

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

A215/02

Unit 1: Modules B4 C4 P4 (Higher Tier)

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

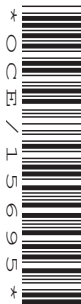
OCR Supplied Materials:
None

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**

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

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

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

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

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

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

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

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

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

3

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Question 1 starts on page 4

PLEASE DO NOT WRITE ON THIS PAGE

4

Answer **all** the questions.

- 1 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]

5

(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]

2 Carl runs in a race.

His muscle cells take in oxygen and glucose from the blood.

(a) Oxygen only enters muscle cells by diffusion.

Glucose enters by either diffusion or active transport.

Explain the difference between diffusion and active transport.

Use ideas about **concentration and energy** in your answer.

.....

.....

.....

..... [3]

7

- (b) After the race Carl notices that he produces a small volume of concentrated urine.

The concentration of urine is controlled by the hormone ADH.

- (i) Which gland releases ADH into the bloodstream?

Put a ring around the correct answer.

adrenal

pancreas

pituitary

thyroid

[1]

- (ii) Alcohol and Ecstasy are drugs that affect the production of ADH.

Draw straight lines to join each **drug** to the correct **effect on ADH production**.

Draw straight lines to join each **effect on ADH production** to the correct **effects on the urine** produced.

drug	effect on ADH production	effects on the urine
alcohol	increased ADH production	greater volume and less dilute
		greater volume and more dilute
Ecstasy	decreased ADH production	smaller volume and less dilute
		smaller volume and more dilute

[3]

[Total: 7]

8

- 3** Sheila works in a bakery where it is very hot.

Her body's temperature control system detects that her blood temperature is rising.

- (a)** Where in her body are the receptors for this system?

..... [1]

- (b)** Explain how vasodilation can help reduce her temperature.

.....

.....

..... [2]

[Total: 3]

4 This question is about the element lithium.

(a) Some students suggest why lithium is where it is in the Periodic Table.

Who gives the **best** answer?

Alex The elements are arranged in groups.		Brenda The elements are arranged in order of number of protons.
Daisy The elements are arranged in order of mass.		Charles The elements are arranged in order of number of neutrons.

answer [1]

(b) Watch batteries often use lithium metal as one of the electrodes.

The lithium atoms in the battery give off electrons.

(i) How many electrons does each atom of lithium give off when it reacts?

answer [1]

(ii) The inside of the lithium battery contains **compounds in a liquid** that conduct electricity.

Explain how these compounds conduct electricity.

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

10

(c) Lithium batteries should not be cut open.

This is because lithium reacts with water.

(i) 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	tick one from this column	tick one from this column	tick one from this column
it floats	✓	no movement at all	
it sinks		some movement	
it sinks to the bottom then rises		violent movement	
		it gets smaller	
		it stays the same size	
		it gets larger	
		no visible reaction	
		it produces bubbles	
		it catches fire	

[2]

(ii) Write a **word** equation for the reaction between lithium and water.

..... [1]

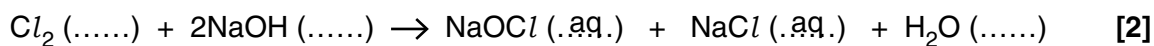
[Total: 8]

5 Chlorine gas is highly reactive.

(a) Chlorine gas reacts with sodium hydroxide solution.

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

Some have been done for you.



(ii) NaOCl is ionic. What is the charge on the OCl ion?

Put a (ring) around the correct answer.

OCl^{2+} OCl^{+} OCl^{-} OCl^{2-} [1]

(b) (i) Chlorine gas, Cl_2 , will also react with sodium.

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

..... [2]

(ii) Chlorine is a gas.

Bromine and iodine can easily be turned into gases.

Put one tick (✓) in each table to show how well these gases might react with sodium.

chlorine

highly reactive	
reactive	
less reactive	
unreactive	

bromine

highly reactive	
reactive	
less reactive	
unreactive	

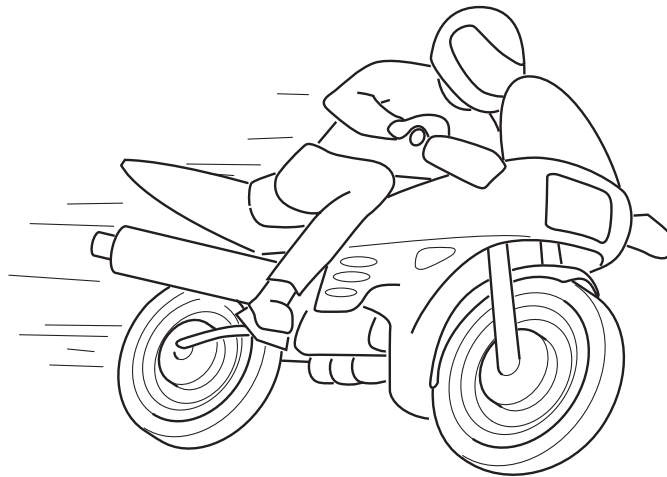
iodine

highly reactive	
reactive	
less reactive	
unreactive	

[1]

[Total: 6]

- 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.

.....

.....

.....

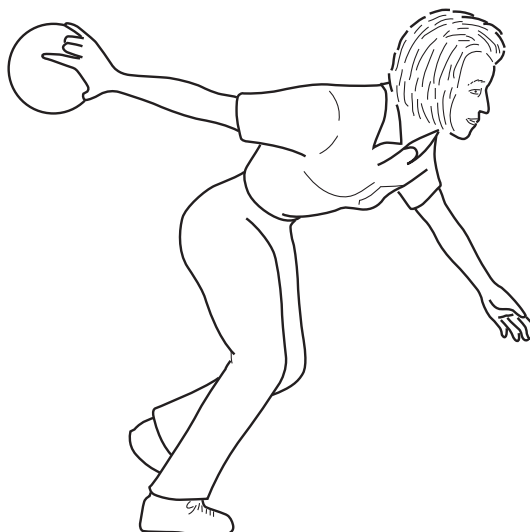
..... [2]

[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.

