

Candidate Forename						Candidate Surname				
Centre Number						Candidate Number				

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
GENERAL CERTIFICATE OF SECONDARY EDUCATION**

**A215/01**

**TWENTY FIRST CENTURY SCIENCE  
ADDITIONAL SCIENCE A**

**Unit 1: Modules B4 C4 P4 (Foundation Tier)**

**MONDAY 25 JANUARY 2010: Afternoon**

**DURATION: 40 minutes**

**SUITABLE FOR VISUALLY IMPAIRED CANDIDATES**

**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 clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **ALL** the questions.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

## **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 and 5.
- A copy of the Periodic Table is provided.

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## TWENTY FIRST CENTURY SCIENCE EQUATIONS

### USEFUL RELATIONSHIPS

#### EXPLAINING MOTION

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

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{change of momentum} = \text{resultant force} \times \text{time for which it acts}$$

$$\text{work done by a force} = \text{force} \times \text{distance moved by the force}$$

$$\text{change in energy} = \text{work done}$$

$$\text{change in GPE} = \text{weight} \times \text{vertical height difference}$$

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

## 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 Sue is a doctor.**

**She treats patients for either heat stroke or hypothermia at different times of the year.**

**(a) Draw straight lines from each SYMPTOM to the correct CONDITION.**

**Draw straight lines from each TREATMENT to the correct CONDITION.**

<b><u>SYMPTOM</u></b>	<b><u>CONDITION</u></b>	<b><u>TREATMENT</u></b>
rapid pulse rate		wrap in wet towels
shivering	hypothermia	insulate the patient
slurred speech	heat stroke	keep the patient as still as possible
dry skin		use a fan

**[4]**

(b) (i) Sue takes the temperature of a patient suffering from HEAT STROKE.

Put a **ring** around the temperature she is most likely to find.

34 °C

37 °C

40 °C

[1]

(ii) Sue takes the temperature of a patient suffering from HYPOTHERMIA.

Put a **ring** around the temperature she is most likely to find.

