Name: _____

TOPIC 1: KEY CONCEPTS IN BIOLOGY PART 1 QP

Date:

Time:

Total marks available:

Total marks achieved: _____

Questions

Q1.

DNA can code for the amino acids in the active site of an enzyme.

Explain the role of the active site of an enzyme.

(2)

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Q2.

DNA can code for the amino acids in the active site of an enzyme.

Explain the role of the active site of an enzyme.

(2)

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Q3.

Many cells contain an enzyme called catalase.

Catalase breaks down hydrogen peroxide into water and oxygen.

A scientist investigated the effect of hydrogen peroxide concentration on the time taken to produce 20 cm^3 of oxygen.

Figure 12 shows the equipment used.

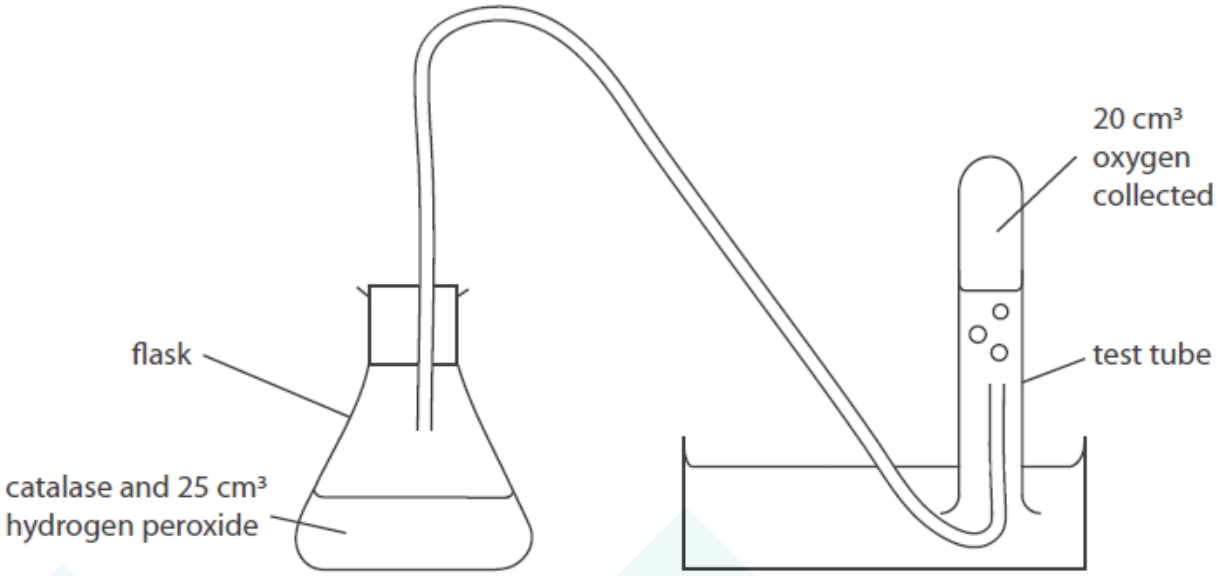

Figure 12

(i) State how the scientist could control the temperature of the flask.

(1)

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(ii) Explain why the temperature should be controlled in this investigation.

(3)

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(iii) This investigation used five different concentrations of hydrogen peroxide.

Figure 13 shows the results of this investigation.

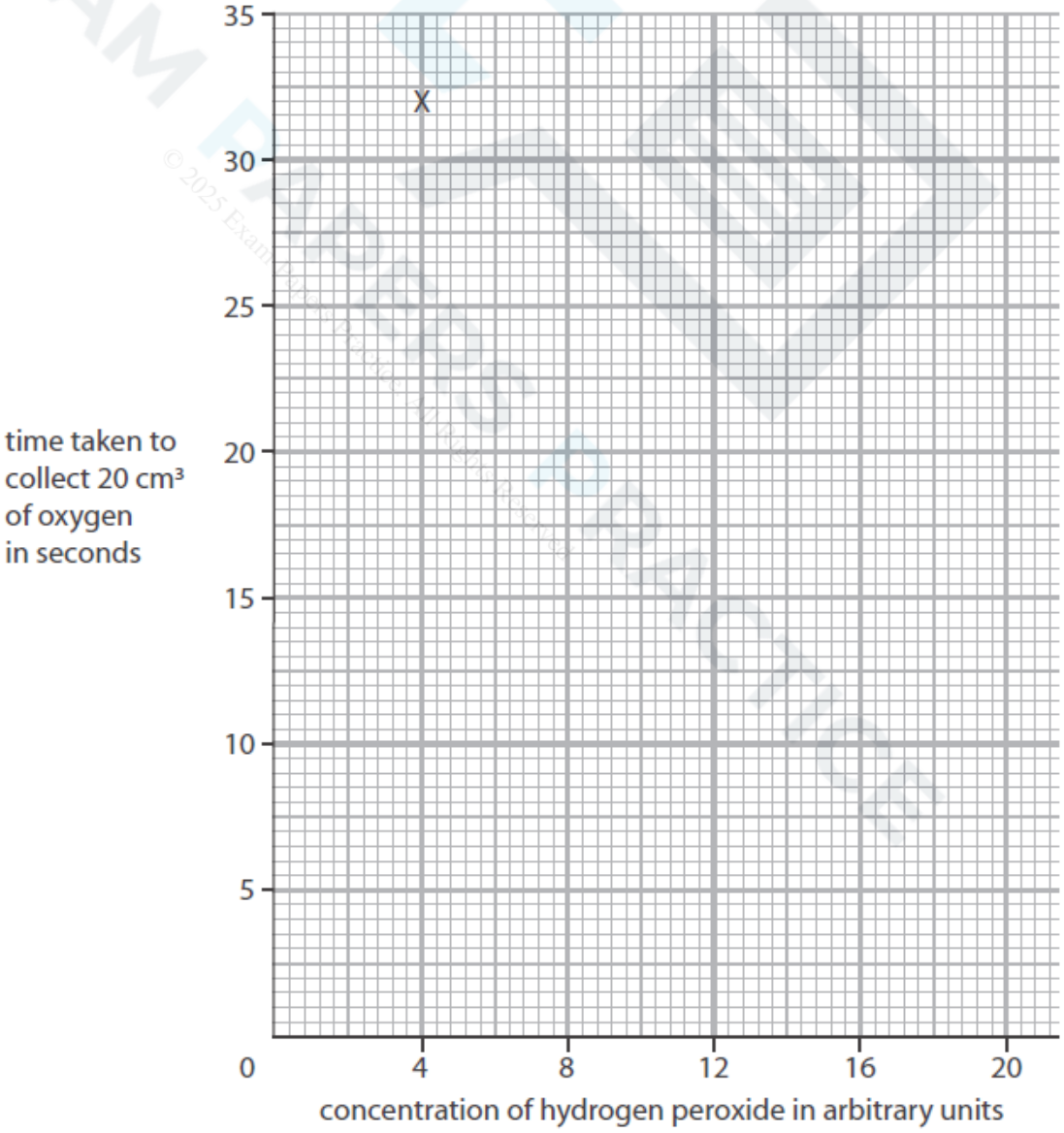
concentration of hydrogen peroxide in arbitrary units	time taken to collect 20 cm^3 of oxygen in seconds
4	32
8	14
12	9
16	7
20	6

Figure 13

Complete the graph by plotting the points and drawing a line to show the trend in the data.

The first point has been plotted for you.

(2)



(iv) Describe the trend shown in the graph.

Use data from the table in Figure 13 to support your answer.

(3)

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(Total for question = 9 marks)

Q4.

A student investigated mitosis in the root tip of a garlic plant.

(i) Explain why the student used the tip of the root.

(2)

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(ii) The student squashed the root tip on a microscope slide to spread out the cells.

The slide was placed on the stage of a microscope.

Describe how to use the microscope to obtain a clear image of the cells.

(2)

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(iii) The student could not see the chromosomes inside the cells.

State what can be added to the root tip squash to make the chromosomes visible.

(1)

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.....

(Total for question = 5 marks)

Q5.

A student mixed 10 cm^3 of starch solution with 5 cm^3 of amylase solution and kept the tube in a water bath at 25°C.

The student tested the solution for starch and for glucose every 30 seconds.

Figure 6 shows the results.

time in seconds	starch detected	glucose detected
0	Yes	No
30	Yes	No
60	Yes	Yes
90	Yes	Yes
120	Yes	Yes
150	No	Yes
180	No	Yes

Figure 6

(i) Give **one** reason for the result at 150 seconds.

(1)

.....

.....

.....

(ii) Another student repeated the investigation with the same volumes of solutions and at the same temperature of 25°C.

Give **two** other variables that would need to be controlled in the investigation.

(2)

1 .....

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2 .....

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(iii) Both students also included a tube containing 10 cm^3 of starch solution with 5 cm^3 of distilled water instead of 5 cm^3
of amylase solution.

They tested the solution for starch and for glucose every 30 seconds.

Give **one** reason why this tube was included in their investigations.

(1)

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(Total for question = 4 marks)

Q6.

A scientist investigated how the length of starch grains in potatoes changed when the potatoes were stored in the dark.

Figure 21 shows a potato after being stored in the dark.

Figure 21

Three potatoes were used in the investigation.

