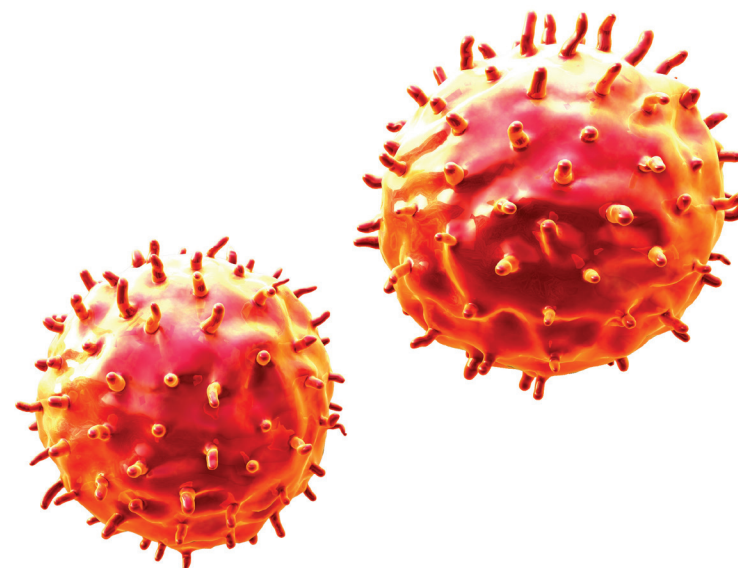


Interactive Example Candidate Responses

Paper 6 (May / June 2016), Question 1

Cambridge IGCSE™
Biology 0610



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- 1 Metabolic reactions in cells produce toxic chemicals which can be converted to harmless or less toxic chemicals.

Hydrogen peroxide is broken down using the enzyme catalase which is found in most cells.

Fig. 1.1 shows this reaction.

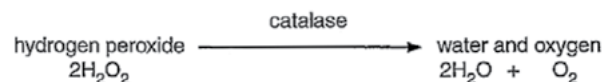


Fig. 1.1

A student investigated the effect of alcohol (ethanol) on the activity of catalase found in potato, using three pieces of potato cut to the same size.

Fig. 1.2 shows these pieces of potato.

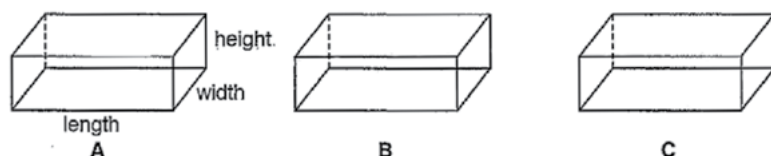


Fig. 1.2

- (a) (i). Measure the length, width and height of one of these pieces of potato.

Record your results in Table 1.1.

Table 1.1

length of potato piece /mm	width of potato piece /mm	height of potato piece /mm
30	10	10

[1]

- Step 1 The student labelled six test-tubes, 1, 2, 3, 4, 5, and 6 and used a syringe to add 10 cm³ of hydrogen peroxide solution to each of the test-tubes.
- Step 2 They cut potato piece A to obtain two slices of similar size.
- Step 3 The student placed the free end of a delivery tube into a large test-tube containing water.
- Step 4 They placed one of the slices of potato piece A into the hydrogen peroxide solution in test-tube 1.
- Step 5 The student immediately placed the rubber bung attached to the delivery tube into test-tube 1 and pushed it in as tightly as possible, as shown in Fig. 1.3.

Select page

Your Mark

1(a)(i)

1(a)(ii)

1(b)(i)

1(b)(ii)

Q1	Mark scheme
(a)(i)	length: 30 (mm) width: 10 (mm) height: 10 (mm) ; 1 mark
(a)(ii)	1 table drawn with rows or columns ; 1 graphs 2 table drawn with cells for at least 6 bubble readings and 3 means; 3 appropriate column headings with units R if units given in cells instead of header (number of) bubbles per (or in) 3 minutes/min or (number of) bubbles/minute or min potato/piece of potato/piece/tube slice/stick and 1 or 2 mean/average (number of bubbles per 3 min (or per 1 min) ; 4 correct tally results recorded ; 5 correct mean/average calculated for each potato piece ; 5 marks
(b)(i)	prevents leakage of oxygen/all oxygen collected; A gas/air/bubbles can observe reaction/bubbles as soon as it starts/AW; I no air/oxygen can enter tube I "quicker" unqualified for mp 2 1 mark
(b)(ii)	prevents leakage of oxygen/all oxygen collected ; A gas/air/bubbles I loose bung could come out/no gas from outside enters the tube I fair test comments increases accuracy/results will be comparable/consistent/reliable/valid; allow a pressure to build up/bubbles to form; 2 marks

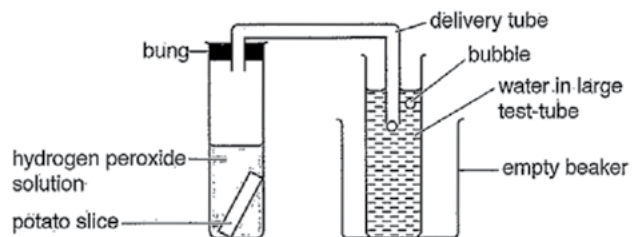


Fig. 1.3

Step 6 They counted the number of bubbles released from the delivery tube in 3 minutes.

Step 7 The student repeated steps 4–6 for the second slice of potato piece A using test-tube 2.

Step 8 They repeated steps 2–7 for potato piece B using test-tubes 3 and 4.

Step 9 They repeated steps 2–7 for potato piece C using test-tubes 5 and 6.

The student used a tally to count the number of bubbles.

Fig. 1.4 shows their tally count.

A1		A2	
B1		B2	
C1		C2	

Fig. 1.4

MEAN CALCULATIONS

$$A = \frac{5 + 3}{2} = 4$$

$$B = \frac{18 + 14}{2} = 14.5$$

$$C = \frac{12 + 10}{2} = 11$$

Select
page

Your
Mark

1(a)(i)

1(a)(ii)

1(b)(i)

1(b)(ii)

Q1	Mark scheme
(a)(i)	length: 30 (mm) width: 10 (mm) height: 10 (mm) ; 1 mark
(a)(ii)	1 table drawn with rows or columns ; I graphs 2 table drawn with cells for at least 6 bubble readings and 3 means; 3 appropriate column headings with units R if units given in cells instead of header (number of) bubbles per (or in) 3 minutes/min or (number of) bubbles/minute or min potato/piece of potato/piece/tube slice/stick and 1 or 2 mean/average (number of bubbles per 3 min (or per 1 min) ; 4 correct tally results recorded ; 5 correct mean/average calculated for each potato piece ; 5 marks
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- (ii) Prepare a table to record the student's results.
Your table should show:

- the numbers of bubbles produced by each slice of potato in 3 minutes
- the mean number of bubbles produced by each of potato piece A, B and C.

Complete your table using the results from Fig. 1.4.

