Write your name here

Surname	Other names

Pearson BTEC Level 1/Level 2 First

Centre Number

Learner Registration Number

Application of Science

Unit 8: Scientific Skills

Monday 9 June 2014 – Afternoon
Time: 1 hour 15 minutes

Paper Reference
20474E

You must have:
Calculator, Ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and learner registration number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 50.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 4 4 8 6 0 A 0 1 1 6

PEARSON

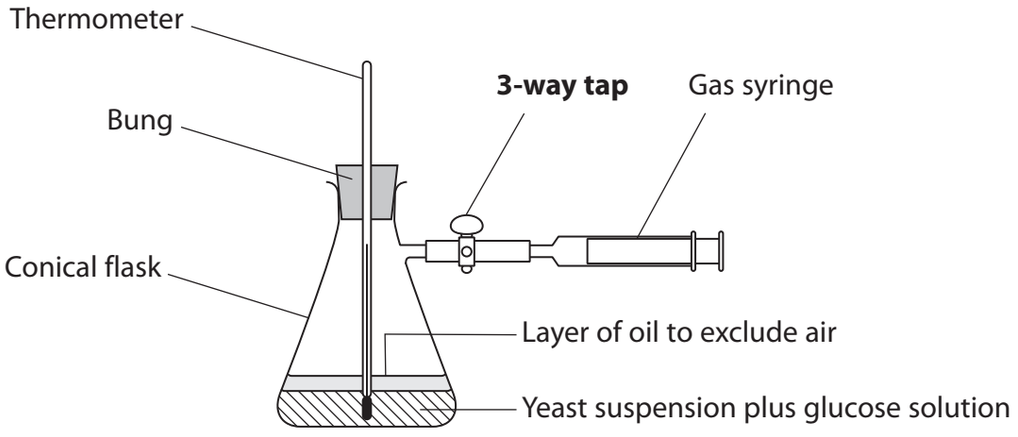
Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Martin and Hazel have set up an experiment to investigate how temperature affects the respiration rate of yeast.

Yeast will respire in the presence of glucose, producing carbon dioxide gas.

The rate at which carbon dioxide is produced depends on how fast the yeast respires.



(a) (i) Identify, from the diagram, the piece of equipment used to measure the volume of gas collected.

(1)

.....

(ii) Identify from the diagram the piece of equipment used to measure the temperature.

(1)

.....

(b) State **two** reasons why Martin and Hazel must open the **3-way tap** at the start of the experiment.

(2)

1 .....

.....

2 .....

.....

(c) Martin and Hazel need to control the yeast suspension for their experiment.

(i) State **two** ways in which they could control the yeast suspension.

(2)

1 .....

.....

2 .....

.....

(ii) Identify the dependent variable in this experiment.

(1)

.....

(d) Martin and Hazel want to find out what the optimum temperature for the respiration of yeast is.

They make a hypothesis:

> As the temperature increases the yeast will respire faster, until it reaches the optimum temperature. When the temperature goes above 40 °C the yeast will stop respiring.

Write a plan for this experiment that would test this hypothesis.

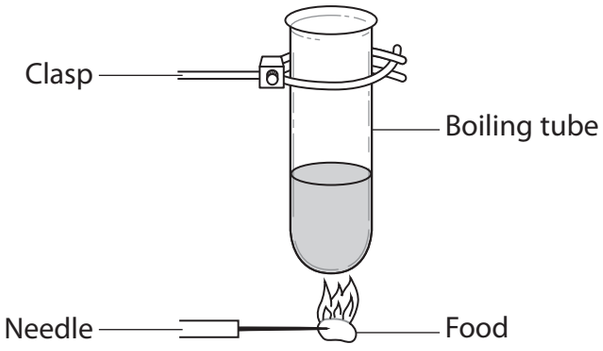
(6)

(Total for Question 1 = 13 marks)

2 Joe and Nigel investigated the amount of energy in pasta and potato chips.

They burnt the same mass of each food under 20 cm^3 of water.

