

**GENERAL CERTIFICATE OF SECONDARY EDUCATION  
TWENTY FIRST CENTURY SCIENCE  
ADDITIONAL SCIENCE A**

**A215/01**

Unit 1: Modules B4 C4 P4 (Foundation Tier)

Candidates answer on the Question Paper  
A calculator may be used for this paper

**OCR Supplied Materials:**  
None

**Other Materials Required:**

- Pencil
- Ruler (cm/mm)

**Monday 25 January 2010  
Afternoon**

**Duration: 40 minutes**



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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**MODIFIED LANGUAGE**

**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **42**.
- A list of physics equations is printed on page 2.
- The Periodic Table is printed on the back page.
- This document consists of **16** pages. Any blank pages are indicated.

## TWENTY FIRST CENTURY SCIENCE EQUATIONS

### Useful Relationships

#### Explaining Motion

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{change of momentum} = \text{resultant force} \times \text{time for which it acts}$$

$$\text{work done by a force} = \text{force} \times \text{distance moved by the force}$$

$$\text{change in energy} = \text{work done}$$

$$\text{change in GPE} = \text{weight} \times \text{vertical height difference}$$

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times [\text{velocity}]^2$$

#### Electric Circuits

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

$$\text{energy transferred} = \text{power} \times \text{time}$$

$$\text{power} = \text{potential difference} \times \text{current}$$

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

#### The Wave Model of Radiation

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

Answer **all** the questions.

1 Sue is a doctor.

At different times of the year, she treats patients for either heat stroke or hypothermia.

(a) Draw straight lines from each **symptom** to the correct **condition**.

Draw straight lines from each **treatment** to the correct **condition**.

symptom	condition	treatment
rapid pulse rate	hypothermia	wrap in wet towels
shivering		insulate the patient
slurred speech	heat stroke	keep the patient as still as possible
dry skin		use a fan

[4]

(b) (i) Sue takes the temperature of a patient suffering from **heat stroke**.

Put a **ring** around the temperature she is most likely to find.

34 °C

37 °C

40 °C

[1]

(ii) Sue takes the temperature of a patient suffering from **hypothermia**.

Put a **ring** around the temperature she is most likely to find.

34 °C

36 °C

38 °C

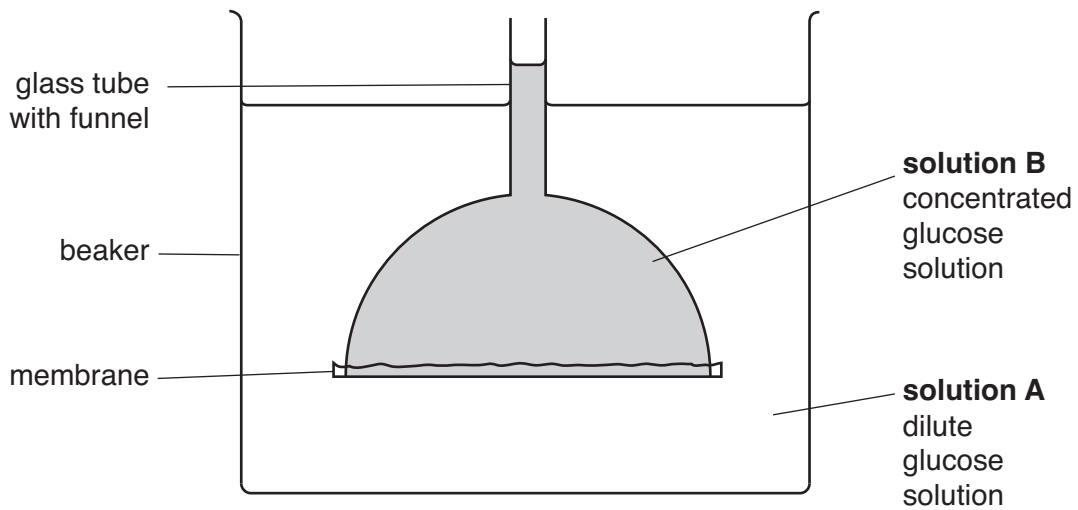
40 °C

42 °C

[1]

[Total: 6]

2 Barry sets up an experiment to investigate osmosis.



(a) What type of membrane should Barry use to investigate osmosis?

..... [1]

(b) Barry sees that the level in the tube goes up.