POTATO PIECES	BUBBLES PRODUCED in 3min	MEAN of bubbles
A ₁	5	4
A ₂	3	
B ₁	18	14.5
B ₂	11	
C ₁	12	11
C ₂	10	

[5]

- (b) (i) Suggest why the free end of the delivery tube was placed in the water before adding the potato slice to the hydrogen peroxide solution and connecting the test-tube to the bung of the delivery tube.

TO MAKE SURE THAT THE TEST TUBE WAS COVERED
AS FAST AS POSSIBLE

[1]

- (ii) Explain why the bung of the delivery tube must fit tightly into the test-tube.

BECAUSE THERE WILL NO LOSS OF O₂ IN THE AIR
OUTSIDE AND ALL THE O₂ PRODUCED WILL PASS
THROUGH THE DELIVERY TUBE

[2]

Your
Mark

1(a)(i)

1(a)(ii)

1(b)(i)

1(b)(ii)

Q1 Mark scheme

(a)(i)	length: 30 (mm) width: 10 (mm) height: 10 (mm) ;	1 mark
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(c) The pieces of potato that the student used in their investigation were soaked in different concentrations of alcohol for 24 hours.

- Potato piece **A** was soaked in 20% alcohol.
- Potato piece **B** was soaked in 2% alcohol.
- Potato piece **C** was soaked in 10% alcohol.

(i) Suggest the relationship between the number of bubbles and the activity of catalase.

THE ACTIVITY OF THE CATALASE IS RELATED TO THE AMOUNT OF ALCOHOL IN WHICH THE PIECES WERE SOAKED, WHERE AS THE ALCOHOL INCREASES IT STOPS THE ACTIVITY OF THE CATALASE AND SO LESS BUBBLES ARE PRODUCED [1]

(ii) Compare the activity of catalase in the potato pieces **A**, **B** and **C**.

THE ACTIVITY IS MORE EFFICIENT IN PIECE B (14.5 bubbles) WHILE IT DECREASES IN C (4) AND THE LEAST EFFICIENT WAS IN A (4 bubbles) [1]

(iii) Predict the number of bubbles that would be produced in 3 minutes if a piece of potato was soaked in 50% alcohol before being placed in hydrogen peroxide solution.

IT WILL BE LESS THAN 4, maybe 2 or 1 or none. [1]

(d) (i) State **one** variable that has been controlled in the student's investigation.

Describe how this variable was controlled.

variable the sizes of the potatoes the amount of $2H_2O_2$
how it was controlled IT WAS CONTROLLED BY CUTTING PIECES OF THE SAME SIZE USING A SYRINGE. IT WAS ADDED 10 cm^3 IN EACH TEST TUBE [2]

(ii) The method of measuring the oxygen gas produced is a source of error.

State **one** reason why this method is a source of error.

COUNTING THE BUBBLES DELIVERED ISN'T RELIABLE.

Suggest how to improve the method to minimise this error.

Repeat the experiment more times and to have a more accurate mean.

Your
Mark

1(c)(i)

1(c)(ii)

1(c)(iii)

1(d)(i)

1(d)(ii)

Q1 Mark scheme

(c)(i)	catalase produces more bubbles when it is active/ora; A as number of bubbles increases the activity of the catalase increases/positive correlation the lower the percentage of alcohol (used for soaking) the more bubbles are produced/AW/ora; need not refer to catalase (more bubbles means more activity) the higher the percentage of alcohol used the lower the activity of the catalase/ora; 1 mark
(c)(ii)	B has more catalase activity/bubbles, A has least activity/bubbles; I restatement of results (number of bubbles from each piece of potato) A B more, C medium and A fewer bubbles/AW 1 mark
(c)(iii)	number 4 or less than 4 ; A no bubbles/none/zero 1 mark

(c) The pieces of potato that the student used in their investigation were soaked in different concentrations of alcohol for 24 hours.

- Potato piece A was soaked in 20% alcohol.
- Potato piece B was soaked in 2% alcohol.
- Potato piece C was soaked in 10% alcohol.

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State one reason why this method is a source of error.

COUNTING THE BUBBLES DELIVERED ISN'T RELIABLE.

Suggest how to improve the method to minimise this error.

Repeat the experiment more times and to have a more accurate mean.

Your
Mark

1(c)(i)

1(c)(ii)

1(c)(iii)

1(d)(i)

1(d)(ii)

Q1 Mark scheme

(d)(i)	variable must match control given	
	variable	controlled by
	hydrogen peroxide (volume/concentration).	measured 10 cm^3 or used same strength solution;
	Potato (size/length/volume/surface area/type of potato sample of potato);	same dimensions used for each piece//30 mm \times 5 mm \times 10 mm or pieces cut from same potato/type of potato;
	time for measuring bubbles ;	counted for 3 min for each piece
	time of soaking in alcohol;	same time/24 hours for each piece;

2 marks

(d)(ii)	method must match the error. 1 mark for error, 1 mark for method.	
	source of error	method of reducing error
	bubbles are all different sizes;	measure the volume use a gas syringe/collect in a measuring cylinder/AVP;
	bubbles difficult to count ;	use a (tally) counter/ method of collecting the gas/measure the volume/ use 2 people/repeat for reliability/AW;
	setting up and starting time;	use 2 people;

2 marks

(iii) Identify the source of error in step 2. State why this is a source of error.

source of error the sizes are similar, not identical

reason As the sizes are not the same the number of bubbles will be different for sure.

[2]

(iv) Describe a control experiment that the student could carry out for this investigation.

instead of putting the pieces of potato in hydrogen peroxide solution, put them in distilled water and do all the steps of the real experiment.

[2]

(v) Predict the result expected from the control experiment described in (iv).

there will be no bubbles produced

[1]

(e) State one safety precaution required when ethanol is used in an investigation.

use proper safety glasses and gloves

[1]

Your
Mark

1(d)(iii)

1(d)(iv)

1(d)(v)

1(e)

1(f)(i)

1(f)(ii)

1(f)(iii)

Q1 Mark scheme

(d)(iii)	size/mass/volume/of the slices or type/age of potato, may not be equal ; surface area is different/quantity of available catalase is different/AW ; 2 marks
(d)(iv)	use exactly the same procedure/do the same/repeat/AW/or description of original method; I use boiled potato/boiled catalase/repeat without potato/ use water instead of hydrogen peroxide/use liver or yeast/ use glass beads except soak potato in water (and not ethanol)/use 0% alcohol/without alcohol/use untreated potato/AW; 2 marks
(d)(v)	same or greater number of bubbles than 2% alcohol/B/ figures quoted (11–18) (mean of 14.5+)/more bubbles as more gas produced/most number of bubbles; 1 mark
(e)	keep away from flames/heat source ; wear goggles/safety glasses: A use a water bath when heating ethanol wear gloves; wear lab coat; use tongs/AW; 1 mark
(f)(i)	280; 1 mark
(f)(ii)	A axes labelled even scale; y-axis: (mean) reaction time/ms x-axis: before drinking alcohol and after drinking alcohol/ before and after/r key given x-axis labels approximately under each bar P both plots accurate $\pm \frac{1}{2}$ small square ; C columns not touching R superimposed columns of same width columns at least half the grid on y-axis; 3 marks
(f)(iii)	220–350 (milliseconds) ; 1 mark

- (f) In an investigation into the effects of alcohol on the nervous system, people were asked to carry out a test on their reaction time.

