

Monday 21 May 2012 – Morning

**GCSE TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A**

A215/02 Unit 1: Modules B4 C4 P4 (Higher Tier)

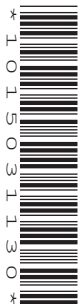
Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: 40 minutes



Candidate forename		Candidate surname	
Centre number		Candidate number	

MODIFIED LANGUAGE

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.

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

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

BLANK PAGE

Question 1 begins on page 4

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

1 Kidneys are important organs in the body.

(a) Kidneys make urine.

They filter molecules such as glucose from the blood.

(i) What happens to the glucose after it has been filtered?

..... [1]

(ii) Which two other chemicals are filtered from the blood?

Put rings around the **two** correct answers.

enzymes

protein

salt

starch

urea

[1]

(b) The amount of water in the urine depends on the concentration of blood plasma.

Here are some factors that affect the concentration of blood plasma.

A high external temperature

B drinking lots of water

C eating salty food

D doing vigorous exercise

What effect will each factor have on urine concentration?

Write each letter, **A**, **B**, **C**, and **D**, in the correct column in the table.

Makes urine more concentrated	Makes urine more dilute

[2]

- (c) (i) The volume of urine produced is controlled by the hormone ADH.

Which gland releases this hormone?

Put a ring around the correct answer.

adrenal

pituitary

sweat

thyroid

[1]

- (ii) Ecstasy is a drug that changes the volume of urine produced.

Here are possible steps in this process.

Not all of the steps are correct, and they are not in the right order.

- A** Less urine is produced.
- B** More urine is produced.
- C** ADH reaches the kidney via the bloodstream.
- D** ADH reaches the kidney via the nervous system.
- E** More ADH is produced.
- F** Less ADH is produced.

Andrew takes some Ecstasy. How does this affect his urine production?

Choose from the steps **A**, **B**, **C**, **D**, **E** and **F** and fill in the boxes to show the correct order.

--	--	--

[1]

[Total: 6]

2 Steve is trekking across a hot desert.

He is sweating a lot.

After a while his sweating stops and his skin becomes dry.

(a) Explain why this might happen, and describe the possible consequences.

.....

.....

.....

.....

..... [3]

(b) The support team arrive to treat Steve.

They give him water to drink.

Which two other treatments should they use?

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

give him food

☐

sponge him with water

☐

give him alcoholic drinks

☐

handle him gently to keep blood flow to the limbs low

☐

use a fan

☐

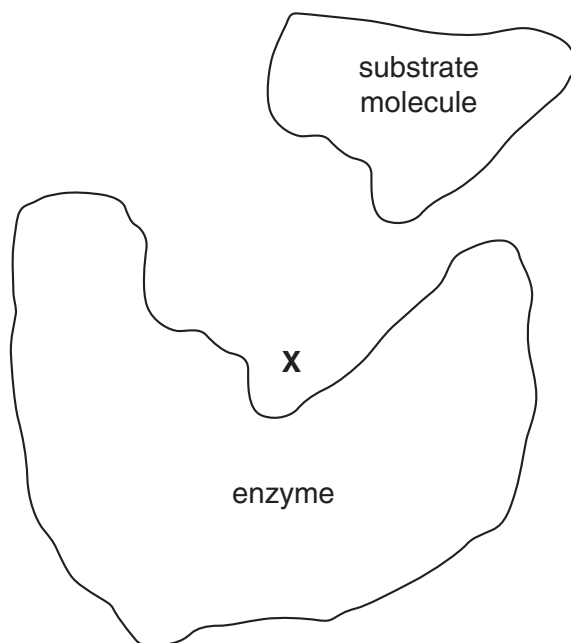
insulate him

☐

[1]

[Total: 4]

- 3 Enzymes are molecules that can speed up chemical reactions. The chemical that an enzyme works on is called the substrate.



- (a) Complete the sentence.

The area marked **X** on the diagram is called the [1]

- (b) Explain how raising the temperature can **slow** an enzyme reaction.

.....

.....

.....

.....

