PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

BIOLOGY



EXAM QUESTION PACK

TOPIC 1: KEY CONCEPTS IN BIOLOGY (PAPER 2, PACK 2)

SCORE	PERCENTAGE
/125	%

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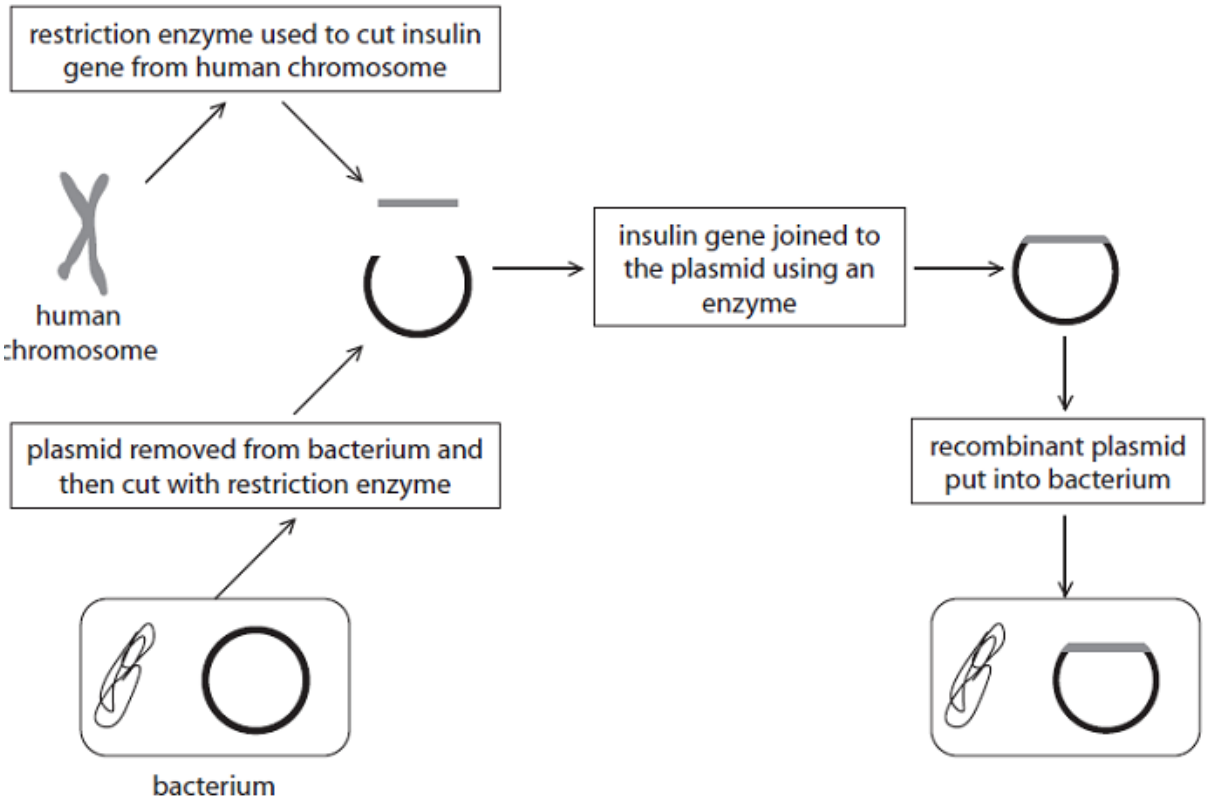
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Q1.

Enzyme technology

The diagram shows how the human insulin gene can be used to genetically modify bacteria.



(a) (i) Name the enzyme used to join the insulin gene to the plasmid.

(1)

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(ii) Suggest why the same restriction enzyme was used to cut the human chromosome and the plasmid.

(2)

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*(b) Enzyme technology can be used in the production of foods including sweets, vegetarian cheese and lactose-free milk.

Describe how enzyme technology can be used to produce these food products.

(6)

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(c) Washing powders can be biological or non-biological.

Describe how biological washing powders can make clothes cleaner than nonbiological washing powders.

(2)

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(Total for question = 11 marks)

Q2.

Enzymes

DNA and RNA are involved in the synthesis of proteins such as enzymes.

(a) Protein synthesis involves transcription and translation.

Which row shows the molecules involved in both transcription and translation?