34 °C

36 °C

38 °C

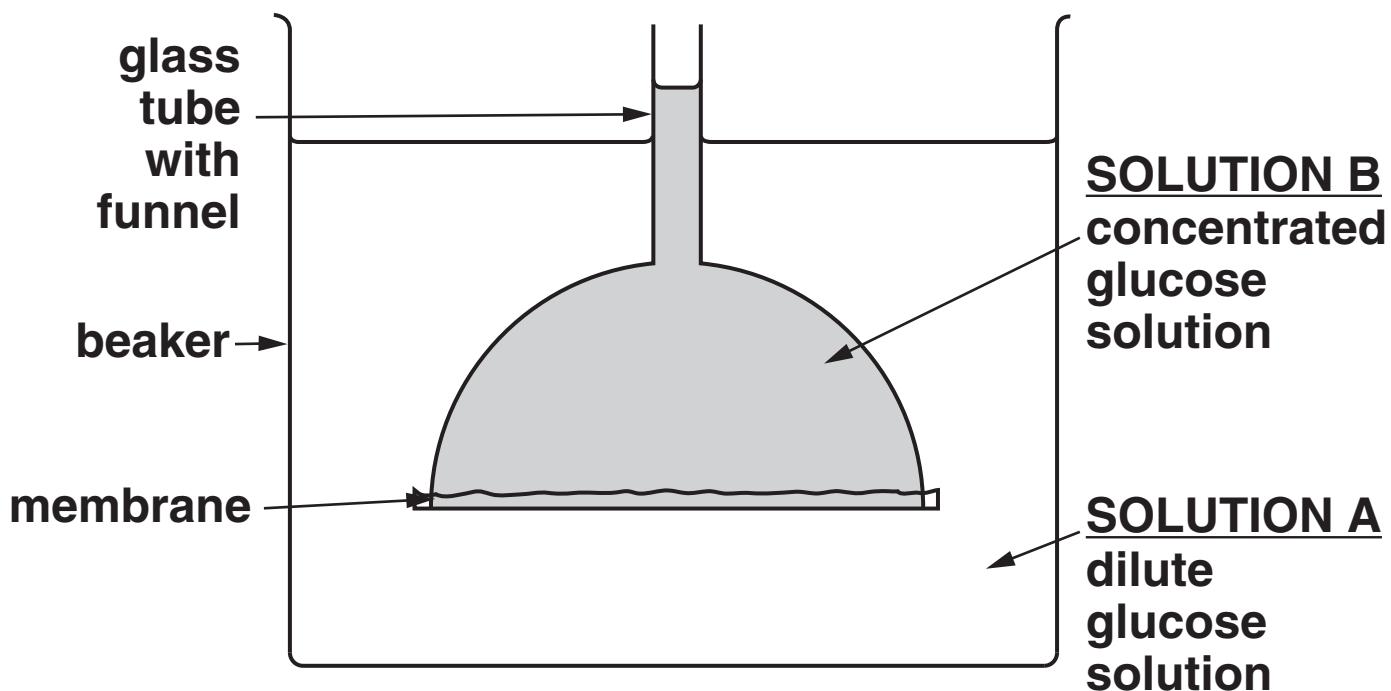
40 °C

42 °C

[1]

[Total: 6]

## 2 Barry sets up an experiment to investigate osmosis.



(a) What type of membrane should Barry use to investigate osmosis?

[1]

(b) Barry sees that the level in the tube goes up.

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

only water moves from SOLUTION A to SOLUTION B

only glucose moves from SOLUTION A to SOLUTION B

both water and glucose move from SOLUTION A to SOLUTION B

[1]

(c) Barry repeats the experiment. He wants to change his experiment so that the level in the tube does not change.  
What should he do?

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

add more water to SOLUTION A

add more glucose to SOLUTION A

warm up SOLUTION A

[1]

[Total: 3]

3 Tina investigates the effect of temperature on enzymes.  
She uses the enzyme catalase to break down hydrogen peroxide.  
She collects the oxygen gas given off by the reaction.  
Here are some of her results.

TEMPERATURE OF CATALASE AND HYDROGEN PEROXIDE IN °C	VOLUME OF GAS COLLECTED IN 1 MINUTE IN CM <sup>3</sup>
20	18
30	36
40	40
90	

(a) Suggest and explain how much gas will be produced at 90 °C.

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[2]

**(b) Tina tries to use a different enzyme to break down hydrogen peroxide.**

**Use the lock and key model to explain why this will not work.**

[3]

[Total: 5]

4 Atoms are made up of protons, neutrons and electrons.

(a) The charge and the mass of protons, neutrons and electrons are not the same.

Draw straight lines to join each type of PARTICLE to its CHARGE.

Draw straight lines to join each type of PARTICLE to its RELATIVE MASS.

CHARGE

0

-1

+1

PARTICLE

proton

neutron

electron

RELATIVE MASS

almost zero

1

[2]

**(b) Many chemical changes involve ions.**

**Draw ONE line between the two boxes which BEST describe what an ion is.**

**A crystal  
lattice ...**

**... which has gained or  
lost electrons.**

**or**

**A group of  
atoms ...**

**... which has gained or  
lost protons.**

**or**

**An atom or a  
group of atoms ...**

**... which has gained or  
lost neutrons.**

**or**

**An atom ...**

**... which has moved from  
one group to another.**

**[2]**

**[Total: 4]**

**5 David's teacher does an experiment using sodium.**

**(a) The sodium is stored in a bottle of oil.  
Why must it be stored in oil?**

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**[2]**

**(b) Sodium is in group 1 of the Periodic Table.  
Here is an outline of the Periodic Table.  
The cross (X) shows one of the group 1 metals.**

**Put crosses (X) in TWO MORE boxes that are group 1 metals.**

X						

**[1]**

(c) The teacher puts a small piece of sodium into a beaker of water.

State two things you would SEE happen in the beaker.

---

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[2]

(d) David watches a firework display. He suspects that a firework contains sodium compounds. What is the clue that makes him suspect this?

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

The firework burns rapidly.

The firework makes a strong smell.

The firework produces grey smoke.

The firework burns with a yellow flame.

[1]

[Total: 6]

**6 Bromine is a toxic and corrosive liquid.**

**(a) Which two safety symbols should be on bottles of bromine?**

**Put a ring around each of the TWO correct labels.**

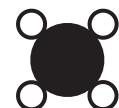


**[1]**

**(b) The symbol for a bromine molecule is  $\text{Br}_2$ .**

**Which of these diagrams could be of a bromine molecule?**

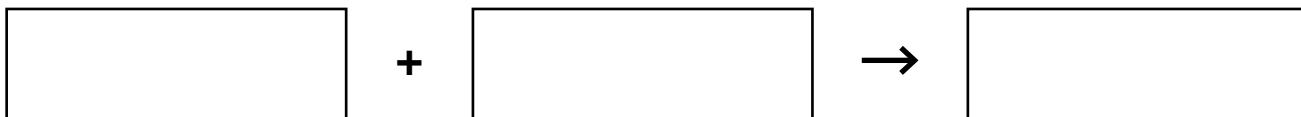
**Put a ring around the correct answer.**



