

**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)

**Wednesday 25 May 2011
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, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- 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).
- Answer **all** the questions.
- Do **not** write in the bar codes.

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 **24** 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

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

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Question 1 starts on page 4

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

1 Arjun is swimming the English Channel.

In the first part of the swim his core body temperature stays the same.

(a) How much heat energy is he producing?

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

less than the energy that he loses

the same as the energy that he loses

more than the energy that he loses

[1]

(b) The water is cold.

What is Arjun's core body temperature?

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

the same as the temperature in his fingers

less than the temperature in his fingers

higher than the temperature in his fingers

[1]

(c) Arjun has receptors to sense the temperature of his blood.

Where are they?

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

brain

eye

kidney

liver

[1]

(d) The crew of the safety boat pull Arjun from the water.

They think that he has hypothermia.

(i) Arjun has hypothermia.

What is his body temperature?

Put a ring around the correct answer.

42 °C 40 °C 38 °C 36 °C 34 °C

[1]

(ii) Write about hypothermia.

In your answer describe

- two symptoms of hypothermia
- how to treat it.

.....

.....

.....

..... [3]

[Total: 7]

2 Talesha loses water from her body when she excretes urine.

(a) Put **rings** around **two** other ways she loses water.

breathing out eating growing sweating

[1]

(b) Talesha's kidneys balance the level of water and other chemicals in her blood.

Her kidneys filter chemicals from the blood.

Some of the chemicals are reabsorbed.

Draw **one** straight line from **each chemical** to show **how much her kidneys reabsorb**.

chemical

how much her kidneys reabsorb

sugar

all of it

water

as much as the body needs

salt

[2]

[Total: 3]

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Question 3 starts on page 8

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3 Vikram is studying enzymes.

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

Enzymes are ...

... carbohydrates that slow down chemical reactions.

... carbohydrates that speed up chemical reactions.

... proteins that slow down chemical reactions.

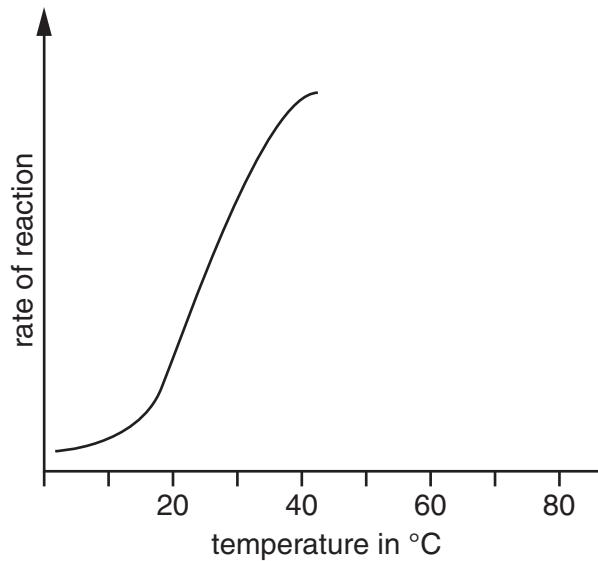
... proteins that speed up chemical reactions.

[1]

(b) Vikram does some experiments with enzymes.

He measures the rate of reaction at different temperatures.

Here is a graph of his results.



	As the temperature ...	... the frequency of collisions ...	... and the rate of reaction ...
A	... increases ...	... decreases ...	... increases.
B	... increases ...	... increases ...	... increases.
C	... decreases ...	... increases ...	... increases.
D	... decreases ...	... decreases ...	... increases.

Which row, **A**, **B**, **C** or **D**, is the best explanation for his results?

row [1]

(c) Vikram continues to increase the temperature in his experiment.

What will happen?

Put a **ring** around the correct word in each sentence.

The rate of reaction will **increase** / **decrease** / **stay the same**.