The length of starch grains in potato 1 were measured at the start.

The length of starch grains were measured in potato 2 after 5 weeks in the dark.

The length of starch grains were measured in potato 3 after 10 weeks in the dark.

Figure 22 shows the results.

potato	time after placing in the dark in weeks	mean length of starch grains in μm
1	0	64
2	5	50
3	10	30

Figure 22

(i) Calculate the percentage difference in the mean length of starch grains in potato 2 at 5 weeks and in potato 3 at 10 weeks.

(2)

.....%

(ii) State **two** variables the scientist should have controlled to improve this investigation.

(2)

1 .....

.....

2 .....

.....

(iii) The starch grains in the potatoes became smaller as the starch was converted into glucose.

State why the potatoes need glucose.

(1)

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(Total for question = 5 marks)

Q7.

A scientist investigated how the length of starch grains in potatoes changed when the potatoes were stored in the dark.

Figure 5 shows a potato after being stored in the dark.

Figure 5

Three potatoes were used in the investigation.

The length of starch grains in potato 1 were measured at the start.

The length of starch grains were measured in potato 2 after 5 weeks in the dark.

The length of starch grains were measured in potato 3 after 10 weeks in the dark.

Figure 6 shows the results.

potato	time after placing in the dark in weeks	mean length of starch grains in μm
1	0	64
2	5	50
3	10	30

Figure 6

(i) Calculate the percentage difference in the mean length of starch grains in potato 2 at 5 weeks and in potato 3 at 10 weeks.

(2)

.....%

(ii) State **two** variables the scientist should have controlled to improve this investigation.

(2)

1 .....

.....

2 .....

.....

(iii) The starch grains in the potatoes became smaller as the starch was converted into glucose.

State why the potatoes need glucose.

(1)

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.....

(iv) Describe how starch is broken down into glucose.

(2)

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(Total for question = 7 marks)

Q8.

Starch is a nutrient in food.

Starch is a source of energy.

Enzymes from different parts of the digestive system were used to investigate the breakdown of starch.

Figure 10 shows the apparatus used in this investigation.

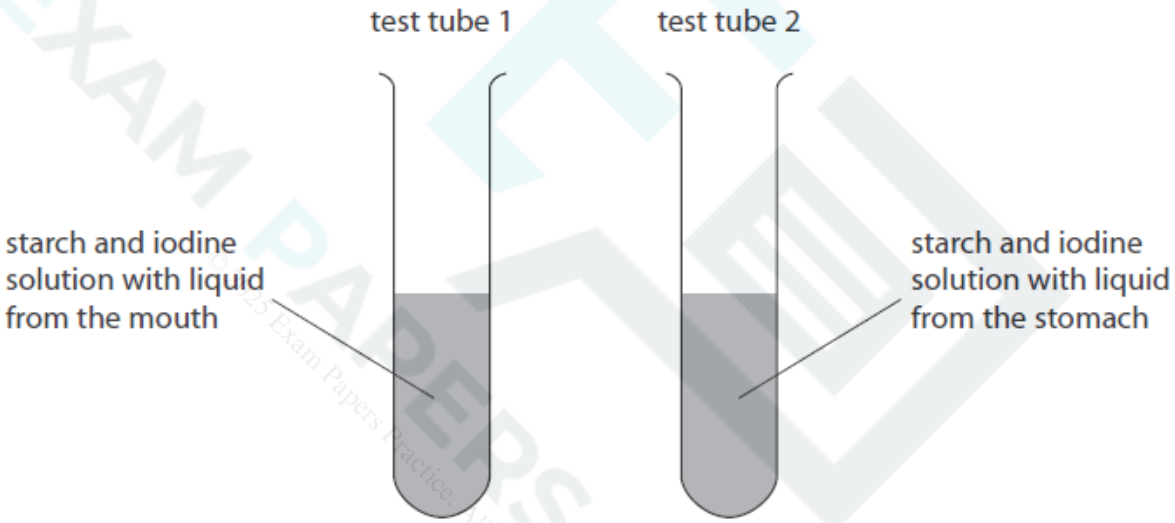

Figure 10

The colour of the contents of each test tube was recorded every two minutes for a total of ten minutes.

The results are shown in Figure 11.

time in minutes	colour of the contents of each test tube	
	test tube 1 starch and iodine solution with liquid from the mouth	**test tube 2** starch and iodine solution with liquid from the stomach
0	blue-black	blue-black
2	blue-black	blue-black
4	brown	blue-black
6	orange	blue-black
8	orange	blue-black
10	orange	blue-black

Figure 11

(i) Give **one** reason why the contents of both test tubes were blue-black at the beginning of the investigation.

(1)

.....

(ii) Explain the results of this investigation after ten minutes.

(3)

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(Total for question = 4 marks)

Q9.

A student placed three different sized cubes of agar jelly into separate beakers containing the

same concentration of hydrochloric acid.

The cubes contained a pink indicator.

This indicator becomes clear when in contact with an acid.

Figure 7 shows the results of the investigation after the cubes had been in the acid for 120 seconds.

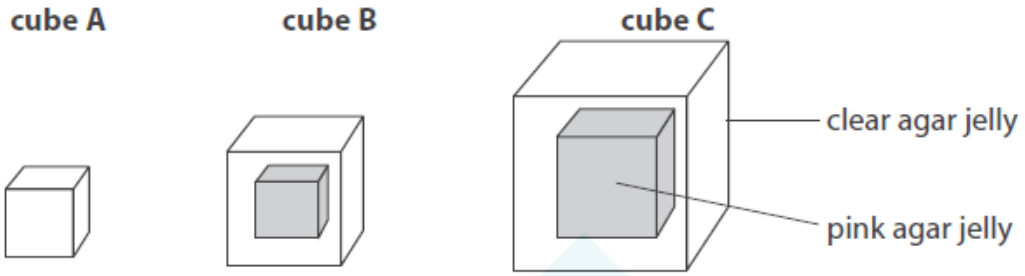

Figure 7

(i) The distance from the outside of cube B to the pink area was 3 mm.

Calculate the distance diffused by hydrochloric acid in **one** second.

(2)

..... mm

(ii) The student wanted to confirm their results.

Give **one** improvement the student should make to this investigation to confirm their results.

(1)

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.....

.....

(Total for question = 3 marks)

Q10.

A student wanted to investigate the movement of water into and out of cells in potatoes.

The student had the equipment shown in Figure 11.

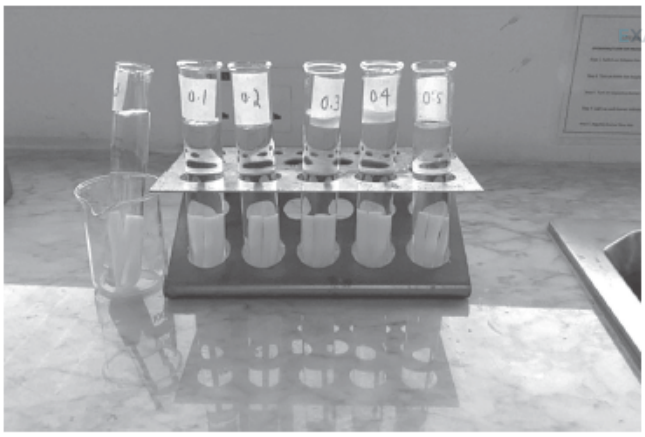

Figure 11

The test tubes in the rack contain different concentrations of sodium chloride solution.

The solutions were 0.1 M, 0.2 M, 0.3 M, 0.4 M and 0.5 M sodium chloride solution.

The test tube in the beaker contains distilled water.

There are three potato chips in each of the six test tubes.

(i) State why the test tube in the beaker only contains distilled water and three potato chips.

(1)

.....

.....

(ii) State **two** variables that need to be controlled in this investigation.

(2)

1 .....

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2 .....

.....

(iii) Explain why the chips in the 0.5 M sodium chloride solution lost mass.

(3)

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(Total for question = 6 marks)

Q11.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Birds are classified in the domain Eukarya.

(i) Why are the cells from birds described as eukaryotic?

(1)

☒ **A** they have membrane-bound organelles

☒ **B** they do not have nuclei

☒ **C** they have a rigid cell wall

☒ **D** they have a cell membrane

(ii) Give **one** reason why the three domain classification system was proposed.

(1)

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(Total for question = 2 marks)

Q12.

A person with kidney disease may need kidney dialysis treatment.

Figure 15 shows an experiment to show how a dialysis membrane works.

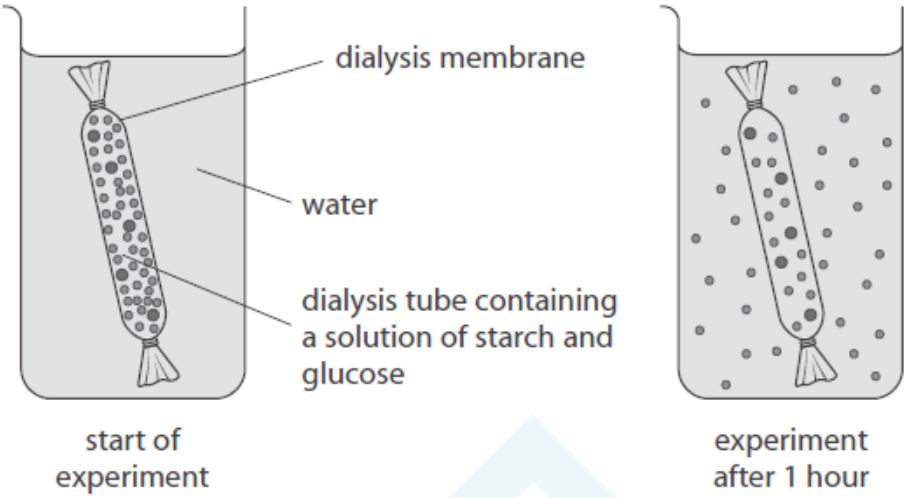

Figure 15

(i) Describe the method that would be used to find out what is present in the solution in the beaker, after one hour.

