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Monday 30 January 2012 – Afternoon

GCSE TWENTY FIRST CENTURY SCIENCE ADDITIONAL SCIENCE A

A215/01 Unit 1: Modules B4 C4 P4 (Foundation Tier)

A213470112

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)

Duration: 40 minutes

A215015

Candidate forename		Candidate surname	

Centre number						Candidate number				

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. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- 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).
- 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 **20** pages. Any blank pages are indicated.

DC (SHW (CGW) 00654 12/10) 42725/6

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 Charlotte feels hot.

She goes to the fridge for a cold drink.

(a) The fridge has a control system to keep the temperature constant.

Parts of the temperature control system in the fridge act like parts of the human body.

Draw a straight line from each **part in the control system** to the **part in the human body** that does the same job.

You should draw **three** lines.

part in the control system	part in the human body
processor	receptor
temperature sensor inside fridge	effector
pump and coolant	brain

[2]

(b) Charlotte has a cold drink to cool down.

Her body cools down in other ways as well.

How else might her body cool down?

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

- Blood transfers heat to her skin surface. ☐
- Blood transfers heat to her brain. ☐
- Sweat evaporates. ☐
- Sweat condenses. ☐
- She shivers. ☐

[2]

(c) Charlotte goes outside into the heat.

Her body reacts to the heat in a number of stages.

The stages shown below are in the wrong order.

A Sweat glands produce sweat.

B The brain triggers the sweat glands to be more active.

C The brain receives information from the receptors.

D Temperature receptors detect the increased temperature.

Fill in the boxes to show the correct order of the stages. Use the letters **A**, **B**, **C** and **D**.

[2]

[Total: 6]

2 Cole does an experiment with enzymes.

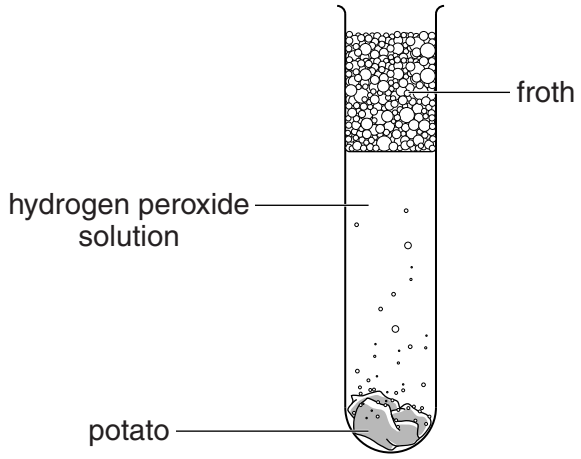
He places some raw potato at the bottom of a test tube.

He pours some hydrogen peroxide solution on top of it.

An enzyme in the potato causes oxygen to be released.

Bubbles are produced which form a layer of froth on top of the hydrogen peroxide solution.

Cole measures the height of the froth after five seconds.



When he uses hydrogen peroxide solution at 30 °C, Cole gets 3 cm of froth.

(a) He repeats the experiment at 20 °C.

What will the height of the froth most likely be?

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

0 cm **1 cm** **3 cm** **5 cm** **6 cm**

[1]

(b) Cole now uses boiled potato instead of raw potato.

What will the height of the froth most likely be?

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

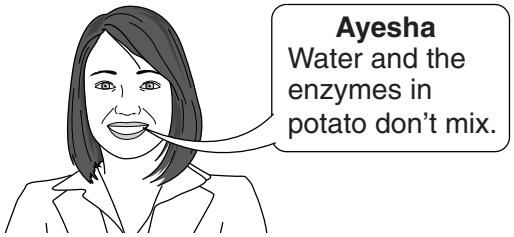
0 cm **1 cm** **3 cm** **5 cm** **6 cm**

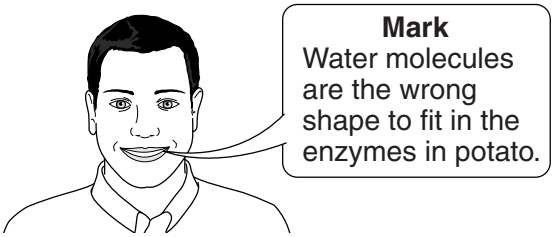
[1]

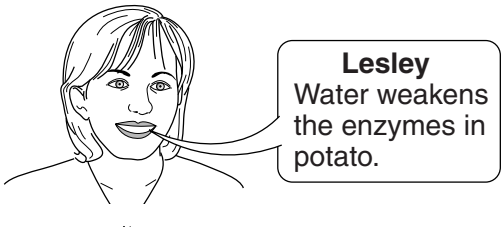
(c) Cole does the experiment using only water instead of hydrogen peroxide.

