Candidate forename		Candidate surname	

Centre number					Candidate number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCSE

A215/01

TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A

Unit 1: Modules B4 C4 P4 (Foundation 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.

<u>OCR SUPPLIED MATERIALS:</u>

None

<u>OTHER MATERIALS REQUIRED:</u>

Pencil
Ruler (cm/mm)

<u>READ INSTRUCTIONS OVERLEAF</u>

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 <u>ALL</u> 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 <u>42</u>.

- A list of physics equations is printed on pages <u>4–5</u>.

- The Periodic Table is printed on the back page.

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TWENTY FIRST CENTURY SCIENCE EQUATIONS

USEFUL RELATIONSHIPS

EXPLAINING MOTION

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

momentum = mass × velocity

change of momentum = resultant force × time for which it acts

work done by a force = force × distance moved in the direction of the force

change in energy = work done

change in GPE = weight × vertical height difference

kinetic energy = $\frac{1}{2}$ × mass × [velocity]^2

ELECTRIC CIRCUITS

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

$$\text{energy transferred} = \text{power} \times \text{time}$$

$$\text{power} = \text{potential difference} \times \text{current}$$

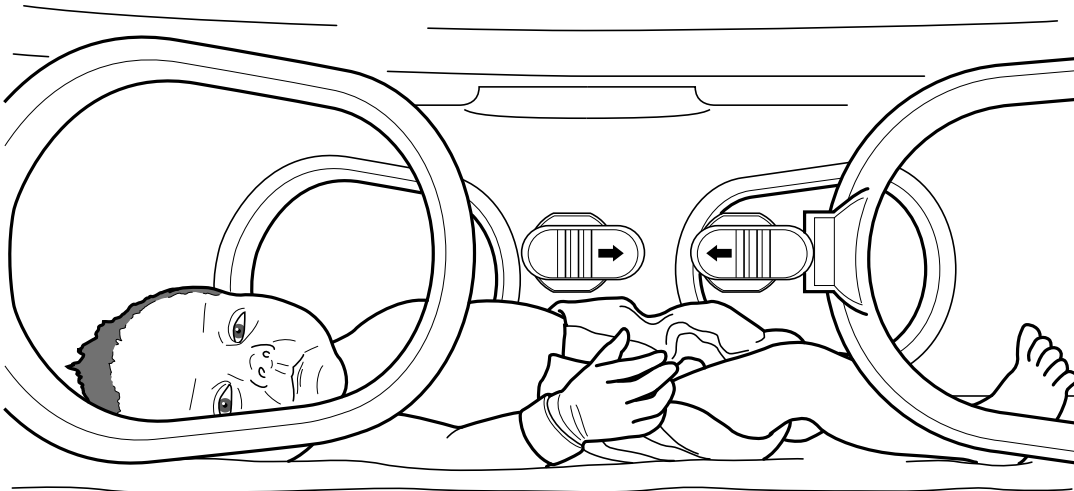$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

THE WAVE MODEL OF RADIATION

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

Answer ALL the questions.

1   Sasha is a newborn baby. She is in hospital in an incubator.

The incubator keeps the temperature constant.

_____

_____

_____

(a)   The incubator's temperature control system has a sensor (receptor), a processing centre and an effector.

What does each part do?

_____

_____

_____

_____

_____ [3]

(b) Sasha's father feels too hot in the hospital.

How does his body lose heat?

Put a (ring) around the correct answer.

shivering

sweating

running

[1]

[Total: 4]

2 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]

[Total: 4]

3   Adrian is climbing a mountain.

The weather becomes very cold and wet.

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

At first Adrian's body temperature stays the same.

This means his heat gain is

less than	
more than	
equal to	

his heat loss.

Later, his core body temperature falls.

His heat gain is now

less than	
more than	
equal to	

his heat loss.

His temperature falls below 35°C.

He now suffers from

hypothermia.	
hypothalamus.	
homeostasis.	