..... [3]

[Total: 4]

4 Sodium is a Group 1 metal.

Here is some information about Group 1 metals.

	Melting point in °C	Boiling point in °C
Lithium	180	1342
Sodium		883
Potassium	63	760

(a) Estimate the melting point of sodium.

answer °C [1]

(b) Complete the table to show the particles in an atom of sodium.

Particle	Number in an atom of sodium
electron	11
proton
.....	12

[1]

(c) Sodium should be stored away from water because it will react.

When sodium reacts with water it makes sodium hydroxide and hydrogen gas.

What is the formula of the sodium hydroxide?

formula [1]

[Total: 3]

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Question 5 begins on page 10

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5 Joe evaporates some seawater.

Crystals of sodium chloride (salt) begin to form.

(a) Joe knows that salt is sodium chloride.

He does a flame test to show that there is sodium in his salt crystals.

He looks at the spectrum.

Explain how the flame and its spectrum show that sodium is present.

.....

.....

.....

..... [3]

(b) A group of students describe what happens when sodium chloride crystals dissolve in water.

Some of these statements are true, and some are false.

Put a tick (✓) in the correct box next to each statement to show if it is **true** or **false**.

When sodium chloride crystals dissolve in water ...

	true	false
... the ions move freely.	<input type="checkbox"/>	<input type="checkbox"/>
... the ions turn into atoms.	<input type="checkbox"/>	<input type="checkbox"/>
... hydrogen gas is produced.	<input type="checkbox"/>	<input type="checkbox"/>
... the solution will conduct electricity.	<input type="checkbox"/>	<input type="checkbox"/>
... the ions separate from each other.	<input type="checkbox"/>	<input type="checkbox"/>
... the crystals float on the surface and react.	<input type="checkbox"/>	<input type="checkbox"/>

[2]

(c) Seawater also contains small amounts of phosphate ions.

Phosphate ions can combine with sodium ions to make sodium phosphate, Na_3PO_4 .

The charge on a sodium ion is single positive (1+).

What is the charge on a phosphate ion?

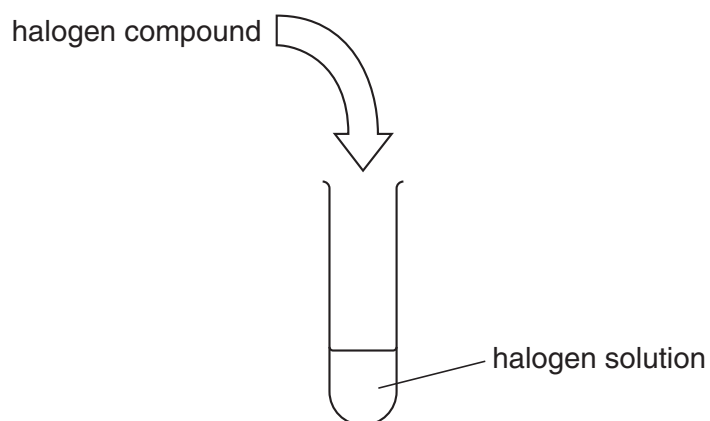
Put a (ring) around the correct answer.

1+ 1- 3+ 3- 4- 5+

[1]

[Total: 6]

- 6 Johnny adds solutions of halogen compounds to halogen solutions to see if there is a reaction.



Here is a table of his results.

	Sodium bromide solution [colourless]	Sodium chloride solution [colourless]	Sodium iodide solution [colourless]
Bromine solution [orange]	solution stays orange	solution stays orange	solution goes brown
Chlorine solution [pale green]	solution goes orange	solution stays pale green	solution goes brown
Iodine solution [brown]	solution stays brown	solution stays brown	solution stays brown

- (a) Use the table to put the three halogens in order of their reactivity.

