Write your name here

Surname	Other names

Pearson BTEC Level 3 Extended Certificate

Centre Number

Learner Registration Number

Applied Science

Unit 3: Science Investigation Skills

Part B

Friday 4 May 2018
Time: 1 hour 30 minutes

Paper Reference
31619H

You must have:
a calculator and a ruler.

Total Marks

Instructions

- You will need your results/observations from the practical investigation in **Part A**.
- **Part B** contains material for the completion of the set task under supervised conditions.
- **Part B** must be undertaken in a single session of 1 hour and 30 minutes on the date timetabled by Pearson.
- **Part B** is specific to each series and this material must only be issued to learners who have been entered to undertake the task in the relevant series.
- **Part B** should be kept securely until the start of the 1 hour and 30 minute supervised assessment period.
- 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 60.
- 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 5 3 9 8 3 A 0 1 2 0

Pearson

Answer ALL questions in Section 1 and Section 2.

Write your answers in the spaces provided.

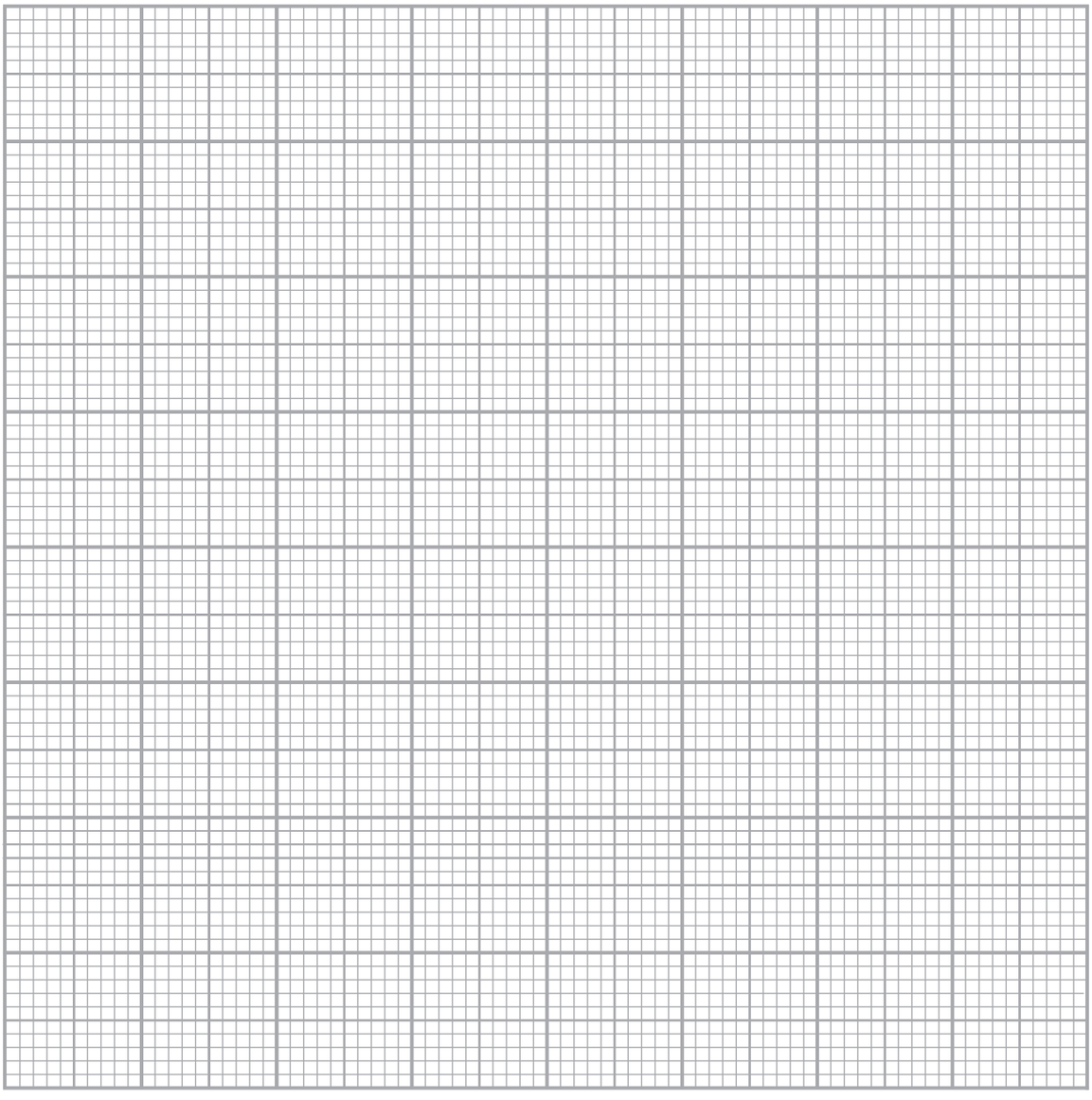
SECTION 1

1 (a) Record all your experimental results, including average mass of extracted apple juice, in a suitable table, using the space provided. Circle any anomalous results.

(3)

(b) Plot a line graph of average mass of extracted apple juice against pectinase concentration.

(3)



(c) (i) Describe, using information from your graph, how the change in the concentration of pectinase affected the mass of extracted apple juice.

(2)

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(ii) Identify, using information from your graph, the optimum concentration of pectinase for extracting apple juice.

(1)

..... %

(iii) Give **one** reason why the pectinase concentration you identified in (c)(ii) is the optimum.

(1)

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.....

(d) Give **one** reason why it was important to stir the pureed apple and pectinase solution.

(1)

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(e) Describe how you made sure that the mass of extracted apple juice was measured accurately.

(3)

(f) Temperature was one of the variables controlled in your investigation.

The rate of enzyme activity is affected by temperature. Pectinase has an optimum temperature at which it works best.

(i) Explain how a temperature **below** the optimum would affect the rate of pectinase activity.

(2)

(ii) Explain how a temperature **above** the optimum would affect the rate of pectinase activity.