[3]

(b) Adrian is treated by the mountain rescue team.

As his body temperature returns to normal, the enzymes in his cells begin to work better.

Explain why.

_____

_____

_____

_____ **[3]**

[Total: 6]

4   Joe evaporates some seawater.

Crystals of sodium chloride (salt) begin to form.

(a) Joe writes down the colour of the salt crystals.

What colour are they?

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

blue   ☐

brown   ☐

green   ☐

colourless ☐

[1]

(b) 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]

(c) Sodium chloride is an ionic solid.

Two of these statements about sodium chloride are true.

Put ticks (✓) in the boxes next to the TWO correct statements.

Solid sodium chloride always conducts electricity. ☐

Solid sodium chloride often conducts electricity. ☐

Melted sodium chloride conducts electricity. ☐

Sodium chloride solution conducts electricity. ☐

[1]

[Total: 5]

5 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) There are **11** electrons in a sodium atom.

(i) How many PROTONS are there in a sodium atom?

Put a (ring) around the correct answer.

2

8

11

23

[1]

(ii) **What else are the atoms made of?**

Put a (ring) around the correct answer.

crystals

halogens

molecules

neutrons

[1]

(c) **The electron arrangement of a sodium ATOM is 2.8.1.**

A sodium atom loses one electron to make a sodium ion.

What is the electron arrangement of a sodium ION?

Put a (ring) around the correct answer.

2.8

2.7.1

1.8.1

2.8.1

[1]

(d) 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 sodium hydroxide?

Put a ⟨ring⟩ around the correct answer.

NaOH

Na_2OH

$NaOH_2$

$Na(OH)_2$

[1]

[Total: 5]

6 **Chlorine gas is very harmful.**

Tony finds out about safety procedures for working with chlorine gas.

(a) Put a tick (✓) in the box next to the MOST important safety procedure when working with chlorine gas.

wear gloves ☐

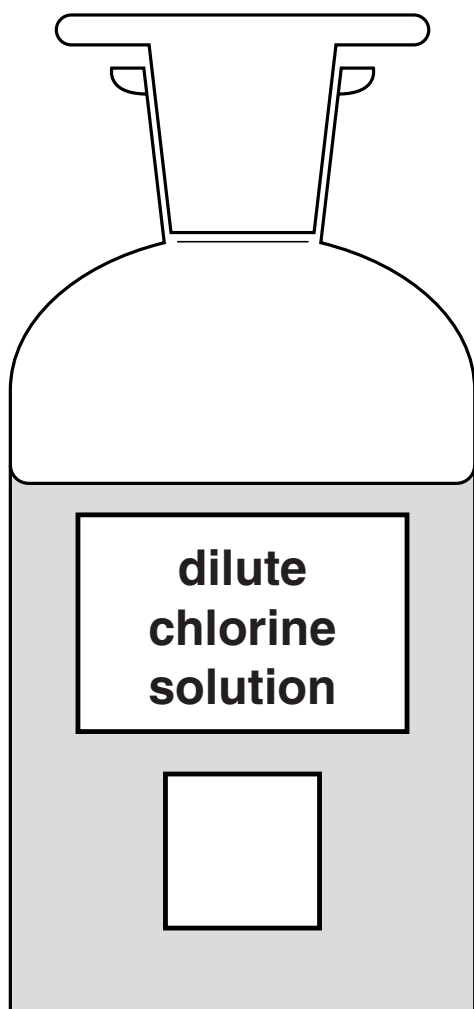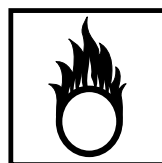wear a lab coat ☐

use a fume cupboard ☐
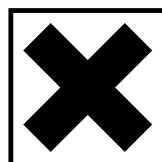
tie any long hair back ☐

[1]

(b) A dilute solution of chlorine is harmful, but not toxic.

Which symbol should go on bottles of chlorine solution?

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

dilute chlorine solution

[1]

(c) Chlorine, bromine and iodine are halogens.

