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)

WEDNESDAY 25 MAY 2011: Morning
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

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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. Pencil may be used for graphs and diagrams only.**
- **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).**
- **Answer ALL the questions.**

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.**
- **The Periodic Table is provided.**

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TWENTY FIRST CENTURY SCIENCE EQUATIONS

USEFUL RELATIONSHIPS

EXPLAINING MOTION

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

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

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

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

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

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

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

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 Arjun is swimming the English Channel.

In the first part of the swim his core body temperature stays the same.

(a) How much heat energy is he producing?

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

less than the energy that he loses ☐

the same as the energy that he loses ☐

more than the energy that he loses ☐

[1]

(b) The water is cold.

What is Arjun's core body temperature?

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

THE SAME as the temperature in his fingers ☐

LESS THAN the temperature in his fingers ☐

HIGHER THAN the temperature in his fingers ☐

[1]

(c) Arjun has receptors to sense the temperature of his blood.

Where are they?

Put a (ring) around the correct answer.

brain

eye

kidney

liver

[1]

(d) The crew of the safety boat pull Arjun from the water.

They think that he has hypothermia.

(i) Arjun has hypothermia.

What is his body temperature?

Put a (ring) around the correct answer.

42 °C

40 °C

38 °C

36 °C

34 °C

[1]

(ii) Write about hypothermia.

In your answer describe

- **two symptoms of hypothermia**
- **how to treat it.**

_____

_____

_____

_____ **[3]**

[Total: 7]

2 Talesha loses water from her body when she excretes urine.

(a) Put (rings) around TWO other ways she loses water.

breathing out

eating

growing

sweating

[1]

(b) Talesha's kidneys balance the level of water and other chemicals in her blood.

Her kidneys filter chemicals from the blood.

Some of the chemicals are reabsorbed.

Draw ONE straight line from EACH CHEMICAL to show HOW MUCH HER KIDNEYS REABSORB.

CHEMICAL	HOW MUCH HER KIDNEYS REABSORB
sugar	all of it
water	as much as the body needs
salt	

[2]

[Total: 3]

3 Vikram is studying enzymes.

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

Enzymes are …

… carbohydrates that slow down chemical reactions. ☐

… carbohydrates that speed up chemical reactions. ☐

… proteins that slow down chemical reactions. ☐

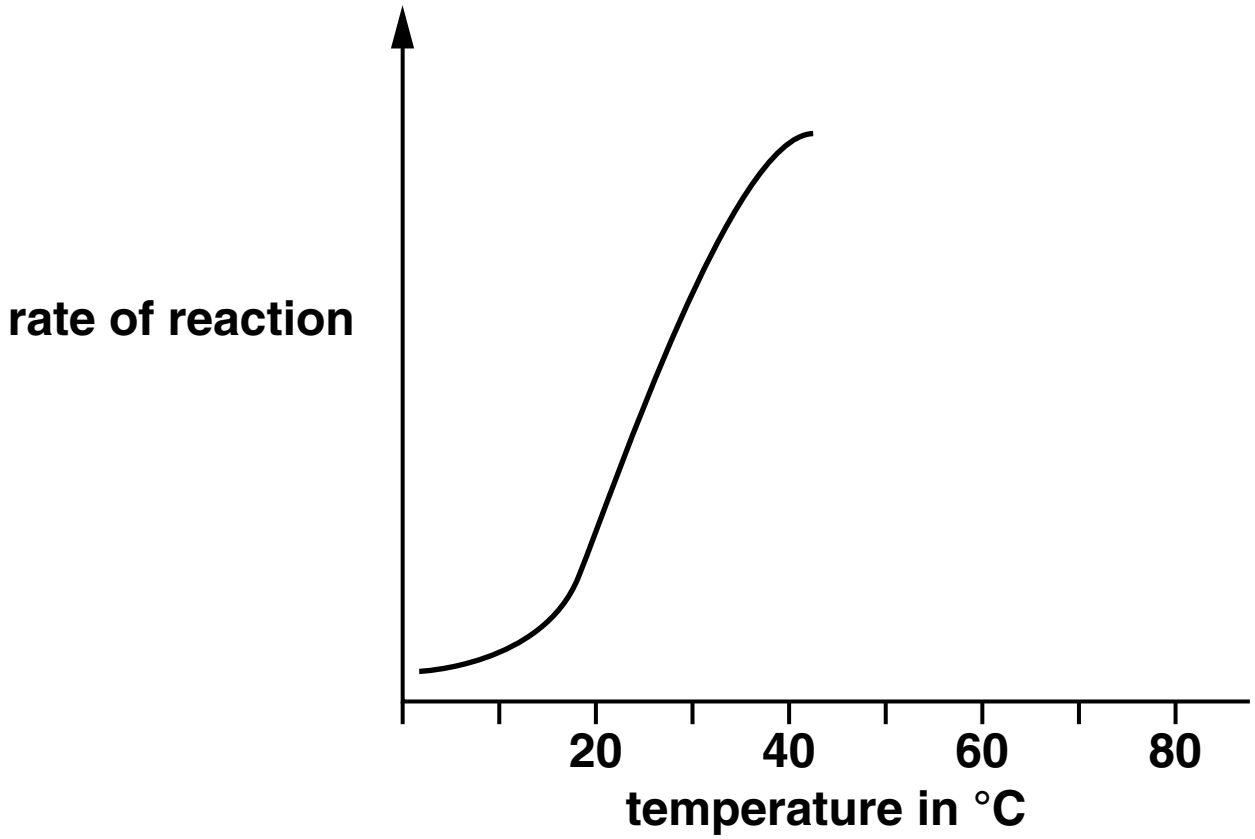
… proteins that speed up chemical reactions. ☐