Put a tick (✓) in the box next to the correct reason.

only water moves from **solution A** to **solution B**

only glucose moves from **solution A** to **solution B**

both water and glucose move from **solution A** to **solution B**

[1]

(c) Barry repeats the experiment. He wants to change his experiment so that the level in the tube does not change.

What should he do?

Put a tick (✓) in the box next to the correct answer.

add more water to **solution A**

add more glucose to **solution A**

warm up **solution A**

[1]

[Total: 3]

- 3** Tina investigates the effect of temperature on enzymes. She uses the enzyme catalase to break down hydrogen peroxide. She collects the oxygen gas given off by the reaction. Here are some of her results.

temperature of catalase and hydrogen peroxide in °C	volume of gas collected in 1 minute in cm <sup>3</sup>
20	18
30	36
40	40
90	

- (a)** Suggest and explain how much gas will be produced at 90 °C.

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

- (b)** Tina tries to use a different enzyme to break down hydrogen peroxide.

Use the lock and key model to explain why this will not work.

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

[Total: 5]

4 Atoms are made up of protons, neutrons and electrons.

(a) The charge and the mass of protons, neutrons and electrons are not the same.

Draw straight lines to join each type of **particle** to its **charge**.

Draw straight lines to join each type of **particle** to its **relative mass**.

charge	particle	relative mass
0	proton	almost zero
-1	neutron	1
+1	electron	

[2]

(b) Many chemical changes involve ions.

Draw **one** line between the two boxes which **best** describe what an ion is.

A crystal lattice ...	... which has gained or lost electrons.
or	or
A group of atoms ...	... which has gained or lost protons.
or	or
An atom or a group of atoms ...	... which has gained or lost neutrons.
or	or
An atom ...	... which has moved from one group to another.

[2]

[Total: 4]

5 David's teacher does an experiment using sodium.

- (a) The sodium is stored in a bottle of oil.  
Why must it be stored in oil?

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

- (b) Sodium is in group 1 of the Periodic Table.  
Here is an outline of the Periodic Table.  
The cross (X) shows one of the group 1 metals.

Put crosses (X) in **two more** boxes that are group 1 metals.

X									

[1]

- (c) The teacher puts a small piece of sodium into a beaker of water.

State two things you would **see** happen in the beaker.

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

- (d) David watches a firework display. He suspects that a firework contains sodium compounds.  
What is the clue that makes him suspect this?

Put a tick (✓) in the box next to the **best** answer.

- The firework burns rapidly.
- The firework makes a strong smell.
- The firework produces grey smoke.
- The firework burns with a yellow flame.

[1]

[Total: 6]

6 Bromine is a toxic and corrosive liquid.

(a) Which two safety symbols should be on bottles of bromine?

Put a **ring** around each of the **two** correct labels.



[1]

(b) The symbol for a bromine molecule is Br<sub>2</sub>.

Which of these diagrams could be of a bromine molecule?

Put a **ring** around the correct answer.



[1]

(c) Bromine reacts with sodium to make sodium bromide.

Use the spaces to write a word equation for this reaction.



[1]

(d) Solid sodium bromide is ionic.

Draw **one** line between the boxes to describe what happens to the ions when solid sodium bromide dissolves in water.

Ions are in the solid at the start.

Ions then spread through the liquid.

or

or

Ions form when the solid dissolves.

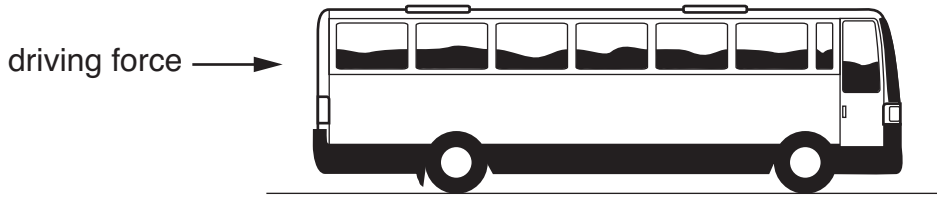
Ions then sink to the bottom of the liquid.