Some halogens will react with other halogen compounds.

Halogen added	Sodium bromide solution	Sodium chloride solution	Sodium iodide solution
Bromine	no reaction	no reaction	reaction
Chlorine	reaction	no reaction	reaction
Iodine	no reaction	no reaction	no reaction

Use the table to put the three halogens in order of their reactivity.

most reactive _____

_____

least reactive _____ [1]

(d) Chlorine reacts with sodium iodide.

Sodium chloride and iodine are made.

Write a word equation for this reaction.

_____ [1]

[Total: 4]

7 **Jane chooses a new car.**
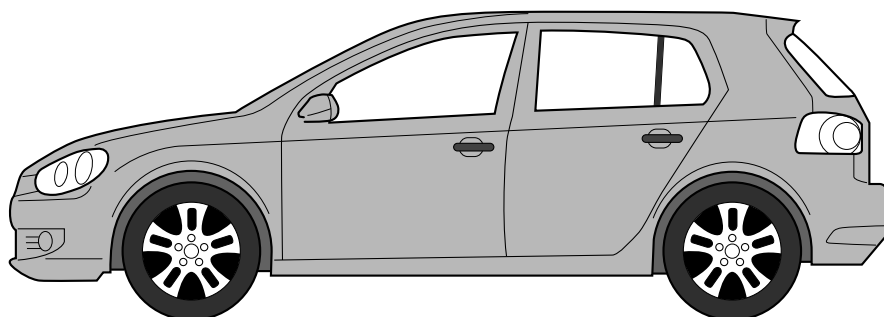
(a) **She takes it for a test drive.**

The car seat pushes her forwards. The average resultant force on her is 200 N.

Her speed increases for 9 s.

How should Jane calculate her change of momentum?

Put a (ring) around the correct calculation.

$$\frac{200}{9}$$

$$200 \times 9$$

$$\frac{9}{200}$$

[1]

(b) Jane puts on the brakes.

Below are some sentences about the car as it slows down.

Put a (ring) around the correct word in CAPITALS to complete each sentence.

As the car slows down the counter force is

BIGGER / SMALLER than the driving force.

The driving force and counter force act in the

SAME / OPPOSITE direction.

[1]

(c) The car has air-bags, seatbelts and crumple zones.

These are safety devices.

Explain how ONE of these devices makes Jane safer.

_____

_____

_____

_____

_____ [3]

[Total: 5]

8 Bill investigates friction by pulling blocks across a table with a force-meter.
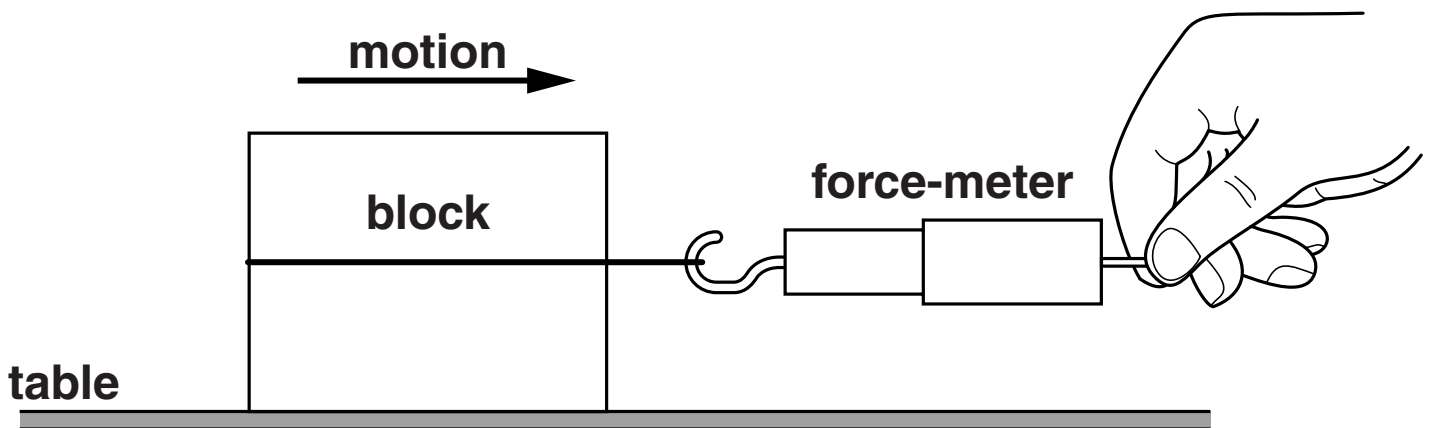
He pulls each block across the table at a steady speed.