[1]

(b) Vikram does some experiments with enzymes.

He measures the rate of reaction at different temperatures.

Here is a graph of his results.



	As the temperature …	… the frequency of collisions …	… and the rate of reaction …
A	… increases …	… decreases …	… increases.
B	… increases …	… increases …	… increases.
C	… decreases …	… increases …	… increases.
D	… decreases …	… decreases …	… increases.

Which row, A, B, C or D, is the best explanation for his results?

row _____ [1]

(c) Vikram continues to increase the temperature in his experiment.

What will happen?

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

The rate of reaction will INCREASE / DECREASE / STAY THE SAME.

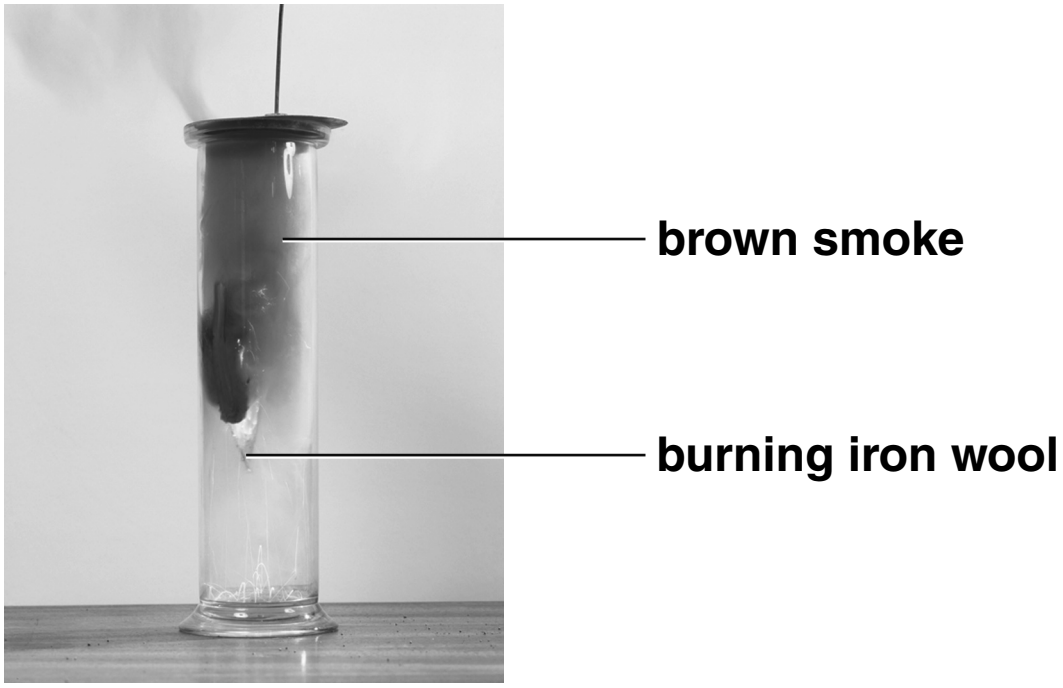
This is because the enzyme is BROKEN DOWN / DENATURED / KILLED.