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

(1)

	transcription	translation
☐ **A**	tRNA	tRNA
☐ **B**	mRNA	DNA
☐ **C**	tRNA	DNA
☐ **D**	mRNA	mRNA

(b) Describe what happens to the molecule produced by transcription before it is translated.

(2)

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(c) Explain how the lock and key hypothesis models how enzymes work.

You may use labelled diagrams in your answer.

(3)

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*(d) Describe how named factors affect the rate of enzyme-catalysed reactions.

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(Total for question = 12 marks)

Q3.

Enzymes

DNA and RNA are involved in the synthesis of proteins such as enzymes.

(a) Protein synthesis involves transcription and translation.

Which row shows the molecules involved in both transcription and translation?

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

(1)

	transcription	translation
☐ **A**	tRNA	tRNA
☐ **B**	mRNA	DNA
☐ **C**	tRNA	DNA
☐ **D**	mRNA	mRNA

(b) Describe what happens to the molecule produced by transcription before it is translated.

(2)

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(c) Explain how the lock and key hypothesis models how enzymes work.

You may use labelled diagrams in your answer.

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*(d) Describe how named factors affect the rate of enzyme-catalysed reactions.

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(Total for question = 12 marks)

Q4.

* A student investigated the movement of water.

Hens' eggs were placed in vinegar for two days to dissolve the shell.

This makes the eggs permeable to water.

The eggs were then weighed and placed in different solutions.

After 24 hours the eggs were weighed again.

Figure 11 shows the results.

solution	mass of the egg at the start in grams	mass of the egg after 24 hours in grams
tap water	77	84
5% salt	77	77
10% salt	77	75

Figure 11

Evaluate the results of this investigation.

You should include calculations using the data in Figure 11.

(6)

(Total for question = 6 marks)

Q5.

Potato cells contain the enzyme catalase.

This enzyme catalyses the breakdown of hydrogen peroxide into oxygen and water.

Figure 15 shows what happened when a student placed a potato disc in a 5% hydrogen peroxide solution.

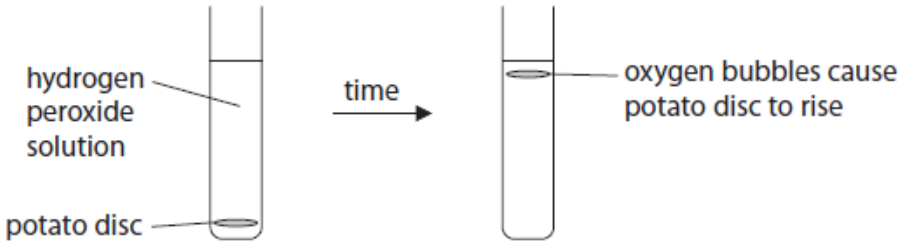


Figure 15

The student measured the time taken for the potato disc to rise.

The student repeated the investigation using 10%, 15% and 20% concentrations of hydrogen peroxide solution.

Figure 16 shows the results of this investigation.

The student calculated the rate of reaction using

$$\frac{1}{\text{time in seconds}}$$

concentration of hydrogen peroxide solution (%)	time taken for disc to rise (s)	rate (s^{-1})
5	325	0.003
10	245	0.004
15	132	0.008
20	72	0.014

Figure 16

(i) State and explain a conclusion based on these results.

(4)

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(ii) The student repeated the investigation with a 25% hydrogen peroxide solution and recorded a time of 75 seconds.

Calculate the rate of reaction for the 25% hydrogen peroxide solution.

(2)

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(iii) The student decided that the rate for the 25% hydrogen peroxide solution was not anomalous.

Give the reason why the result was not anomalous.

(1)

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(Total for question = 7 marks)

Q6.

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 7 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 7

(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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(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)

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(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)

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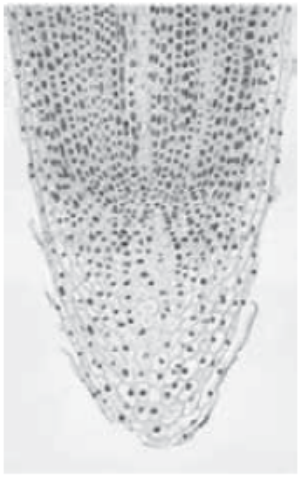
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(Total for question = 8 marks)

Q7.