They measured the temperature of the water at the start of the experiment and after two minutes.



(a) Identify **two** risks when carrying out this experiment.

(2)

1 .....

.....

2 .....

.....

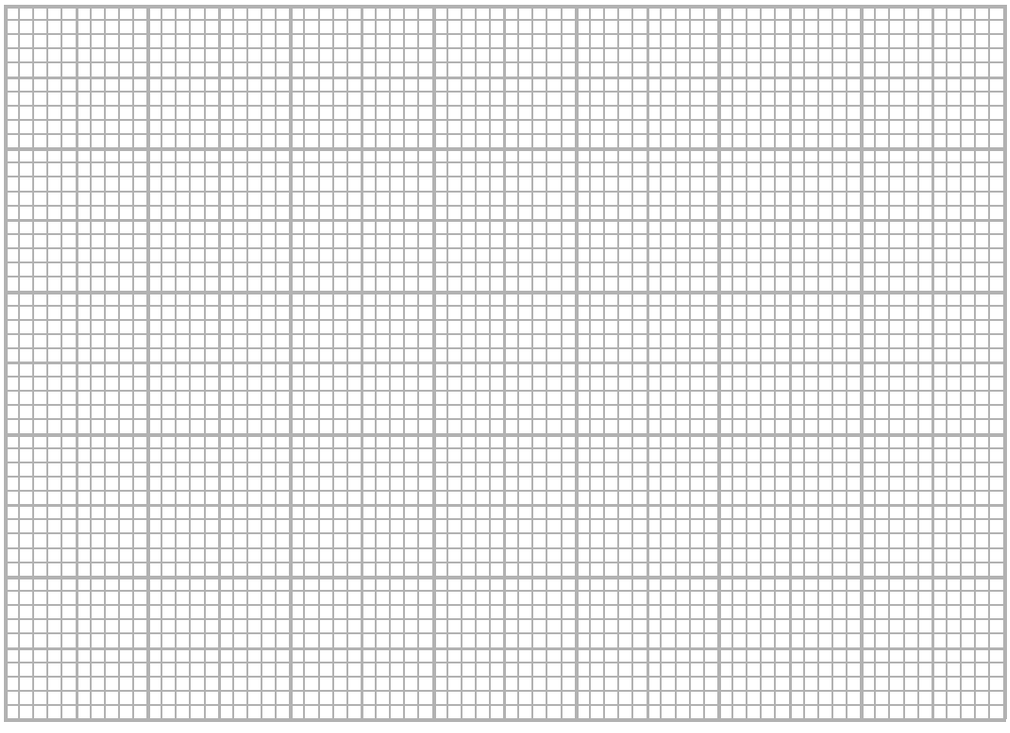
(b) Joe and Nigel carried out the experiment using the same mass of pasta and measured the temperature every 20 seconds for **two** minutes.

Time (s)	0	20	40	60	80	100	120
Temperature of water heated by burning pasta (°C)	21	24	27	30	33	36	40

Plot a line graph of these results.

Use the graph paper below.

(6)



(c) Joe and Nigel repeated the experiment for a potato chip.

Food	Time (s)	0	20	40	60	80	100	120
Pasta	Temperature of water (°C)	21	24	27	30	33	36	40
Potato chip	Temperature of water (°C)	21	28	32	36	40	44	48

Describe what the data shows about the temperature change of the water produced by burning the foods.

(2)

.....

.....

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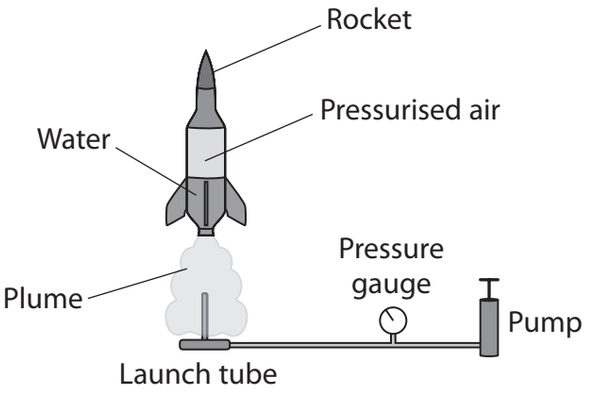
.....