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

(a) Here are some directions of forces.

The block moves to the RIGHT. In which direction does the friction force act?

Put a (ring) around the correct direction.
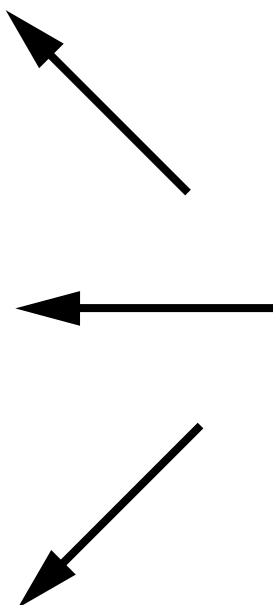
[1]

(b) In one experiment the force-meter reads **8.0** N.

   (i) Calculate the work done when the block moves **0.6** m across the table.

     work done = _____ J   **[1]**

  (ii) Bill pulls the block across the table at a steady speed.

     This increases a property of the block.

     As the block moves at a STEADY speed, which of these properties INCREASES?

     Put a (ring) around the correct answer.

     mass

     momentum

     temperature

     weight

                                  [1]

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

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

He plots the results of his experiments on a graph.

friction in N

mass in kg
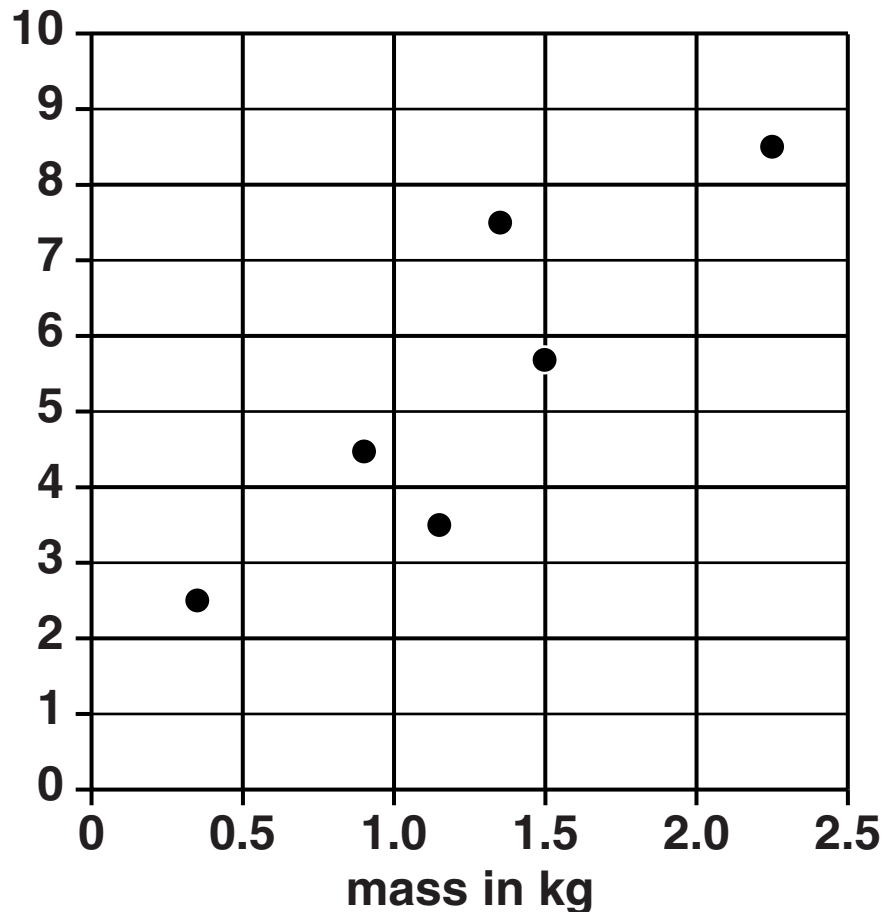
(i) Put a ⟨ring⟩ around the point on the graph for a mass of 0.9 kg. **[1]**