**[1]**

**(c) Bromine reacts with sodium to make sodium bromide.**

**Use the spaces to write a word equation for this reaction.**



**[1]**

**(d) Solid sodium bromide is ionic.**

**Draw ONE line between the boxes to describe what happens to the ions when solid sodium bromide dissolves in water.**

**Ions are in the solid at the start.**

**OR**

**Ions form when the solid dissolves.**

**Ions then spread through the liquid.**

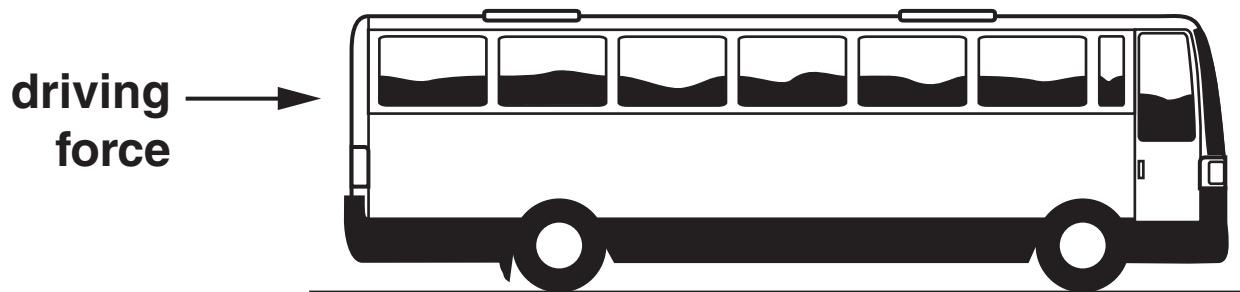
**OR**

**Ions then sink to the bottom of the liquid.**

**[1]**

**[Total: 4]**

7 Joe drives a bus along a level road.



(a) A driving force acts forwards on the bus when it is moving at a steady speed.

Explain why the driving force does not increase the speed of the bus.

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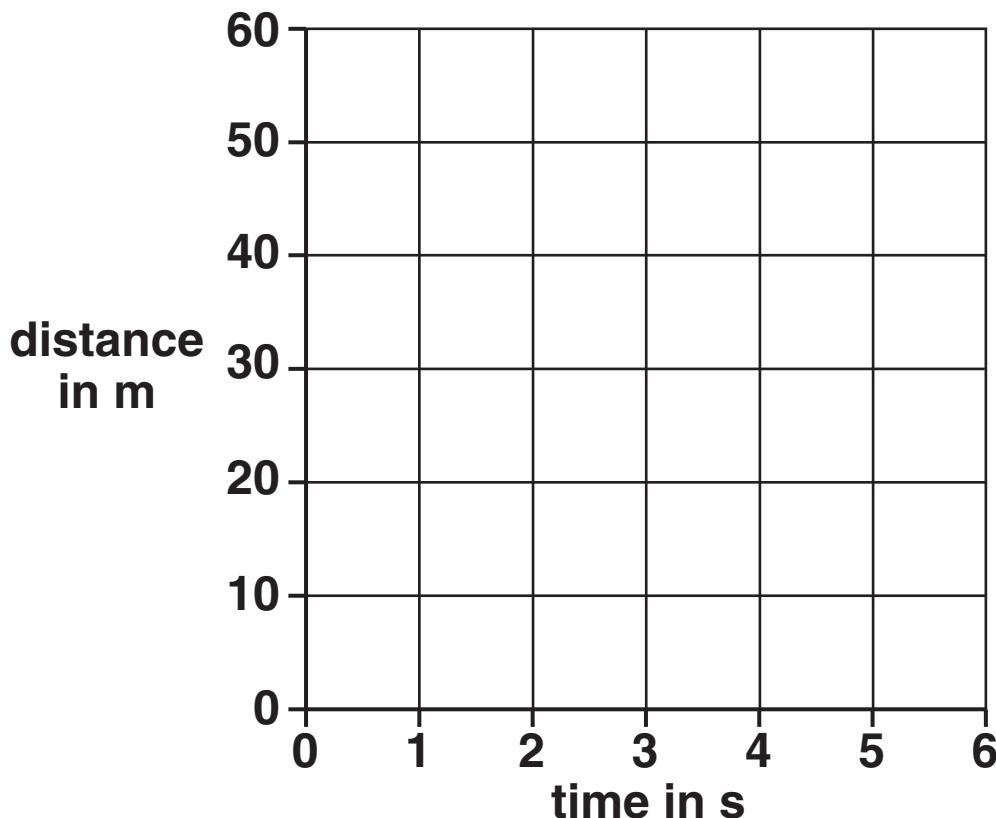
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[2]