Figure 12 shows a root tip with cells in different stages of mitosis.

The image was magnified 400 ×.



© WIM VAN EGMOND/SCIENCE PHOTO LIBRARY

Figure 12

Explain how a magnification of 400 × can be obtained using the lenses on a light microscope.

(2)

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(Total for question = 2 marks)

Q8.

* A student set up an experiment to investigate osmosis as shown in Figure 7.

The student used visking tubing which is a partially permeable membrane.

The student put 25 cm^3 of 20% sucrose solution into visking tube 1 and 25 cm^3 of distilled water into visking tube 2.

Both tubes were placed in a 5% sucrose solution and left for 1 hour.

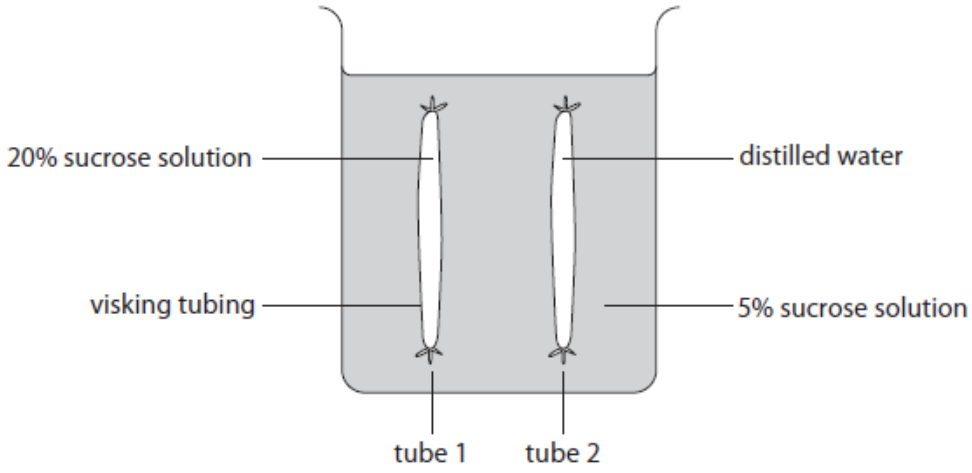


Figure 7

Explain how and why tube 1 and tube 2 would look different after one hour.

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(Total for question = 6 marks)

Q9.

The potatoes of a potato plant develop underground.

Explain **one** difference in the sub-cellular structures in a cell in the potato and those in a cell in the leaf of the potato plant.

(2)

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(Total for question = 2 marks)

Q10.

Chymosin can be produced by genetically modified bacteria.

Figure 8 shows a bacterial cell.

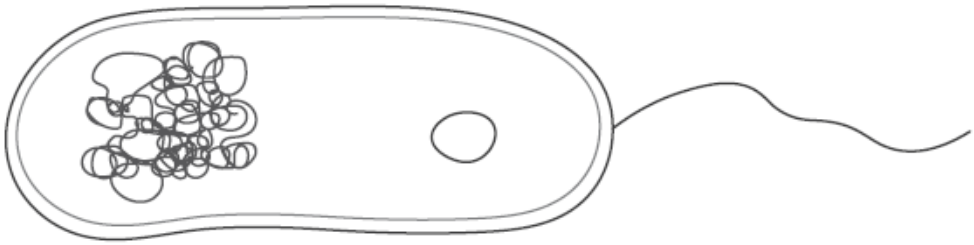


Figure 8

Explain how to genetically modify a bacterial cell to produce chymosin.

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(Total for question = 3 marks)

Q11.

A student investigated the fat content of two types of milk: milk A and milk B.

Before starting the investigation, the student added a drop of oil from a pipette into a test tube of water as
shown in Figure 3.

The drop of oil rose to the surface of the water.



(Source: © Nana_studio/Shutterstock)

Figure 3

5 cm^3 of milk B and 1 cm^3 of lipase were added to a different test tube.

The pH of this mixture was pH 7.

This test tube was placed in a water bath for 10 minutes.

The pH of the mixture changed from pH 7 to pH 5.

(i) Explain what caused this change in pH.

(3)

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(ii) This procedure was repeated with milk A.

There was no change in the pH of this mixture after 10 minutes.