The enzyme now has the wrong SHAPE / MASS / CHEMICALS for the other molecules to fit.

[2]

[Total: 4]

4 William's teacher burns some hot iron wool in chlorine gas.



(a) The iron wool glows red-hot as it reacts. It makes a brown smoke.

What is the brown smoke?

Put a tick (✓) next to the best answer.

chlorine ☐

iron oxide ☐

iron vapour ☐

iron chloride ☐

[1]

(b) William's teacher then puts hot iron wool into iodine vapour.

This time the iron wool does not glow as much.

Explain why.

_____

_____ **[2]**

(c) William's teacher then burns some sodium in a jar of chlorine gas.

(i) Sodium is dangerous, and it is stored in a bottle of oil.

Explain why it is stored in oil.

_____

_____ **[2]**

(ii) When the sodium burns it makes sodium chloride.

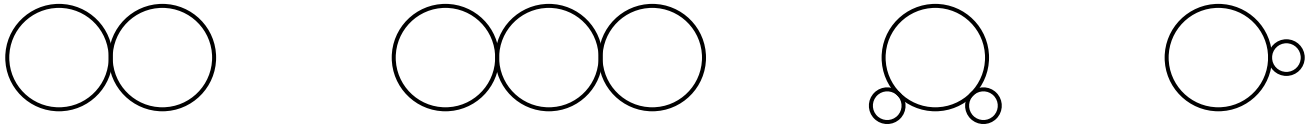
sodium + chlorine → sodium chloride

Write the chemical formula of sodium chloride.

answer _____ **[1]**

(iii) **William draws a diagram of a chlorine molecule, Cl_2.**

Put a (ring) around the correct diagram.



[1]

[Total: 7]

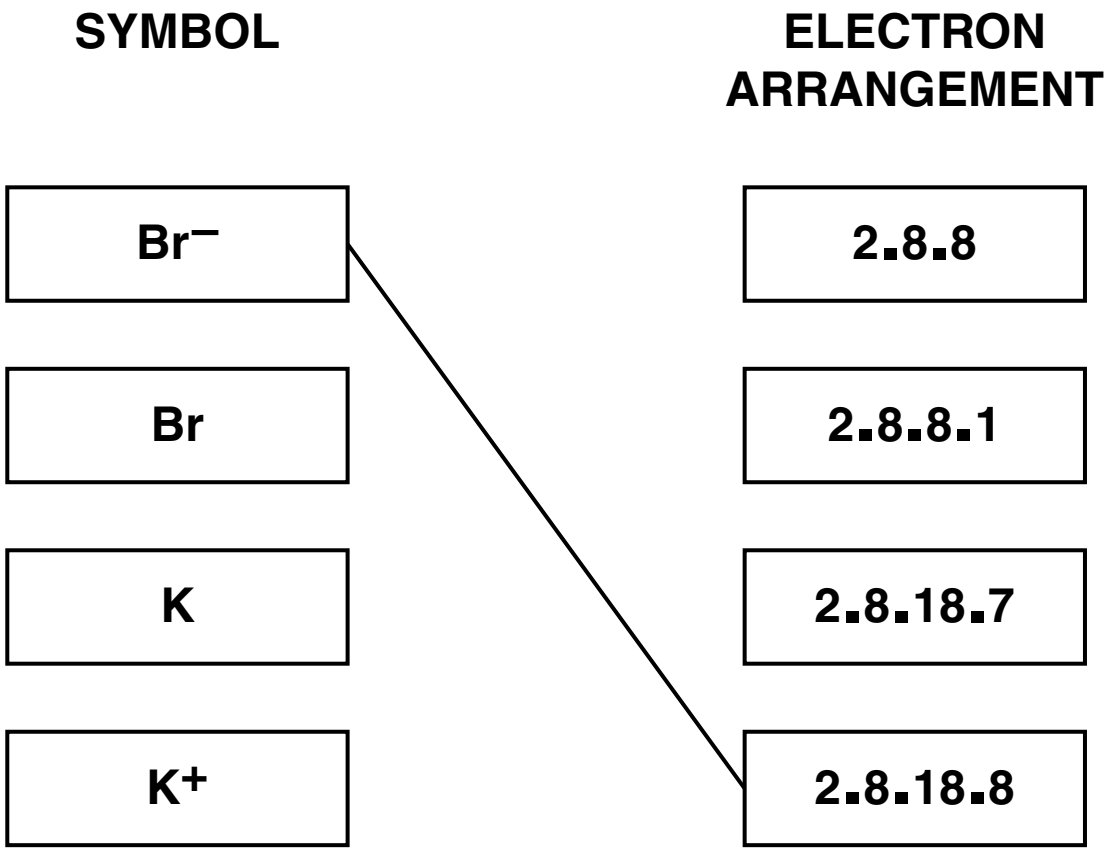
5 Potassium bromide contains potassium ions, K^+, and bromide ions, Br^-.