(4)

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(ii) Explain how this experiment represents a simple model of kidney dialysis treatment.

(2)

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(Total for question = 6 marks)

Q13.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Trypsin is a protease enzyme used in the manufacture of food for babies.

(i) Which food group is digested by trypsin?

(1)

☐ **A** carbohydrates

☐ **B** lipids

☐ **C** fibre

☐ **D** proteins

(ii) The food is mashed before the trypsin is added.

Explain the advantage of mashing the food before adding the trypsin.

(2)

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(Total for question = 3 marks)

Q14.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Chymosin is an enzyme that causes milk to curdle.

When milk curdles the proteins in the milk clump together and become solid.

As part of an investigation, milk was heated in test tubes to different temperatures using a Bunsen burner.

Two drops of chymosin solution were added to each test tube and the time taken for the milk to curdle was recorded.

Figure 11 shows the results.

temperature of the milk in °C	time taken for milk to curdle in seconds
25	125
30	105
35	90
40	70
45	75

Figure 11

(i) Which variables need to be kept constant in this investigation?

(1)

☒ **A** the volume of milk and the time

☒ **B** the temperature and the time

☒ **C** the volume of milk and the concentration of chymosin

☒ **D** the temperature and the concentration of chymosin

(ii) Explain why the time taken for the milk to curdle decreases from 30°C to 40°C.

(2)

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(iii) Explain what the expected result would be if two drops of chymosin were added to the milk at 70°C in the test tube.

(2)

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.....

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(iv) As part of this investigation, test tubes containing only milk were heated to each temperature and no chymosin solution was added.

State why these test tubes containing only milk were used.

(1)

.....

.....

(v) Describe **two** improvements that could be made to the method of this investigation so that the optimum temperature for chymosin can be found.

(2)

1 .....

.....

2 .....

.....

(Total for question = 8 marks)

Q15.

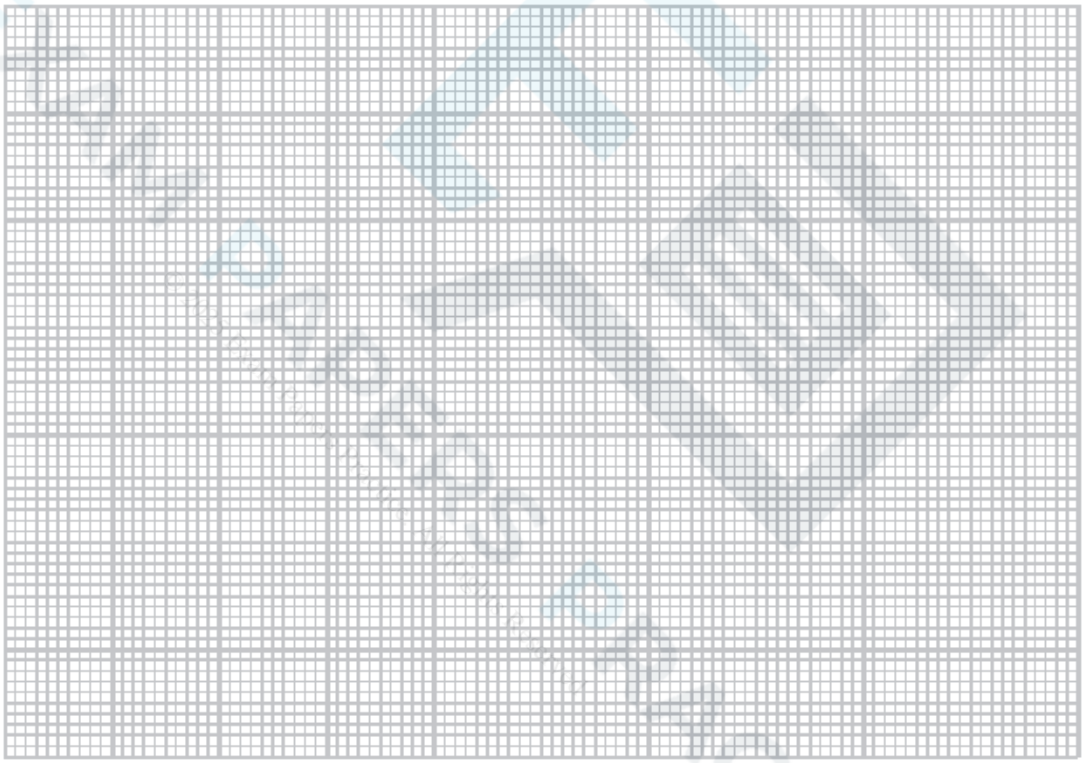
Figure 2 shows the mass of protein and carbohydrate in different types of seed.

type of seed	mass of protein in grams	mass of carbohydrate in grams
pumpkin	30	11
sesame	18	23
flax	18	29
sunflower	21	20
chia	17	42

Figure 2

(i) Plot a bar chart to show the mass of protein in each of these types of seed.

(3)



(ii) What is used to test for the presence of protein in the seeds?

(1)

☒ **A** Biuret reagent

☒ **B** Benedict's solution

☒ **C** iodine solution

☒ **D** ethanol test

(iii) Some of the carbohydrates found in the seeds are reducing sugars.

Describe a method to test for the presence of a reducing sugar in the seeds.

(3)

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(iv) State **one** safety precaution that should be taken when testing the seeds for the presence of a reducing sugar.

(1)

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(Total for question = 8 marks)

Q16.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Body mass index (BMI) is calculated using the equation:

$$\text{BMI} = \frac{\text{mass (kg)}}{(\text{height (m)})^2}$$

(i) Person A is 1.8 m tall and has a mass of 64.8 kg.

Calculate the BMI of person A.

(2)

BMI = ...

(ii) Figure 9 shows some information about BMI.

BMI	BMI category
less than 18.5	underweight
18.5 to 24.9	healthy weight
25 to 29.9	overweight
more than 29.9	obese

Figure 9

Person B has a BMI of 18.5.

Which category is correct for person B?

(1)

☒ **A** underweight

☒ **B** healthy weight

☒ **C** overweight

☒ **D** obese

(iii) Person C has a BMI of 28.5.

Explain **one** way person C could change their lifestyle to reach a healthy weight.

(2)

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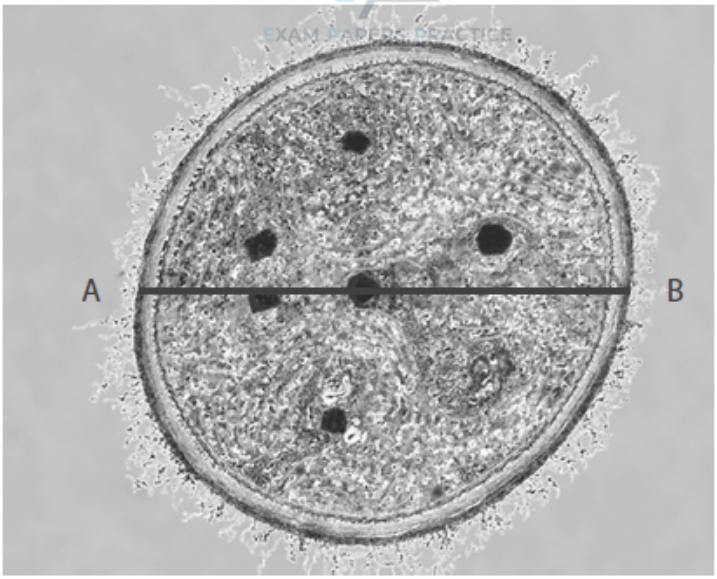
.....

(Total for question = 5 marks)

Q17.

Figure 7 shows a cyanobacterium magnified 50 000 times.

The line AB shows the diameter of the bacterial cell.



(Source: © The Christian Science Monitor)

Figure 7

(i) Calculate the actual diameter of the cyanobacterium.

Give your answer in micrometres (µm).

(3)

..... µm

(ii) Bacterial cells contain plasmids.

Describe **three** other features of a bacterial cell.

(3)

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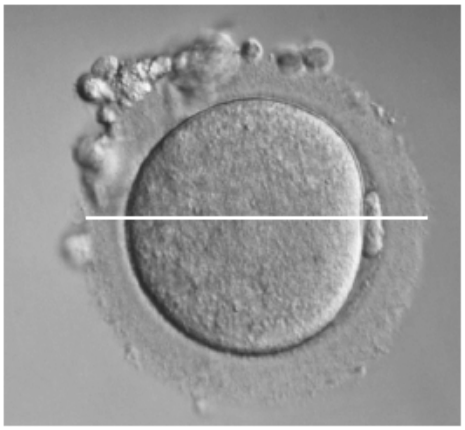
(Total for question = 6 marks)

Q18.

