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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	
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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. 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

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

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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

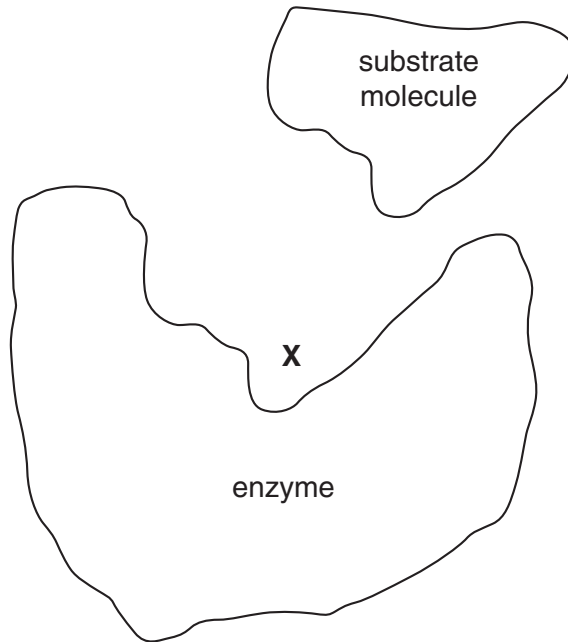
use a fan

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?

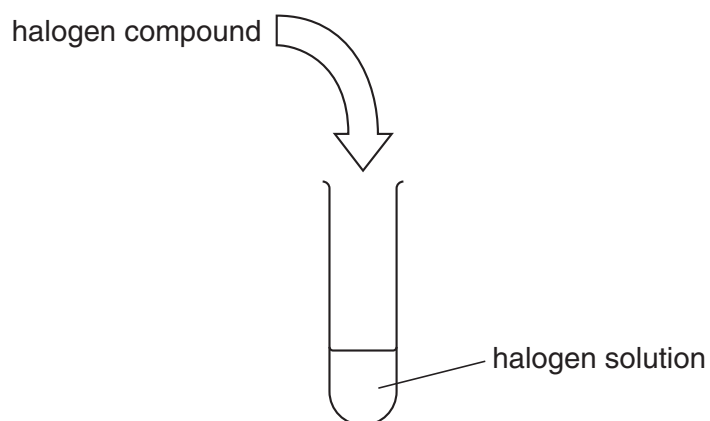
Put a (ring) around the correct answer.

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.

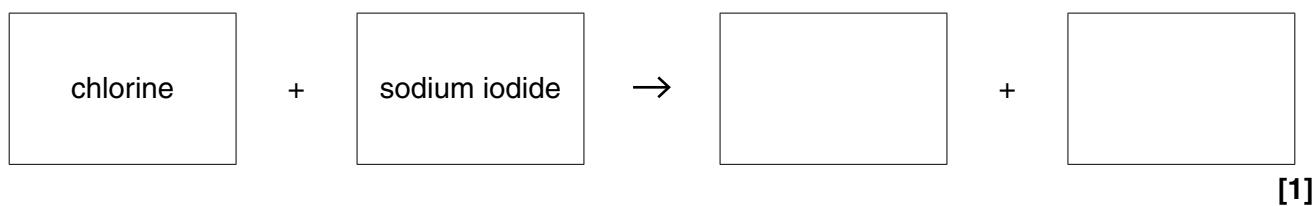
most reactive

.....

least reactive

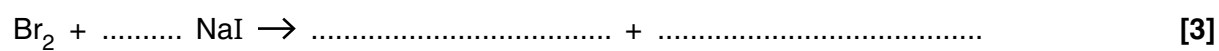
[1]

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



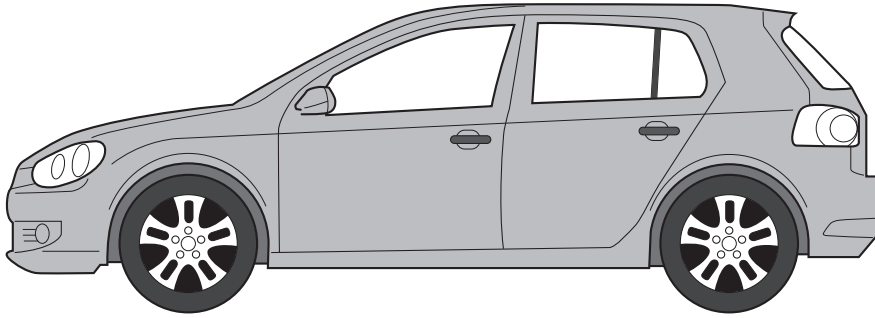
(c) When bromine reacts with sodium iodide it makes sodium bromide and iodine.