The person being tested looked at a coloured block on a computer screen.
As soon as the colour changed they pressed a button.
The time taken to press the button was recorded by the computer.
This was their reaction time.

Twenty people were tested before and after consuming a drink containing the same concentration of alcohol

Table 1.2 shows the results of this investigation.

Table 1.2

test person	reaction time before consuming alcohol /milliseconds	reaction time after consuming alcohol /milliseconds
1	272	322
2	310	350
3	225	270
4	243	290
5	240	308
6	264	315
7	201	238
8	262	300
9	225	252
10	235	278
11	225	253
12	247	271
13	226	266
14	194	220
15	206	239
16	309	340
17	223	261
18	243	286
19	270	316
20	180	225
mean	240	280

- (i) Calculate the mean for the reaction time after consuming alcohol.

Write your answer in Table 1.2.

[1]

Your
Mark

1(d)(iii)

1(d)(iv)

1(d)(v)

1(e)

1(f)(i)

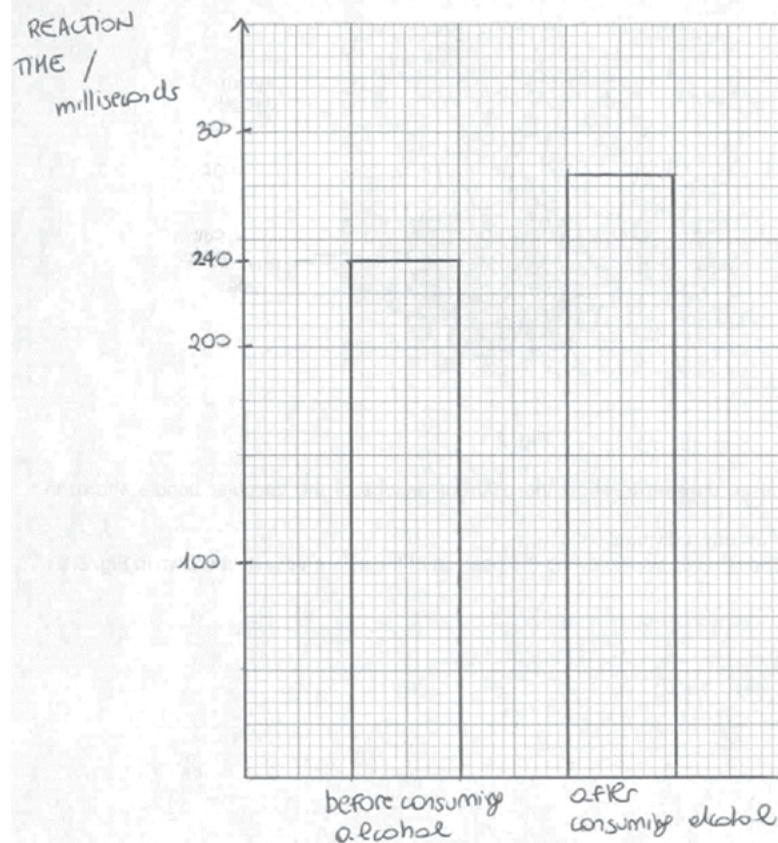
1(f)(ii)

1(f)(iii)

Q1 Mark scheme

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(e)	keep away from flames/heat source ; wear goggles/safety glasses: A use a water bath when heating ethanol wear gloves; wear lab coat; use tongs/AW; 1 mark
(f)(i)	280; 1 mark
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(f)(iii)	220–350 (milliseconds) ; 1 mark

- (ii) Plot a bar chart to show the mean reaction time of the people tested before and after consuming alcohol.



[3]

- (iii) The range of reaction times recorded before consuming alcohol is 180–310 milliseconds.

Use Table 1.2 to identify the range of reaction times recorded after consuming alcohol.

225 ~~250~~ – 350 milliseconds [1]

[Total: 27]

Your
Mark

1(d)(iii)

1(d)(iv)

1(d)(v)

1(e)

1(f)(i)

1(f)(ii)

1(f)(iii)

Q1 Mark scheme

(d)(iii)	size/mass/volume/of the slices or type/age of potato, may not be equal ; surface area is different/quantity of available catalase is different/AW ; 2 marks
(d)(iv)	use exactly the same procedure/do the same/repeat/AW/or description of original method; I use boiled potato/boiled catalase/repeat without potato/use water instead of hydrogen peroxide/use liver or yeast/use glass beads except soak potato in water (and not ethanol)/use 0% alcohol/without alcohol/use untreated potato/AW; 2 marks
(d)(v)	same or greater number of bubbles than 2% alcohol/B/figures quoted (11–18) (mean of 14.5+)/more bubbles as more gas produced/most number of bubbles; 1 mark
(e)	keep away from flames/heat source ; wear goggles/safety glasses: A use a water bath when heating ethanol wear gloves; wear lab coat; use tongs/AW; 1 mark
(f)(i)	280; 1 mark
(f)(ii)	A axes labelled even scale; y-axis: (mean) reaction time/ms x-axis: before drinking alcohol and after drinking alcohol/ before and after/r key given x-axis labels approximately under each bar P both plots accurate $\pm \frac{1}{2}$ small square ; C columns not touching R superimposed columns of same width columns at least half the grid on y-axis; 3 marks
(f)(iii)	220–350 (milliseconds) ; 1 mark

- 1 Metabolic reactions in cells produce toxic chemicals which can be converted to harmless or less toxic chemicals.

Hydrogen peroxide is broken down using the enzyme catalase which is found in most cells.

Fig. 1.1 shows this reaction.

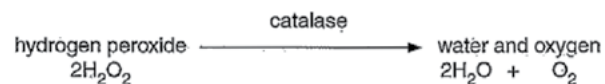


Fig. 1.1

A student investigated the effect of alcohol (ethanol) on the activity of catalase found in potato, using three pieces of potato cut to the same size.

Fig. 1.2 shows these pieces of potato.

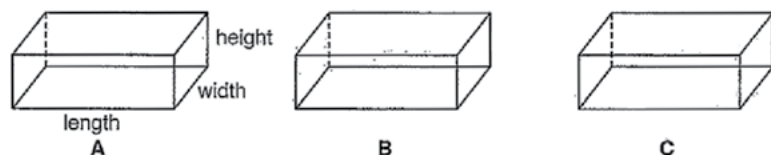


Fig. 1.2

- (a) (i) Measure the length, width and height of one of these pieces of potato.

Record your results in Table 1.1.

Table 1.1

length of potato piece /mm	width of potato piece /mm	height of potato piece /mm
30	10	10

[1]

- Step 1 The student labelled six test-tubes, 1, 2, 3, 4, 5, and 6 and used a syringe to add 10 cm³ of hydrogen peroxide solution to each of the test-tubes.
- Step 2 They cut potato piece A to obtain two slices of similar size.
- Step 3 The student placed the free end of a delivery tube into a large test-tube containing water.
- Step 4 They placed one of the slices of potato piece A into the hydrogen peroxide solution in test-tube 1.
- Step 5 The student immediately placed the rubber bung attached to the delivery tube into test-tube 1 and pushed it in as tightly as possible, as shown in Fig. 1.3.