Put rings around the **two** forces.

friction

mass

momentum

reaction

velocity

weight

[2]

(b) Mel gives the ball 20 kg m/s of momentum in a time of 0.5 seconds.

Put a ring around the average force she exerts on the ball.

0.025 N

10 N

20 N

40 N

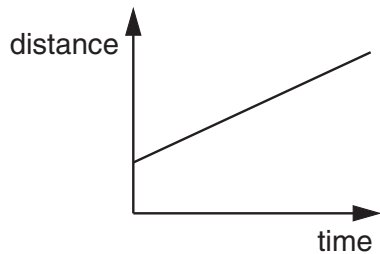
[1]

15

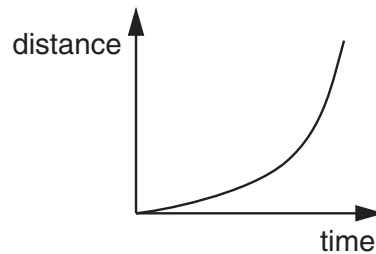
- (c) The ball leaves her hand and rolls along the lane.

The ball slows down gradually as it moves along the lane.

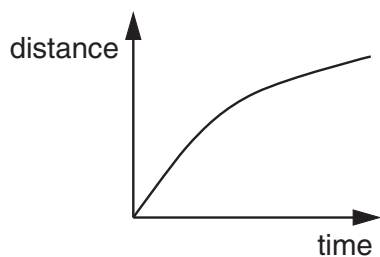
- (i) Which of these distance-time graphs shows the ball slowing down?



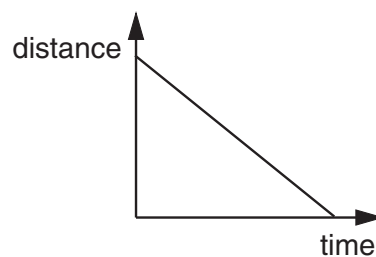
A



B



C



D

answer [1]

- (ii) Here are some statements about the ball as it rolls along the lane.

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

The momentum of the ball remains constant.

☐

The reaction from the track slows the ball down.

☐

There must be a force pushing it along the track.

☐

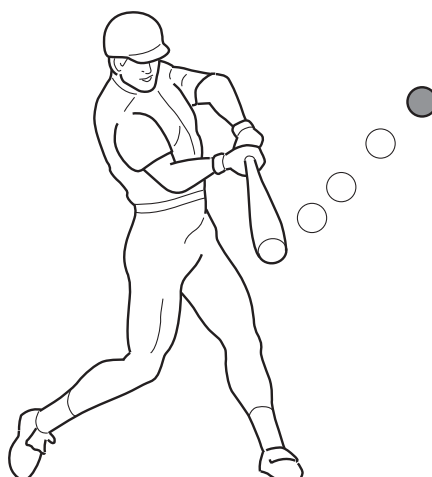
The average speed will be less than the initial speed.

☐

[1]

[Total: 5]

- 8 Matt hits a ball with his bat.



- (a) 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.

[1]

- (b) Here are some statements about the ball **after** it has left the bat.

Put ticks (✓) in the boxes next to the **two** correct statements.

The velocity of the ball increases as it rises up.

☐

The reaction force from the bat slows the ball down.

☐

The weight of the ball increases its downwards momentum.

☐

The total energy of the ball will stay the same if there is no friction.

☐

The counter force will be less than the driving force as it moves forward.

☐

[2]

17

- (c) The ball gains 100 J of gravitational potential energy before it starts to fall back to the ground.

The ball has a weight of 5 N.

How high did it rise after leaving the bat?

Put a ring around the correct answer.

20 m

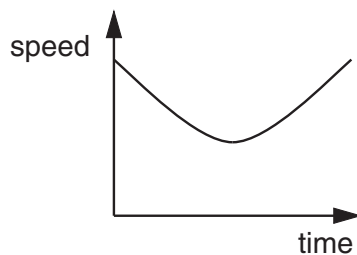
50 m

200 m

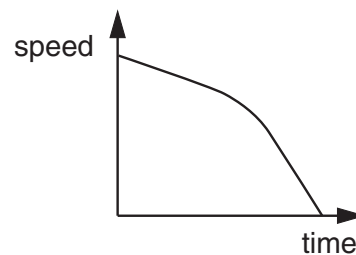
500 m

[1]

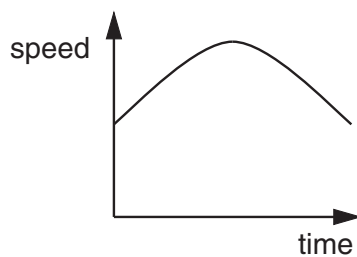
- (d) Which of these speed-time graphs is for the ball as it rises through the air and falls back to the ground?



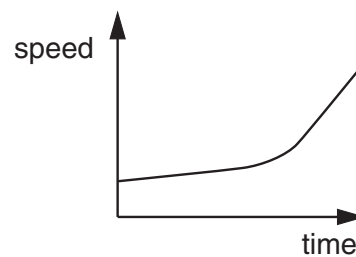
A



B



C



D

answer [1]

[Total: 5]

END OF QUESTION PAPER

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The Periodic Table of the Elements

1	2	Key										3	4	5	6	7	0		
		relative atomic mass atomic symbol atomic (proton) number																	
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	63.5 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	[98] 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	119 Sn tin 50	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	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86		
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated								

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

* 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.