

Candidate forename						Candidate surname					
Centre number						Candidate number					

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCSE

A215/02

TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A

Unit 1: Modules B4 C4 P4 (Higher Tier)

MONDAY 21 MAY 2012: Morning

DURATION: 40 minutes
plus your additional time allowance

MODIFIED ENLARGED

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)

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes on the first page. 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).

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 printed on the back page.

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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

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

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.

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[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

☐

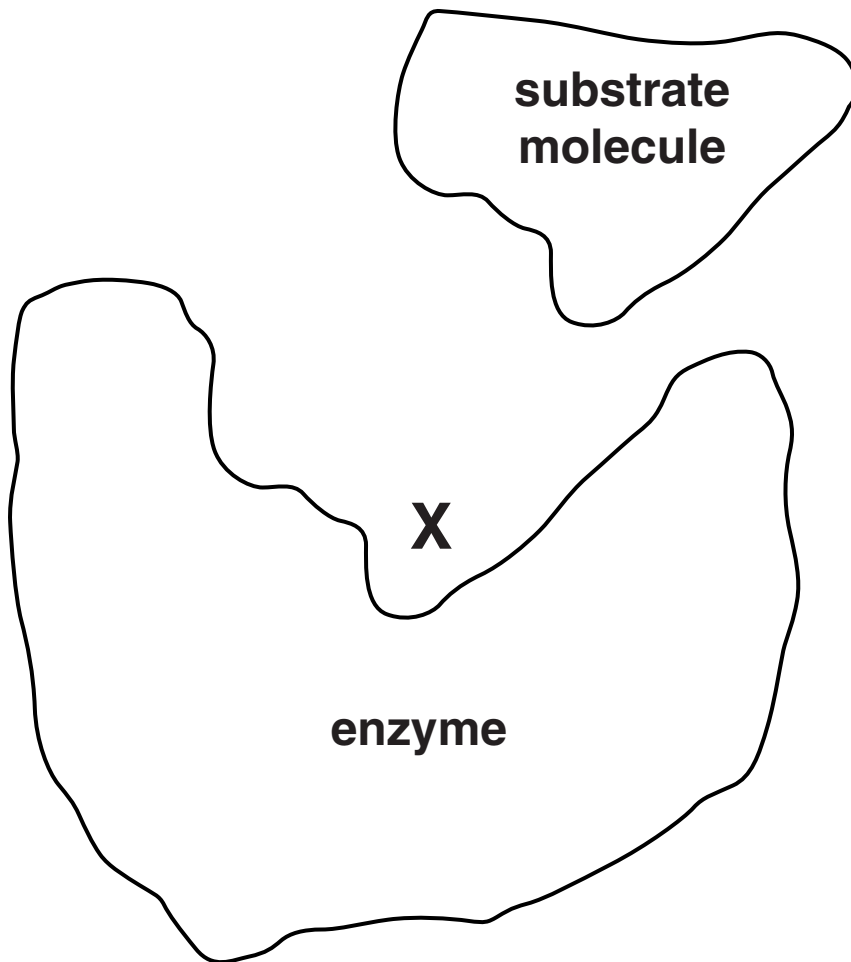
insulate him

☐

[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]

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+

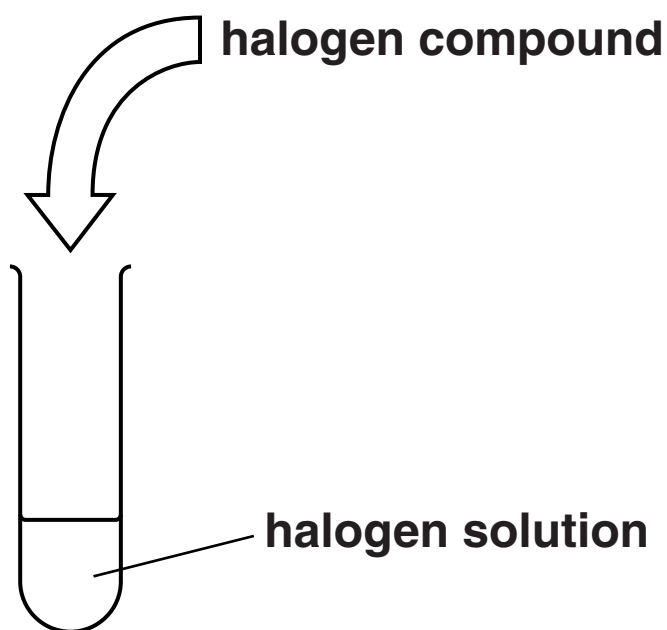
[1]