Select page

Your Mark

1(a)(i)

1(a)(ii)

1(b)(i)

1(b)(ii)

Q1	Mark scheme
(a)(i)	length: 30 (mm) width: 10 (mm) height: 10 (mm) ; 1 mark
(a)(ii)	1 table drawn with rows or columns ; 1 graphs 2 table drawn with cells for at least 6 bubble readings and 3 means; 3 appropriate column headings with units R if units given in cells instead of header (number of) bubbles per (or in) 3 minutes/min or (number of) bubbles/minute or min potato/piece of potato/piece/tube slice/stick and 1 or 2 mean/average (number of bubbles per 3 min (or per 1 min) ; 4 correct tally results recorded ; 5 correct mean/average calculated for each potato piece ; 5 marks
(b)(i)	prevents leakage of oxygen/all oxygen collected; A gas/air/bubbles can observe reaction/bubbles as soon as it starts/AW; I no air/oxygen can enter tube I "quicker" unqualified for mp 2 1 mark
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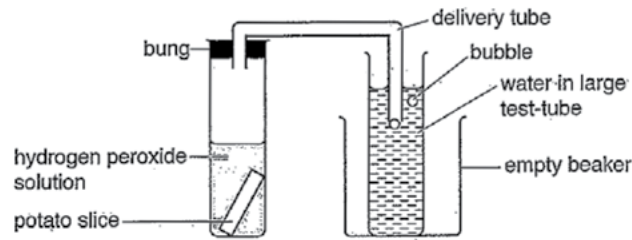


Fig. 1.3

Step 6 They counted the number of bubbles released from the delivery tube in 3 minutes.

Step 7 The student repeated steps 4–6 for the second slice of potato piece A using test-tube 2.

Step 8 They repeated steps 2–7 for potato piece B using test-tubes 3 and 4.

Step 9 They repeated steps 2–7 for potato piece C using test-tubes 5 and 6.

The student used a tally to count the number of bubbles.

Fig. 1.4 shows their tally count.

4	
A1 IIII 5	A2 III 3
B1 IIII IIII 10	B2 IIII I 6
C1 IIII II 12	C2 IIII I 6

Fig. 1.4

Your
Mark

1(a)(i)

1(a)(ii)

1(b)(i)

1(b)(ii)

Q1	Mark scheme
(a)(i)	length: 30 (mm) width: 10 (mm) height: 10 (mm) ; 1 mark
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- (ii) Prepare a table to record the student's results.
Your table should show:

- the numbers of bubbles produced by each slice of potato in 3 minutes
- the mean number of bubbles produced by each of potato piece A, B and C.

Complete your table using the results from Fig. 1.4.

number of bubbles	potato pieces					
	A		B		C	
	1	2	1	2	1	2
number of bubbles produced	5	3	18	11	12	10
mean	4		14.5		11	

[5]

- (b) (i) Suggest why the free end of the delivery tube was placed in the water before adding the potato slice to the hydrogen peroxide solution and connecting the test-tube to the bung of the delivery tube.

To prevent the escape of oxygen gas, as the potato slice contains the catalase enzyme.

[1]

- (ii) Explain why the bung of the delivery tube must fit tightly into the test-tube.

To prevent the gas pressure inside from blocking the tube.

[2]

Your
Mark

1(a)(i)

1(a)(ii)

1(b)(i)

1(b)(ii)

Q1	Mark scheme
(a)(i)	length: 30 (mm) width: 10 (mm) height: 10 (mm) ; 1 mark
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(c) The pieces of potato that the student used in their investigation were soaked in different concentrations of alcohol for 24 hours.

- Potato piece **A** was soaked in 20% alcohol.
- Potato piece **B** was soaked in 2% alcohol.
- Potato piece **C** was soaked in 10% alcohol.

(i) Suggest the relationship between the number of bubbles and the activity of catalase.

As the activity of catalase enzyme increases, ^{the} more hydrogen peroxide ~~broken~~ water and oxygen bubbles are produced. [1]

(ii) Compare the activity of catalase in the potato pieces **A**, **B** and **C**.

The activity in potato piece **B** was more, as the mean number of bubbles was 14.5, while the mean number of bubbles in **A** was 4 and in **C**, it was 11. [1]

(iii) Predict the number of bubbles that would be produced in 3 minutes if a piece of potato was soaked in 50% alcohol before being placed in hydrogen peroxide solution.

10 bubbles. $\frac{4}{10} \rightarrow 0.2$ [1]

(d) (i) State **one** variable that has been controlled in the student's investigation.

Describe how this variable was controlled.

variable temperature
how it was controlled by using a water bath, which can regulate the temperature. [2]

(ii) The method of measuring the oxygen gas produced is a source of error.

State **one** reason why this method is a source of error.

As the student can miscount the number of bubbles produced. [2]

Suggest how to improve the method to minimise this error.

By measuring the volume of oxygen produced by attaching a gas syringe to the apparatus. [2]

Your
Mark

1(c)(i)

1(c)(ii)

1(c)(iii)

1(d)(i)

1(d)(ii)

Q1 Mark scheme

(c)(i)	catalase produces more bubbles when it is active/ora; A as number of bubbles increases the activity of the catalase increases/positive correlation the lower the percentage of alcohol (used for soaking) the more bubbles are produced/AW/ora; need not refer to catalase (more bubbles means more activity) the higher the percentage of alcohol used the lower the activity of the catalase/ora; 1 mark
(c)(ii)	B has more catalase activity/bubbles, A has least activity/bubbles; I restatement of results (number of bubbles from each piece of potato) A B more, C medium and A fewer bubbles/AW 1 mark
(c)(iii)	number 4 or less than 4 ; A no bubbles/none/zero 1 mark

(c) The pieces of potato that the student used in their investigation were soaked in different concentrations of alcohol for 24 hours.

- Potato piece **A** was soaked in 20% alcohol.
- Potato piece **B** was soaked in 2% alcohol.
- Potato piece **C** was soaked in 10% alcohol.

(i) Suggest the relationship between the number of bubbles and the activity of catalase.

As the activity of catalase enzyme increases, ^{the} more hydrogen peroxide ~~broken~~ water and oxygen bubbles are produced. [1]

(ii) Compare the activity of catalase in the potato pieces **A**, **B** and **C**.

The activity in potato piece **B** was more, as the mean number of bubbles was 14.5, while the mean number of bubbles in **A** was 4 and in **C**, it was 11. [1]

(iii) Predict the number of bubbles that would be produced in 3 minutes if a piece of potato was soaked in 50% alcohol before being placed in hydrogen peroxide solution.

10 bubbles. $\frac{4}{10} \rightarrow 0.2$ [1]

(d) (i) State **one** variable that has been controlled in the student's investigation.

Describe how this variable was controlled.

variable temperature
how it was controlled by using a water bath, which can regulate the temperature. [2]

(ii) The method of measuring the oxygen gas produced is a source of error.