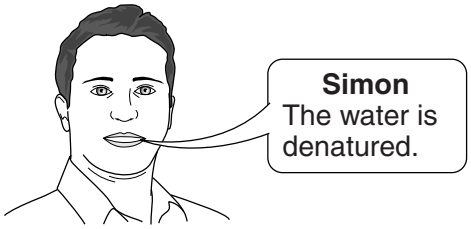
There is no froth.

He asks people in his class to suggest why.









Who gives the best explanation?

answer ..... **[1]**

[Total: 3]

3 Lucien runs a race.

(a) Oxygen and water move between his blood and his muscle cells.

Describe and explain the **processes** that move oxygen and water between his blood and muscle cells.

.....

.....

.....

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

(b) As Lucien runs his body loses water.

This makes his blood plasma more concentrated.

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

Lucien's kidneys will now produce urine that is

more dilute / more concentrated / the same concentration.

This is an example of **homeostasis / evaporation / hypothermia**.

[1]

(c) At the end of the race Lucien has an alcoholic drink.

Draw **one** line from the correct **effect of alcohol on urine** to the correct **consequence**.

effect of alcohol on urine	**consequence**
increased volume	could lead to dehydration
decreased volume	could lead to rehydration

[1]

[Total: 5]

4 The element helium was discovered in the Sun before it was found on Earth.

Suggest what astronomers on Earth can do to find out what elements are in the Sun.

.....

.....

.....

.....

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

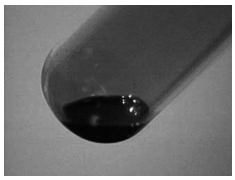
[Total: 3]

5 Tony studies the halogens.

(a) He takes photographs of three of the halogens at room temperature and pressure.

(i) Draw a line from each **photograph** of a halogen to its **name**.

Draw another line from the **name** of each halogen to its **colour**.

photograph	**name**	**colour**
 gas	bromine	green
 liquid	chlorine	grey/black
 solid	iodine	red/brown

[3]

(ii) Chlorine reacts with a coloured dye.

It makes the dye colour fade away.

What does the chlorine do to the dye?

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

bleaches it ☐

burns it ☐

evaporates it ☐

neutralises it ☐

[1]

(iii) Chlorine is also used to treat drinking water.

How does it do this?

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

It attracts bacteria.	☐
It kills bacteria.	☐
It neutralises bacteria.	☐
It repels bacteria.	☐

[1]

(b) Sodium reacts with bromine to make sodium bromide.

(i) Fill in the boxes to write a word equation for this reaction.

☐ + ☐ → ☐

[1]

(ii) Put a ring around the formula of sodium bromide.

NABR **NaBr** **NabR** **nABr**

[1]

(iii) Tony knows that sodium chloride melts at 800 °C, and that sodium iodide melts at 660 °C.

Suggest the melting point of sodium bromide.

melting point ..... °C **[1]**

[Total: 8]

6 Atoms are made of protons, neutrons and electrons.

(a) Which of the following is most important when deciding which element an atom belongs to?

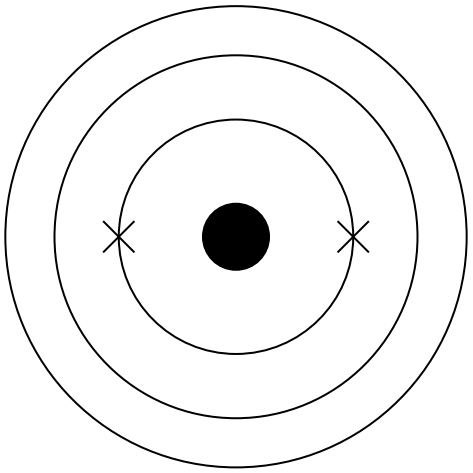
Put a tick (✓) in the box next to the best answer.

The number of protons in the atom.	☐
The number of neutrons in the atom.	☐
The relative atomic mass of the atom.	☐
The size of the atom.	☐

[1]

(b) A sulfur atom has 16 protons, 16 neutrons and 16 electrons.

Complete the diagram to show the electron arrangement of a sulfur atom.



[1]

(c) The element to the right of sulfur in the Periodic Table is chlorine.

Chlorine forms a chloride ion, Cl^-.

What is the difference between a chloride ion and a chlorine atom?