[Total: 6]

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TURN OVER FOR QUESTION 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

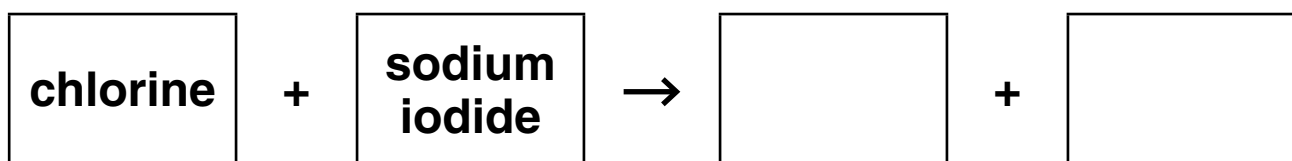
- (a) Use the table to put the three halogens in order of their reactivity.

most reactive _____

least reactive _____

[1]

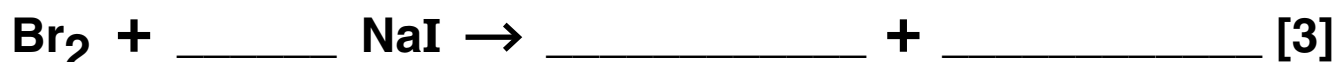
- (b) Complete the word equation for the reaction between chlorine and sodium iodide.



[1]

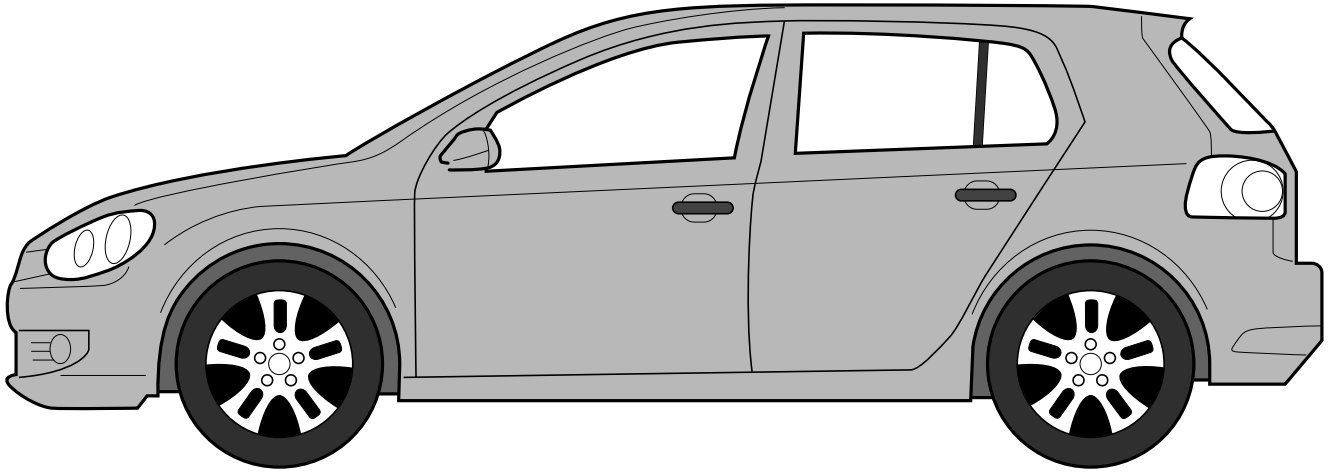
- (c) When bromine reacts with sodium iodide it makes sodium bromide and iodine.

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?

ALAN
 $65 \times 30 \times 9$



CARLO

$$\begin{array}{r} 65 \times 30 \\ \hline 9 \end{array}$$



BESS

$$\begin{array}{r} 30 \times 9 \\ \hline 65 \end{array}$$



DAVINA

$$\begin{array}{r} 65 \times 9 \\ \hline 30 \end{array}$$



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.