State **one** reason why this method is a source of error.

As the student can miscount the number of bubbles produced. [2]

Suggest how to improve the method to minimise this error.

By measuring the volume of oxygen produced by attaching a gas syringe to the apparatus. [2]

Your
Mark

1(c)(i)

1(c)(ii)

1(c)(iii)

1(d)(i)

1(d)(ii)

Q1 Mark scheme

(d)(i)	variable must match control given	
	<i>variable</i>	<i>controlled by</i>
	hydrogen peroxide (volume/ concentration).	measured 10 cm ³ or used same strength solution;
	Potato (size/length/ volume/surface area/ type of potato sample of potato);	same dimensions used for each piece//30 mm × 5 mm × 10 mm or pieces cut from same potato/type of potato;
	time for measuring bubbles ;	counted for 3 min for each piece
(d)(ii)	time of soaking in alcohol;	same time/24 hours for each piece;
	2 marks	
	method must match the error. 1 mark for error, 1 mark for method.	
	<i>source of error</i>	<i>method of reducing error</i>
	bubbles are all different sizes;	measure the volume use a gas syringe/collect in a measuring cylinder/AVP;
	bubbles difficult to count ;	use a (tally) counter/ method of collecting the gas/measure the volume/ use 2 people/repeat for reliability/AW;
	setting up and starting time;	use 2 people;
	2 marks	

(iii) Identify the source of error in step 2. State why this is a source of error.

source of error ^{parallel} ~~area~~ error may have occurred, while measuring the sides.

reason as the ruler wasn't on the potato, while measuring its length, width and height.

[2]

(iv) Describe a control experiment that the student could carry out for this investigation.

By doing the same experiment, but using ~~the~~ a boiled piece of potato to denature the catalase enzyme.

[2]

(v) Predict the result expected from the control experiment described in (iv).

no oxygen bubbles will be produced.

[1]

(e) State one safety precaution required when ethanol is used in an investigation.

using a water-bath, when heating to prevent the ~~ethanol~~ ethanol from splashing.

[1]

Your
Mark

1(d)(iii)

1(d)(iv)

1(d)(v)

1(e)

1(f)(i)

1(f)(ii)

1(f)(iii)

Q1	Mark scheme
(d)(iii)	size/mass/volume/of the slices or type/age of potato, may not be equal ; surface area is different/quantity of available catalase is different/AW ; 2 marks
(d)(iv)	use exactly the same procedure/do the same/repeat/AW/or description of original method; I use boiled potato/boiled catalase/repeat without potato/ use water instead of hydrogen peroxide/use liver or yeast/ use glass beads except soak potato in water (and not ethanol)/use 0% alcohol/without alcohol/use untreated potato/AW; 2 marks
(d)(v)	same or greater number of bubbles than 2% alcohol/B/ figures quoted (11–18) (mean of 14.5+)/more bubbles as more gas produced/most number of bubbles; 1 mark
(e)	keep away from flames/heat source ; wear goggles/safety glasses: A use a water bath when heating ethanol wear gloves; wear lab coat; use tongs/AW; 1 mark
(f)(i)	280; 1 mark
(f)(ii)	A axes labelled even scale; y-axis: (mean) reaction time/ms x-axis: before drinking alcohol and after drinking alcohol/ before and after/r key given x-axis labels approximately under each bar P both plots accurate $\pm \frac{1}{2}$ small square ; C columns not touching R superimposed columns of same width columns at least half the grid on y-axis; 3 marks
(f)(iii)	220–350 (milliseconds) ; 1 mark

- (f) In an investigation into the effects of alcohol on the nervous system, people were asked to carry out a test on their reaction time.

The person being tested looked at a coloured block on a computer screen.
As soon as the colour changed they pressed a button.
The time taken to press the button was recorded by the computer.
This was their reaction time.

Twenty people were tested before and after consuming a drink containing the same concentration of alcohol.

Table 1.2 shows the results of this investigation.

Table 1.2

test person	reaction time before consuming alcohol /milliseconds	reaction time after consuming alcohol /milliseconds
1	272	322
2	310	350
3	225	270
4	243	290
5	240	308
6	264	315
7	201	238
8	262	300
9	225	252
10	235	278
11	225	253
12	247	271
13	226	266
14	194	220
15	206	239
16	309	340
17	223	261
18	243	286
19	270	316
20	180	225
mean	240	280

- (i) Calculate the mean for the reaction time after consuming alcohol.

Write your answer in Table 1.2.

[1]

Your
Mark

1(d)(iii)

1(d)(iv)

1(d)(v)

1(e)

1(f)(i)

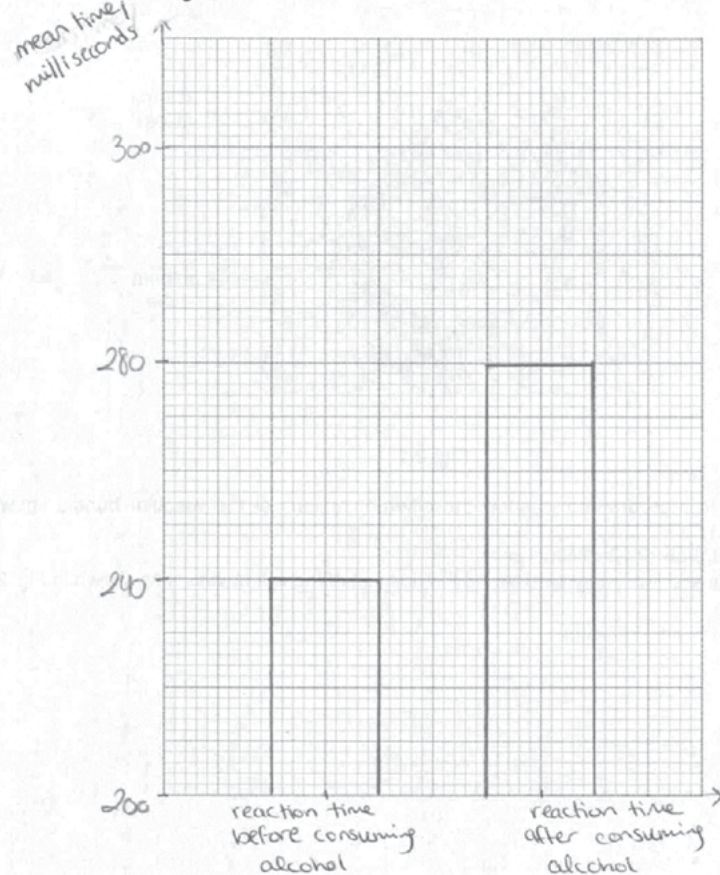
1(f)(ii)

1(f)(iii)

Q1 Mark scheme

(d)(iii)	size/mass/volume/of the slices or type/age of potato, may not be equal ; surface area is different/quantity of available catalase is different/AW ; 2 marks
(d)(iv)	use exactly the same procedure/do the same/repeat/AW/or description of original method; I use boiled potato/boiled catalase/repeat without potato/use water instead of hydrogen peroxide/use liver or yeast/use glass beads except soak potato in water (and not ethanol)/use 0% alcohol/without alcohol/use untreated potato/AW; 2 marks
(d)(v)	same or greater number of bubbles than 2% alcohol/B/figures quoted (11–18) (mean of 14.5+)/more bubbles as more gas produced/most number of bubbles; 1 mark
(e)	keep away from flames/heat source ; wear goggles/safety glasses: A use a water bath when heating ethanol wear gloves; wear lab coat; use tongs/AW; 1 mark
(f)(i)	280; 1 mark
(f)(ii)	A axes labelled even scale; y-axis: (mean) reaction time/ms x-axis: before drinking alcohol and after drinking alcohol/ before and after/r key given x-axis labels approximately under each bar P both plots accurate $\pm \frac{1}{2}$ small square ; C columns not touching R superimposed columns of same width columns at least half the grid on y-axis; 3 marks
(f)(iii)	220–350 (milliseconds) ; 1 mark

(ii) Plot a bar chart to show the mean reaction time of the people tested before and after consuming alcohol.