Explain why there was no change in the pH of the mixture containing milk A.

(2)

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(iii) The student repeated this procedure with lipase that had been boiled and left to cool.

This was added to another sample of milk B.

Describe why the pH did not change in this mixture.

(3)

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(Total for question = 8 marks)

Q12.

When bacteria divide they replicate their genome and synthesise their cell wall.

Figure 12 outlines the stages of bacterial replication.

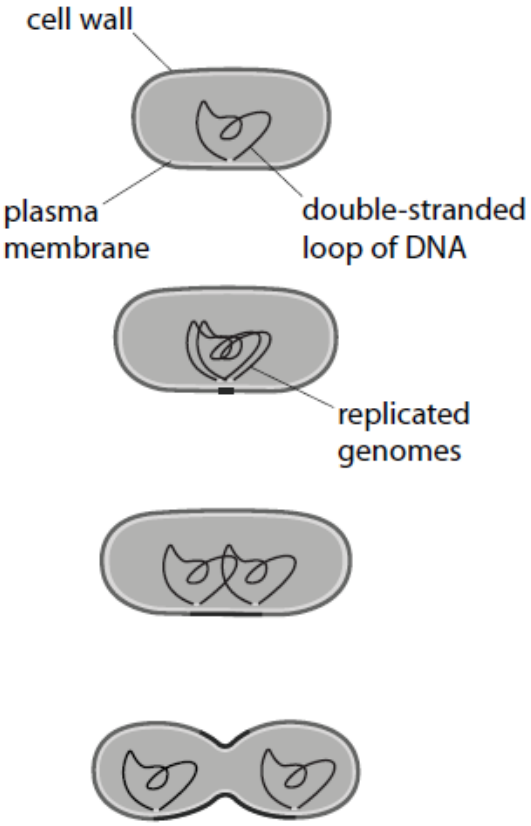


Figure 12

Penicillin inhibits the synthesis of the cell wall in bacteria.

Explain the effect of penicillin on bacterial and human cells.

(3)

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(Total for question = 3 marks)

Q13.

Figure 15 shows the results of this investigation.

seedling in test tube	length at the start in mm	length after 7 days in mm
1	4	11
2	6	17
3	5	26

Figure 15

(i) Explain why there are differences in the change in the lengths of the seedlings.

(2)

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(ii) Explain how nitrate ions were absorbed by the seedling in test tube 3.

(3)

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(Total for question = 5 marks)

Q14.

Amylase is produced by salivary glands and the pancreas.

Explain why amylase is not produced in the stomach.

(3)

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(Total for question = 3 marks)

Q15.

Different enzymes catalyse specific reactions.

Explain why enzymes can only catalyse specific reactions.

(2)

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(Total for question = 2 marks)

Q16.

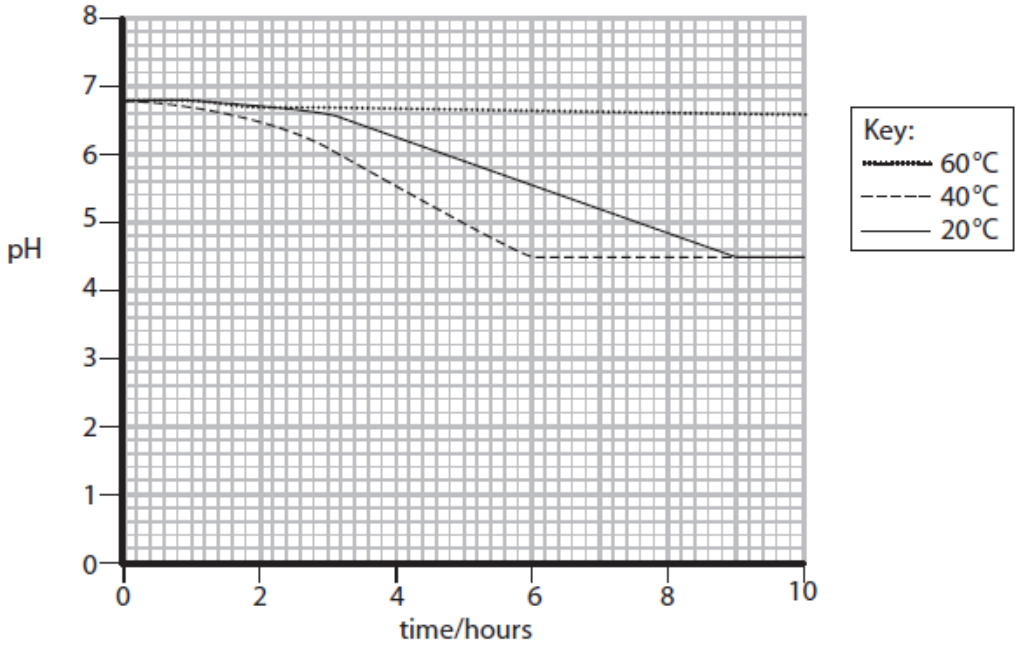
* Yogurt can be produced by adding a starter culture of microorganisms to milk.