(2)

(Total for Question 1 = 18 marks)

2 (a) Your colleague carried out a similar investigation.
They extracted juice from two different types of apple: Jazz and Gala.

(i) State a null hypothesis for your colleague's investigation.

(2)

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(ii) The table shows the mass of apple juice extracted from the Jazz and Gala apples.

Experimental repeats	Mass of juice extracted (g)	
	Jazz apples	Gala apples
1	102.0	141.0
2	95.0	160.0
3	134.0	155.0
4	115.0	130.0
5	97.0	120.0
6	132.0	191.0
7	119.0	154.0
8	107.0	203.0
9	126.0	170.0
10	111.0	176.0
Mean mass of juice extracted (g)	113.8	160.0
Standard deviation (s)	13.93	26.00

Calculate, using the unpaired *t*- test, the value of *t* for your colleague's investigation.

(6)

Use the equation.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Show your working.

t = ...

(iii) Calculate the degrees of freedom for your colleague's investigation.

(2)

Use the equation $(n_1 + n_2) - 2$

Show your working.

degrees of freedom = ...

(iv) Give the critical value of *t* at the p = 0.05 level.

(1)

Use the *t* table shown.

		p = 0.05
degrees of freedom	16	2.120
	17	2.110
	18	2.101
	19	2.093
	20	2.086
	21	2.080
	22	2.074

***t* table**

critical value of *t* = ...

(v) Explain whether the null hypothesis should be accepted or rejected.

(3)

(Total for Question 2 = 14 marks)

3 (a) (i) The ripeness of the apples used in your investigation was a variable that could not be controlled.

Explain why the differences in ripeness did not affect your results.

(2)

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(ii) Identify **two** other variables in your investigation that could not be controlled.

(2)

1 .....

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2 .....

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(b) Explain **two** ways you could extend your investigation to provide a more accurate value for the optimum concentration of pectinase.

(4)

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(Total for Question 3 = 8 marks)

TOTAL FOR SECTION 1 = 40 MARKS

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SECTION 2

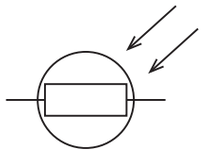
4 Variation in resistance with light brightness

The brightness of a lamp can be altered by changing the power supplied to it.

The resistance of a light-dependent resistor (LDR) changes with the brightness of the light falling on the LDR.

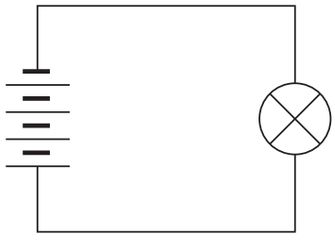
The images show an LDR and the circuit symbol used to represent it.