(iii) The range of reaction times recorded before consuming alcohol is 180–310 milliseconds.

Use Table 1.2 to identify the range of reaction times recorded after consuming alcohol.

220–350 milliseconds [1]

[Total: 27]

Your
Mark

1(d)(iii)

1(d)(iv)

1(d)(v)

1(e)

1(f)(i)

1(f)(ii)

1(f)(iii)

Q1 Mark scheme

(d)(iii)	size/mass/volume/of the slices or type/age of potato, may not be equal ; surface area is different/quantity of available catalase is different/AW ; 2 marks
(d)(iv)	use exactly the same procedure/do the same/repeat/AW/or description of original method; I use boiled potato/boiled catalase/repeat without potato/use water instead of hydrogen peroxide/use liver or yeast/use glass beads except soak potato in water (and not ethanol)/use 0% alcohol/without alcohol/use untreated potato/AW; 2 marks
(d)(v)	same or greater number of bubbles than 2% alcohol/B/figures quoted (11–18) (mean of 14.5+)/more bubbles as more gas produced/most number of bubbles; 1 mark
(e)	keep away from flames/heat source ; wear goggles/safety glasses: A use a water bath when heating ethanol wear gloves; wear lab coat; use tongs/AW; 1 mark
(f)(i)	280; 1 mark
(f)(ii)	A axes labelled even scale; y-axis: (mean) reaction time/ms x-axis: before drinking alcohol and after drinking alcohol/ before and after/r key given x-axis labels approximately under each bar P both plots accurate $\pm \frac{1}{2}$ small square ; C columns not touching R superimposed columns of same width columns at least half the grid on y-axis; 3 marks
(f)(iii)	220–350 (milliseconds) ; 1 mark

- 1 Metabolic reactions in cells produce toxic chemicals which can be converted to harmless or less toxic chemicals.

Hydrogen peroxide is broken down using the enzyme catalase which is found in most cells.

Fig. 1.1 shows this reaction.

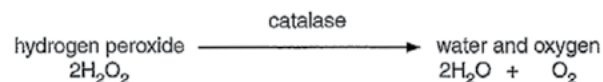


Fig. 1.1

A student investigated the effect of alcohol (ethanol) on the activity of catalase found in potato, using three pieces of potato cut to the same size.

Fig. 1.2 shows these pieces of potato.

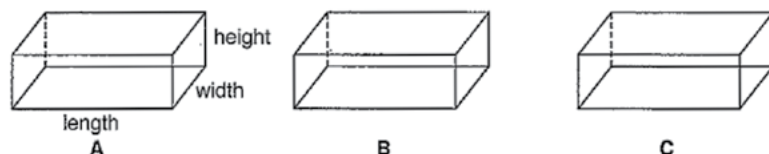


Fig. 1.2

- (a) (i) Measure the length, width and height of one of these pieces of potato.

Record your results in Table 1.1.

Table 1.1

length of potato piece /mm	width of potato piece /mm	height of potato piece /mm
3mm	1mm	1mm

[1]

- Step 1 The student labelled six test-tubes, 1, 2, 3, 4, 5, and 6 and used a syringe to add 10 cm³ of hydrogen peroxide solution to each of the test-tubes.
- Step 2 They cut potato piece A to obtain two slices of similar size.
- Step 3 The student placed the free end of a delivery tube into a large test-tube containing water.
- Step 4 They placed one of the slices of potato piece A into the hydrogen peroxide solution in test-tube 1.
- Step 5 The student immediately placed the rubber bung attached to the delivery tube into test-tube 1 and pushed it in as tightly as possible, as shown in Fig. 1.3.

Select page

Your Mark

1(a)(i)

1(a)(ii)

1(b)(i)

1(b)(ii)

Q1	Mark scheme
(a)(i)	length: 30 (mm) width: 10 (mm) height: 10 (mm) ; 1 mark
(a)(ii)	1 table drawn with rows or columns ; 1 graphs 2 table drawn with cells for at least 6 bubble readings and 3 means; 3 appropriate column headings with units R if units given in cells instead of header (number of) bubbles per (or in) 3 minutes/min or (number of) bubbles/minute or min potato/piece of potato/piece/tube slice/stick and 1 or 2 mean/average (number of bubbles per 3 min (or per 1 min) ; 4 correct tally results recorded ; 5 correct mean/average calculated for each potato piece ; 5 marks
(b)(i)	prevents leakage of oxygen/all oxygen collected; A gas/air/bubbles can observe reaction/bubbles as soon as it starts/AW; I no air/oxygen can enter tube I "quicker" unqualified for mp 2 1 mark
(b)(ii)	prevents leakage of oxygen/all oxygen collected ; A gas/air/bubbles I loose bung could come out/no gas from outside enters the tube I fair test comments increases accuracy/results will be comparable/consistent/reliable/valid; allow a pressure to build up/bubbles to form; 2 marks

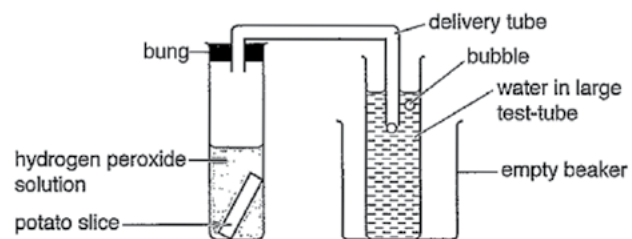


Fig. 1.3

Step 6 They counted the number of bubbles released from the delivery tube in 3 minutes.

Step 7 The student repeated steps 4–6 for the second slice of potato piece A using test-tube 2.

Step 8 They repeated steps 2–7 for potato piece B using test-tubes 3 and 4.

Step 9 They repeated steps 2–7 for potato piece C using test-tubes 5 and 6.

The student used a tally to count the number of bubbles.

Fig. 1.4 shows their tally count.