If an atom gains an electron it turns into a negative ion.

If an atom loses an electron it turns into a positive ion.

(a) Draw lines to link each SYMBOL for an atom or ion to its correct ELECTRON ARRANGEMENT.

One has been done for you.



[2]

(b) The potassium bromide forms ionic crystals.

Matilda dissolves potassium bromide crystals to form a solution.

What happens to the solid as it dissolves?

Put a tick (✓) in the box to complete this sentence.

As the solid dissolves …

… the particles turn into ions. ☐

… the particles stay as ions. ☐

… the particles turn into molecules. ☐

… the particles turn into atoms. ☐

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

When the solid dissolves, the particles …

… settle to the bottom. ☐

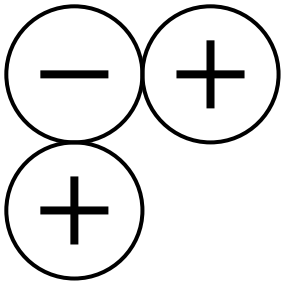
… go into the air. ☐

… move randomly through the solution. ☐

[2]

(c) Matilda starts to draw a diagram of the ions in a potassium bromide crystal.

Continue her diagram by drawing in FOUR more of the ions.



[1]

[Total: 5]

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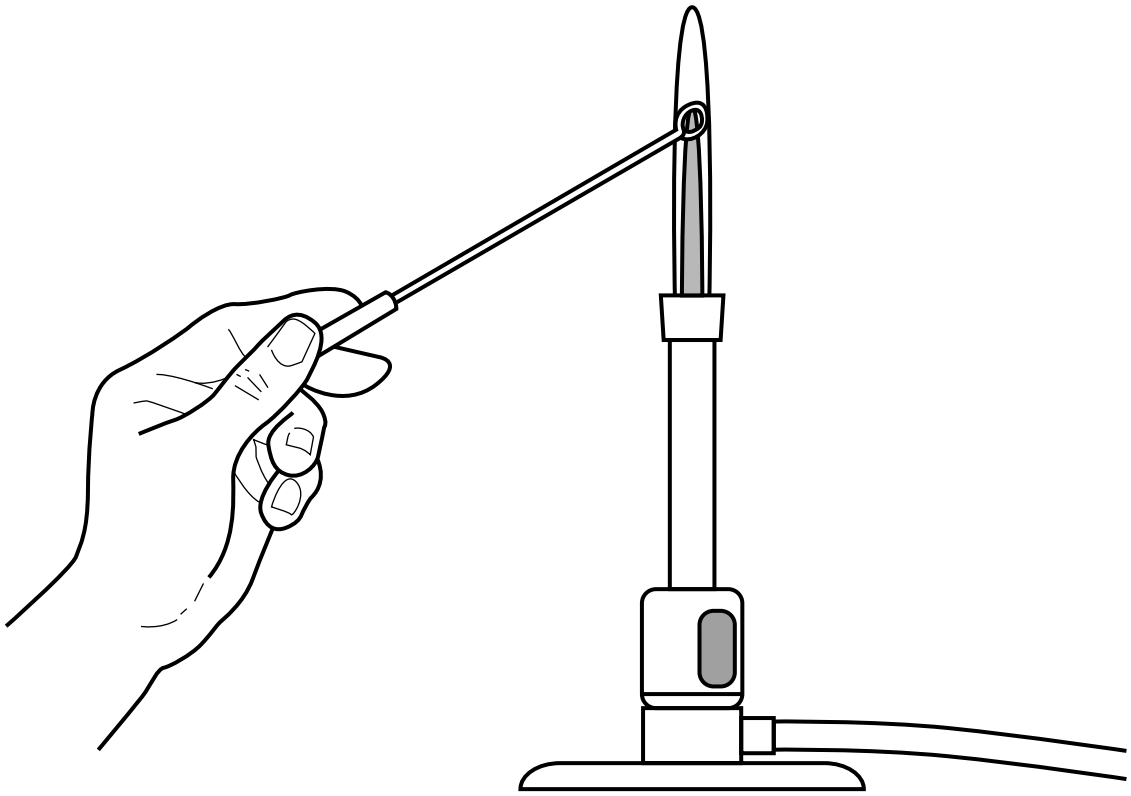
QUESTION 6 STARTS ON PAGE 20

6 Stephen makes some sodium chloride in the laboratory.

He looks at its flame colour through a spectroscope.