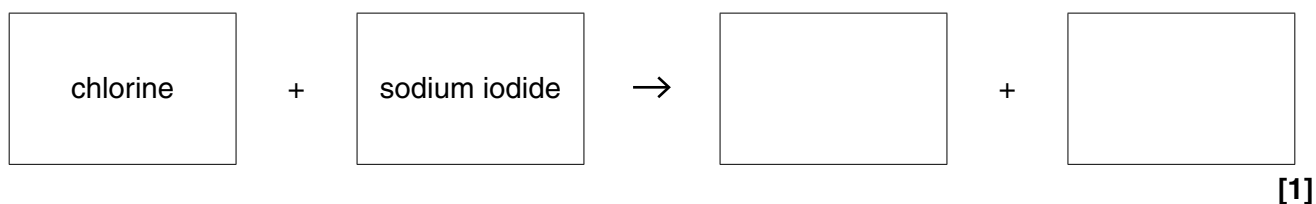
most reactive

.....

least reactive

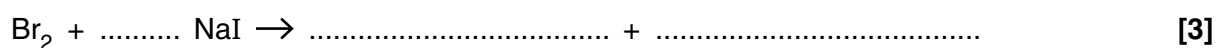
[1]

(b) Complete the word equation for the reaction between chlorine and sodium iodide.



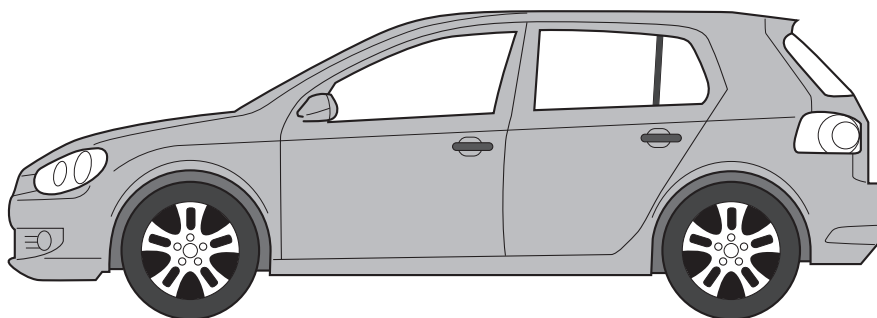
(c) When bromine reacts with sodium iodide it makes sodium bromide and iodine.

Put the correct formulae into the spaces and then balance the equation for this reaction.



[Total: 5]

- 7 Jane chooses a new car. She takes it for a test drive.



- (a) Jane has a mass of 65 kg.

The new car can increase her speed from 0 m/s to 30 m/s in only 9 s.

She asks her friends to calculate the resultant force on her.

Which of her friends does the correct calculation?

<div data-bbox="231 996 459 1131" data-label="Text"> <p>Alan $65 \times 30 \times 9$</p> </div>		 <div data-bbox="1133 996 1361 1160" data-label="Text"> <p>Bess $\frac{30 \times 9}{65}$</p> </div>
<div data-bbox="231 1339 459 1503" data-label="Text"> <p>Carlo $\frac{65 \times 30}{9}$</p> </div>		 <div data-bbox="1133 1368 1361 1532" data-label="Text"> <p>Davina $\frac{65 \times 9}{30}$</p> </div>

answer [1]

- (b) Jane takes her foot off the accelerator and puts on the brakes.

Complete the sentence about the car as it slows down.

Choose words from this list.

counter driving gravity reaction weight

The car slows down because the force is larger than the force.

[1]

- (c) The car has a crumple zone.

Explain how this reduces the force on Jane if the car has a head-on collision.

Use ideas about momentum.

.....

.....

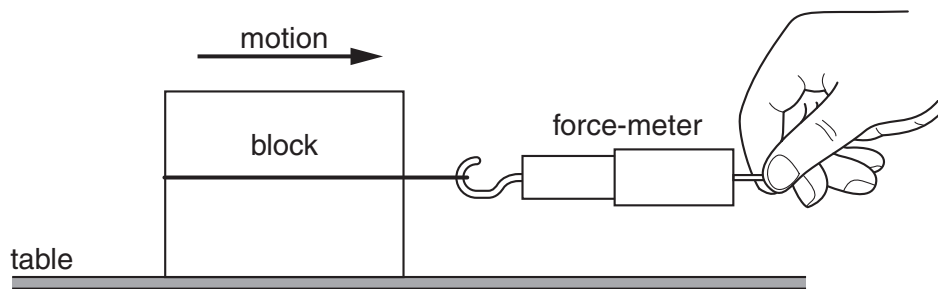
.....