A1		A2	
B1		B2	
C1		C2	

Fig. 1.4

Your
Mark

1(a)(i)

1(a)(ii)

1(b)(i)

1(b)(ii)

Q1	Mark scheme
(a)(i)	length: 30 (mm) width: 10 (mm) height: 10 (mm) ; 1 mark
(a)(ii)	1 table drawn with rows or columns ; I graphs 2 table drawn with cells for at least 6 bubble readings and 3 means; 3 appropriate column headings with units R if units given in cells instead of header (number of) bubbles per (or in) 3 minutes/min or (number of) bubbles/minute or min potato/piece of potato/piece/tube slice/stick and 1 or 2 mean/average (number of bubbles per 3 min (or per 1 min) ; 4 correct tally results recorded ; 5 correct mean/average calculated for each potato piece ; 5 marks
(b)(i)	prevents leakage of oxygen/all oxygen collected; A gas/air/bubbles can observe reaction/bubbles as soon as it starts/AW; I no air/oxygen can enter tube I "quicker" unqualified for mp 2 1 mark
(b)(ii)	prevents leakage of oxygen/all oxygen collected ; A gas/air/bubbles I loose bung could come out/no gas from outside enters the tube I fair test comments increases accuracy/results will be comparable/consistent/reliable/valid; allow a pressure to build up/bubbles to form; 2 marks

- (ii) Prepare a table to record the student's results.
Your table should show:

- the numbers of bubbles produced by each slice of potato in 3 minutes
- the mean number of bubbles produced by each of potato piece A, B and C.

Complete your table using the results from Fig. 1.4.

	Number of bubbles Produced by each slice of potato in 3mins	the mean # of bubbles produced by each of potato piece
A ₁	6	4
B ₁	18	14.5
C ₁	12	11
A ₂	3	
B ₂	11	
C ₂	10	

- (b) (i) Suggest why the free end of the delivery tube was placed in the water before adding the potato slice to the hydrogen peroxide solution and connecting the test-tube to the bung of the delivery tube.

So no reaction happens without the delivery tube and connecting the test-tube to the bung being there. [1]

- (ii) Explain why the bung of the delivery tube must fit tightly into the test-tube.

① So nothing can escape
② So results are accurate [2]

Your
Mark

1(a)(i)

1(a)(ii)

1(b)(i)

1(b)(ii)

Q1	Mark scheme
(a)(i)	length: 30 (mm) width: 10 (mm) height: 10 (mm) ; 1 mark
(a)(ii)	1 table drawn with rows or columns ; 1 graphs 2 table drawn with cells for at least 6 bubble readings and 3 means; 3 appropriate column headings with units R if units given in cells instead of header (number of) bubbles per (or in) 3 minutes/min or (number of) bubbles/minute or min potato/piece of potato/piece/tube slice/stick and 1 or 2 mean/average (number of bubbles per 3 min (or per 1 min) ; 4 correct tally results recorded ; 5 correct mean/average calculated for each potato piece ; 5 marks
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(c) The pieces of potato that the student used in their investigation were soaked in different concentrations of alcohol for 24 hours.

- Potato piece **A** was soaked in 20% alcohol.
- Potato piece **B** was soaked in 2% alcohol.
- Potato piece **C** was soaked in 10% alcohol.

(i) Suggest the relationship between the number of bubbles and the activity of catalase.

they aren't the same

[1]

(ii) Compare the activity of catalase in the potato pieces **A**, **B** and **C**.

they are all different

[1]

(iii) Predict the number of bubbles that would be produced in 3 minutes if a piece of potato was soaked in 50% alcohol before being placed in hydrogen peroxide solution.

25

[1]

(d) (i) State **one** variable that has been controlled in the student's investigation.

Describe how this variable was controlled.

variable potato slice

how it was controlled in each test tube the same size of potato slice

[2]

(ii) The method of measuring the oxygen gas produced is a source of error.

State **one** reason why this method is a source of error.

Because it can be more or less ^{oxygen} in each test tube

Suggest how to improve the method to minimise this error.

Use the same tube

[2]

Your
Mark

1(c)(i)

1(c)(ii)

1(c)(iii)

1(d)(i)

1(d)(ii)

Q1 Mark scheme

(c)(i)	catalase produces more bubbles when it is active/ora; A as number of bubbles increases the activity of the catalase increases/positive correlation the lower the percentage of alcohol (used for soaking) the more bubbles are produced/AW/ora; need not refer to catalase (more bubbles means more activity) the higher the percentage of alcohol used the lower the activity of the catalase/ora; 1 mark
(c)(ii)	B has more catalase activity/bubbles, A has least activity/bubbles; I restatement of results (number of bubbles from each piece of potato) A B more, C medium and A fewer bubbles/AW 1 mark
(c)(iii)	number 4 or less than 4 ; A no bubbles/none/zero 1 mark

(c) The pieces of potato that the student used in their investigation were soaked in different concentrations of alcohol for 24 hours.

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(i) Suggest the relationship between the number of bubbles and the activity of catalase.

they aren't the same

[1]

(ii) Compare the activity of catalase in the potato pieces **A**, **B** and **C**.

they are all different

[1]

(iii) Predict the number of bubbles that would be produced in 3 minutes if a piece of potato was soaked in 50% alcohol before being placed in hydrogen peroxide solution.

25

[1]

(d) (i) State **one** variable that has been controlled in the student's investigation.

Describe how this variable was controlled.

variable potato slice

how it was controlled in each test tube the same size of potato slice

[2]

(ii) The method of measuring the oxygen gas produced is a source of error.

State **one** reason why this method is a source of error.

Because it can be more or less ^{oxygen} in each test tube

Suggest how to improve the method to minimise this error.

Use the same tube

[2]

Your
Mark

1(c)(i)

1(c)(ii)

1(c)(iii)

1(d)(i)

1(d)(ii)

Q1 Mark scheme

(d)(i)	variable must match control given	
	<i>variable</i>	<i>controlled by</i>
	hydrogen peroxide (volume/ concentration).	measured 10 cm ³ or used same strength solution;
	Potato (size/length/ volume/surface area/ type of potato sample of potato);	same dimensions used for each piece//30 mm × 5 mm × 10 mm or pieces cut from same potato/type of potato;
	time for measuring bubbles ;	counted for 3 min for each piece
		time of soaking in alcohol;
		same time/24 hours for each piece;
2 marks		
(d)(ii)	method must match the error. 1 mark for error, 1 mark for method.	
	<i>source of error</i>	<i>method of reducing error</i>
	bubbles are all different sizes;	measure the volume use a gas syringe/collect in a measuring cylinder/AVP;
	bubbles difficult to count ;	use a (tally) counter/ method of collecting the gas/measure the volume/ use 2 people/repeat for reliability/AW;
	setting up and starting time;	use 2 people;
2 marks		

(iii) Identify the source of error in step 2. State why this is a source of error.

source of error Cutting potato ² to two slices

reason the slices ~~to~~ might not be equally the same

[2]

(iv) Describe a control experiment that the student could carry out for this investigation.

Boiled enzymes

[2]

(v) Predict the result expected from the control experiment described in (iv).

faster results

[1]

(e) State one safety precaution required when ethanol is used in an investigation.