Here is the spectrum for his sample.

He finds the spectrum for sodium in a book. It looks like this.

What can he tell about his own sample?

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

All the lines for sodium are present. ☐

Some of the sodium lines are missing. ☐

All the lines in the sample are different from the lines in sodium. ☐

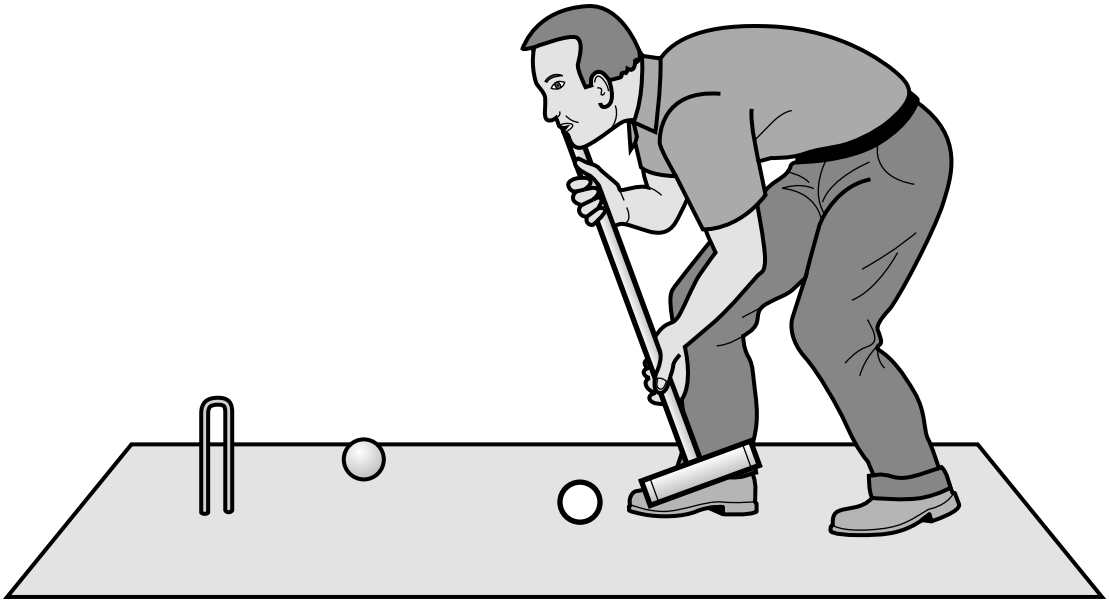
This is not sodium, it is a different element. ☐

The spectrum shows that sodium and at least one other element are present. ☐

[2]