.....

..... [3]

[Total: 5]

- 8 Bill investigates friction by pulling blocks across a table with a force-meter.



He pulls each block across the table at a steady speed.

- (a) Draw lines to link each **force** on the block with its **direction**.

force	direction
friction from table	↑
weight of block	→
reaction from table	↓
	←

[1]

- (b) Bill pulls a block at a constant speed across a **horizontal** table.

Here are some statements about this experiment.

Put a tick (✓) in the box next to the **two** correct statements.

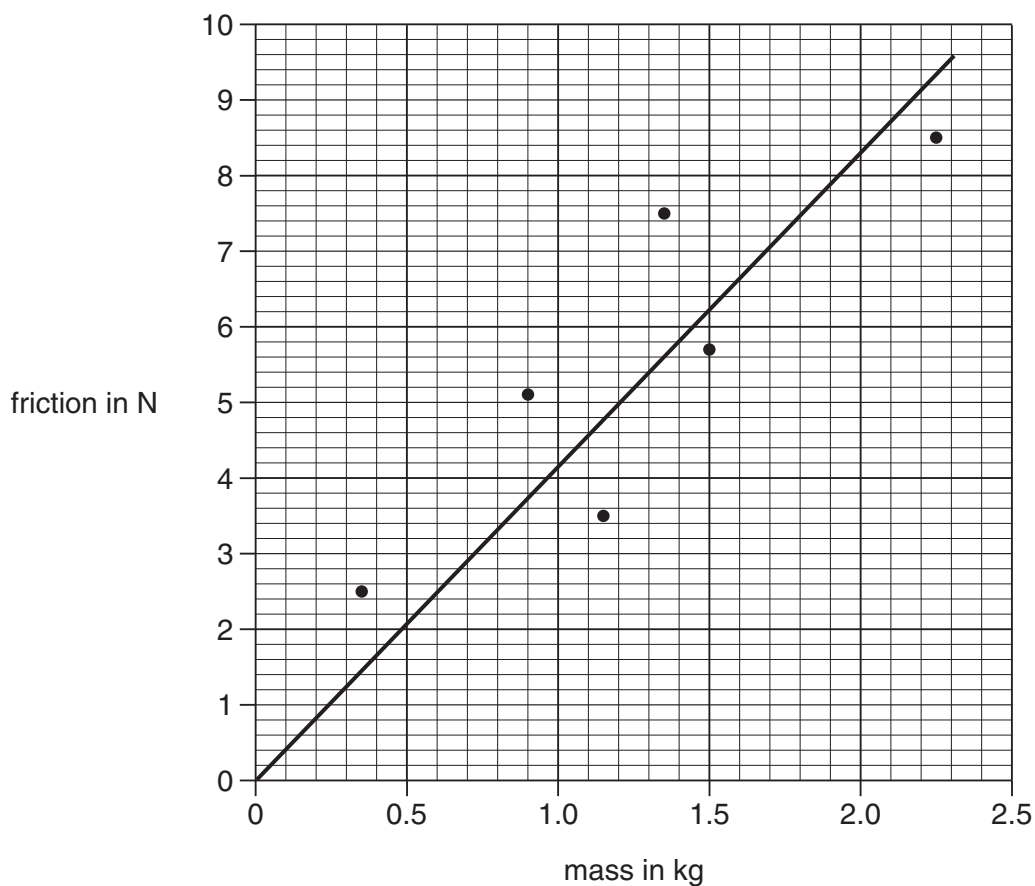
The kinetic energy of the block increases.	<input type="checkbox"/>
The block cools down as it heats the table.	<input type="checkbox"/>
Bill transfers energy to the block by doing work on it.	<input type="checkbox"/>
Bill does no work because the block does not speed up.	<input type="checkbox"/>
The gravitational potential energy of the block decreases.	<input type="checkbox"/>
Friction transfers energy as heat to the table and the block.	<input type="checkbox"/>

[2]

- (c) Bill repeats the experiment with blocks of different masses.

