diversity*.

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



(ii) Many species of tree frog have become extinct in the last ten years.

Suggest how the loss of tree frogs from the rain forest could damage the ecosystem.

.....

.....

.....

..... [2]

9 Hydrocarbons are compounds which contain only the elements hydrogen and carbon.

(a) The simplest hydrocarbon is methane, which is an important fuel.

(i) State **one** natural source of methane.

..... [1]

(ii) Complete the displayed (graphical) formula of a methane molecule.



[2]

(iii) Carbon dioxide and carbon monoxide are compounds released into the atmosphere when methane burns.

Describe **one** environmental disadvantage of each compound.

carbon dioxide

.....

.....

carbon monoxide

.....

..... [3]

(b) Table 9.1 shows the molecular formulae and boiling points of four hydrocarbons.

Table 9.1

molecular formula	boiling point/°C
C_6H_{14}	69
$C_{10}H_{22}$	174
$C_{12}H_{26}$	216
C_5H_{12}	36

(i) Name a process which could be used to separate a mixture of the compounds in Table 9.1.

..... [1]

(ii) Use the information in Table 9.1 to describe how the boiling point of a hydrocarbon is affected by the mass of its molecules.

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

DATA SHEET
The Periodic Table of the Elements

		Group												
		I	II	III	IV	V	VI	VII	VIII	IX	X			
		1 H Hydrogen 1												
		9 Be Beryllium 4												
		23 Na Sodium 11												
		40 Ca Calcium 20												
		88 Sr Strontium 38												
		137 Ba Barium 56												
		226 Ra Radium 88												
		227 Ac Actinium 89												
		†												
		5 B Boron 5												
		11 Al Aluminium 13												
		13 Si Silicon 14												
		14 P Phosphorus 15												
		15 S Sulfur 16												
		16 Cl Chlorine 17												
		17 Ar Argon 18												
		19 K Potassium 19												
		20 Ca Calcium 20												
		21 Sc Scandium 21												
		22 Ti Titanium 22												
		23 V Vanadium 23												
		24 Cr Chromium 24												
		25 Mn Manganese 25												
		26 Fe Iron 26												
		27 Co Cobalt 27												
		28 Ni Nickel 28												
		29 Cu Copper 29												
		30 Zn Zinc 30												
		31 Ga Gallium 31												
		32 Ge Germanium 32												
		33 As Arsenic 33												
		34 Se Selenium 34												
		35 Br Bromine 35												
		36 Kr Krypton 36												
		37 Rb Rubidium 37												
		38 Sr Strontium 38												
		39 Y Yttrium 39												
		40 Zr Zirconium 40												
		41 Nb Niobium 41												
		42 Mo Molybdenum 42												
		43 Tc Technetium 43												
		44 Ru Ruthenium 44												
		45 Rh Rhodium 45												
		46 Pd Palladium 46												
		47 Ag Silver 47												
		48 Cd Cadmium 48												
		49 In Indium 49												
		50 Sn Tin 50												
		51 Sb Antimony 51												
		52 Te Tellurium 52												
		53 I Iodine 53												
		54 Xe Xenon 54												
		55 Cs Caesium 55												
		56 Ba Barium 56												
		57 La Lanthanum 57												
		72 Hf Hafnium 72												
		73 Ta Tantalum 73												
		74 W Tungsten 74												
		75 Re Rhenium 75												
		76 Os Osmium 76												
		77 Ir Iridium 77												
		78 Pt Platinum 78												
		79 Au Gold 79												
		80 Hg Mercury 80												
		81 Tl Thallium 81												
		82 Pb Lead 82												
		83 Bi Bismuth 83												
		84 Po Polonium 84												
		85 At Astatine 85												
		86 Rn Radon 86												
		87 Fr Francium 87												
		88 Ra Radium 88												
		89 Ac Actinium 89												
		†												
		90 Th Thorium 90												
		91 Pa Protactinium 91												
		92 U Uranium 92												
		93 Np Neptunium 93												
		94 Pu Plutonium 94												
		95 Am Americium 95												
		96 Cm Curium 96												
		97 Bk Berkelium 97												
		98 Cf Californium 98												
		99 Es Einsteinium 99												
		100 Fm Fermium 100												
		101 Md Mendelevium 101												
		102 No Nobelium 102												
		103 Lr Lawrencium 103												
		104 Rf Rutherfordium 104												
		105 Db Dubnium 105												
		106 Sg Seaborgium 106												
		107 Bh Bohrium 107												
		108 Hs Hassium 108												
		109 Mt Meitnerium 109												
		110 Ds Darmstadtium 110												
		111 Rg Roentgenium 111												
		112 Cn Copernicium 112												
		113 Nh Nihonium 113												
		114 Fl Flerovium 114												
		115 Mc Moscovium 115												
		116 Lv Livermorium 116												
		117 Ts Tennessine 117												
		118 Og Oganesson 118												
		119 Uue Ununennium 119												
		120 Uuo Unbinilium 120												
		121 Uuq Untrium 121												
		122 Uuq Unquadrium 122												
		123 Uup Unpentium 123												
		124 Uuq Unsextium 124												
		125 Uuq Unseptium 125												
		126 Uuq Unoctium 126												
		127 Uuq Unnennium 127												
		128 Uuq Undecium 128												
		129 Uuq Undecium 129												
		130 Uuq Untridecium 130												
		131 Uuq Unquadium 131												
		132 Uuq Unpentium 132												
		133 Uuq Unsexium 133												
		134 Uuq Unseptium 134												
		135 Uuq Unoctium 135												
		136 Uuq Unnennium 136												
		137 Uuq Undecium 137												
		138 Uuq Undecium 138												
		139 Uuq Untridecium 139												
		140 Ce Cerium 58												
		59 Pr Praseodymium 59												
		60 Nd Neodymium 60												
		61 Pm Promethium 61												
		62 Sm Samarium 62												
		63 Eu Europium 63												
		64 Gd Gadolinium 64												
		65 Tb Terbium 65												
		66 Dy Dysprosium 66												
		67 Ho Holmium 67												
		68 Er Erbium 68												
		69 Tm Thulium 69												
		70 Yb Ytterbium 70												
		71 Lu Lutetium 71												
		72 Hf Hafnium 72												
		73 Ta Tantalum 73												
		74 W Tungsten 74												
		75 Re Rhenium 75												
		76 Os Osmium 76												
		77 Ir Iridium 77												
		78 Pt Platinum 78												
		79 Au Gold 79												
		80 Hg Mercury 80												
		81 Tl Thallium 81												
		82 Pb Lead 82												
		83 Bi Bismuth 83												
		84 Po Polonium 84												
		85 At Astatine 85												
		86 Rn Radon 86												
		87 Fr Francium 87												
		88 Ra Radium 88												
		89 Ac Actinium 89												
		†												
		90 Th Thorium 90												
		91 Pa Protactinium 91												
		92 U Uranium 92												
		93 Np Neptunium 93												
		94 Pu Plutonium 94												
		95 Am Americium 95												
		96 Cm Curium 96												
		97 Bk Berkelium 97												
		98 Cf Californium 98												
		99 Es Einsteinium 99												
		100 Fm Fermium 100												
		101 Md Mendelevium 101												
		102 No Nobelium 102												
		103 Lr Lawrencium 103												
		104 Rf Rutherfordium 104												
		105 Db Dubnium 105												
		106 Sg Seaborgium 106												
		107 Bh Bohrium 107												