Figure 14 shows a human egg cell, magnified ×700.



(Source: © Pascal Goetgheluck / Science Photo Library)

Figure 14

Calculate the actual width of the region indicated by the line on Figure 14.

Give your answer in millimetres, in standard form.

(3)

..... mm

(Total for question = 3 marks)

Q19.

Figure 16 shows the number of neurones in the brain of different animals.

animal	number of neurones in the brain
lobster	1.0×10^5
frog	1.6×10^7
rat	2.0×10^8
human	8.6×10^{10}

Figure 16

(i) Calculate the difference between the number of neurones in the brain of the rat and the brain of the frog.

Give your answer in standard form.

(2)

..... neurones

(ii) Most neurones in the brain are unmyelinated whereas motor neurones are myelinated.

Explain why myelination is needed on motor neurones but not on neurones in the brain.

(3)

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.....

(Total for question = 5 marks)

Q20.

Figure 3 shows a diagram of a red blood cell from a turtle and a diagram of a red blood cell from a human.

Figure 3

(i) These cells are animal cells.

Animal cells do not have

(1)

☒ **A** cytoplasm

☒ **B** a cell membrane

☒ **C** a cell wall

☒ **D** mitochondria

(ii) The actual length of the red blood cell from a turtle is 20.5 µm.

Calculate the length of the magnified image of the red blood cell of the turtle when magnified 400 ×.

(2)

..... µm

(iii) The width of the human red blood cell, when magnified 400 ×, is 3.08 mm.

Calculate the actual width of the cell and show your answer in standard form.

(2)

..... mm

(Total for question = 5 marks)

Q21.

A plant leaf cell is 0.04 mm long.

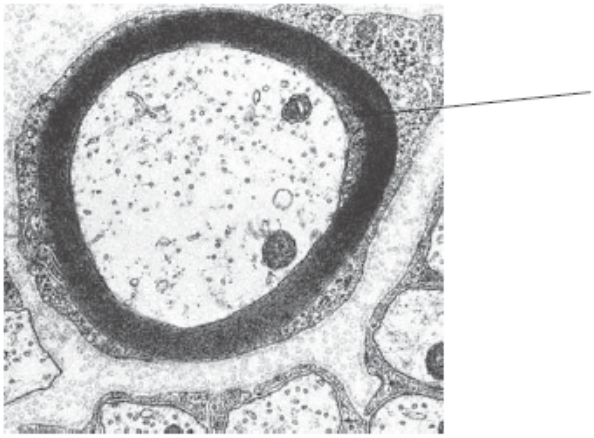
Calculate the length of the image after this cell has been magnified 500 times.

length of image = ...mm

(Total for question = 2 marks)

Q22.

Figure 6 is an electron micrograph showing a cross section through a neurone.



(Source: © Dr. Donald Fawcett, Visuals Unlimited / Science Photo Library)

Figure 6

The myelin sheath of this neurone is 250 nm in thickness.

(i) Calculate the magnification of this electron micrograph.

(3)

magnification .....

Answer the question with a cross in the box you think is correct ☒ . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒ .

(ii) Which part of a motor neurone is surrounded by the myelin sheath?

(1)

☐ **A** nucleus

☐ **B** cell body

☐ **C** axon

☐ **D** receptor

(Total for question = 4 marks)

Q23.

Figure 1 is an electron micrograph showing a cross section through a neurone.

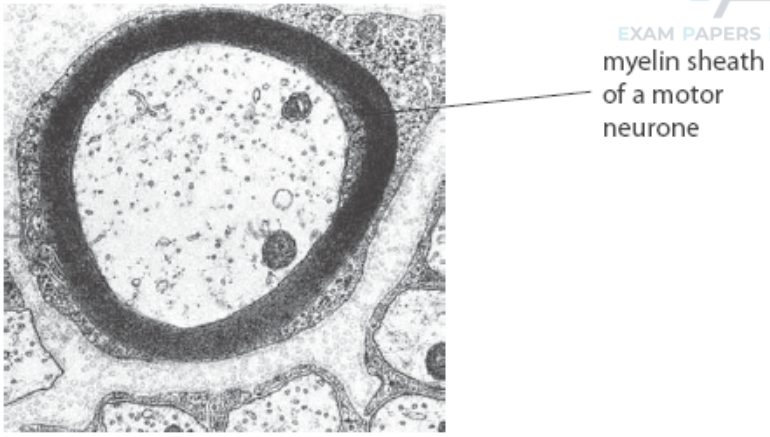


Figure 1

The myelin sheath of this neurone is 250 nm in thickness.

Calculate the magnification of this electron micrograph.

(3)

magnification .....

(Total for question = 3 marks)

Q24.

A scientist obtained a mass of 0.0062 nanograms of DNA from a diploid human cell.

Calculate the mass of DNA the scientist should obtain from a haploid human cell.

Give your answer in picograms.

(1 nanogram = 1000 picograms)

(2)

..... picograms

(Total for question = 2 marks)

Q25.

A scientist obtained a mass of 0.0062 nanograms of DNA from a diploid human cell.

Calculate the mass of DNA the scientist should obtain from a haploid human cell.

Give your answer in picograms.

(1 nanogram = 1000 picograms)

(2)

..... picograms

(Total for question = 2 marks)

Q26.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

A slide of potato cells was viewed using a light microscope.

Figure 20 is a drawing of the slide showing starch grains in the potato cells.

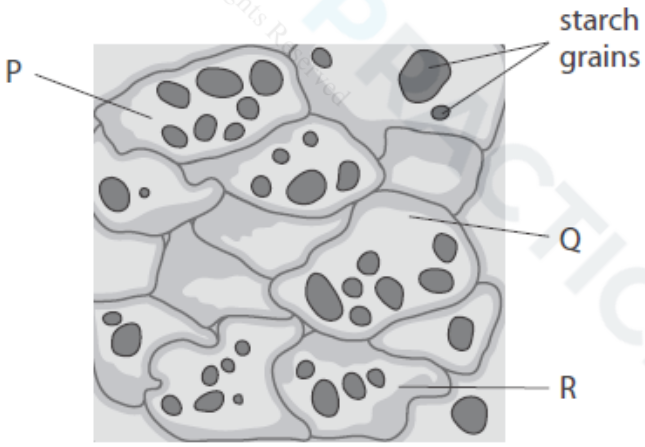


Figure 20

(i) Calculate the mean number of starch grains in potato cells P, Q and R.

(1)

..... starch grains

(ii) Which structures are found in plant cells but are **not** found in animal cells?

(1)

☒ **A** cell membrane, nucleus, chloroplast

☒ **B** cell wall, cell membrane, cytoplasm

☒ **C** nucleus, large vacuole, chloroplast

☒ **D** cell wall, chloroplast, large vacuole

(Total for question = 2 marks)

Q27.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

A slide of potato cells was viewed using a light microscope.

Figure 4 is a drawing of the slide showing starch grains in the potato cells.

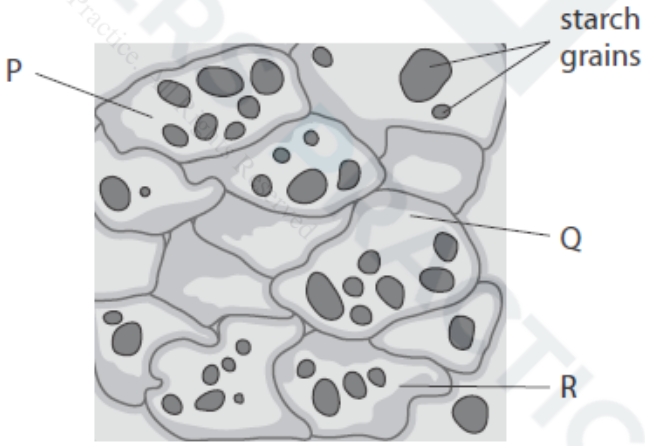


Figure 4

(i) Calculate the mean number of starch grains in potato cells P, Q and R.

(1)

.....starch grains

(ii) Which structures are found in plant cells but are **not** found in animal cells?

(1)

☒ **A** cell membrane, nucleus, chloroplast

☒ **B** cell wall, cell membrane, cytoplasm

☒ **C** nucleus, large vacuole, chloroplast

☒ **D** cell wall, chloroplast, large vacuole

(Total for question = 2 marks)

Q28.

A student investigated the effect of enzyme concentration on the mass of product formed in one hour.
Figure 6 shows the results of this investigation.

concentration of enzyme in arbitrary units	mass of product formed in grams
5	15
10	22
15	25
20	32
25	38
30	40
35	40
40	40

Figure 6

The ratio of enzyme concentration to the mass of product formed, using an enzyme concentration of 40 arbitrary units, is 1:1.

Calculate the ratio of enzyme concentration to product formed when the enzyme concentration is 5 arbitrary units.

(2)

ratio .....

(Total for question = 2 marks)

Q29.

Factors affecting the rate of diffusion can be investigated using agar cubes.