(Total for Question 2 = 10 marks)

3 Kim and Emma launched a toy rocket.

They investigated how pressure affected the maximum height reached by the rocket.

Pressure is measured in atmospheres (atm).



Kim and Emma recorded the following results for the pressure and the launch height of the rocket.

2.0 atm	32 m	1.0 atm	25 m		
3.0 atm	39 m	2.5 atm	35 m	1.5 atm	28 m

(a) Put these results in the table with appropriate column headings and units.

(3)

Kim and Emma repeated the experiment for 1.5 atm and recorded the following four heights:

28 m 29 m 27 m 29 m

(b) Calculate the average for these four heights, to two significant figures.

(2)

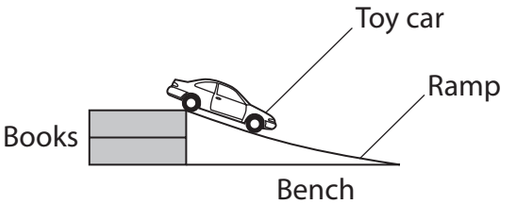
..... m

(Total for Question 3 = 5 marks)

4 Connor and Ebony were investigating the speed of a toy car travelling down a ramp.

They:

- changed the height of the ramp
- measured the length of the ramp
- measured the time taken for a car to travel down the ramp
- calculated the average speed of the car for each different ramp height.



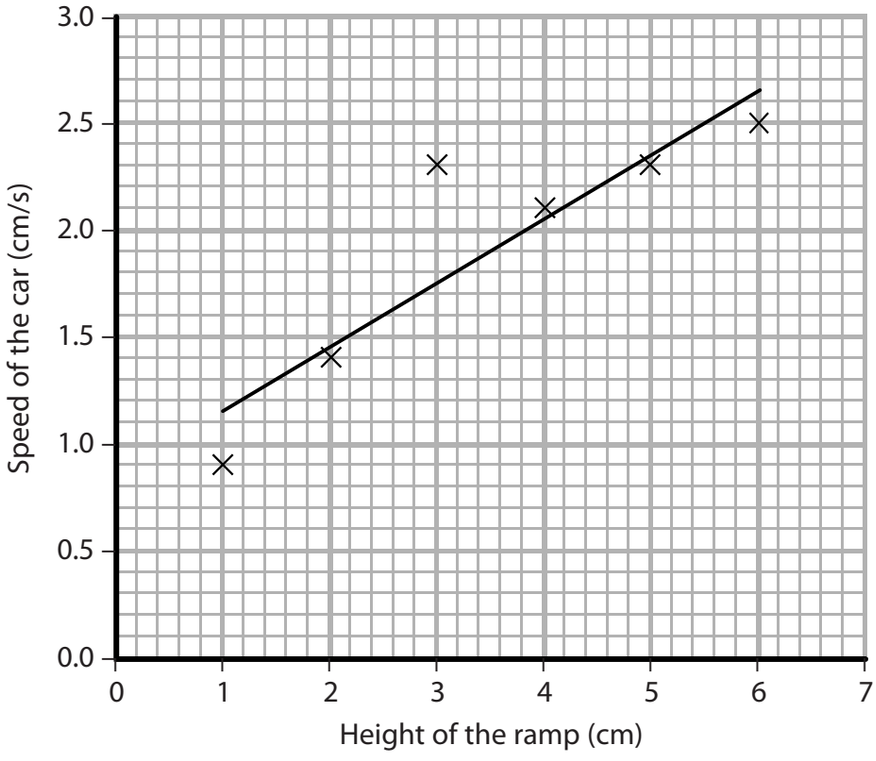
Height of the ramp (cm)	1	2	3	4	5	6
Speed of car (cm/s)	0.9	1.4	2.3	2.1	2.3	2.5

(a) State what effect increasing the height of the ramp has on the speed of the car.