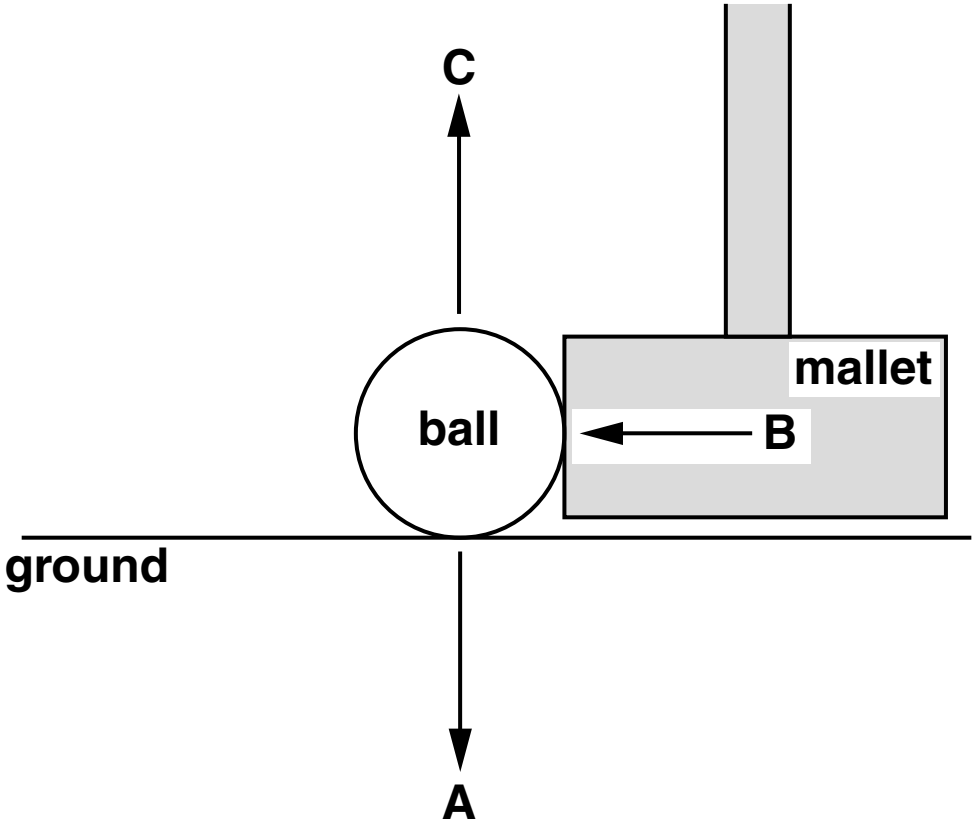
[Total: 2]

7 Jim enjoys playing croquet.



(a) Jim hits the ball with the mallet.

The diagram shows three forces acting on the ball when it is hit by the mallet.



(i) Complete the table with A, B or C to show the names of the forces.

weight due to gravity	
reaction from the ground	
driving force from the mallet	

[2]

(ii) In this case, all three forces have the same size of 5 N.

What is the size of the RESULTANT force on the ball?

Put a (ring) around the correct answer.

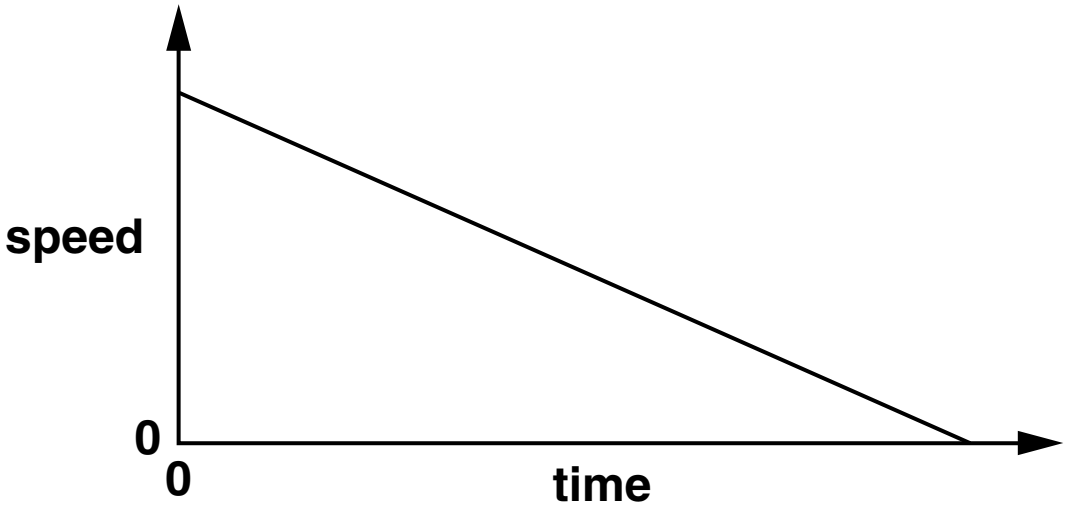
0 N

5 N

15 N

[1]

(b) The graph shows how the speed of the ball changes with time after Jim has hit it.



What happens to the speed of the ball AFTER it is hit by the mallet?

Give a reason for this change.

_____

_____

_____ **[2]**

[Total: 5]

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QUESTION 8 STARTS ON PAGE 26

8 Pete enjoys a short run.

(a) Pete has a mass of 70 kg. He runs in a straight line at a steady speed of 5 m/s.

What is the correct way of calculating his momentum?

Put a (ring) around the correct answer.