[1]

[Total: 4]



7 Joe drives a bus along a level road.



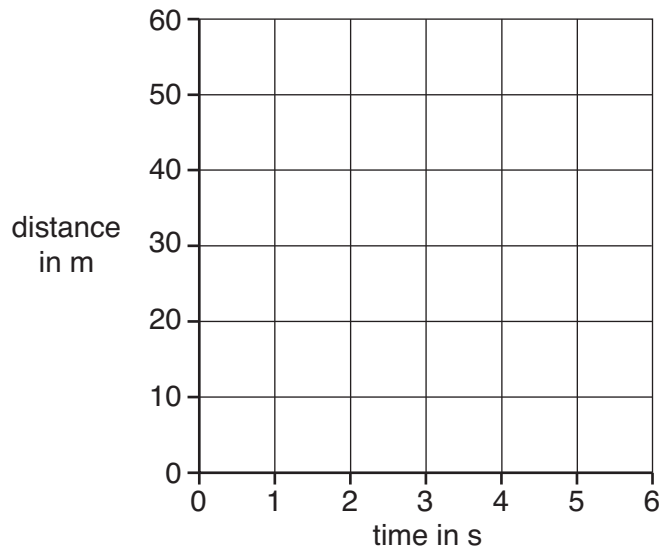
(a) A driving force acts forwards on the bus when it is moving at a steady speed.

Explain why the driving force does not increase the speed of the bus.

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

(b) On the axes below, sketch a **distance-time** graph for the bus as it travels at a steady speed of 15 m/s.

Start the graph at the point 0,0.



[2]

[Total: 4]

- 8 A small jet aircraft is speeding up along a runway.



- (a) The engines exert a force of 6000 N on the aircraft as it moves along the runway. Which calculation shows the change of momentum of the aircraft in 12 s?

Put a ring around the correct answer.

$$\frac{6000}{12}$$

$$6000 \times 12$$

$$\frac{12}{6000}$$

[1]

- (b) Put a ring around the correct choice in each sentence.

The jet engines increase the forward speed of the aircraft.

The engines do this by pushing gas **backwards** / **forwards**.

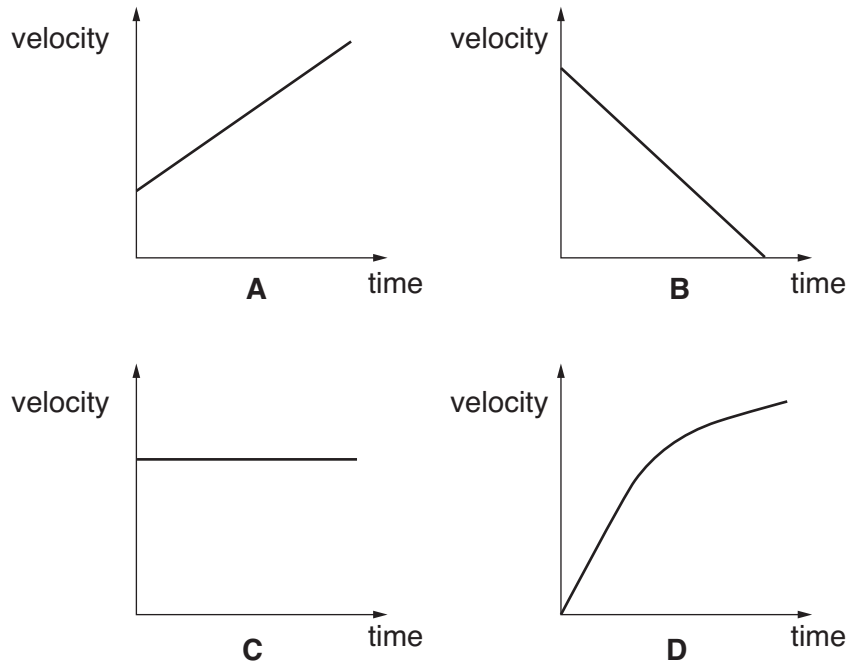
The force needed on the gas is in the **backwards** / **forwards** direction.

This results in a force on the engines in the **same** / **opposite** direction.

The force on the engines is **greater than** / **the same as** / **smaller than** the force on the gas.

[2]

(c) Which of these **velocity-time** graphs shows a steadily increasing velocity?



answer ..... [1]

(d) The aircraft takes off when it has a forward velocity of 48 m/s.

Put a tick (✓) in the box next to the correct meaning of the word **velocity**.

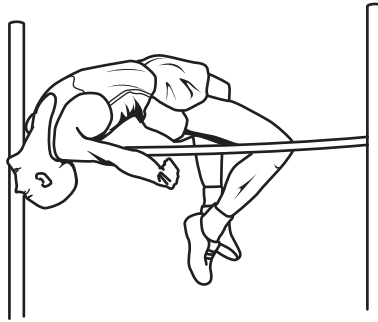
The velocity of an object is ...

