

**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  
Calculators may be used for this paper

**OCR Supplied Materials:**  
None

**Other Materials Required:**

- Pencil
- Ruler (cm/mm)

**Wednesday 26 May 2010  
Morning**

**Duration: 40 minutes**



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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**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. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).

**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 **20** pages. Any blank pages are indicated.

## TWENTY FIRST CENTURY SCIENCE EQUATIONS

### Useful Relationships

#### Explaining Motion

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

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

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

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

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

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

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

#### Electric Circuits

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

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

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

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

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

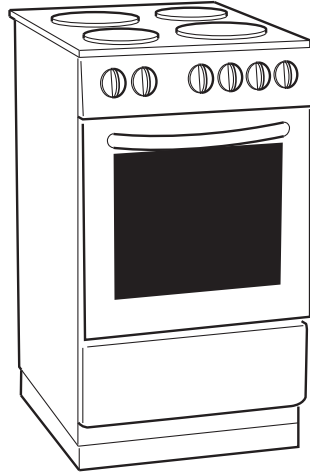
#### The Wave Model of Radiation

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

Answer **all** the questions.

1 Petra roasts a chicken in the oven.

The oven contains a control system that keeps it at 180 °C.



(a) Petra’s body has a control system that keeps it at 37 °C.

Draw a straight line to match each **part** of a control system with its **function**.

<b>part</b>	<b>function</b>
effector	detects stimuli
receptor	produces the responses
processing centre	receives information and coordinates the responses

[2]

(b) While working in the kitchen, Petra becomes too hot.

Describe one way her temperature control system cools her down.

.....

.....

..... [2]

[Total: 4]

2 Billy breathes air into his lungs.

Oxygen moves from the air into his red blood cells.

(a) How does the oxygen move into his red blood cells?

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

**active transport**

**diffusion**

**homeostasis**

**osmosis**

[1]

(b) Each sentence below has three options to link the beginning and the end of the sentence.

For each sentence put a **ring** around the correct phrase.

The air Billy breathes in contains ...

**less oxygen than**

**the same amount of oxygen as**

**more oxygen than**

... the air he breathes out.

The blood going into Billy's lungs contains ...

**less oxygen than**

**the same amount of oxygen as**

**more oxygen than**

... the blood leaving his lungs.

The air Billy breathes out contains more ...

**nitrogen**

**carbon dioxide**

**urea**

... than the air he breathes in.

[2]

(c) Billy breathes air in through his nose.

This warms the air.

This helps to keep Billy's body at a constant temperature.

Why is it important for Billy's body to have a constant temperature?

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

Molecules need energy to collide with proteins.

Chemical reactions go better when the temperature is high.

Enzymes need a specific temperature to work at their best.

Cells change shape at low temperatures.

[1]

[Total: 4]

3 Carl runs a race on a hot day.

He sweats a lot.

(a) What happens to the concentration of his blood plasma during the race?

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

**becomes more dilute                      stays the same                      becomes more concentrated**

[1]

(b) Carl's kidneys filter sugar, urea, salt and water from his blood.

Some of the water is reabsorbed.

How much of other substances is reabsorbed?

Write about

- sugar
- urea
- salt.

.....

.....

.....

.....

.....

.....

.....

[3]

(c) Some drugs would change the volume and concentration of Carl's urine.

Put a **(ring)** around the correct words to complete each sentence.

Alcohol results in a **greater / smaller** volume of **more / less** dilute urine.

Ecstasy results in a **greater / smaller** volume of **more / less** dilute urine.

[2]

[Total: 6]

**7**  
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4 Some watch batteries contain lithium atoms.

(a) The symbol for lithium is Li.

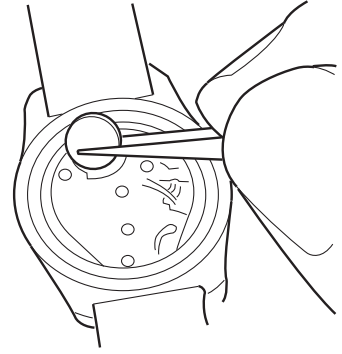
Lithium is element number 3.

Find lithium in the Periodic Table.

(i) Which group is lithium in?

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

1      2      3      4      5      6      7      8



[1]

(ii) Complete the table for the structure of a lithium atom.

relative atomic mass	
number of electrons	
number of protons	

[2]

(iii) Some students suggest why each element is where it is in the Periodic Table.

Who gives the correct answer?

**Alex**  
The elements are arranged alphabetically.



**Brenda**  
The elements are arranged in order of number of protons.



**Daisy**  
The most reactive elements come first.



**Charles**  
The elements are arranged in order of the date they were discovered.



answer ..... [1]



(b) The lithium atoms in the battery give off electrons.