(ii) Here are some possible conclusions for Bill's experiment.

Put a tick (✓) in the box next to the BEST conclusion.

The friction is the same for all of the blocks. ☐

There is no link between the friction and the mass. ☐

Increasing the mass of the block increases the friction. ☐

Increasing the mass of the block decreases the friction. ☐

[1]

[Total: 5]

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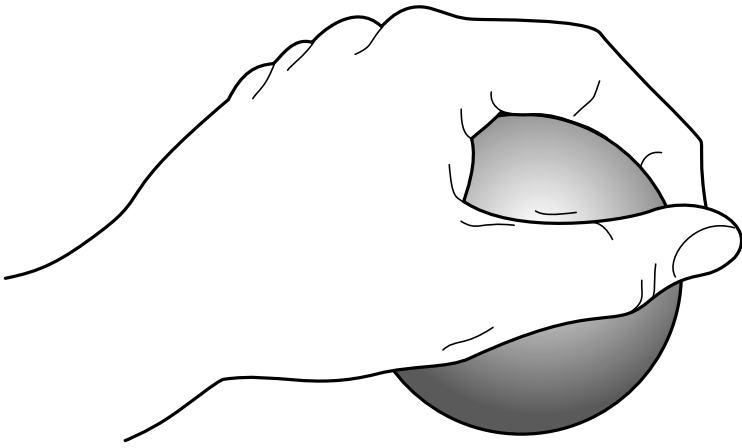
Here is a velocity-time graph for the ball during its fall.

velocity in m/s

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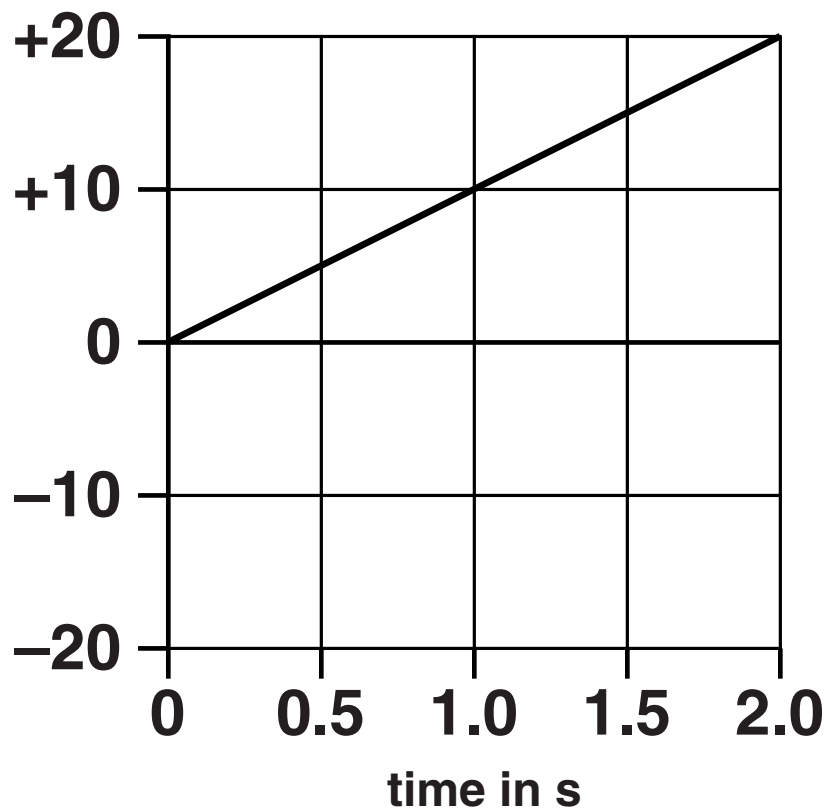
(a) **What is the AVERAGE speed of the ball on its way down?**