- ... how fast its speed is changing.
- ... its speed and direction of motion.
- ... how fast its direction is changing.

[1]

[Total: 5]

9 Jim takes part in a high jump contest.



(a) Complete the sentences.

Choose words from this list.

**gravitational potential**

**kinetic**

**momentum**

**work**

Jim stands 10m away from the high jump.

He runs towards the high jump, gaining ..... energy.

He then jumps up to the bar, gaining ..... energy.

[2]

(b) Jim has a mass of 65 kg. His velocity is 10 m/s just before he jumps up.

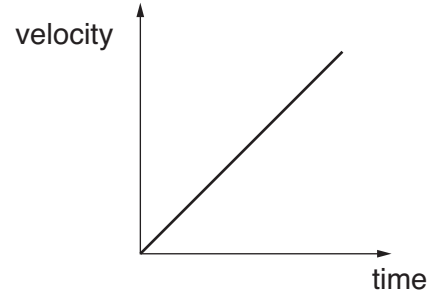
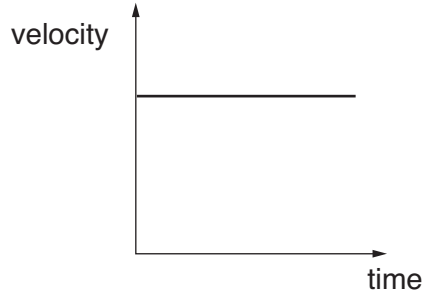
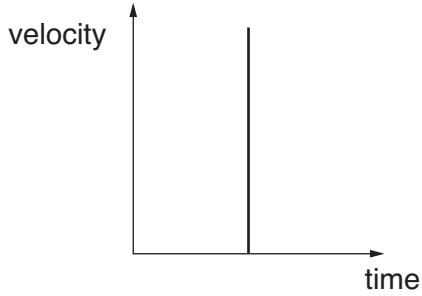
Who has the correct way of calculating his momentum?

 <p><b>Alan</b> <math>\frac{1}{2} \times 65 \times 10^2</math></p>	 <p><b>Bess</b> <math>65 \times 10 \times 10</math></p>
	
	
 <p><b>Carlos</b> <math>65 \times 10</math></p>	 <p><b>Davina</b> <math>\frac{1}{2} \times 65 \times 10</math></p>

answer ..... [1]

(c) Jim clears the bar and falls back to the ground.

Put a (ring) around the correct **velocity-time** graph for Jim as he falls vertically to the ground.



[1]

(d) Jim stops moving when he lands.

Put a tick (✓) in the box next to the correct statement.

His kinetic energy is lost through heating.

He gains momentum through friction.

He loses weight through reaction.

[1]

[Total: 5]

**END OF QUESTION PAPER**

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# The Periodic Table of the Elements