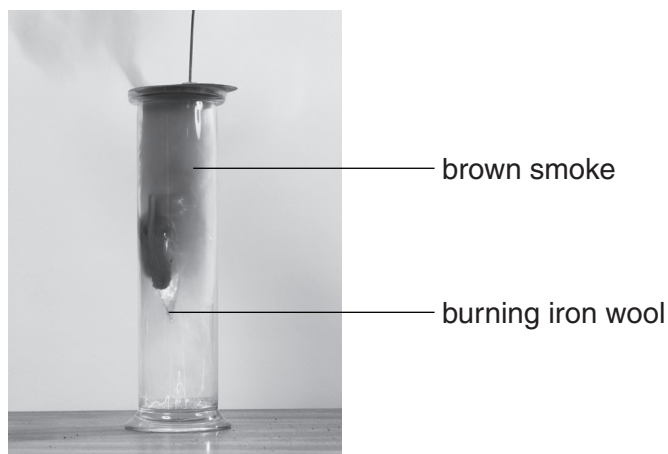
This is because the enzyme is **broken down** / **denatured** / **killed**.

The enzyme now has the wrong **shape** / **mass** / **chemicals** for the other molecules to fit.

[2]

[Total: 4]

- 4 William's teacher burns some hot iron wool in chlorine gas.



- (a) The iron wool glows red-hot as it reacts. It makes a brown smoke.

What is the brown smoke?

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

chlorine

iron oxide

iron vapour

iron chloride

[1]

- (b) William's teacher then puts hot iron wool into iodine vapour.

This time the iron wool does not glow as much.

Explain why.

.....

..... [2]

(c) William's teacher then burns some sodium in a jar of chlorine gas.

(i) Sodium is dangerous, and it is stored in a bottle of oil.

Explain why it is stored in oil.

.....
 [2]

(ii) When the sodium burns it makes sodium chloride.

sodium + chlorine \rightarrow sodium chloride

Write the chemical formula of sodium chloride.

answer [1]

(iii) William draws a diagram of a chlorine molecule, Cl_2 .

Put a ring around the correct diagram.



[1]

[Total: 7]

- 5 Potassium bromide contains potassium ions, K^+ , and bromide ions, Br^- .

If an atom gains an electron it turns into a negative ion.

If an atom loses an electron it turns into a positive ion.

- (a) Draw lines to link each **symbol** for an atom or ion to its correct **electron arrangement**.

One has been done for you.

symbol	electron arrangement
Br^-	2.8.8
Br	2.8.8.1
K	2.8.18.7
K^+	2.8.18.8

A line is drawn from the Br^- symbol box to the 2.8.18.8 electron arrangement box.

[2]

- (b) The potassium bromide forms ionic crystals.

Matilda dissolves potassium bromide crystals to form a solution.

What happens to the solid as it dissolves?

Put a tick (✓) in the box to complete this sentence.

As the solid dissolves ...

... the particles turn into ions.

... the particles stay as ions.

... the particles turn into molecules.

... the particles turn into atoms.

13

Put a tick (✓) in the box to complete the next sentence.

When the solid dissolves, the particles ...

... settle to the bottom.

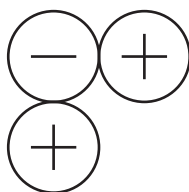
... go into the air.

... move randomly through the solution.

[2]

(c) Matilda starts to draw a diagram of the ions in a potassium bromide crystal.

Continue her diagram by drawing in **four** more of the ions.

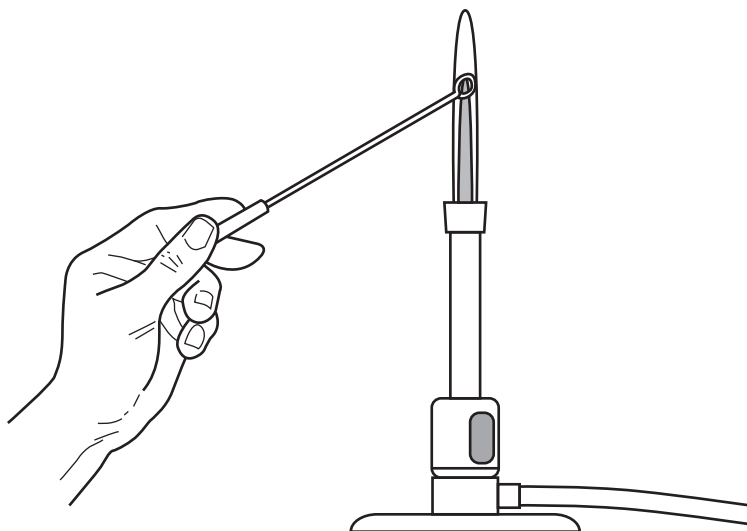


[1]

[Total: 5]

6 Stephen makes some sodium chloride in the laboratory.

He looks at its flame colour through a spectroscope.