How many electrons does a lithium atom give off when it reacts?

answer ..... [1]

(c) Lithium batteries should not be cut open.

This is because lithium reacts with water.

Put ticks (✓) in the boxes next to the **two** products of this reaction.

reaction with water	first product		second product
	lithium oxide	<input type="checkbox"/>	oxygen <input type="checkbox"/>
	<b>or</b>		<b>or</b>
lithium + water →	lithium chloride	<input type="checkbox"/>	+ hydrogen <input type="checkbox"/>
	<b>or</b>		<b>or</b>
	lithium hydroxide	<input type="checkbox"/>	carbon dioxide <input type="checkbox"/>

[2]

(d) Brenda's teacher drops a small piece of lithium into a beaker of water.

Tick (✓) one box in each column to describe what happens to the lithium.

The first one has been done for you.

**tick one from  
this column**

it floats	✓
it sinks	
it sinks to the bottom then rises	

**tick one from  
this column**

no movement at all	
some movement	
violent movement	

**tick one from  
this column**

it gets smaller	
it stays the same size	
it gets larger	

**tick one from  
this column**

no visible reaction	
it produces bubbles	
it catches fire	

[2]

[Total: 9]

5 Chlorine gas is added to water to make the water safe to drink.

(a) How does this make the water safe?

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

(b) Chlorine is a very poisonous gas.

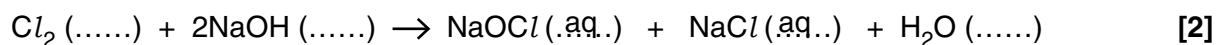
Suggest the most important safety precaution for people working with chlorine gas.

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

(c) Chlorine gas reacts with sodium hydroxide solution.

Write state symbols, s, l, g, aq, to complete the equation for this reaction.

Some have been done for you.



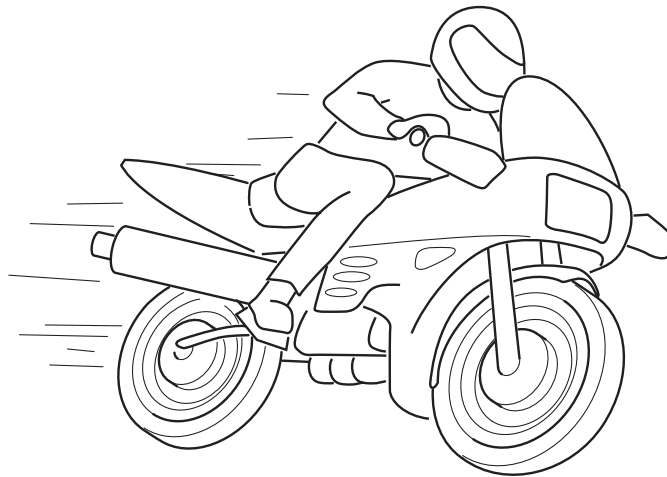
(d) Sodium will react with chlorine. The reaction makes sodium chloride.

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

..... [1]

[Total: 5]

6 Sylvia tries out her motorbike on a race track.



She gets to her top speed from a standing start in a distance of 200 m.

To do this, her motorbike has to exert a constant horizontal force of 600 N.

Sylvia and her motorbike weigh 1500 N.

(a) Calculate the work done on her motorbike as it travels 200 m.

work done = ..... J [2]

(b) Work done on a motorbike increases its kinetic energy.

The work done on Sylvia's motorbike is more than its final kinetic energy.

Write about

- why the work done is more than the kinetic energy
- what happens to the missing energy.

.....

.....

.....

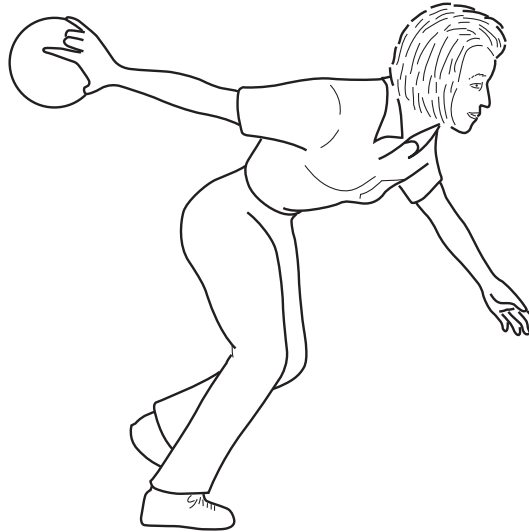
..... [2]

[Total: 4]

13  
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7 Mel goes bowling.