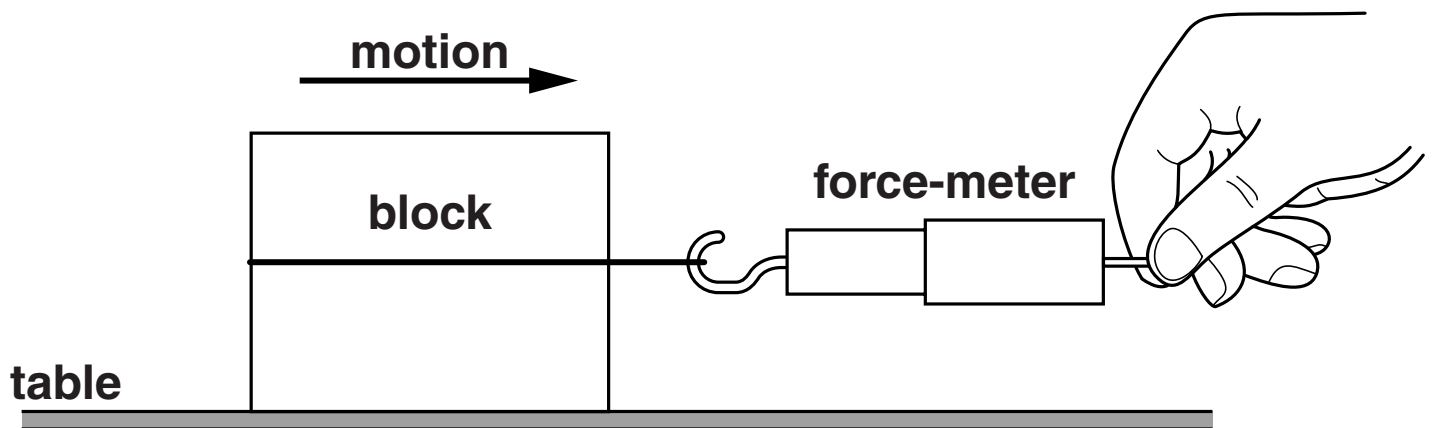
Explain how this reduces the force on Jane if the car has a head-on collision.