	1	2	3	4	5	6	7	0																																																								
	7 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4	11 <b>Na</b> sodium 11	12 <b>C</b> carbon 6	13 <b>Al</b> aluminium 13	14 <b>N</b> nitrogen 7	15 <b>O</b> oxygen 8	16 <b>F</b> fluorine 9	17 <b>Ne</b> neon 10																																																							
	19 <b>K</b> potassium 19	20 <b>Ca</b> calcium 20	21 <b>Sc</b> scandium 21	22 <b>Ti</b> titanium 22	23 <b>V</b> vanadium 23	24 <b>Cr</b> chromium 24	25 <b>Mn</b> manganese 25	26 <b>Fe</b> iron 26	27 <b>Co</b> cobalt 27	28 <b>Ni</b> nickel 28	29 <b>Cu</b> copper 29	30 <b>Zn</b> zinc 30	31 <b>Ga</b> gallium 31	32 <b>Ge</b> germanium 32	33 <b>As</b> arsenic 33	34 <b>Se</b> selenium 34	35 <b>Br</b> bromine 35	36 <b>Kr</b> krypton 36																																														
	37 <b>Rb</b> rubidium 37	38 <b>Sr</b> strontium 38	39 <b>Y</b> yttrium 39	40 <b>Zr</b> zirconium 40	41 <b>Nb</b> niobium 41	42 <b>Mo</b> molybdenum 42	43 <b>Tc</b> technetium [98]	44 <b>Ru</b> ruthenium 44	45 <b>Rh</b> rhodium 45	46 <b>Pd</b> palladium 46	47 <b>Ag</b> silver 47	48 <b>Cd</b> cadmium 48	49 <b>In</b> indium 49	50 <b>Sn</b> tin 50	51 <b>Sb</b> antimony 51	52 <b>Te</b> tellurium 52	53 <b>I</b> iodine 53	54 <b>Xe</b> xenon 54																																														
	87 <b>Fr</b> francium 87	88 <b>Ra</b> radium 88	89 <b>Ac*</b> actinium 89	90 <b>Th</b> thorium 90	91 <b>Pa</b> protactinium 91	92 <b>U</b> uranium 92	93 <b>Np</b> neptunium 93	94 <b>Pu</b> plutonium 94	95 <b>Am</b> americium 95	96 <b>Cm</b> curium 96	97 <b>Bk</b> berkelium 97	98 <b>Cf</b> californium 98	99 <b>Es</b> einsteinium 99	100 <b>Fm</b> fermium 100	101 <b>Mendelevium</b> 101	102 <b>Nobelium</b> 102	103 <b>Lr</b> lawrencium 103	104 <b>Rf</b> rutherfordium 104	105 <b>Db</b> dubnium 105	106 <b>Sg</b> seaborgium 106	107 <b>Bh</b> bohrium 107	108 <b>Hs</b> hassium 108	109 <b>Mt</b> meitnerium 109	110 <b>Ds</b> darmstadtium 110	111 <b>Rg</b> roentgenium 111	112 <b>Cn</b> copernicium 112	113 <b>Nh</b> nihonium 113	114 <b>Fl</b> flerovium 114	115 <b>Mc</b> moscovium 115	116 <b>Lv</b> livermorium 116	117 <b>Ts</b> tennessine 117	118 <b>Og</b> oganeson 118																																
	133 <b>Cs</b> caesium 55	137 <b>Ba</b> barium 56	138 <b>La*</b> lanthanum 57	139 <b>Ce</b> cerium 58	140 <b>Pr</b> praseodymium 59	141 <b>Nd</b> neodymium 60	142 <b>Pm</b> promethium 61	143 <b>Sm</b> samarium 62	144 <b>Eu</b> europium 63	145 <b>Gd</b> gadolinium 64	146 <b>Tb</b> terbium 65	147 <b>Dy</b> dysprosium 66	148 <b>Ho</b> holmium 67	149 <b>Er</b> erbium 68	150 <b>Tm</b> thulium 69	151 <b>Yb</b> ytterbium 70	152 <b>Lu</b> lutetium 71	153 <b>Hf</b> hafnium 72	154 <b>Ta</b> tantalum 73	155 <b>W</b> tungsten 74	156 <b>Re</b> rhenium 75	157 <b>Os</b> osmium 76	158 <b>Ir</b> iridium 77	159 <b>Pt</b> platinum 78	160 <b>Au</b> gold 79	161 <b>Hg</b> mercury 80	162 <b>Tl</b> thallium 81	163 <b>Pb</b> lead 82	164 <b>Bi</b> bismuth 83	165 <b>Po</b> polonium 84	166 <b>At</b> astatine 85	167 <b>Rn</b> radon 86	168 <b>Fr</b> francium 87	169 <b>Ra</b> radium 88	170 <b>Ac*</b> actinium 89	171 <b>Th</b> thorium 90	172 <b>Pa</b> protactinium 91	173 <b>U</b> uranium 92	174 <b>Np</b> neptunium 93	175 <b>Pu</b> plutonium 94	176 <b>Am</b> americium 95	177 <b>Cm</b> curium 96	178 <b>Bk</b> berkelium 97	179 <b>Cf</b> californium 98	180 <b>Es</b> einsteinium 99	181 <b>Fm</b> fermium 100	182 <b>Mendelevium</b> 101	183 <b>Nobelium</b> 102	184 <b>Lr</b> lawrencium 103	185 <b>Rf</b> rutherfordium 104	186 <b>Db</b> dubnium 105	187 <b>Sg</b> seaborgium 106	188 <b>Bh</b> bohrium 107	189 <b>Hs</b> hassium 108	190 <b>Mt</b> meitnerium 109	191 <b>Ds</b> darmstadtium 110	192 <b>Rg</b> roentgenium 111	193 <b>Cn</b> copernicium 112	194 <b>Nh</b> nihonium 113	195 <b>Fl</b> flerovium 114	196 <b>Mc</b> moscovium 115	197 <b>Lv</b> livermorium 116	198 <b>Ts</b> tennessine 117	199 <b>Og</b> oganeson 118
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	417 <b>Fr</b> francium 87	418 <b>Ra</b> radium 88	419 <b>Ac*</b> actinium 89	420 <b>Th</b> thorium 90	421 <b>Pa</b> protactinium 91	422 <b>U</b> uranium 92	423 <b>Np</b> neptunium 93	426 <b>Pu</b> plutonium 94	430 <b>Am</b> americium 95	432 <b>Cm</b> curium 96	436 <b>Bk</b> berkelium 97	438 <b>Cf</b> californium 98	442 <b>Es</b> einsteinium 99	443 <b>Fm</b> fermium 100	444 <b>Mendelevium</b> 101	447 <b>Nobelium</b> 102	450 <b>Lr</b> lawrencium 103	451 <b>Rf</b> rutherfordium 104	452 <b>Db</b> dubnium 105	453 <b>Sg</b> seaborgium 106	454 <b>Bh</b> bohrium 107	455 <b>Hs</b> hassium 108	456 <b>Mt</b> meitnerium 109	457 <b>Ds</b> darmstadtium 110	458 <b>Rg</b> roentgenium 111	459 <b>Cn</b> copernicium 112	460 <b>Nh</b> nihonium 113	461 <b>Fl</b> flerovium 114	462 <b>Mc</b> moscovium 115	463 <b>Lv</b> livermorium 116	464 <b>Ts</b> tennessine 117	465 <b>Og</b> oganeson 118																																
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	565 <b>Fr</b> francium 87	566 <b>Ra</b> radium 88	567 <b>Ac*</b> actinium 89	568 <b>Th</b> thorium 90	569 <b>Pa</b> protactinium 91	570 <b>U</b> uranium 92	571 <b>Np</b> neptunium 93	572 <b>Pu</b> plutonium 94	576 <b>Am</b> americium 95	578 <b>Cm</b> curium 96	582 <b>Bk</b> berkelium 97	584 <b>Cf</b> californium 98	588 <b>Es</b> einsteinium 99	589 <b>Fm</b> fermium 100	590 <b>Mendelevium</b> 101	593 <b>Nobelium</b> 102	596 <b>Lr</b> lawrencium 103	597 <b>Rf</b> rutherfordium 104	598 <b>Db</b> dubnium 105	599 <b>Sg</b> seaborgium 106	600 <b>Bh</b> bohrium 107	601 <b>Hs</b> hassium 108	602 <b>Mt</b> meitnerium 109	603 <b>Ds</b> darmstadtium 110	604 <b>Rg</b> roentgenium 111	605 <b>Cn</b> copernicium 112	606 <b>Nh</b> nihonium 113	607 <b>Fl</b> flerovium 114	608 <b>Mc</b> moscovium 115	609 <b>Lv</b> livermorium 116	610 <b>Ts</b> tennessine 117	611 <b>Og</b> oganeson 118																																
	641 <b>Fr</b> francium 87	642 <b>Ra</b> radium 88	643 <b>Ac*</b> actinium 89	644 <b>Th</b> thorium 90	645 <b>Pa</b> protactinium 91	646 <b>U</b> uranium 92	647 <b>Np</b> neptunium 93	648 <b>Pu</b> plutonium 94	652 <b>Am</b> americium 95	654 <b>Cm</b> curium 96	658 <b>Bk</b> berkelium 97	660 <b>Cf</b> californium 98	664 <b>Es</b> einsteinium 99	665 <b>Fm</b> fermium 100	666 <b>Mendelevium</b> 101	669 <b>Nobelium</b> 102	672 <b>Lr</b> lawrencium 103	673 <b>Rf</b> rutherfordium 104	674 <b>Db</b> dubnium 105	675 <b>Sg</b> seaborgium 106	676 <b>Bh</b> bohrium 107	677 <b>Hs</b> hassium 108	678 <b>Mt</b> meitnerium 109	679 <b>Ds</b> darmstadtium 110	680 <b>Rg</b> roentgenium 111	681 <b>Cn</b> copernicium 112	682 <b>Nh</b> nihonium 113	683 <b>Fl</b> flerovium 114	684 <b>Mc</b> moscovium 115	685 <b>Lv</b> livermorium 116	686 <b>Ts</b> tennessine 117	687 <b>Og</b> oganeson 118																																