Here is the spectrum for his sample.



He finds the spectrum for sodium in a book. It looks like this.



What can he tell about his own sample?

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

All the lines for sodium are present.

Some of the sodium lines are missing.

All the lines in the sample are different from the lines in sodium.

This is not sodium, it is a different element.

The spectrum shows that sodium and at least one other element are present.

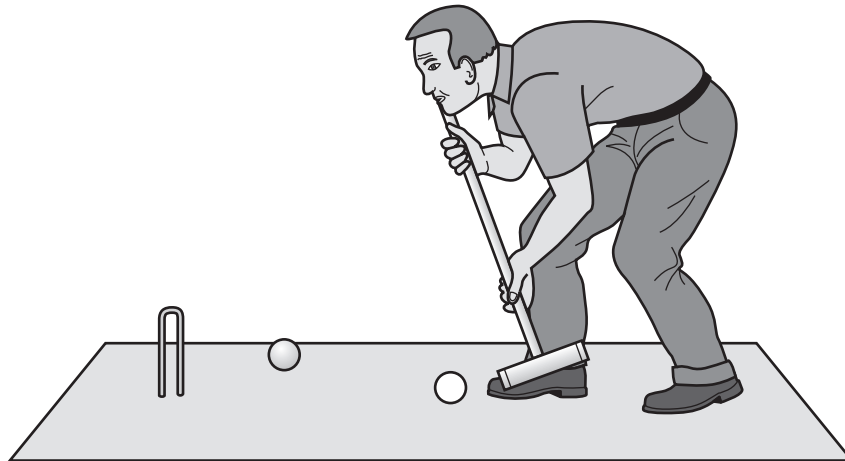
[2]

[Total: 2]

15
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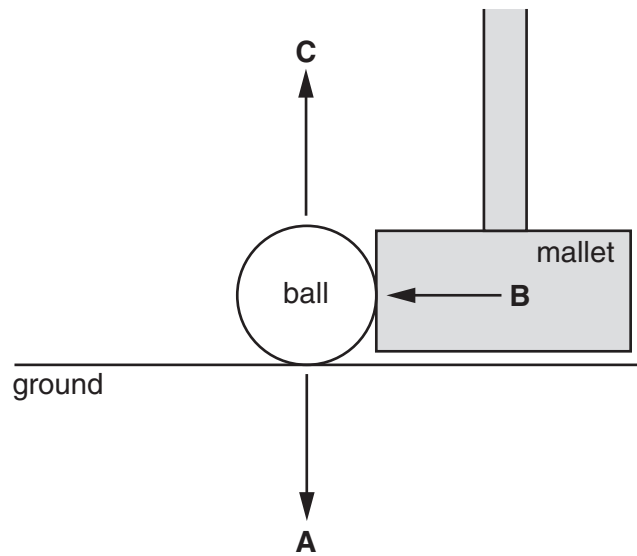
Question 7 starts on page 16
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7 Jim enjoys playing croquet.



(a) Jim hits the ball with the mallet.

The diagram shows three forces acting on the ball when it is hit by the mallet.



(i) Complete the table with **A**, **B** or **C** to show the names of the forces.

weight due to gravity	
reaction from the ground	
driving force from the mallet	

[2]

(ii) In this case, all three forces have the same size of 5 N.

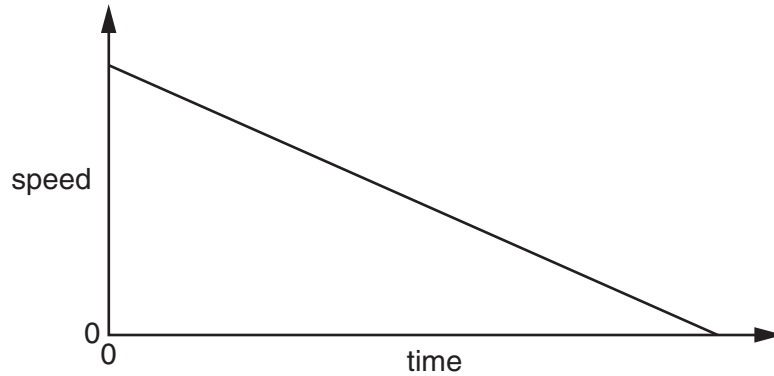
What is the size of the **resultant** force on the ball?