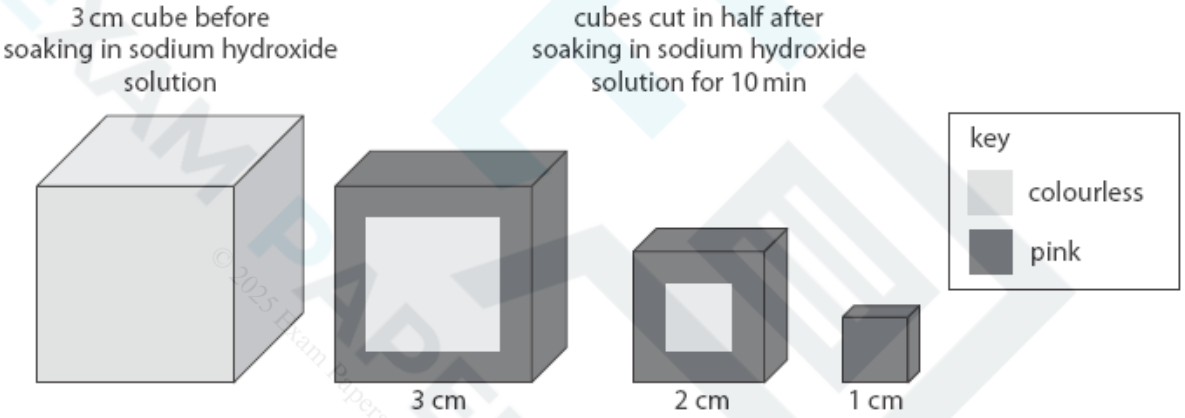
The agar cubes contain an indicator called phenolphthalein.

Phenolphthalein is colourless, but turns pink in the presence of an alkali, such as sodium hydroxide solution.

Cubes of agar, with sides 3 cm, 2 cm and 1 cm, are placed into sodium hydroxide solution for 10 minutes.

The cubes are then cut in half to see how far the sodium hydroxide solution has diffused into them.

Figure 5 shows the results.



cube side / cm	surface area of cube / cm^2	volume of cube / cm^3	surface area to volume ratio	distance into cube of diffusion / cm
1	6	1	6:1	0.5
2	24	8	3:1	0.5
3	54	27	?	0.5

Figure 5

(i) Calculate the surface area to volume ratio for the cube with side 3 cm.

(1)

.....

(ii) Calculate the rate of diffusion for the 10 minutes of the investigation.

(1)

..... cm per min

(iii) Describe the effect of the size of the cube on the rate of diffusion.

(1)

.....

.....

.....

.....

(iv) Explain why the sodium hydroxide diffuses into the cube.

(2)

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(Total for question = 5 marks)

Q30.

Figure 11 shows two potato chips.

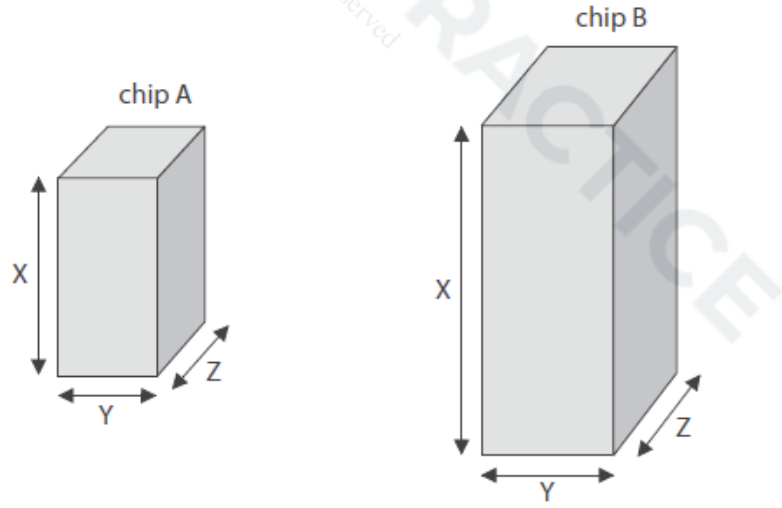

Figure 11

Figure 12 shows some information about each potato chip.

potato chip	length of X in cm	length of Y in cm	length of Z in cm	total surface area of four sides in cm^2	total surface area of top and bottom in cm^2	total surface area of chip in cm^2
A	3.0	1.5	1.5	18.0	4.5	22.5
B	5.0	2.0	2.0	?	?	?

Figure 12

(i) Calculate the total surface area of potato chip B using the formula,

Total surface area = 2XY + 2XZ + 2YZ

(2)

total surface area = ... cm^2

(ii) The potato chips were placed in distilled water for 20 minutes.

Figure 13 shows the increase in mass of each potato chip.

potato chip	increase in mass in grams
A	0.1
B	0.3

Figure 13

Explain why potato chip B has a greater increase in mass than potato chip A.

(2)

.....

.....

.....

.....

(iii) Potato chip A is transferred from the distilled water into a concentrated salt solution.

Explain what will happen to the cells in potato chip A.

(3)

.....

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.....

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.....

.....

(Total for question = 7 marks)

Q31.

Figure 5 shows two potato chips.

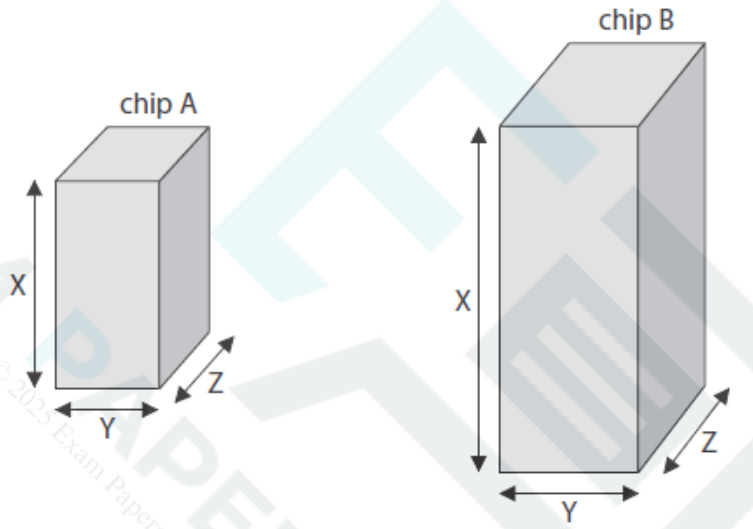

Figure 5

Figure 6 shows some information about each potato chip.

potato chip	length of X in cm	length of Y in cm	length of Z in cm	total surface area of four sides in cm^2	total surface area of top and bottom in cm^2	total surface area of chip in cm^2
A	3.0	1.5	1.5	18.0	4.5	22.5
B	5.0	2.0	2.0	?	?	?

Figure 6

(i) Calculate the total surface area of potato chip B using the formula,

Total surface area = 2XY + 2XZ + 2YZ

(2)

total surface area = ... cm^2

(ii) The potato chips were placed in distilled water for 20 minutes.

Figure 7 shows the increase in mass of each potato chip.

potato chip	increase in mass in grams
A	0.1
B	0.3

Figure 7

Explain why potato chip B has a greater increase in mass than potato chip A.

(2)

.....

.....

.....

.....

(iii) Potato chip A is transferred from the distilled water into a concentrated salt solution.

Explain what will happen to the cells in potato chip A.

(3)

.....

.....

.....

.....

.....

.....

(Total for question = 7 marks)

Q32.

Chia seeds contain the highest mass of carbohydrate.
Reducing sugar forms 85% of the carbohydrate in the chia seeds.

Calculate the mass of reducing sugar in the sample of chia seeds.

(2)

..... g

(Total for question = 2 marks)

Q33.

Some students investigated the effect of sucrose concentration on the change in mass of beetroot chips.
A beetroot chip was weighed, immersed in water for 30 minutes and then reweighed.
This was repeated using five more beetroot chips and five different concentrations of sucrose solution.
The results are shown in Figure 8.

chip	concentration of sucrose solution mol per dm^{-3}	starting mass of beetroot chip in grams	end mass of beetroot chip in grams
1	0.0 (water)	2.56	3.89
2	0.2	2.47	2.88
3	0.4	1.99	2.00
4	0.6	2.30	2.12
5	0.8	2.15	1.84
6	1.0	2.22	1.62

Figure 8

(i) Calculate the percentage change in mass for chip 5.

Give your answer to an appropriate number of decimal places.

(3)

..... %

(ii) Explain the difference in the changes in mass of chip 5 and chip 2.

(3)

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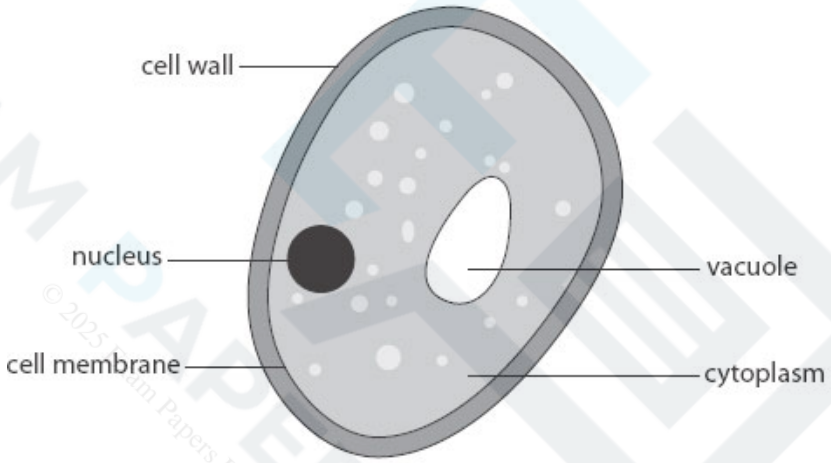
.....