	717 <b>Fr</b> francium 87	718 <b>Ra</b> radium 88	719 <b>Ac*</b> actinium 89	720 <b>Th</b> thorium 90	721 <b>Pa</b> protactinium 91	722 <b>U</b> uranium 92	723 <b>Np</b> neptunium 93	724 <b>Pu</b> plutonium 94	728 <b>Am</b> americium 95	730 <b>Cm</b> curium 96	734 <b>Bk</b> berkelium 97	736 <b>Cf</b> californium 98	740 <b>Es</b> einsteinium 99	741 <b>Fm</b> fermium 100	742 <b>Mendelevium</b> 101	745 <b>Nobelium</b> 102	748 <b>Lr</b> lawrencium 103	749 <b>Rf</b> rutherfordium 104	750 <b>Db</b> dubnium 105	751 <b>Sg</b> seaborgium 106	752 <b>Bh</b> bohrium 107	753 <b>Hs</b> hassium 108	754 <b>Mt</b> meitnerium 109	755 <b>Ds</b> darmstadtium 110	756 <b>Rg</b> roentgenium 111	757 <b>Cn</b> copernicium 112	758 <b>Nh</b> nihonium 113	759 <b>Fl</b> flerovium 114	760 <b>Mc</b> moscovium 115	761 <b>Lv</b> livermorium 116	762 <b>Ts</b> tennessine 117	763 <b>Og</b> oganeson 118																																
	797 <b>Fr</b> francium 87	798 <b>Ra</b> radium 88	799 <b>Ac*</b> actinium 89	800 <b>Th</b> thorium 90	801 <b>Pa</b> protactinium 91	802 <b>U</b> uranium 92	803 <b>Np</b> neptunium 93	804 <b>Pu</b> plutonium 94	808 <b>Am</b> americium 95	810 <b>Cm</b> curium 96	814 <b>Bk</b> berkelium 97	816 <b>Cf</b> californium 98	820 <b>Es</b> einsteinium 99	821 <b>Fm</b> fermium 100	822 <b>Mendelevium</b> 101	825 <b>Nobelium</b> 102	828 <b>Lr</b> lawrencium 103	829 <b>Rf</b> rutherfordium 104	830 <b>Db</b> dubnium 105	831 <b>Sg</b> seaborgium 106	832 <b>Bh</b> bohrium 107	833 <b>Hs</b> hassium 108	834 <b>Mt</b> meitnerium 109	835 <b>Ds</b> darmstadtium 110	836 <b>Rg</b> roentgenium 111	837 <b>Cn</b> copernicium 112	838 <b>Nh</b> nihonium 113	839 <b>Fl</b> flerovium 114	840 <b>Mc</b> moscovium 115	841 <b>Lv</b> livermorium 116	842 <b>Ts</b> tennessine 117	843 <b>Og</b> oganeson 118																																
	877 <b>Fr</b> francium 87	878 <b>Ra</b> radium 88	879 <b>Ac*</b> actinium 89	880 <b>Th</b> thorium 90	881 <b>Pa</b> protactinium 91	882 <b>U</b> uranium 92	883 <b>Np</b> neptunium 93	884 <b>Pu</b> plutonium 94	888 <b>Am</b> americium 95	890 <b>Cm</b> curium 96	894 <b>Bk</b> berkelium 97	896 <b>Cf</b> californium 98	900 <b>Es</b> einsteinium 99	901 <b>Fm</b> fermium 100	902 <b>Mendelevium</b> 101	905 <b>Nobelium</b> 102	908 <b>Lr</b> lawrencium 103	909 <b>Rf</b> rutherfordium 104	910 <b>Db</b> dubnium 105	911 <b>Sg</b> seaborgium 106	912 <b>Bh</b> bohrium 107	913 <b>Hs</b> hassium 108	914 <b>Mt</b> meitnerium 109	915 <b>Ds</b> darmstadtium 110	916 <b>Rg</b> roentgenium 111	917 <b>Cn</b> copernicium 112	918 <b>Nh</b> nihonium 113	919 <b>Fl</b> flerovium 114	920 <b>Mc</b> moscovium 115	921 <b>Lv</b> livermorium 116	922 <b>Ts</b> tennessine 117	923 <b>Og</b> oganeson 118																																