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. ☐

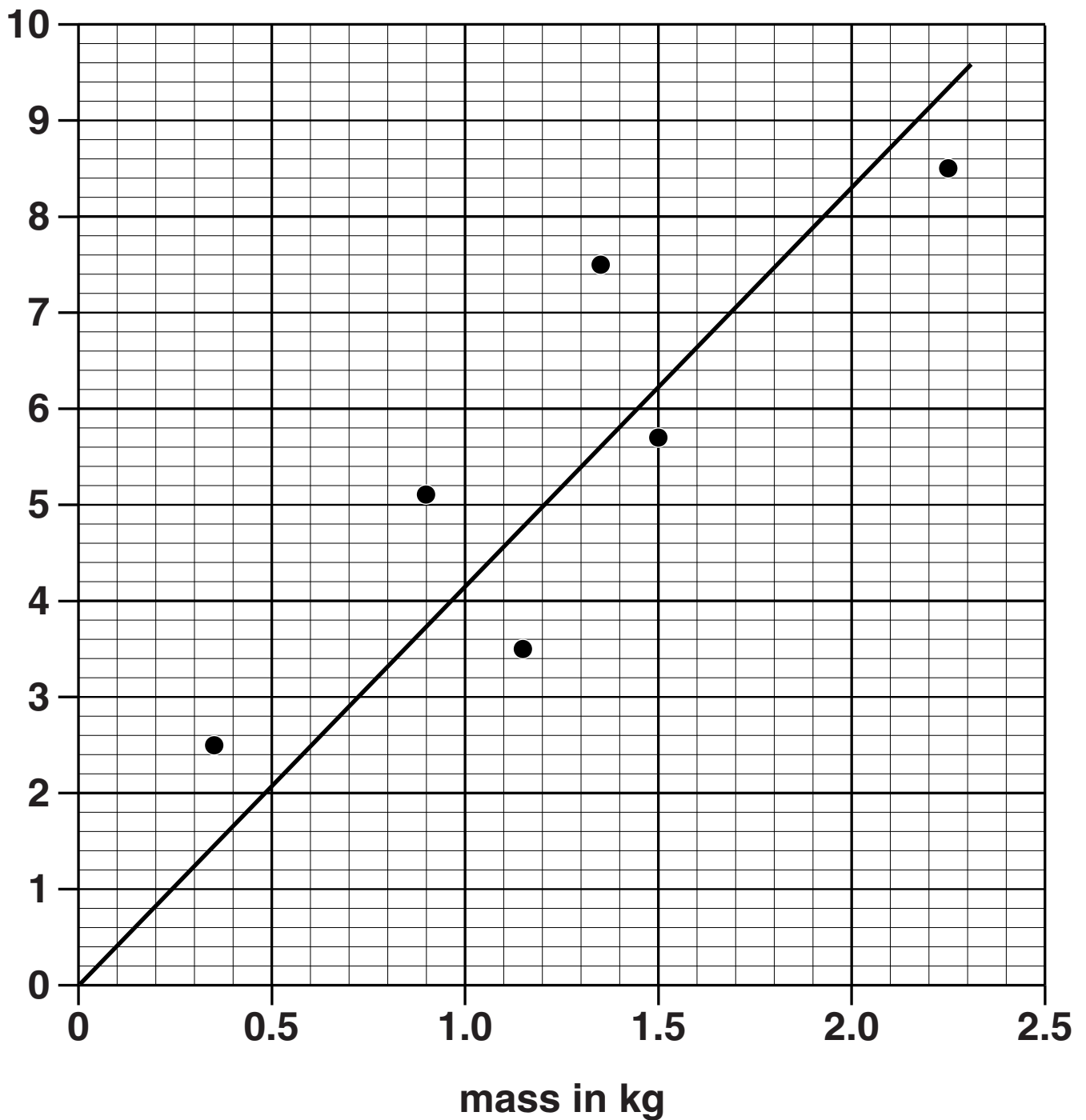
[2]

(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.

friction in N



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

reaction

weight

[1]

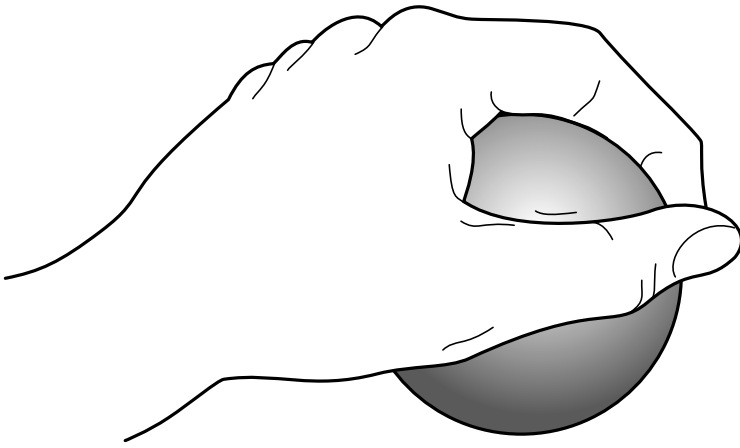
[Total: 5]