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?

<p>Alan</p> $65 \times 30 \times 9$			<p>Bess</p> $\frac{30 \times 9}{65}$
<p>Carlo</p> $\frac{65 \times 30}{9}$			<p>Davina</p> $\frac{65 \times 9}{30}$

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.

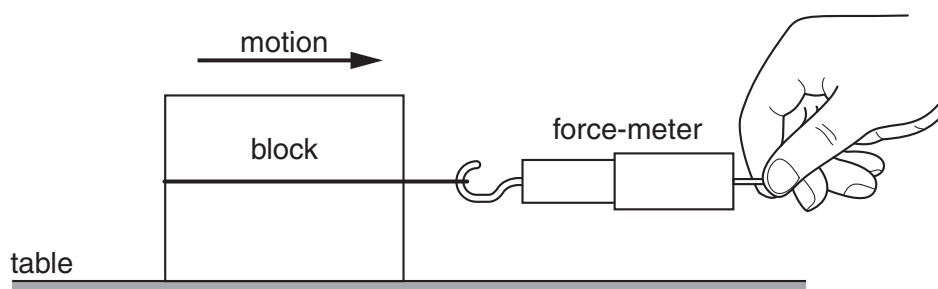
Use ideas about momentum.

.....
.....
.....
.....
.....

[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.

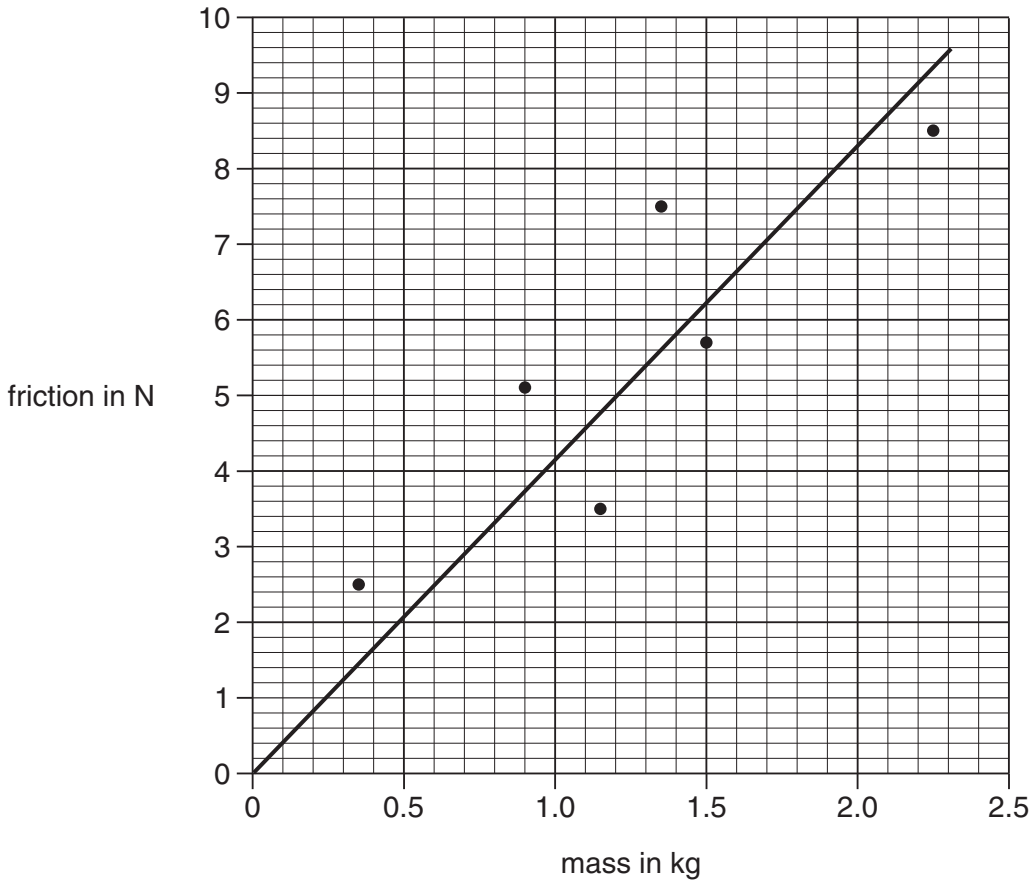
- The kinetic energy of the block increases.
- The block cools down as it heats the table.
- Bill transfers energy to the block by doing work on it.
- Bill does no work because the block does not speed up.
- The gravitational potential energy of the block decreases.
- Friction transfers energy as heat to the table and the block.