Safety goggles

[1]

Your
Mark

1(d)(iii)

1(d)(iv)

1(d)(v)

1(e)

1(f)(i)

1(f)(ii)

1(f)(iii)

Q1	Mark scheme
(d)(iii)	size/mass/volume/of the slices or type/age of potato, may not be equal ; surface area is different/quantity of available catalase is different/AW ; 2 marks
(d)(iv)	use exactly the same procedure/do the same/repeat/AW/or description of original method; I use boiled potato/boiled catalase/repeat without potato/ use water instead of hydrogen peroxide/use liver or yeast/ use glass beads except soak potato in water (and not ethanol)/use 0% alcohol/without alcohol/use untreated potato/AW; 2 marks
(d)(v)	same or greater number of bubbles than 2% alcohol/B/ figures quoted (11–18) (mean of 14.5+)/more bubbles as more gas produced/most number of bubbles; 1 mark
(e)	keep away from flames/heat source ; wear goggles/safety glasses: A use a water bath when heating ethanol wear gloves; wear lab coat; use tongs/AW; 1 mark
(f)(i)	280; 1 mark
(f)(ii)	A axes labelled even scale; y-axis: (mean) reaction time/ms x-axis: before drinking alcohol and after drinking alcohol/ before and after/r key given x-axis labels approximately under each bar P both plots accurate $\pm \frac{1}{2}$ small square ; C columns not touching R superimposed columns of same width columns at least half the grid on y-axis; 3 marks
(f)(iii)	220–350 (milliseconds) ; 1 mark

- (f) In an investigation into the effects of alcohol on the nervous system, people were asked to carry out a test on their reaction time.

The person being tested looked at a coloured block on a computer screen.
As soon as the colour changed they pressed a button.
The time taken to press the button was recorded by the computer.
This was their reaction time.

Twenty people were tested before and after consuming a drink containing the same concentration of alcohol.

Table 1.2 shows the results of this investigation.

Table 1.2

test person	reaction time <u>before</u> consuming alcohol /milliseconds	reaction time after consuming alcohol /milliseconds
1	272	322
2	310	350
3	225	270
4	243	290
5	240	308
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11	225	253
12	247	271
13	226	266
14	194	220
15	206	239
16	309	340
17	223	261
18	243	286
19	270	316
20	180	225
mean	240	280

- (i) Calculate the mean for the reaction time after consuming alcohol.

Write your answer in Table 1.2.

[1]

Select page

Your Mark

1(d)(iii)

1(d)(iv)

1(d)(v)

1(e)

1(f)(i)

1(f)(ii)

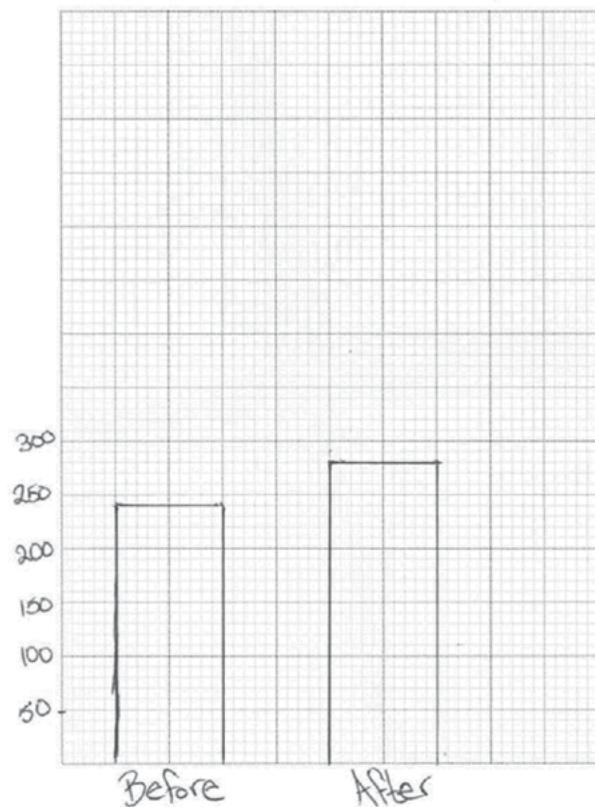
1(f)(iii)

Q1 Mark scheme

(d)(iii)	size/mass/volume/of the slices or type/age of potato, may not be equal ; surface area is different/quantity of available catalase is different/AW ; 2 marks
(d)(iv)	use exactly the same procedure/do the same/repeat/AW/or description of original method; I use boiled potato/boiled catalase/repeat without potato/use water instead of hydrogen peroxide/use liver or yeast/use glass beads except soak potato in water (and not ethanol)/use 0% alcohol/without alcohol/use untreated potato/AW; 2 marks
(d)(v)	same or greater number of bubbles than 2% alcohol/B/figures quoted (11–18) (mean of 14.5+)/more bubbles as more gas produced/most number of bubbles; 1 mark
(e)	keep away from flames/heat source ; wear goggles/safety glasses: A use a water bath when heating ethanol wear gloves; wear lab coat; use tongs/AW; 1 mark
(f)(i)	280; 1 mark
(f)(ii)	A axes labelled even scale; y-axis: (mean) reaction time/ms x-axis: before drinking alcohol and after drinking alcohol/ before and after/r key given x-axis labels approximately under each bar P both plots accurate $\pm \frac{1}{2}$ small square ; C columns not touching R superimposed columns of same width columns at least half the grid on y-axis; 3 marks
(f)(iii)	220–350 (milliseconds) ; 1 mark

777

- (ii) Plot a bar chart to show the mean reaction time of the people tested before and after consuming alcohol.



[3]

- (iii) The range of reaction times recorded before consuming alcohol is 180–310 milliseconds.

Use Table 1.2 to identify the range of reaction times recorded after consuming alcohol.

..... 404.5 milliseconds [1]

[Total: 27]

Select page

Your Mark

1(d)(iii)

1(d)(iv)

1(d)(v)

1(e)

1(f)(i)

1(f)(ii)

1(f)(iii)

Q1 Mark scheme

(d)(iii)	size/mass/volume/of the slices or type/age of potato, may not be equal ; surface area is different/quantity of available catalase is different/AW ; 2 marks
(d)(iv)	use exactly the same procedure/do the same/repeat/AW/or description of original method; I use boiled potato/boiled catalase/repeat without potato/use water instead of hydrogen peroxide/use liver or yeast/use glass beads except soak potato in water (and not ethanol)/use 0% alcohol/without alcohol/use untreated potato/AW; 2 marks
(d)(v)	same or greater number of bubbles than 2% alcohol/B/figures quoted (11–18) (mean of 14.5+)/more bubbles as more gas produced/most number of bubbles; 1 mark
(e)	keep away from flames/heat source ; wear goggles/safety glasses: A use a water bath when heating ethanol wear gloves; wear lab coat; use tongs/AW; 1 mark
(f)(i)	280; 1 mark
(f)(ii)	A axes labelled even scale; y-axis: (mean) reaction time/ms x-axis: before drinking alcohol and after drinking alcohol/ before and after/r key given x-axis labels approximately under each bar P both plots accurate $\pm \frac{1}{2}$ small square ; C columns not touching R superimposed columns of same width columns at least half the grid on y-axis; 3 marks
(f)(iii)	220–350 (milliseconds) ; 1 mark

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