Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

General Certificate of Secondary Education
Higher Tier
June 2014

Additional Applied Science AAS1HP

Unit 1 Science at Work

H

Thursday 15 May 2014 9.00 am to 10.00 am

For this paper you must have:
- a ruler
- a calculator
- the Equations Sheet (enclosed).

Time allowed
- 1 hour

A

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 3 should be answered in continuous prose.
  In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

Advice
- In all calculations, show clearly how you work out your answer.

Answer **all** questions in the spaces provided.

1 **Table 1** shows some of the characteristics of three varieties of tomato plants, **A**, **B** and **C**, and the tomatoes they produce.

Table 1

Characteristic	**Tomato plant A**	**Tomato plant B**	**Tomato plant C**
Average number of tomatoes per plant	25	50	35
Resistance of the plant to disease	none	none	resistant
Height of plant in m	2.5	2.0	1.5
Average diameter of tomatoes in cm	6	8	6

1 (a) (i) An agricultural scientist decides to selectively breed tomato plants **B** and **C** to produce a new variety of tomato plant with better characteristics.

Suggest **three** reasons for choosing tomato plants **B** and **C**.

[3 marks]

1 .....

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2 .....

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3 .....

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1 (a) (ii) Describe the process of selectively breeding tomato plants **B** and **C** to produce plants with the best characteristics.

[3 marks]

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1 (b) The agricultural scientist recommends using a herbicide. Explain how using a herbicide could increase the yield of tomatoes.

[2 marks]

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8

Turn over for the next question

There are no questions printed on this page

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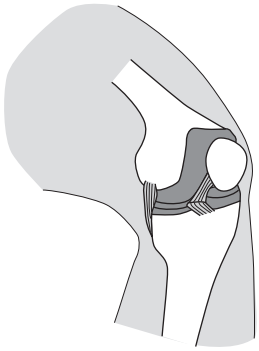
ANSWER IN THE SPACES PROVIDED

2 A footballer is recovering from a cartilage injury in her knee.

Figure 1 shows a diagram of a knee joint.

Figure 1



2 (a) (i) Draw an arrow on **Figure 1** to show the cartilage.

[1 mark]

2 (a) (ii) State **two** functions of the cartilage in a knee joint.

[2 marks]

1 .....

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2 .....

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Question 2 continues on the next page

2 (b) To strengthen her leg muscles, the footballer was asked to stretch a length of elastic rope, as shown in **Figure 2**.

Figure 2

The force needed to extend the elastic rope was investigated.

The results are shown in **Table 2**.

Table 2

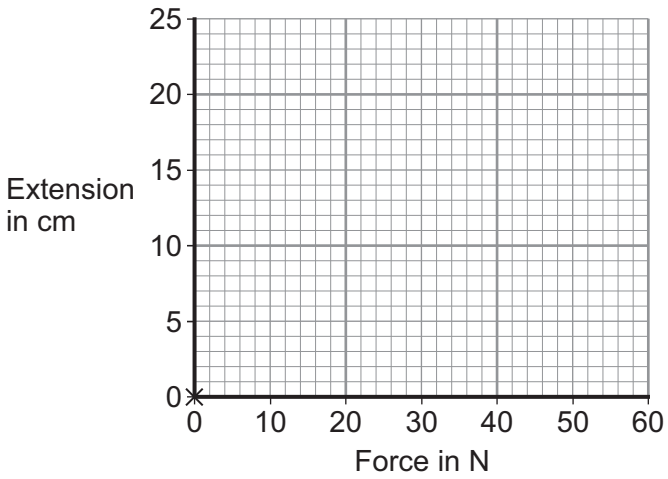
Force in N	Extension in cm
0	0
10	4
20	8
30	15
40	16
50	20

2 (b) (i) On the grid provided (**Figure 3**), plot the results. The first point has been done for you.

Draw a line of best fit.

[3 marks]

Figure 3



2 (b) (ii) Use **Figure 3** to find the force needed to extend the elastic rope by 18 cm.

[1 mark]

Force = ... N

2 (b) (iii) Does the elastic rope obey Hooke's Law?

Explain your answer.

[2 marks]

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9

Turn over for the next question

3 **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Iron rusts when in contact with salty water.

A student suggests that increasing the amount of salt in the water would cause iron to rust more quickly.

Design an experiment to investigate whether the student is correct.

You are provided with normal laboratory apparatus, salt and a mixture of iron nails.

[6 marks]

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Extra space .....