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TURN OVER FOR QUESTION 9

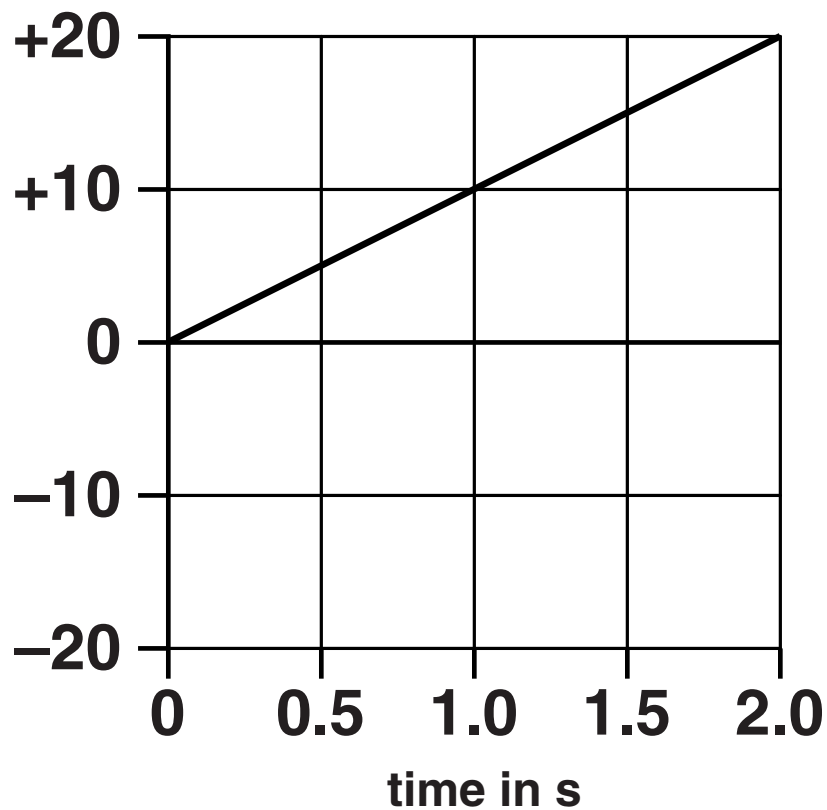
9 Chelsea stands on top of a tall building and drops a ball towards the ground.

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



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

velocity in m/s



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

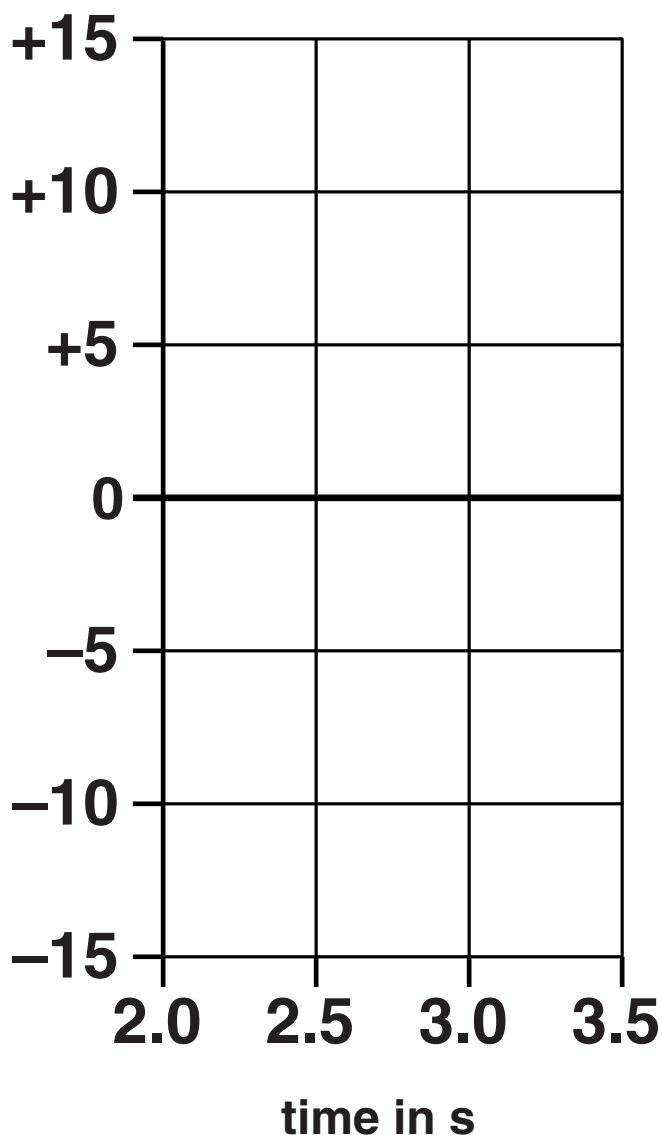
average speed = _____ m/s [1]

(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.

velocity in m/s



[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

The Periodic Table of the Elements

1	2	3										4	5	6	7	0	
		<div>1Hhydrogen1</div>														<div>4Hehelium2</div>	

relative atomic mass
atomic symbol
atomic (proton) number

1	H	1
	hydrogen	

* 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.