The starter culture was added to milk kept at 20°C.

The pH was recorded over 10 hours.

This was repeated with milk kept at 40°C and 60°C.

The graph shows the results.



Using the information in the graph, explain how temperature affects the fermentation process during yogurt production.

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Q17.

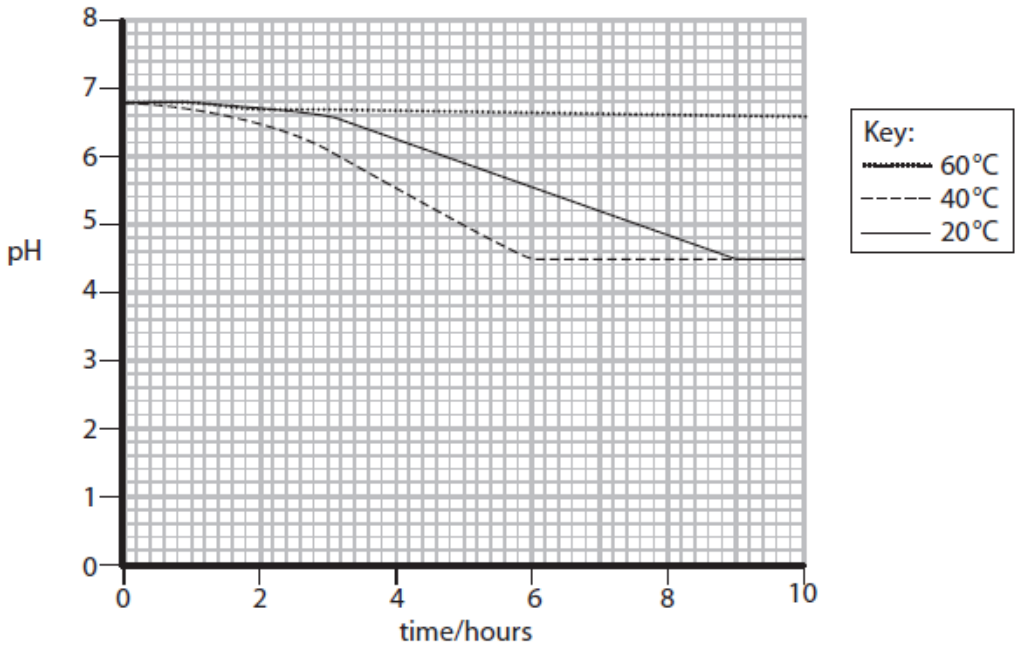
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Q18.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The function of the gall bladder is to

(1)

☒ **A** make bile

☒ **B** make lipase

☒ **C** store bile

☒ **D** store lipase

Q19.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The function of the gall bladder is to

(1)

☒ **A** make bile

☒ **B** make lipase

☒ **C** store bile

☒ **D** store lipase

Q20.

A student investigated the fat content of two types of milk: milk A and milk B.

Before starting the investigation, the student added a drop of oil from a pipette into a test tube of water as
shown in Figure 3.

The drop of oil rose to the surface of the water.



(Source: © Nana_studio/Shutterstock)

Figure 3

The student then placed a drop of milk A into one test tube of water and a drop of milk B into a different test tube of water.

The drop of milk A sank to the bottom and the drop of milk B rose to the surface.

Give **one** reason for the drop of milk B rising to the surface.