LDR

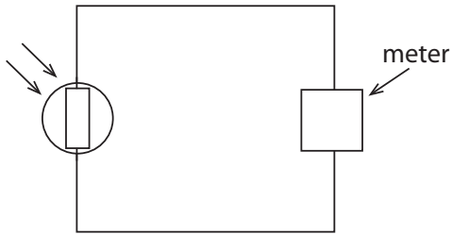


Circuit symbol for the LDR

You have been asked to write a plan for an investigation to find out how the power supplied to the lamp in circuit A is related to the resistance of the LDR in circuit B.



A



B

Changing the brightness of light produced by the lamp in circuit A can change the resistance of the LDR in circuit B.

Your plan should include the following details:

- a hypothesis
- selection and justification of equipment, techniques or standard procedures
- health and safety associated with the investigation
- methods for data collection and analysis to test the hypothesis:
  - quantities to be measured
  - the number and range of measurements to be taken
  - how equipment may be used
  - control variables
  - brief method for data collection analysis.

You may include in your plan the use of any standard laboratory apparatus, electrical components or electrical meters.

(12)

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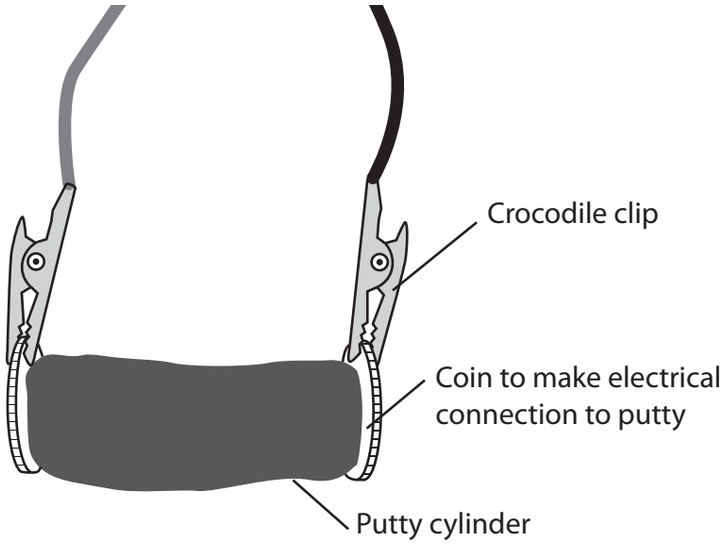
(Total for Question 4 = 12 marks)

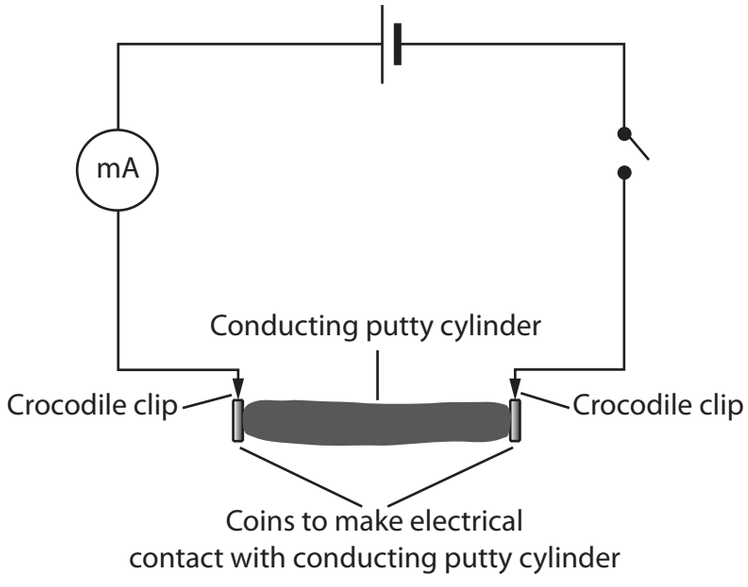
5 Conducting putty is a material that will conduct an electric current.

The conducting putty can be cut to any length.

The image shows a roll of conducting putty with connections to a circuit.