(a) Mel stands on one foot to deliver the ball.

Two forces act **on** her foot **from** the floor.

Complete the sentences. Choose from this list.

**friction**

**mass**

**reaction**

The horizontal force is called .....

The vertical force is called .....

[2]

(b) Mel exerts a force of 40 N on the ball for 0.5 seconds.

Put a **ring** around the correct calculation of the momentum she gives the ball.

$$\frac{40}{0.5}$$

$$40 \times 0.5$$

$$\frac{0.5}{40}$$

[1]

(c) The 10kg ball leaves her hand with a speed of 2 m/s and rolls along the lane at a steady speed.

(i) Here are some statements about the ball as it rolls along the lane at a steady speed.

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

The weight of the ball decreases as it rolls along the track.

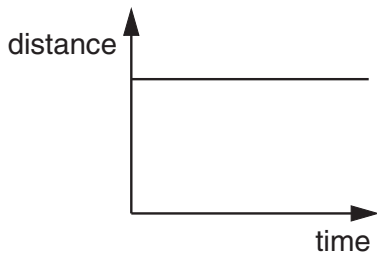
The ball's momentum increases as it moves along the track.

The ball travels a distance of 1.0 metres in every 0.5 second.

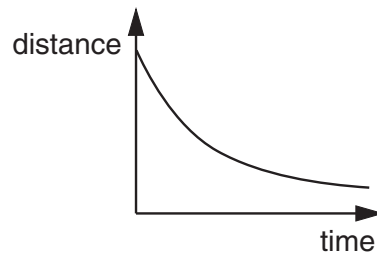
The velocity of the ball increases as it moves along the track.

[1]

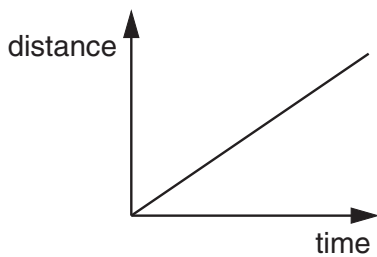
(ii) Which of these distance-time graphs shows the ball moving at a steady speed?



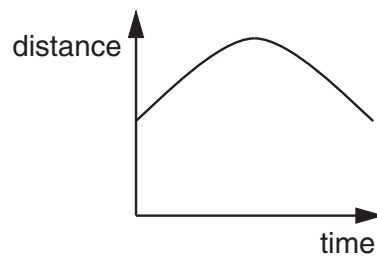
A



B



C

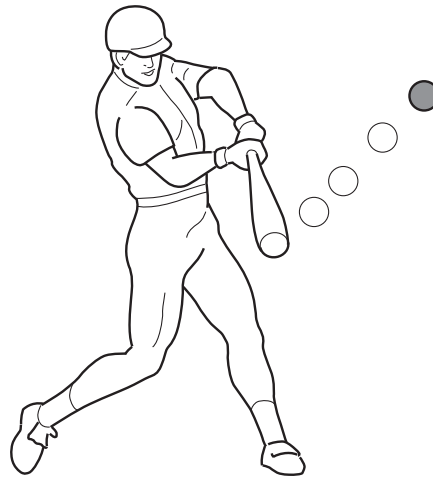


D

answer ..... [1]

[Total: 5]

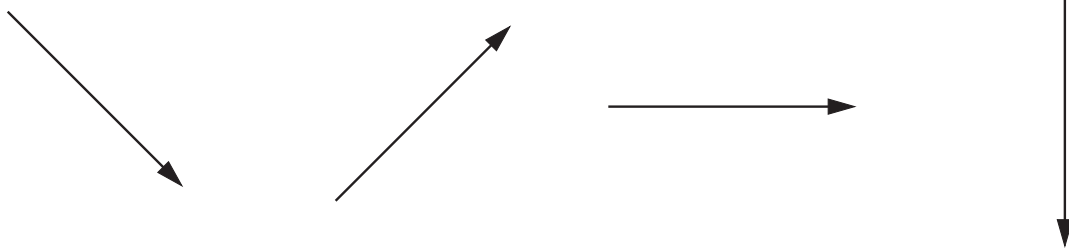
8 Matt hits a ball with his bat.



(a) The ball **rises** into the air away from Matt when it is struck by the bat.

Which of these arrows shows the direction of the force of the bat on the ball?

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



[1]

(b) Put a **ring** around the correct phrase to complete each sentence.

The force of the bat on the ball is ...

**greater than**

**smaller than**

**the same as**

... the force of the ball on the bat.

The force of the bat on the ball acts ...

