Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

A215/02

TWENTY FIRST CENTURY SCIENCE

ADDITIONAL SCIENCE A

UNIT 1: Modules B4 C4 P4
Higher Tier

WEDNESDAY 26 MAY 2010: Morning
DURATION: 40 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

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

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Pencil
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

DC (CW/SW) MEP60305 29565/1

INSTRUCTIONS TO CANDIDATES

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **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.**
- **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 pages 4–5.**
- **The Periodic Table is provided separately.**

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TWENTY FIRST CENTURY SCIENCE EQUATIONS

USEFUL RELATIONSHIPS

EXPLAINING MOTION

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

momentum = mass × velocity

work done by a force = force × distance moved in the direction of the force

work done by a force = force × distance moved by the force

change in energy = work done

change in GPE = weight × 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 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) The sentence below and the two on the facing page each have 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 <u>BEST</u> 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 <u>CONCENTRATION AND ENERGY</u> in your answer.

_____

_____

_____

_____ **[3]**

(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
		greater volume and less dilute
alcohol	increased ADH production	
		greater volume and more dilute
		smaller volume and less dilute
Ecstasy	decreased ADH production	
		smaller volume and more dilute

[3]

[Total: 7]

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.

_____

_____

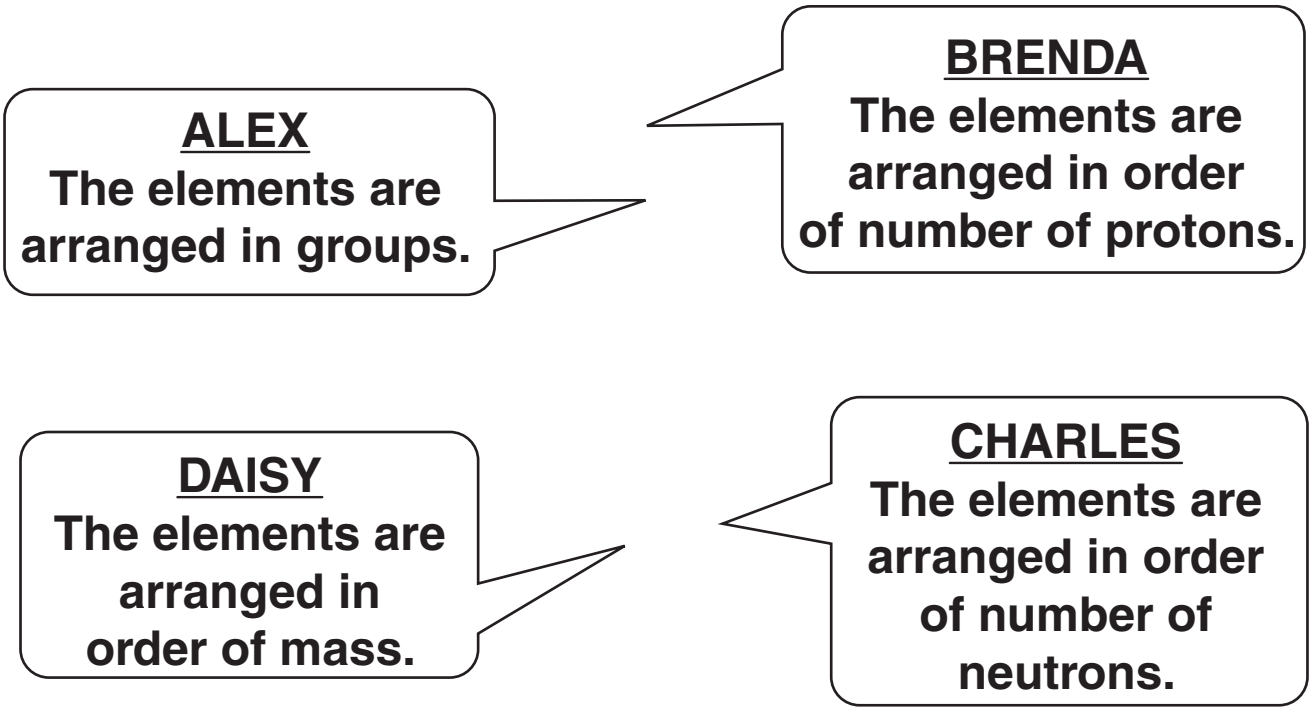
_____ **[2]**

[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 <u>BEST</u> answer?



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 <u>COMPOUNDS IN A LIQUID</u> that conduct electricity.

Explain how these compounds conduct electricity.

_____

_____

_____ **[3]**

(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 gets smaller		no visible reaction	
it sinks		some movement		it stays the same size		it produces bubbles	
it sinks to the bottom then rises		violent movement		it gets larger		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.

Cl_2 (_____) + 2NaOH (_____) →

NaO*Cl* (aq) + Na*Cl* (aq) + H_2O (_____)

[2]

(ii) NaO*Cl* is ionic. What is the charge on the O*Cl* 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]

7 Mel goes bowling.

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

Two forces act ON her foot FROM the floor.

Put (ring) 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.