(Total for question = 6 marks)

Q34.

Yeasts are microorganisms that are used in the brewing and baking industries.

The diagram shows a yeast cell.



(a) (i) State **two** ways in which the structure of this yeast cell differs from the structure of a bacterial cell.

(2)

1 .....

.....

2 .....

.....

(ii) Plant cells can produce glucose.

Suggest why yeast cells cannot produce glucose.

(1)

.....

.....

(b) The table shows the number of different components found in the blood of a healthy person

and the blood of two other people.

	number of components per dm^3 of blood		
component of blood	healthy person	person A	person B
red blood cells	5×10^{12}	6×10^{12}	3×10^{12}
white blood cells	7×10^{9}	5×10^{10}	8×10^{10}
platelets	3×10^{11}	3×10^{11}	3×10^{11}

(i) Calculate the difference in the number of white blood cells per dm3 of blood between the healthy person and person A.

(2)

answer = ...

(ii) Describe the functions of white blood cells.

(2)

.....

.....

.....

.....

(iii) Person B has a low number of red blood cells compared to the healthy person.

Suggest an effect this may have on person B.

(1)

.....

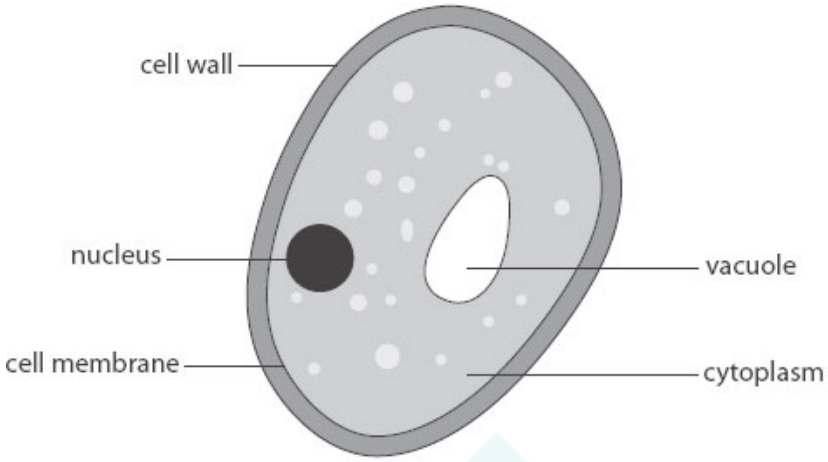
.....

(Total for Question = 8 marks)

Q35.

Yeasts are microorganisms that are used in the brewing and baking industries.

The diagram shows a yeast cell.



(a) (i) State **two** ways in which the structure of this yeast cell differs from the structure of a bacterial cell.

(2)

1 .....

.....

2 .....

.....

(ii) Plant cells can produce glucose.

Suggest why yeast cells cannot produce glucose.

(1)

.....

.....

(b) The table shows the number of different components found in the blood of a healthy person and the blood of two other people.

	number of components per dm^3 of blood		
component of blood	healthy person	person A	person B
red blood cells	5×10^{12}	6×10^{12}	3×10^{12}
white blood cells	7×10^{9}	5×10^{10}	8×10^{10}
platelets	3×10^{11}	3×10^{11}	3×10^{11}

(i) Calculate the difference in the number of white blood cells per dm3 of blood between the healthy person and person A.

(2)

answer = ...

(ii) Describe the functions of white blood cells.

(2)

.....

.....

.....

.....

(iii) Person B has a low number of red blood cells compared to the healthy person.

Suggest an effect this may have on person B.

(1)

.....

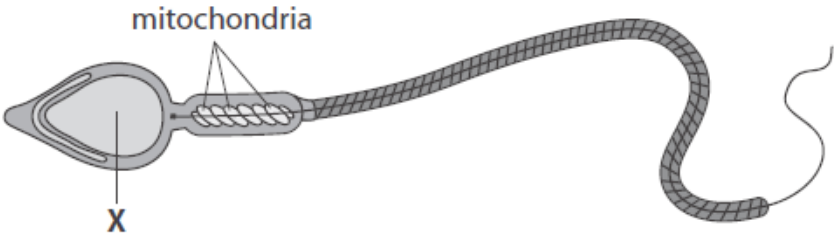
.....

(Total for Question = 8 marks)

Q36.

Cells

The diagram shows a human sperm cell.



(a) (i) Structure **X** on the diagram contains DNA.

Name structure **X**.

(1)

.....

(ii) Which statement is true for DNA?

Place a cross (☒) in the box next to your answer.

(1)

☒ **A** DNA is made up of amino acids and bases.

☒ **B** DNA is made up of amino acids which give instructions to make proteins.

☒ **C** In DNA, the bases A and T are complementary.

☒ **D** Every gene in a DNA molecule contains only three bases.

(b) Sperm cells are involved in fertilisation.

Define fertilisation.

(2)

.....

.....

.....

.....

(c) (i) Describe the function of mitochondria.

(2)

.....

.....

.....

.....

(ii) Gene mutations in DNA can produce abnormal mitochondria.

Explain how a gene mutation can produce a different protein.

(2)

.....

.....

.....

.....

.....

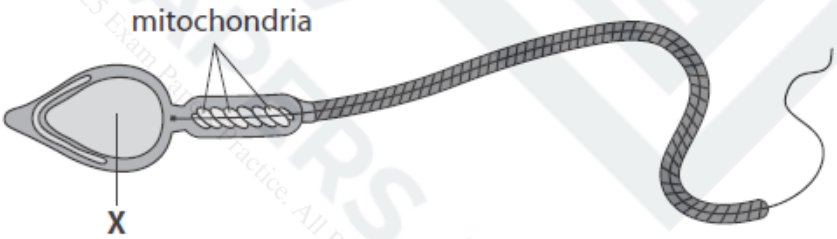
.....

(Total for question = 8 marks)

Q37.

Cells

The diagram shows a human sperm cell.



(a) (i) Structure **X** on the diagram contains DNA.

Name structure **X**.

(1)

.....

(ii) Which statement is true for DNA?

Place a cross (☒) in the box next to your answer.

(1)

☒ **A** DNA is made up of amino acids and bases.

☒ **B** DNA is made up of amino acids which give instructions to make proteins.

☒ **C** In DNA, the bases A and T are complementary.

☒ **D** Every gene in a DNA molecule contains only three bases.

(b) Sperm cells are involved in fertilisation.

Define fertilisation.

(2)

.....

.....

.....

.....

(c) (i) Describe the function of mitochondria.

(2)

.....

.....

.....

.....

(ii) Gene mutations in DNA can produce abnormal mitochondria.

Explain how a gene mutation can produce a different protein.

(2)

.....

.....

.....

.....

.....

.....

(Total for question = 8 marks)

Q38.

A student compared the number of stomata on the upper and lower surfaces of a leaf.

She completed a leaf peel as shown in Figure 5.

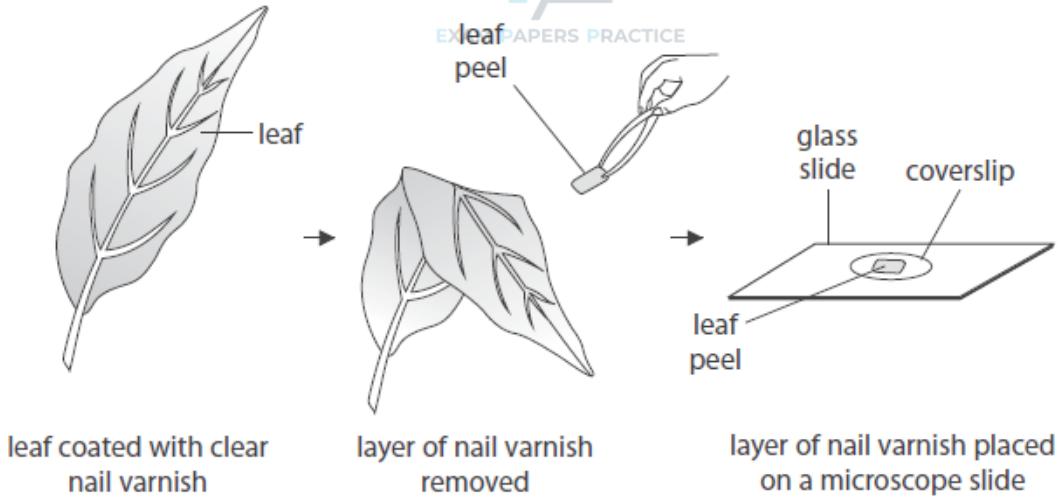


Figure 5

The layer of nail varnish shows an impression of the cells on the surface of the leaf.

(i) State why a coverslip is placed on top of the leaf peel.

(1)

.....

(ii) Explain why the leaf peel rather than the whole leaf was viewed with a microscope.

(2)

.....

.....

.....

.....

(Total for question = 3 marks)

Q39.