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

- 0N 5N 15N

[1]

(b) The graph shows how the speed of the ball changes with time after Jim has hit it.



What happens to the speed of the ball **after** it is hit by the mallet?

Give a reason for this change.

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

[Total: 5]

8 Pete enjoys a short run.



(a) Pete has a mass of 70 kg. He runs in a straight line at a steady speed of 5 m/s.

What is the correct way of calculating his momentum?

Put a (ring) around the correct answer.

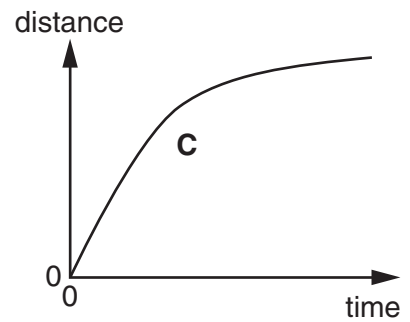
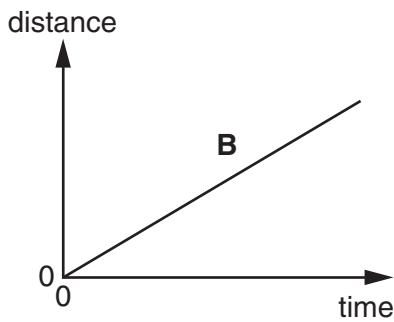
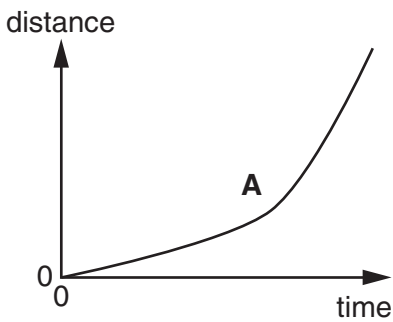
$\frac{70}{5}$ 70×5 $\frac{5}{70}$

[1]

(b) He runs at a steady speed of 5 m/s for 40s. How far does he run in this time?

answer = m [1]

(c) Here are some distance-time graphs.



Which graph, **A**, **B** or **C**, shows Pete running forwards at a steady speed?

answer [1]

(d) Complete the sentences. Choose from these words.

force kinetic momentum work

Pete runs forward at a steady speed.

This is because a pushes him along in the direction of his motion.

The force acting forwards on Pete does on him. **[2]**

[Total: 5]

- 9 Reshma runs at a hurdle and jumps over it.



- (a) As Reshma moves over the bar, she is moving horizontally with a speed of 8 m/s.

Her mass is 50 kg.

What is the correct way of calculating her kinetic energy?

Put a (ring) around the correct answer.

50×8

50×8^2

$\frac{1}{2} \times 50 \times 8^2$

$\frac{1}{2} \times 50 \times 8$

[1]

(b) The diagram shows Reshma when she is moving forwards above the bar.

At that instant, she has both kinetic energy and gravitational potential energy.

Explain how their values change as she drops down towards the ground again.

.....

.....

.....

.....

..... [3]

[Total: 4]

END OF QUESTION PAPER

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The Periodic Table of the Elements

1 2 3 4 5 6 7 0

7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 C carbon 6	13 Al aluminium 13	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	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	56 Fe iron 26	65 Zn zinc 30	70 Ga gallium 31	
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	101 Ru ruthenium 44	112 Cd cadmium 48	115 In indium 49	
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	190 Os osmium 76	201 Hg mercury 80	204 Tl thallium 81	
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[277] Hs hassium 108	[272] Rg roentgenium 111	[222] Rn radon 86	
Elements with atomic numbers 112-116 have been reported but not fully authenticated								[210] At astatine 85	[222] Rn radon 86

1 H hydrogen 1

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.