**in a direction at right angles to**

**in the same direction as**

**in the opposite direction to**

... the force of the ball on the bat.

[2]



(c) Correctly complete the sentences.

Choose words from this list.

**gravitational potential**

**kinetic**

**light**

**weight**

The ball rises into the air, gaining ..... energy.

As it rises, the ball loses ..... energy. [2]

[Total: 5]

**END OF QUESTION PAPER**

**18**  
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# The Periodic Table of the Elements

	1	2	3	4	5	6	7	0	
			1 H hydrogen 1					4 He helium 2	
	7 Li lithium 3	9 Be beryllium 4	Key relative atomic mass atomic symbol name atomic (proton) number					19 F fluorine 9	20 Ne neon 10
	23 Na sodium 11	24 Mg magnesium 12	11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	35.5 Cl chlorine 17	40 Ar argon 18	
	39 K potassium 19	40 Ca calcium 20	27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	79 Br bromine 35	84 Kr krypton 36	
	85 Rb rubidium 37	88 Sr strontium 38	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	127 I iodine 53	131 Xe xenon 54	
	133 Cs caesium 55	137 Ba barium 56	65 Zn zinc 30	63.5 Cu copper 29	112 Cd cadmium 48	119 Sn tin 50	128 Te tellurium 52	[222] Rn radon 86	
	[223] Fr francium 87	[226] Ra radium 88	59 Co cobalt 27	59 Ni nickel 28	103 Rh rhodium 45	106 Pd palladium 46	[209] Po polonium 84	[210] At astatine 85	
			56 Fe iron 26	59 Co cobalt 27	101 Ru ruthenium 44	106 Pd palladium 46	[207] Pb lead 82	[209] Po polonium 84	
			55 Mn manganese 25	59 Ni nickel 28	190 Os osmium 76	195 Pt platinum 78	204 Tl thallium 81	[209] Po polonium 84	
			52 Cr chromium 24	59 Ni nickel 28	192 Ir iridium 77	195 Pt platinum 78	209 Bi bismuth 83	[210] At astatine 85	
			51 V vanadium 23	59 Ni nickel 28	192 Ir iridium 77	195 Pt platinum 78	209 Bi bismuth 83	[210] At astatine 85	
			48 Ti titanium 22	59 Ni nickel 28	192 Ir iridium 77	195 Pt platinum 78	209 Bi bismuth 83	[210] At astatine 85	
			45 Sc scandium 21	59 Ni nickel 28	192 Ir iridium 77	195 Pt platinum 78	209 Bi bismuth 83	[210] At astatine 85	
			89 Y yttrium 39	59 Ni nickel 28	192 Ir iridium 77	195 Pt platinum 78	209 Bi bismuth 83	[210] At astatine 85	
			178 Hf hafnium 72	59 Ni nickel 28	192 Ir iridium 77	195 Pt platinum 78	209 Bi bismuth 83	[210] At astatine 85	
			[227] Ac* actinium 89	59 Ni nickel 28	192 Ir iridium 77	195 Pt platinum 78	209 Bi bismuth 83	[210] At astatine 85	
			[261] Rf rutherfordium 104	59 Ni nickel 28	192 Ir iridium 77	195 Pt platinum 78	209 Bi bismuth 83	[210] At astatine 85	
			[262] Db dubnium 105	59 Ni nickel 28	192 Ir iridium 77	195 Pt platinum 78	209 Bi bismuth 83	[210] At astatine 85	
			[264] Bh bohrium 107	59 Ni nickel 28	192 Ir iridium 77	195 Pt platinum 78	209 Bi bismuth 83	[210] At astatine 85	
			[266] Sg seaborgium 106	59 Ni nickel 28	192 Ir iridium 77	195 Pt platinum 78	209 Bi bismuth 83	[210] At astatine 85	
			[277] Hs hassium 108	59 Ni nickel 28	192 Ir iridium 77	195 Pt platinum 78	209 Bi bismuth 83	[210] At astatine 85	
			[268] Mt meitnerium 109	59 Ni nickel 28	192 Ir iridium 77	195 Pt platinum 78	209 Bi bismuth 83	[210] At astatine 85	
			[271] Ds darmstadtium 110	59 Ni nickel 28	192 Ir iridium 77	195 Pt platinum 78	209 Bi bismuth 83	[210] At astatine 85	
			[272] Rg roentgenium 111	59 Ni nickel 28	192 Ir iridium 77	195 Pt platinum 78	209 Bi bismuth 83	[210] At astatine 85	
			Elements with atomic numbers 112-116 have been reported but not fully authenticated						[222] Rn radon 86

\* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.