A student investigated the effect of enzyme concentration on the mass of product formed in one hour.
Figure 6 shows the results of this investigation.

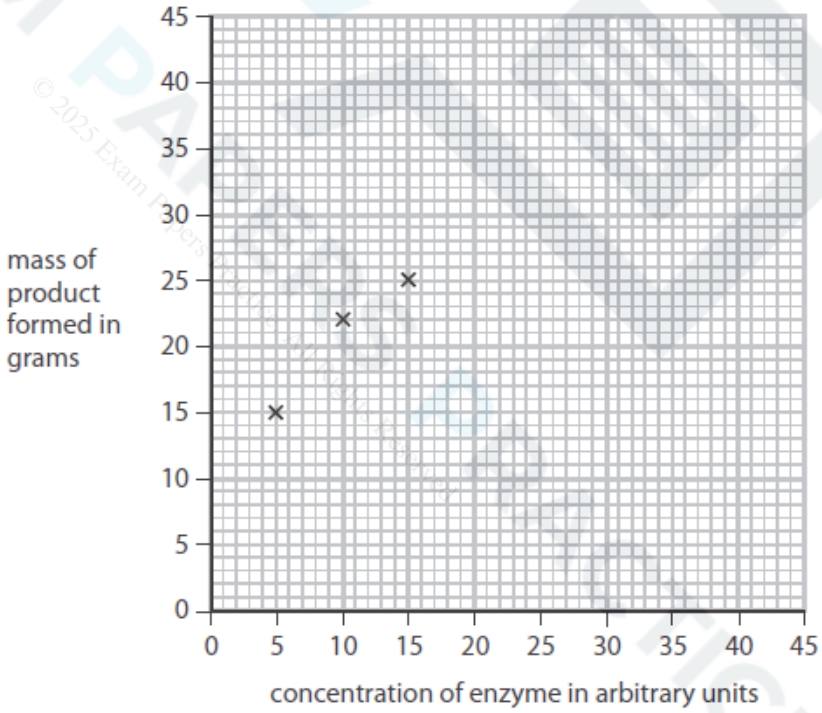
concentration of enzyme in arbitrary units	mass of product formed in grams
5	15
10	22
15	25
20	32
25	38
30	40
35	40
40	40

Figure 6

Complete the graph by plotting the points and drawing a line to show the trend in the data.

The first three points have been plotted for you.

(2)



(Total for question = 2 marks)

Q40.

Figure 2 shows alveoli from a healthy lung.

Figure 2

Smoking can cause a condition called emphysema.

Figure 3 shows alveoli from a person with emphysema.

Figure 3

Use words from the box to complete the following sentences.

(2)

breathing	diffusion	larger
osmosis	smaller	thicker

The alveoli from the person with emphysema have a
.....

surface area than the alveoli from a healthy lung.

The surface area of the alveoli will affect how much oxygen moves into the blood

by the process of ..... .

(Total for question = 2 marks)

Q41.

At high pH values the active site of the enzyme pepsin changes shape.

When the active site of the enzyme changes shape, the enzyme is

(1)

- ☒ **A** specific
- ☒ **B** denatured
- ☒ **C** digested
- ☒ **D** dead

(Total for question = 1 mark)

Q42.

The human immune system helps defend the body against disease.

Figure 1 shows a bacterial cell that can cause disease.

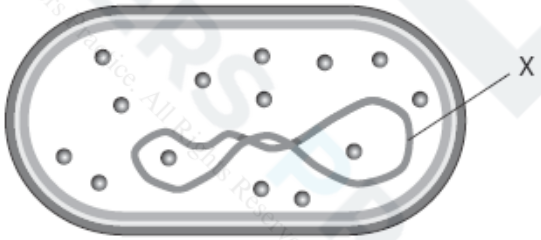


Figure 1

What is the part of the cell labelled X?

(1)

- ☒ **A** cytoplasm
- ☒ **B** nucleus
- ☒ **C** chromosome
- ☒ **D** plasmid

(Total for question = 1 mark)

Q43.

Figure 1 shows a cross section of an artery.

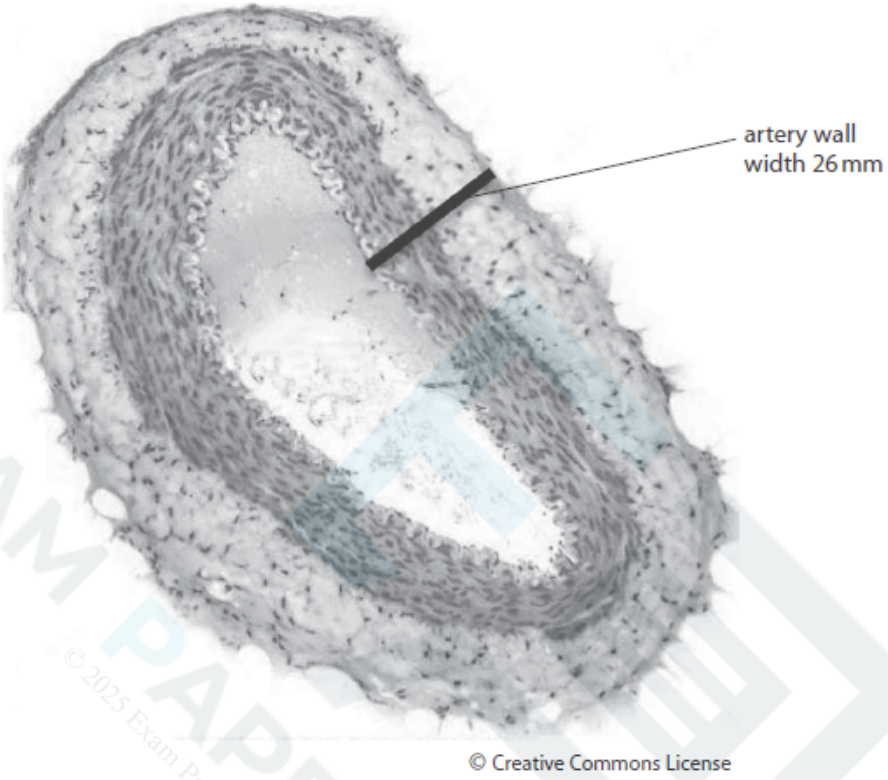


Figure 1

(i) Select words from the box to complete the sentence.

(2)

acidity	concentration	thick	permeable	pressure	thin

Blood in arteries is at high .....

so arteries have ..... elastic walls.

(ii) The image in Figure 1 shows an artery magnified 20×.

The width of the artery wall, labelled on Figure 1, is 26 mm.

Calculate the actual width of the artery wall.

(2)

..... mm

(iii) The aorta is an artery.

Which statement is true for the aorta?

(1)

☒ **A** the aorta transports oxygenated blood towards the heart

☒ **B** the aorta transports oxygenated blood away from the heart

☒ **C** the aorta transports deoxygenated blood towards the heart

☒ **D** the aorta transports deoxygenated blood away from the heart

(Total for question = 5 marks)

Q44.

State why egg cells have a large amount of cytoplasm.

(1)

.....

.....

Q45.

State why egg cells have a large amount of cytoplasm.

(1)

.....

.....

Q46.

A calorimeter can be used to measure the energy content of food.

Figure 6 shows a simple calorimeter.

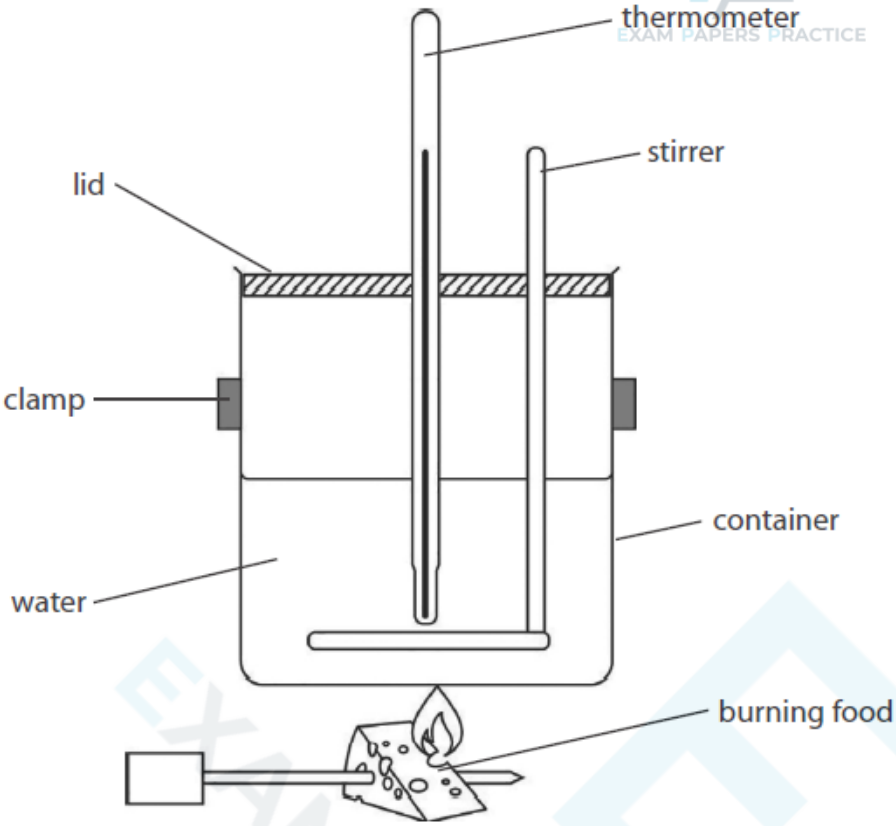


Figure 6

(i) Use words from the box to complete the sentences.