(b) On the axes below, sketch a DISTANCE-TIME graph for the bus as it travels at a steady speed of 15 m/s.

Start the graph at the point 0,0.



[2]

[Total: 4]

8 A small jet aircraft is speeding up along a runway.

(a) The engines exert a force of 6000 N on the aircraft as it moves along the runway. Which calculation shows the change of momentum of the aircraft in 12 s?

Put a **ring** around the correct answer.

$$\frac{6000}{12}$$

$$6000 \times 12$$

$$\frac{12}{6000}$$

[1]

(b) Put a **ring** around the correct choice in each sentence.

The jet engines increase the forward speed of the aircraft.

The engines do this by pushing gas

BACKWARDS / FORWARDS.

The force needed on the gas is in the

BACKWARDS / FORWARDS direction.

This results in a force on the engines in the

SAME / OPPOSITE direction.

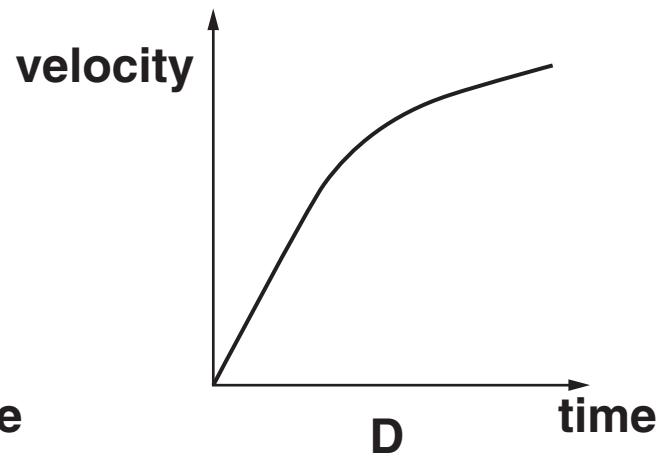
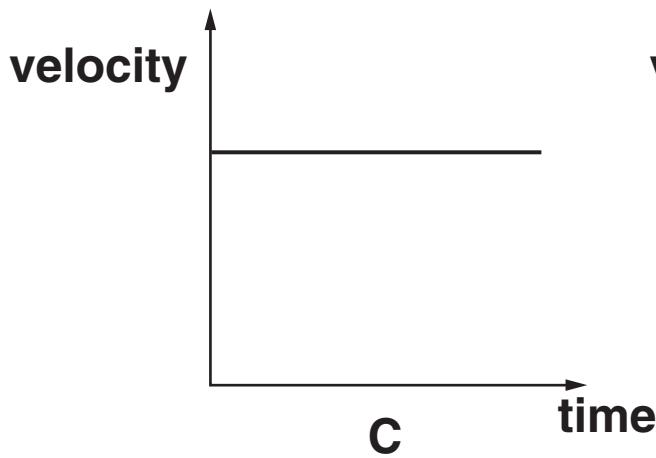
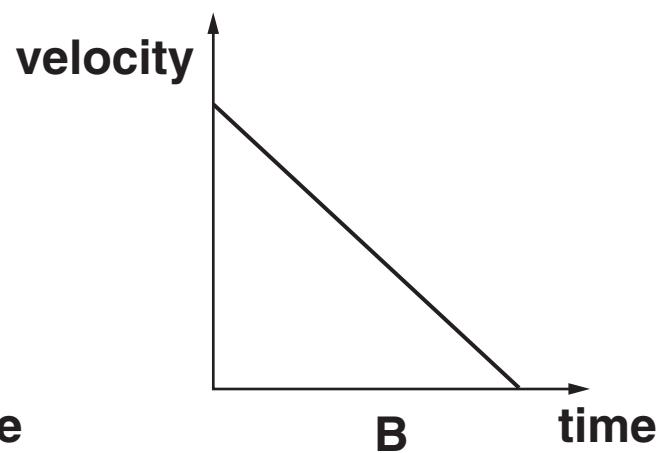
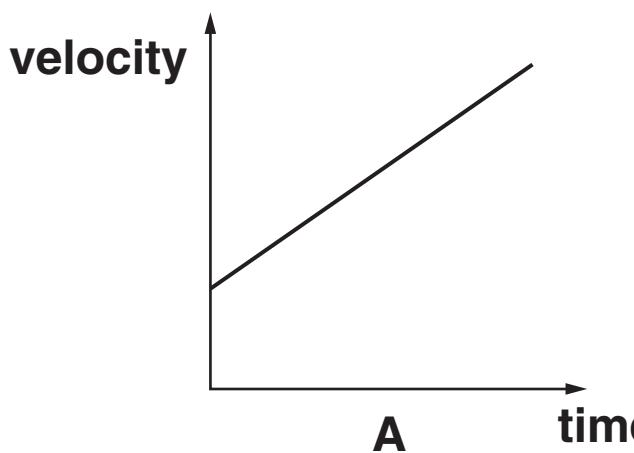
The force on the engines is GREATER THAN /