$\frac{70}{5}$

70×5

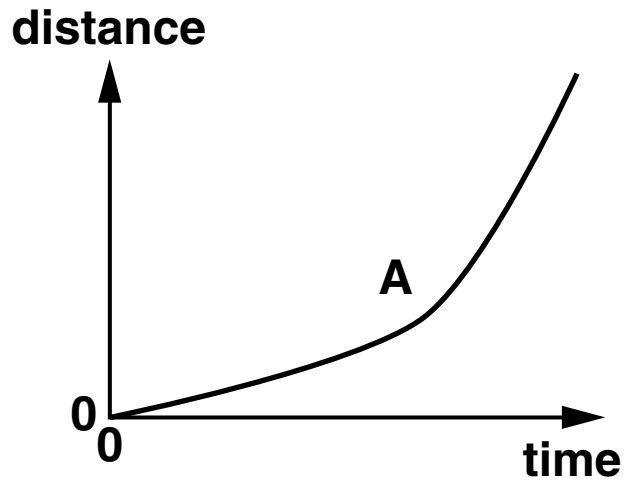
$\frac{5}{70}$

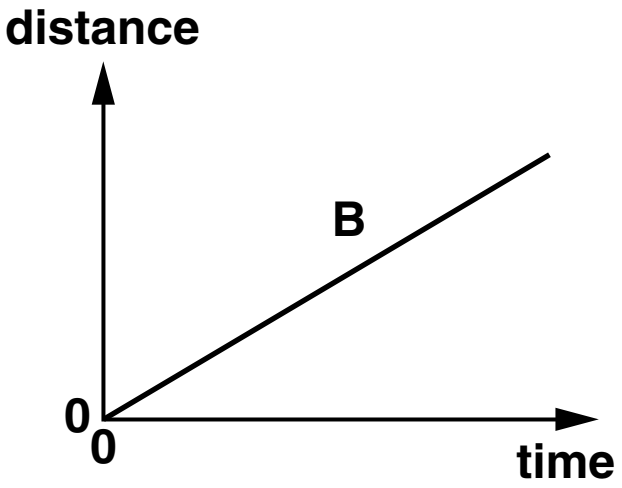
[1]

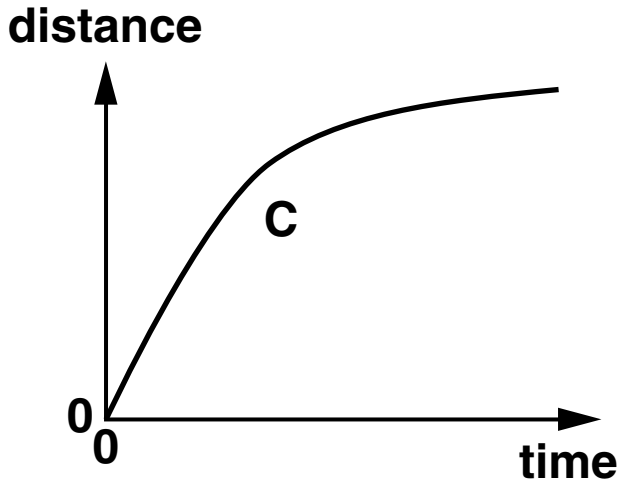
(b) He runs at a steady speed of 5 m/s for 40 s. How far does he run in this time?

answer = _____ m [1]

(c) Here are some distance-time graphs.







Which graph, A, B or C, shows Pete running forwards at a steady speed?

answer _____ [1]

(d) Complete the sentences. Choose from these words.

FORCE

KINETIC

MOMENTUM

WORK

Pete runs forward at a steady speed.

This is because a _____ pushes

him along in the direction of his motion.

The force acting forwards on Pete does

_____ on him. [2]

[Total: 5]

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QUESTION 9 STARTS ON PAGE 30

9 Reshma runs at a hurdle and jumps over it.

(a) As Reshma moves over the bar, she is moving horizontally with a speed of 8 m/s.

Her mass is 50 kg.

What is the correct way of calculating her kinetic energy?

Put a (ring) around the correct answer.

50×8

50×8^2

$\frac{1}{2} \times 50 \times 8^2$

$\frac{1}{2} \times 50 \times 8$

[1]

(b) The diagram shows Reshma when she is moving forwards above the bar.

At that instant, she has both kinetic energy and gravitational potential energy.

Explain how their values change as she drops down towards the ground again.

_____

_____

_____

_____

_____ **[3]**

[Total: 4]

END OF QUESTION PAPER

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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										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 **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						

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.