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

The ion has one electron more than the atom. ☐

The ion has one electron less than the atom. ☐

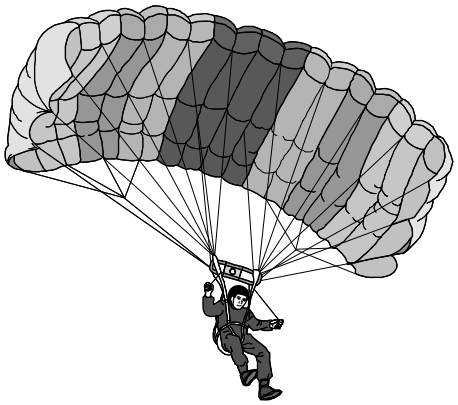
The ion has one electron shell more than the atom. ☐

The ion has one electron shell less than the atom. ☐

[1]

[Total: 3]

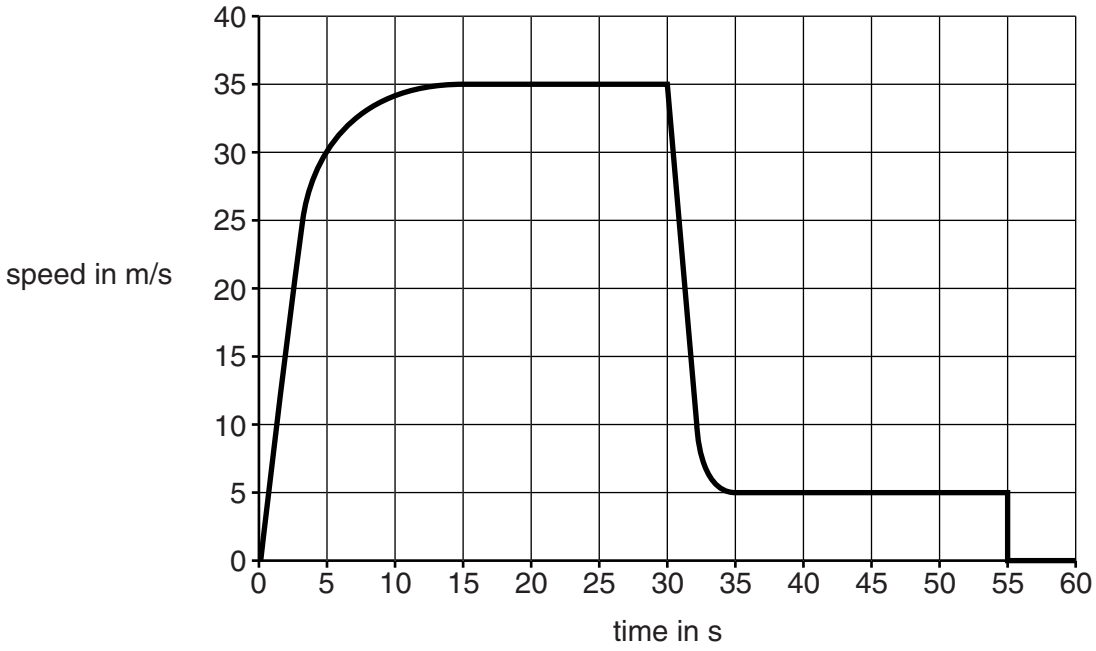
7 Jim jumps out of an aeroplane.



He opens his parachute on the way down and lands safely.

Jim uses a speed sensor to measure his speed as he falls towards the ground.

He uses the data from the sensor to draw a speed–time graph.



(a) Jim jumps out of the aeroplane when the time is 0 s.

What is the maximum speed that he reaches on his way down to the ground?

maximum speed = ... m/s **[1]**

(b) When Jim first jumps out of the aeroplane, his speed increases as he falls.

What happens to Jim's **energy** in the first 5 s of his fall?

Your answer should include

- gravitational potential energy
- kinetic energy
- total energy.

.....

.....

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.....

.....

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

(c) When Jim opens his parachute he slows down.

Why does the parachute slow him down?

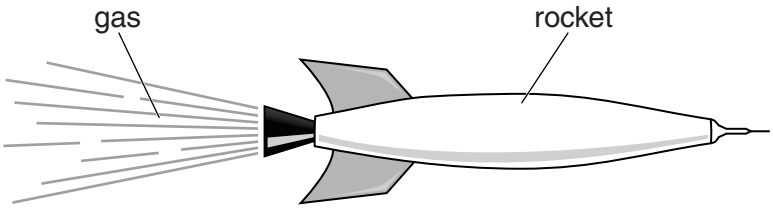
Put a tick (✓) in the box next to the correct reason.

His weight increases.	☐
His weight decreases.	☐
Air resistance increases.	☐
Air resistance decreases.	☐

[1]

[Total: 5]

8 A small rocket in space switches on its engine for 10 seconds.



High speed gas comes out of the engine.

This exerts a force of 1000 N on the rocket in the forward direction.

(a) What is the size and direction of the force on the **gas**?

Give a reason for your answer.

.....

.....

.....

.....

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

(b) The force of 1000 N on the rocket is exerted for 10 s.

What is the correct way of calculating the increase in momentum of the rocket?