average speed = _____ m/s   [1]

(b) After **2** seconds the ball hits the ground and bounces upwards. It has 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

```
+15 ─┬────┬────┬────┐
     │    │    │    │
+10 ─┼────┼────┼────┤
     │    │    │    │
 +5 ─┼────┼────┼────┤
     │    │    │    │
  0 ─┼────┼────┼────┤
     │    │    │    │
 −5 ─┼────┼────┼────┤
     │    │    │    │
−10 ─┼────┼────┼────┤
     │    │    │    │
−15 ─┴────┴────┴────┘
    2.0  2.5  3.0  3.5
         time in s
```
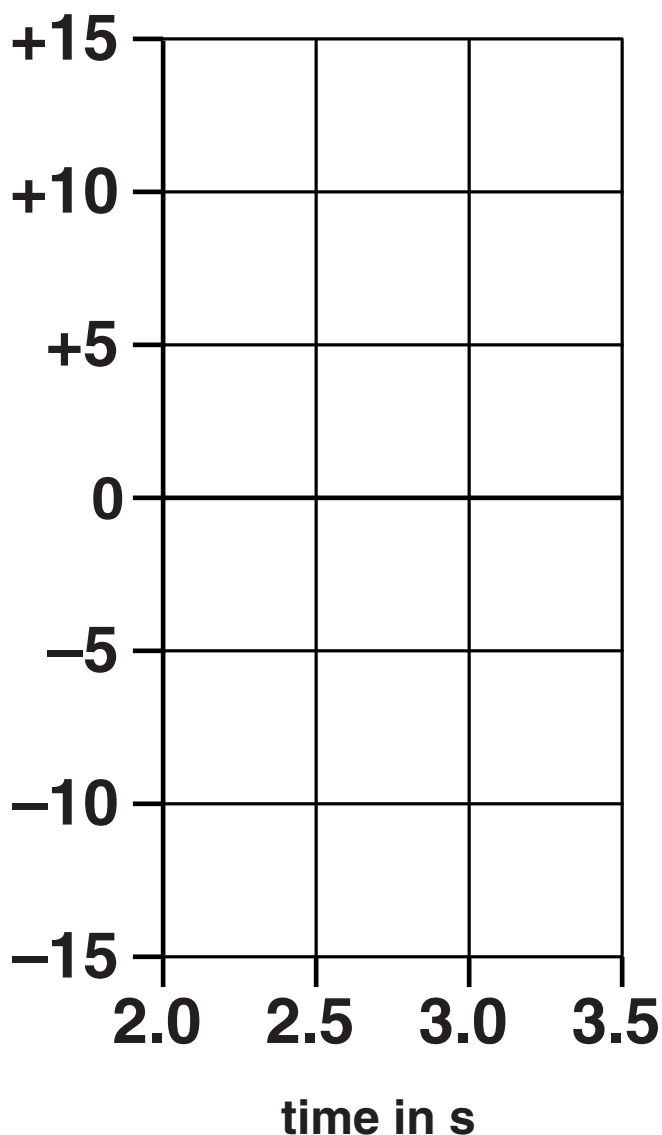
[2]

(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

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The Periodic Table of the Elements

1	2												3	4	5	6	7	0
																		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 **A*l*** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **C*l*** 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 **T*l*** 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

1
H
hydrogen
1

* 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.