THE SAME AS / SMALLER THAN the force on

the gas.

[2]

(c) Which of these VELOCITY-TIME graphs shows a steadily increasing velocity?



answer \_\_\_\_\_ [1]

(d) The aircraft takes off when it has a forward velocity of 48 m/s.

Put a tick (✓) in the box next to the correct meaning of the word VELOCITY.

The velocity of an object is ...

... how fast its speed is changing.

... its speed and direction of motion.

... how fast its direction is changing.

[1]

[Total: 5]

9 Jim takes part in a high jump contest.

(a) Complete the sentences.

Choose words from this list.

GRAVITATIONAL POTENTIAL

KINETIC

MOMENTUM

WORK

Jim stands 10m away from the high jump.

He runs towards the high jump, gaining

\_\_\_\_\_ energy.

He then jumps up to the bar, gaining

\_\_\_\_\_ energy.

[2]

(b) Jim has a mass of 65 kg. Just before he jumps up, his velocity is 10m/s.

Who has the correct way of calculating his momentum?

ALAN

$$\frac{1}{2} \times 65 \times 10^2$$

CARLOS

$$65 \times 10$$

BESS

$$65 \times 10 \times 10$$

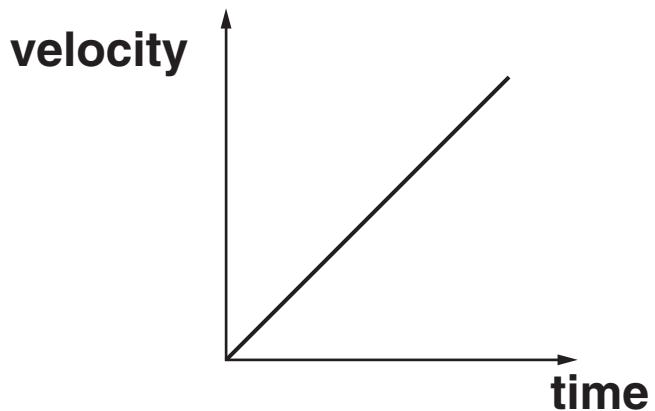
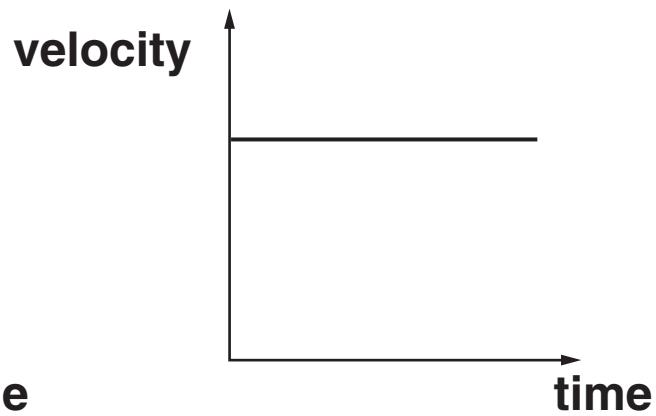
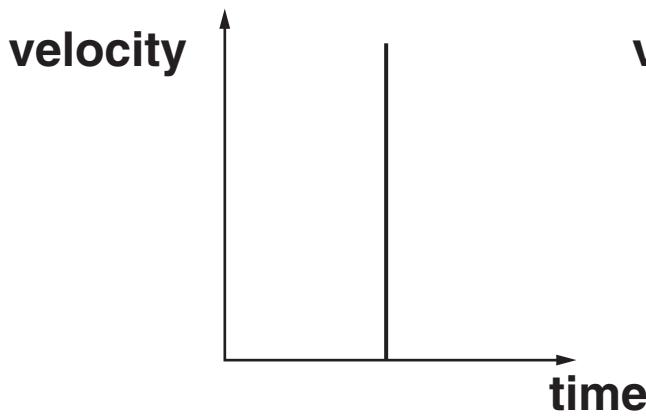
DAVINA