(1)

.....

(b) They plotted the results as a graph.



(i) One of the points appears to be anomalous.

Circle this point on the graph.

(1)

(ii) Explain **two** possible errors that Connor and Ebony could have made in their experiment to produce this anomalous result.

(4)

1 .....

.....

.....

.....

2 .....

.....

.....

.....

(c) Use the line of best fit to find the speed of the car when the height of the ramp is 2.5 cm.

(1)

..... cm/s

(d) When the car is at the top of the ramp it has gravitational potential energy.

The formula for calculating this is:

gravitational potential energy =	**mass** ×	**acceleration due to gravity** ×	**height**
(J)	**(kg)**	**(m/s^2)**	**(m)**

Calculate the gravitational potential energy for a car with a mass of 0.05 kg, at a height of 7 cm.

Acceleration due to gravity is 10 m/s^2.

(2)

Gravitational potential energy = ... J

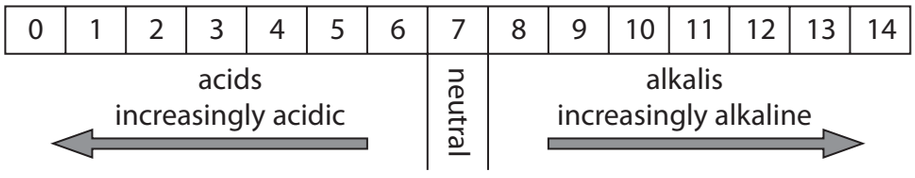
(Total for Question 4 = 9 marks)

5 Gemma and her friends decided to investigate how the amount of sodium carbonate solution added to acid affected its pH.

When sodium carbonate solution is added to acid fizzing occurs.

They watched the reaction until fizzing stopped and then measured the pH.

Here is the pH scale which shows how acidic or alkaline a substance is:



Volume of sodium carbonate solution [cm^3]	pH of mixture
0	3.5
4	3.8
8	5.3
12	7.0
16	9.9

(a) (i) Identify the pH of the mixture when 4 cm^3 of sodium carbonate solution is added to the acid.

(1)

.....

(ii) Which volume of sodium carbonate solution made the acid neutral?

(1)

☒ **A** 4 cm^3

☒ **B** 8 cm^3

☒ **C** 12 cm^3

☒ **D** 16 cm^3

(iii) State what happens to the pH as the volume of sodium carbonate solution is increased.

(1)

.....

.....

(b) Gemma thinks that they could make some improvements to the method to make it repeatable.

Explain **one** improvement that could be made to their method.

Here is their method for the experiment.

1. Choose some amounts of sodium carbonate solution
2. Add some acid
3. When you can't see any more fizzing, measure the pH

(2)

.....

.....

.....

.....

(Total for Question 5 = 5 marks)

6 Stephen and Julie work for a drug company.

They are carrying out a trial on a possible flu vaccination.

(a) State **two** reasons why the flu vaccination has to be trialled.

(2)

1 .....

.....

2 .....

.....

(b) Stephen and Julie are testing whether the vaccination prevents people developing flu.

They tested 8000 volunteers divided into four groups.

Each volunteer was given an injection.

The contents of the injection given to each group are shown below.

Group	Number of people in each group	Contents of injection	Number of people who developed flu
A	2000	5 cm^3 of saline solution	15
B	2000	5 cm^3 of saline solution 0.5 cm^3 of flu vaccine	14
C	2000	5 cm^3 of saline solution 1.0 cm^3 of flu vaccine	15
D	2000	5 cm^3 of saline solution 1.5 cm^3 of flu vaccine	14

Explain the strengths and weaknesses of the trial method used.

Use the information in the table to help you with your answer.

(6)

(Total for Question 6 = 8 marks)

TOTAL FOR PAPER = 50 MARKS