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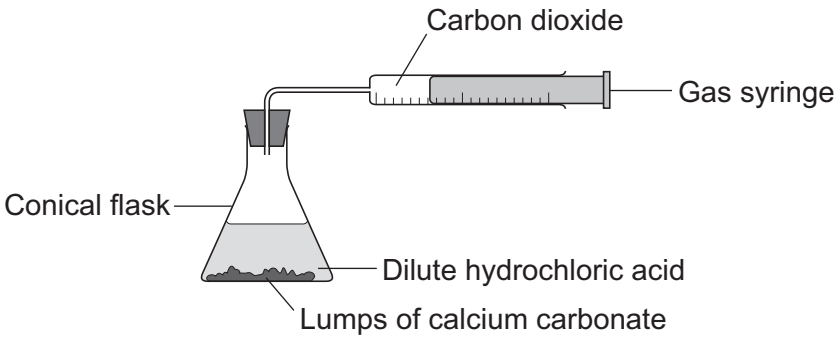
6

Turn over for the next question

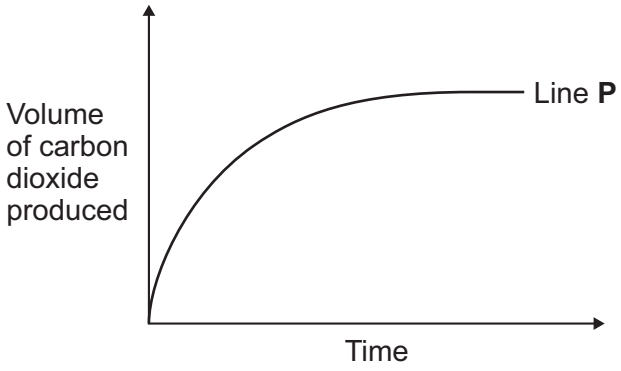
4 A student investigates the rate of reaction between calcium carbonate and dilute hydrochloric acid, as shown in **Figure 4**.

Figure 4



Line **P** on **Figure 5** shows a graph of the student's results.

Figure 5



4 (a) Describe what happens to the **rate** of the reaction during the experiment.

[3 marks]

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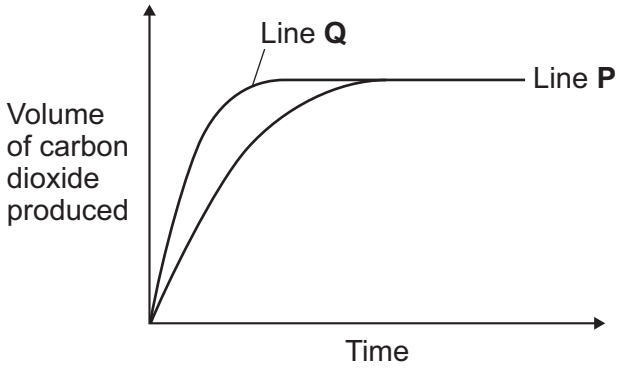
4 (b) Line **Q** on **Figure 6** shows the student's results when the reaction was repeated under different conditions, but with the same concentration of hydrochloric acid.

Figure 6



Suggest **one** condition that has changed and explain your answer.

[2 marks]

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4 (c) Another way to change the rate of this reaction is to increase the concentration of the hydrochloric acid.

Explain what happens to the rate of reaction when the concentration of the hydrochloric acid is increased.

Use ideas about collisions between the reacting particles in your answer.

[3 marks]

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Question 4 continues on the next page

4 (d) The student writes a symbol equation for the reaction between calcium carbonate and dilute hydrochloric acid.

He calculates the relative formula masses of some of the compounds.

$CaCO_3$ + $2HCl$ ⟶ $CaCl_2$ + CO_2 + H_2O

	$CaCO_3$		$CaCl_2$		CO_2		H_2O
relative formula mass	100				44		

4 (d) (i) Fill in the empty box to show the relative formula mass of calcium chloride.

The relative atomic mass of Ca = 40 and of Cl = 35.5.

[1 mark]

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4 (d) (ii) The student uses 5.0 g of calcium carbonate in his experiment.

What is the maximum mass of carbon dioxide that can be made from 5.0 g of calcium carbonate?

[2 marks]

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Answer ..... g

4 (e) The student collects much less carbon dioxide than he expects from 5.0 g of calcium carbonate.

Suggest **one** reason why.

[1 mark]

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12

Turn over for the next question

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5 (a) The oxygen supply to the muscles is very important for an athlete's success.

Describe the function of the heart and lungs in providing oxygen to an athlete's muscles.

[5 marks]

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5 (b) Athletes can respire aerobically or anaerobically during exercise.

The equations show aerobic respiration and anaerobic respiration.

Aerobic: $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$ + 2900 kJ of energy

Anaerobic: $C_6H_{12}O_6 \longrightarrow 2C_3H_6O_3$ + 150 kJ of energy

5 (b) (i) Use your knowledge of anaerobic respiration to suggest the name of the compound with the formula $C_3H_6O_3$

[1 mark]

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5 (b) (ii) Explain why anaerobic respiration releases less energy than aerobic respiration.

[2 marks]

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5 (c) Glucose is also needed for an athlete's success.

During a race, the glucose concentration in the blood becomes too low.

Describe how the body raises the amount of glucose in the blood if the level of glucose is too low.

[3 marks]

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11

Turn over for the next question

6 (a) The properties and uses of a polymer depend on its structure.