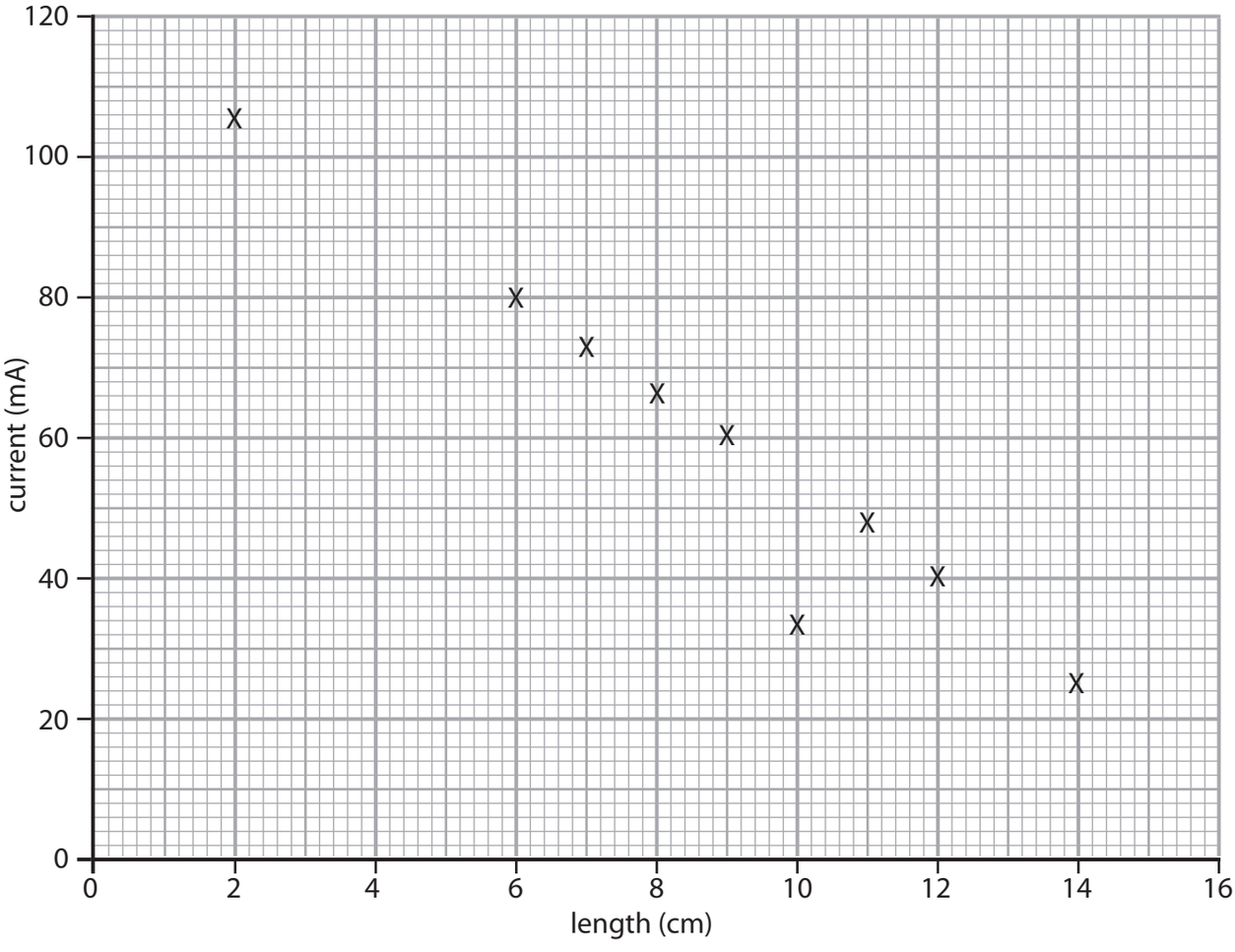
A learner sets up the circuit shown to investigate how the current in the conducting putty varies as its length changes.



Here is the method the learner used.

- measure the length of the conducting putty cylinder
- connect the conducting putty cylinder to the circuit
- measure the current
- cut the conducting putty to a new length
- measure the current for each new length of conducting putty.

The graph shows the results of the learner's investigation.



The learner concludes that:

'The current passing through the conducting putty cylinder decreases as the length of the cylinder decreases'.

Evaluate the learner's investigation.

Your answer should include reference to the:

- method of the experiment
- results collected
- conclusion made.

(8)

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(Total for Question 5 = 8 marks)

TOTAL FOR SECTION 2 = 20 MARKS
TOTAL FOR PAPER = 60 MARKS

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