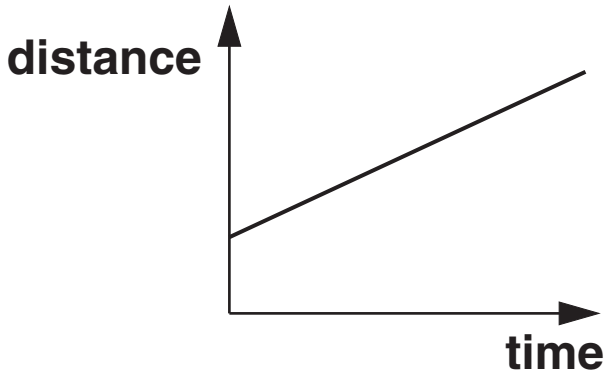
0.025 N **10 N** **20 N** **40 N**

[1]

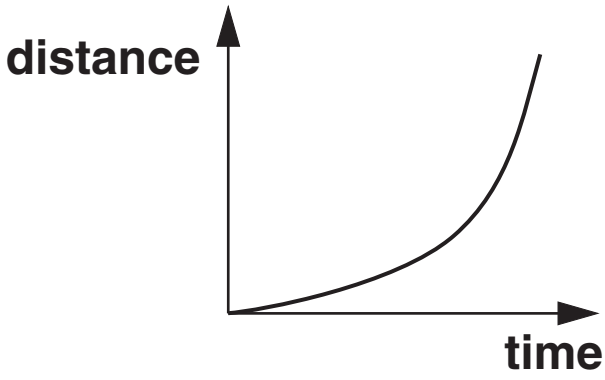
(c) The ball leaves her hand and rolls along the lane.

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

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



A



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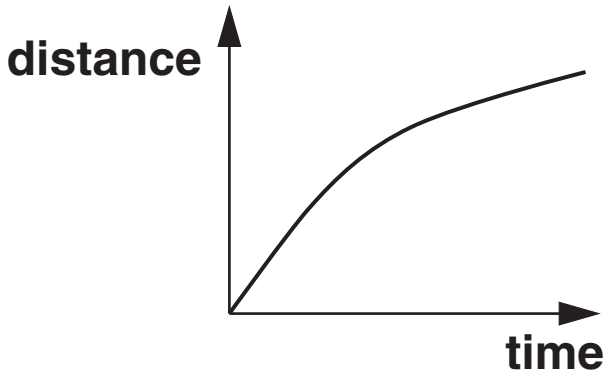
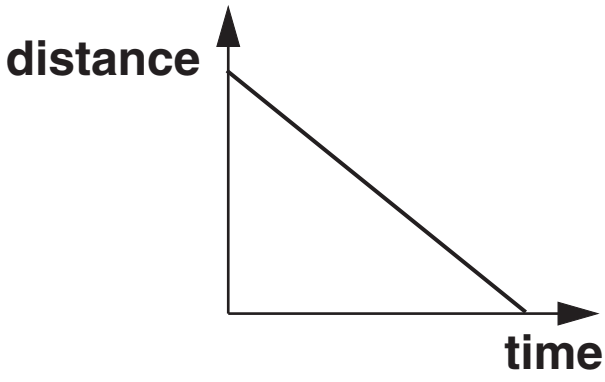


C



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 <u>ONE</u> 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 of the two sentences below.

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]

(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.

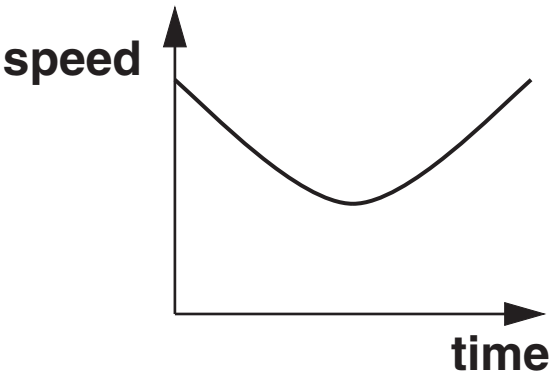
How high did it rise after leaving the bat?

Put a (ring) around the correct answer.

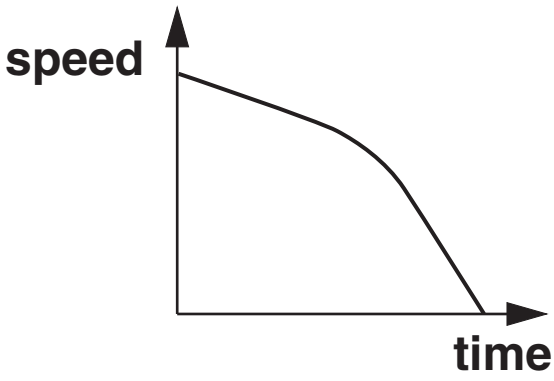
20 m **50 m** **200 m** **500 m**

[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



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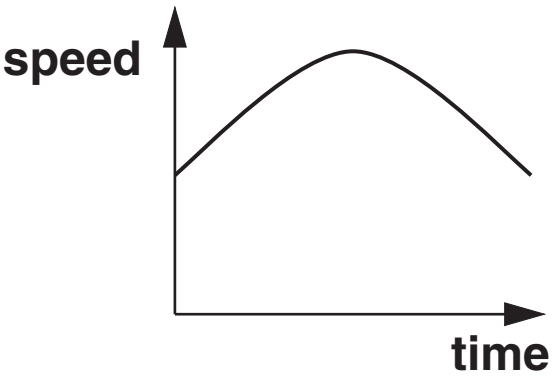

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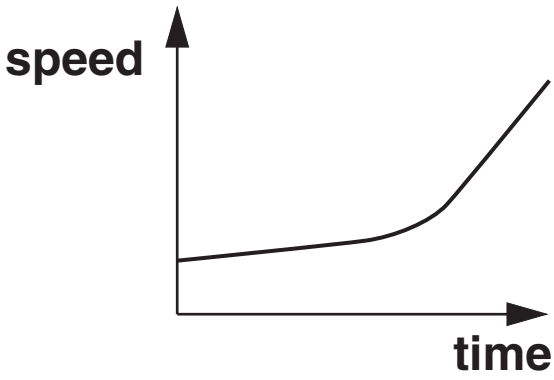

D

answer _____ **[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
							1 **H** hydrogen 1										4 **He** helium 2
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.