He notes the reading of the force-meter each time.

Bill plots the results of his experiments on a graph.



- (i) He uses his graph to predict the work done on a block of mass 1.3kg when it moves 0.25m across the table.

Put a (ring) around the **best** value for his calculation.

1.20 J

1.30 J

1.35 J

3.25 J

21.6 J

[1]

- (ii) Bill did not make sure that all of the blocks were pulled across the table at the same constant speed.

Which property of a block depends on its speed?

Put a (ring) around the correct answer.

gravitational potential energy

mass

momentum

reaction

weight

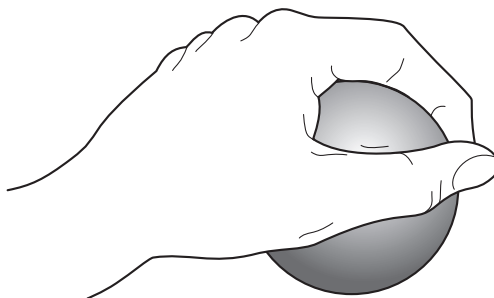
[1]

[Total: 5]

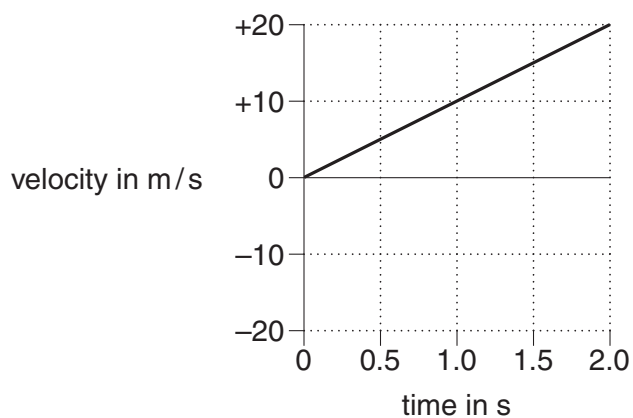
Turn over

- 9 Chelsea stands on top of a tall building and drops a ball towards the ground.

It falls vertically and hits the ground after exactly 2.0 s.



Here is a velocity-time graph for the ball during its fall.



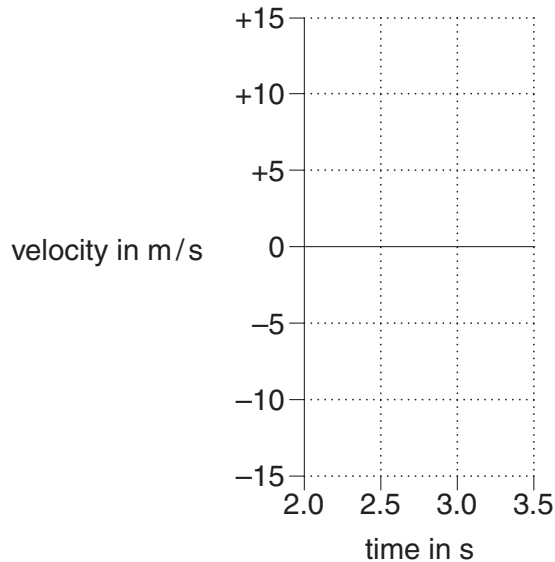
- (a) What is the **average** speed of the ball on its way down?

average speed = m/s [1]

- (b) After 2 seconds the ball hits the ground and bounces upwards with a velocity of -15 m/s .

It slows down steadily and stops 1.5 seconds later.

Sketch the velocity-time graph for the ball after the bounce.



[2]

- (c) Complete the sentence for the ball **after** it bounces off the ground.

Choose words from this list.

decreases

increases

stays the same

As the ball rises through the air its gravitational potential energy

and its kinetic energy

[1]

[Total: 4]

END OF QUESTION PAPER

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The Periodic Table of the Elements

20

1	2	Key					3	4	5	6	7	0					
		relative atomic mass atomic symbol name 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						

* 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.