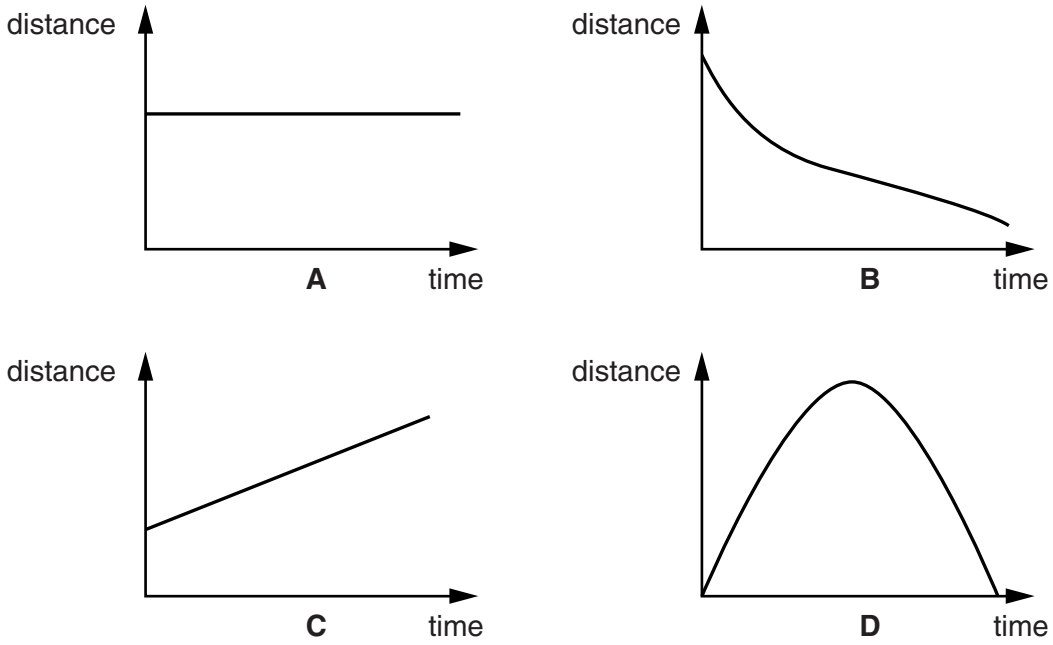
Put a (ring) around the correct calculation.

$\frac{\mathbf{1000}}{\mathbf{10}}$ $\quad$ $\mathbf{1000 \times 10}$ $\quad$ $\frac{\mathbf{10}}{\mathbf{1000}}$

[1]

(c) The rocket has a steady speed after the engine is switched off.

Here are some distance–time graphs for the rocket.

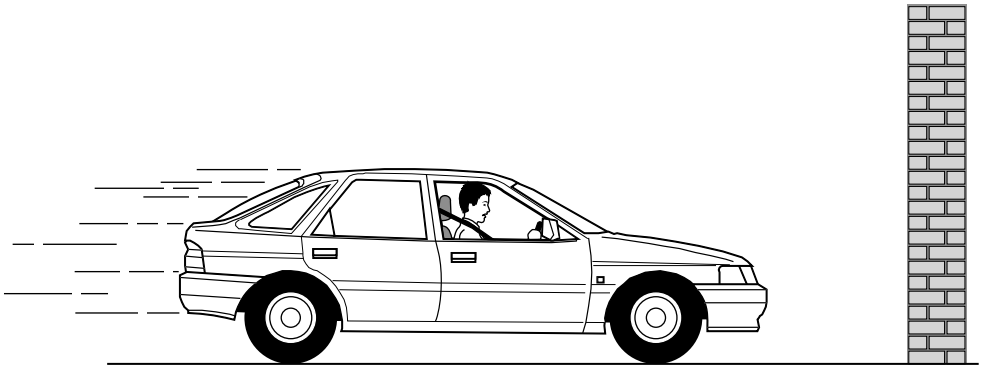


Which graph, **A**, **B**, **C** or **D**, shows the rocket moving at a steady speed?

graph ..... **[1]**

[Total: 5]

9 Jack has a car accident.



He drives his car into a wall.

The seat-belt and crumple zone of the car stop Jack getting hurt.

(a) Here are some possible reasons why the crumple zone protects Jack.

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

It transfers kinetic energy from the car to Jack.	☐
It increases the time for which forces act on Jack.	☐
It provides a counter force to the force from the wall.	☐
It redirects the force from the wall towards the ground.	☐

[1]

(b) The speed of the car drops from 15 m/s to zero as it collides with the wall.

This takes a time of 0.1 s. The car moves 0.75 m in that time.

Calculate the average speed of the car during its collision with the wall.

average speed = ... m/s **[1]**

(c) Complete the following sentences.

Choose words from this list.

force friction mass momentum weight work

Jack has to replace the car seat-belt after the accident.

This is because it has become permanently stretched.

During the accident, a ..... acts on the seat-belt.

This does ..... on the seat-belt.

[2]

[Total: 4]

END OF QUESTION PAPER

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.