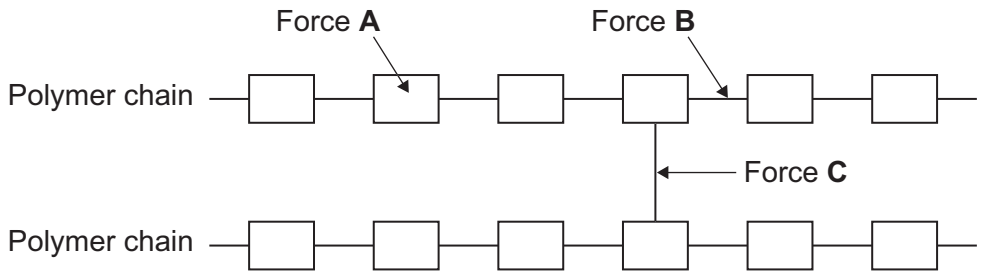
Figure 7 shows where each of three different forces of attraction can be found in a polymer.

Force **A** represents the covalent bonds within the monomer.

Force **B** represents the covalent bonds between monomers.

Force **C** represents cross-links between the polymer chains.

Figure 7



Which **two** statements describe changes that would **increase** the melting point of this polymer?

Tick (✓) **two** boxes.

[2 marks]

make force **A** stronger ☐

make force **B** stronger ☐

make force **C** weaker ☐

introduce more cross-links ☐

make the polymer chains longer ☐

6 (b) In **Table 3**, which row, **P**, **Q**, **R** or **S**, describes a **thermosetting** polymer?

Tick (✓) **one** box.

[1 mark]

Table 3

	Softened by heating	Cross-links between chains	Tick (✓)
P	yes	no	
Q	no	yes	
R	yes	yes	
S	no	no	

6 (c) Explain why a **thermoplastic** polymer would not be suitable for making the case of a plastic kettle.

[1 mark]

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4

Turn over for the next question

7 Paint containers are usually made of steel.

7 (a) State **two** properties of steel which make it a suitable material for making paint containers.

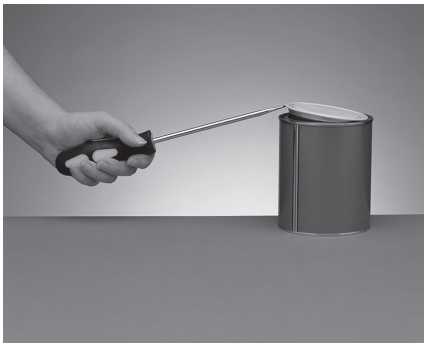
[2 marks]

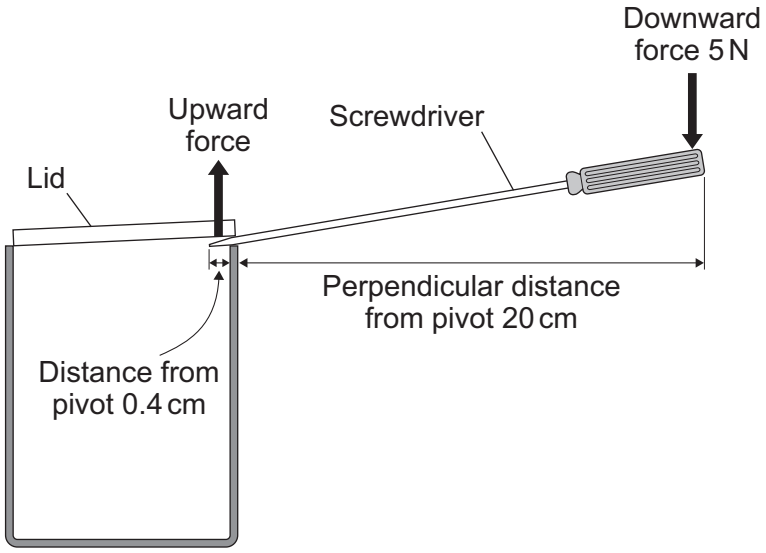
Property 1 .....

Property 2 .....

7 (b) **Figure 8** shows a screwdriver being used to remove the lid from a paint container.

Figure 8





7 (b) (i) The turning effect (moment) produced by the screwdriver is applied to the lid of the paint container.

Calculate the upward force on the lid.

Give the correct unit in your answer.

Use the Equations Sheet and the data from **Figure 8** to help you answer the question.

[3 marks]

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7 (b) (ii) The paint container is made of steel with a density of 7800 kg/m^3.

The mass of the empty paint container and lid is 0.39 kg.

Calculate the volume of steel used to make the paint container and lid.

Use the Equations Sheet to help you answer the question.

[3 marks]

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Volume = ... m^3

7 (b) (iii) Some paint containers are now made of a plastic material with a density of 920 kg/m^3.

Use your knowledge of materials to give **one** advantage and **one** disadvantage of using plastic instead of steel for paint containers.

[2 marks]

Advantage .....

.....

Disadvantage .....

.....

10

END OF QUESTIONS

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Question 7: Figure 8 © Getty