[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 realises that he forgot to 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 | weight |
| reaction | |

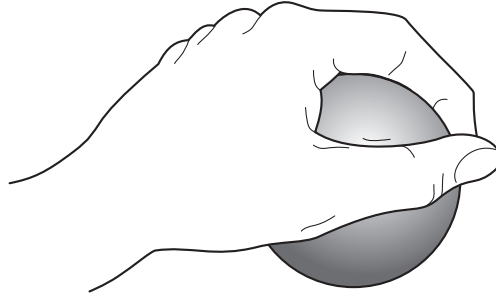
[1]

[Total: 5]

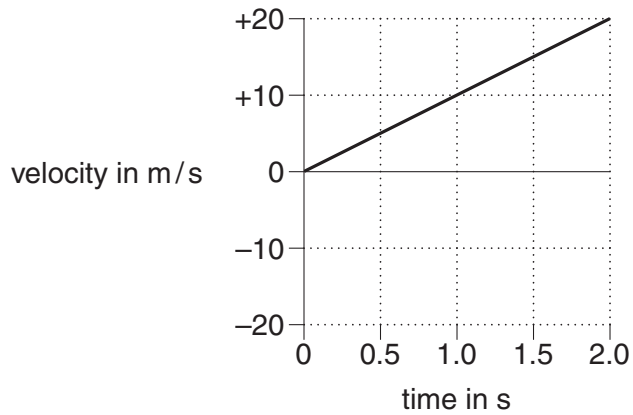
Turn over

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.



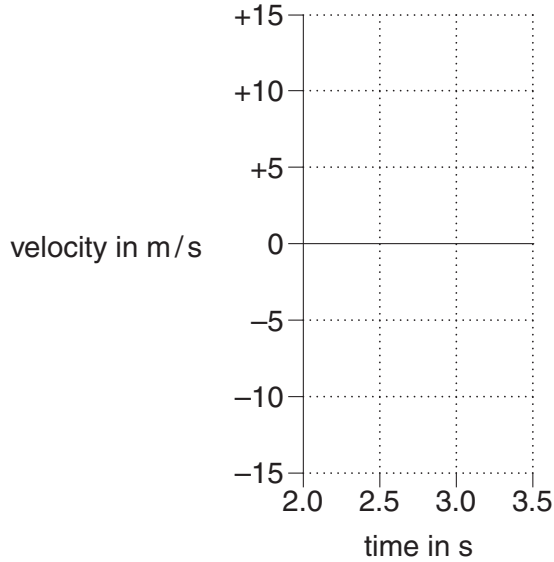
(a) What is the **average** speed of the ball on its way down?

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

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	15 O oxygen 8	16 F fluorine 9	17 Ne neon 10
19 K potassium 19	20 Ca calcium 20	23 Sc scandium 21	24 Ti titanium 22	25 V vanadium 23	26 Cr chromium 24	27 Mn manganese 25	28 Fe iron 26	29 Co cobalt 27
37 Rb rubidium 37	38 Sr strontium 38	39 Y yttrium 39	40 Zr zirconium 40	41 Nb niobium 41	42 Mo molybdenum 42	43 Tc technetium [98]	44 Ru ruthenium 44	45 Rh rhodium 45
55 Cs caesium 55	56 Ba barium 56	57 La* lanthanum 57	72 Hf hafnium 72	73 Ta tantalum 73	74 W tungsten 74	75 Re rhenium 75	76 Os osmium 76	77 Ir iridium 77
87 Fr francium 87	88 Ra radium 88	89 Ac* actinium 89	104 Rf rutherfordium 104	105 Db dubnium 105	106 Sg seaborgium 106	107 Bh bohrium 107	108 Hs hassium 108	109 Mt meitnerium 109
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
223 Fr francium 87	226 Ra radium 88	227 Ac* actinium 89	261 Rf rutherfordium 104	262 Db dubnium 105	266 Sg seaborgium 106	268 Bh bohrium 107	277 Hs hassium 108	272 Mt meitnerium 109
131 Xe xenon 54	127 I iodine 53	128 Te tellurium 52	119 Sn tin 50	122 Sb antimony 51	125 Te tellurium 52	128 Bi bismuth 83	131 Po polonium 84	135 At astatine 85
209 Po polonium 84	210 At astatine 85	209 Bi bismuth 83	207 Pb lead 82	208 Tl thallium 81	209 Pb lead 82	210 Bi bismuth 83	210 Po polonium 84	210 At astatine 85
86 Rn radon 86	[222] Rn radon 86	[222] Rn radon 86	[222] Rn radon 86	[222] Rn radon 86	[222] Rn radon 86	[222] Rn radon 86	[222] Rn radon 86	[222] Rn radon 86
Elements with atomic numbers 112-116 have been reported but not fully authenticated								[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.