(2)

air	clamp	food
lid	thermometer	water.

The stirrer distributes heat evenly in the .....

The calorimeter has a ..... to prevent the loss of heat.

(ii) This calorimeter was used to measure the energy content of a piece of cheese.

Figure 7 shows some of the results.

mass of water in grams	starting temperature of water in °C	final temperature of water in °C
25	21	85

Figure 7

Calculate the energy content of this piece of cheese.

(2)

Use the equation

energy in joules (J) = mass of water × 4.2 × temperature change

energy content of the piece of cheese = ... J

(iii) The same method was used to calculate the energy content of a different type of cheese.

The results are shown in Figure 8.

mass of water in grams	starting temperature of water in °C	final temperature of water in °C	temperature change in °C
25	21	76	55

Figure 8

Explain **one** reason why the results are different for this type of cheese.

(2)

.....

.....

.....

.....

(Total for question = 6 marks)

Q47.

Gregor Mendel used pea plants in plant breeding experiments. He discovered the basis of genetic inheritance.

Peas contain small amounts of fat.

Describe a test to identify fat.

(2)

.....

.....

.....

.....

.....

(Total for question = 2 marks)

Q48.

Gregor Mendel used pea plants in plant breeding experiments. He discovered the basis of genetic inheritance.

Peas contain small amounts of fat.

Describe a test to identify fat.

.....

.....

.....

.....

.....

(Total for question = 2 marks)

Q49.

Describe how a student could test a sample of urine for the presence of protein.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q50.

Figure 13 shows a sperm cell.

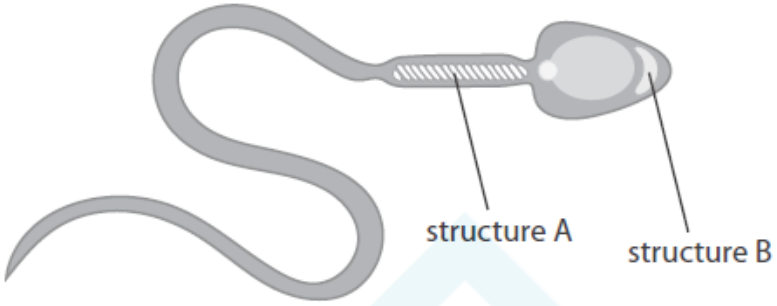


Figure 13

Describe how structure A and structure B enable fertilisation.

(2)

structure A

.....

.....

structure B

.....

.....

(Total for question = 2 marks)

Q51.

Figure 2 shows a calorimeter.

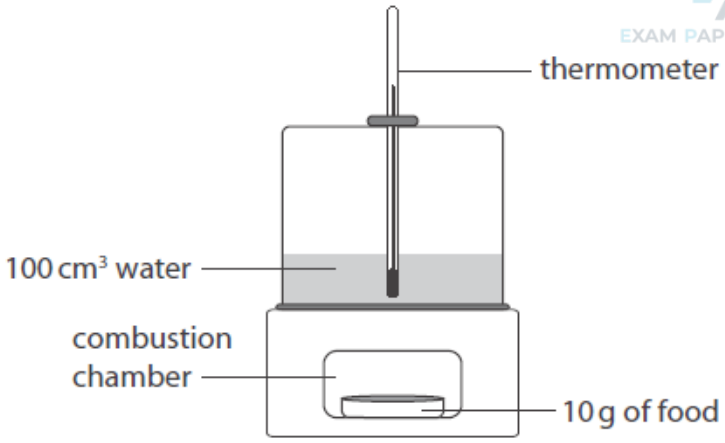


Figure 2

Describe how this calorimeter can be used to find the energy content of 10 g of food.

(3)

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.....

.....

.....

.....

.....

.....

(Total for question = 3 marks)

Q52.

A student placed a prepared slide on the stage of a light microscope.

Describe how to adjust the microscope to view the slide at a magnification of ×400.

(2)

.....

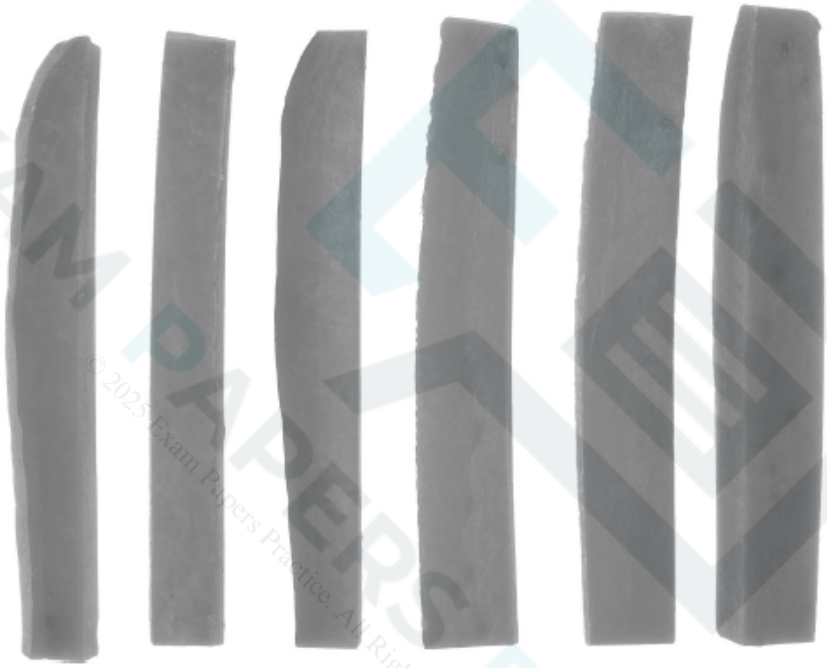
.....

.....

(Total for question = 2 marks)

Q53.

Figure 10 shows some carrot sticks.



(Source: © rukxstockphoto/Shutterstock)

Figure 10

A student chose three carrot sticks and weighed each one.

The carrot sticks were placed in 50 cm^3 of distilled water.

After two hours the student weighed each carrot stick again.

Figure 11 shows the results for these carrot sticks P, Q and R.

carrot stick	mass at the start in grams	mass after two hours in grams	change in mass in grams
P	4.0	4.9	0.9
Q	4.2	5.0	0.8
R	4.1	5.0	0.9

Figure 11

(i) Give **one** reason why the student used three carrot sticks instead of just one carrot stick.

(1)

.....

.....

(ii) Give **two** ways that this method could be improved.

(2)

1 .....

.....

2 .....

.....

(iii) Calculate the percentage change in mass of carrot stick **Q**.

(3)

Use the equation

$$\text{percentage change} = \frac{\text{change in mass}}{\text{mass at the start}} \times 100$$

Give your answer to 2 significant figures.

percentage change = ... %

(iv) Explain the change in mass of the carrot sticks.

(2)

.....

.....

.....

.....

(Total for question = 8 marks)

Q54.

Describe how to test for glucose in the dialysis fluid.

(3)

.....

.....

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.....

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.....

(Total for question = 3 marks)

Q55.

Describe how to test for glucose in the dialysis fluid.

(3)

.....

.....

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.....

.....

(Total for question = 3 marks)

Q56.

Describe the chemical test for starch.

.....

.....

.....

.....

(Total for question = 2 marks)

Q57.

A student investigated the effect of enzyme concentration on the mass of product formed in one hour.
Figure 6 shows the results of this investigation.

concentration of enzyme in arbitrary units	mass of product formed in grams
5	15
10	22
15	25
20	32
25	38
30	40
35	40
40	40

Figure 6

Describe the effect that enzyme concentration has on the mass of product formed.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q58.

Figure 14 shows a banana plantation.

© warmer/Shutterstock

Figure 14

After the bananas have been harvested, the old plants are cut down.

The suckers then develop into mature plants producing the next crop of bananas.

The tip of each sucker contains a group of cells called a meristem.

(i) Describe the function of a meristem in the growth of a plant.

(2)

.....

.....

.....

.....

(ii) A student took a sample of cells from a meristem to view under a light microscope.

Describe how the student would prepare a microscope slide using these cells.

(3)

.....

.....

.....

.....

.....

.....

(Total for question = 5 marks)

Q59.

Figure 2 shows a banana plantation.

© warmer/Shutterstock

Figure 2

After the bananas have been harvested, the old plants are cut down.

The suckers then develop into mature plants producing the next crop of bananas.

The tip of each sucker contains a group of cells called a meristem.

(i) Describe the function of a meristem in the growth of a plant.

(2)

.....

.....

.....

.....

.....

(ii) A student took a sample of cells from a meristem to view under a light microscope.

Describe how the student would prepare a microscope slide using these cells.

(3)

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.....

(Total for question = 5 marks)

Q60.

Protein is an important nutrient in meat.

Describe the laboratory test for protein.

.....

.....

.....

.....

.....

(Total for question = 2 marks)