$$\frac{1}{2} \times 65 \times 10$$

answer \_\_\_\_\_ [1]

(c) Jim clears the bar and falls back to the ground.

Put a **ring** around the correct VELOCITY-TIME graph for Jim as he falls vertically to the ground.



[1]

**(d) Jim stops moving when he lands.**

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

**His kinetic energy is lost through heating.**

**He gains momentum through friction.**

**He loses weight through reaction.**

**[1]**

**[Total: 5]**

**END OF QUESTION PAPER**

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# The Periodic Table of the Elements

1	2	3	4	5	6	7	0
7 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4	20 <b>Ca</b> calcium 20	40 <b>Sc</b> scandium 21	45 <b>Ti</b> titanium 22	48 <b>V</b> vanadium 23	51 <b>Cr</b> chromium 24	52 <b>Mn</b> manganese 25
23 <b>Na</b> sodium 11	24 <b>Mg</b> magnesium 12	39 <b>K</b> potassium 19	88 <b>Y</b> yttrium 39	89 <b>Sr</b> strontium 38	91 <b>Nb</b> niobium 41	93 <b>Zr</b> zirconium 40	96 <b>Mo</b> molybdenum 42
39 <b>Rb</b> rubidium 37	85 <b>Yt</b> yttrium 39	137 <b>La*</b> lanthanum 57	139 <b>Hf</b> hafnium 72	178 <b>Ta</b> tantalum 73	181 <b>W</b> tungsten 74	184 <b>Re</b> rhenium 75	186 <b>Os</b> osmium 76
[223] <b>Ra</b> francium 87	[226] <b>Ac*</b> actinium 88	[227] <b>Rf</b> rutherfordium 89	[261] <b>Db</b> dubnium 104	[262] <b>Bh</b> bohrium 105	[264] <b>Sg</b> seaborgium 106	[268] <b>Mt</b> meitnerium 107	[277] <b>Hs</b> hassium 108
11 <b>B</b> boron 5	12 <b>C</b> carbon 6	14 <b>N</b> nitrogen 7	16 <b>O</b> oxygen 8	19 <b>F</b> fluorine 9	20 <b>Ne</b> neon 10	20 <b>Ar</b> argon 18	4 <b>He</b> helium 2
31 <b>P</b> phosphorus 15	32 <b>S</b> sulfur 16	33 <b>Cl</b> chlorine 17	35.5 <b>Br</b> bromine 35	37 <b>Se</b> selenium 34	79 <b>Ge</b> germanium 32	75 <b>As</b> arsenic 33	80 <b>Kr</b> krypton 36
59 <b>Co</b> cobalt 27	65 <b>Cu</b> copper 29	63.5 <b>Ni</b> nickel 28	70 <b>Zn</b> zinc 30	73 <b>Ga</b> gallium 31	75 <b>Ge</b> germanium 32	79 <b>Se</b> selenium 34	84 <b>Xe</b> xenon 54
101 <b>Ru</b> ruthenium 44	103 <b>Rh</b> rhodium 45	106 <b>Pd</b> palladium 46	108 <b>Ag</b> silver 47	112 <b>Cd</b> cadmium 48	115 <b>In</b> indium 49	119 <b>Sb</b> antimony 51	127 <b>Tl</b> tellurium 52
192 <b>Ir</b> iridium 77	195 <b>Pt</b> platinum 78	197 <b>Au</b> gold 79	201 <b>Hg</b> mercury 80	204 <b>Tl</b> thallium 81	207 <b>Pb</b> lead 82	209 <b>Bi</b> bismuth 83	210 <b>At</b> astatine 85
268 <b>Mt</b> meitnerium 109	277 <b>Ds</b> darmstadtium 110	271 <b>Rg</b> roentgenium 111	[272] <b>Rg</b> 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.