(1)

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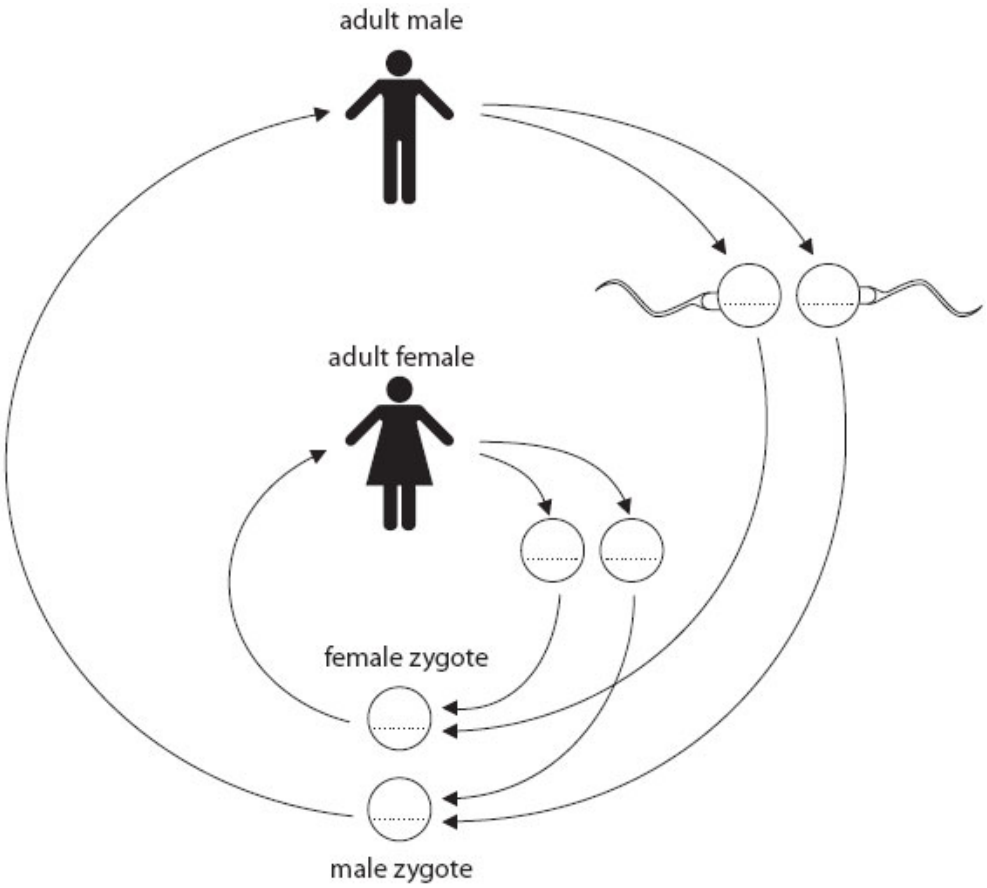
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(Total for question = 1 mark)

Q21.

The diagram shows the human life cycle.

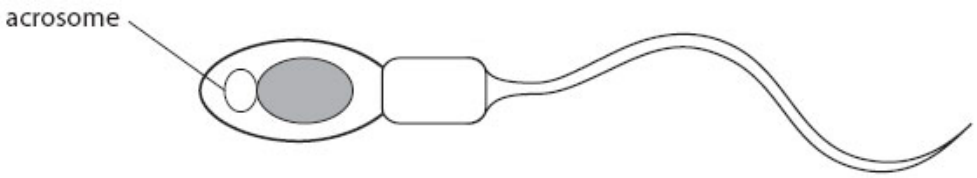
When a sperm cell fertilises an egg cell, a zygote is formed.



(a) Complete the diagram by writing the sex chromosomes in the egg cells, sperm cells, male zygote and female zygote.

(2)

(b) The diagram shows a sperm cell.



Complete the sentence by putting a cross (☒) in the box next to your answer.

The acrosome contains

(1)

☒ **A** enzymes to help get through the membrane of the egg cell

☒ **B** mitochondria to supply energy to swim

☒ **C** muscle fibres to swim

☒ **D** 23 chromosomes

(c) State why egg cells have a large amount of cytoplasm.

(1)

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(d) During ovulation an egg cell is released from the ovary.

Explain how changes in the levels of hormones result in ovulation.

(2)

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(e) Explain what happens to the uterus lining if the egg cell is fertilised.

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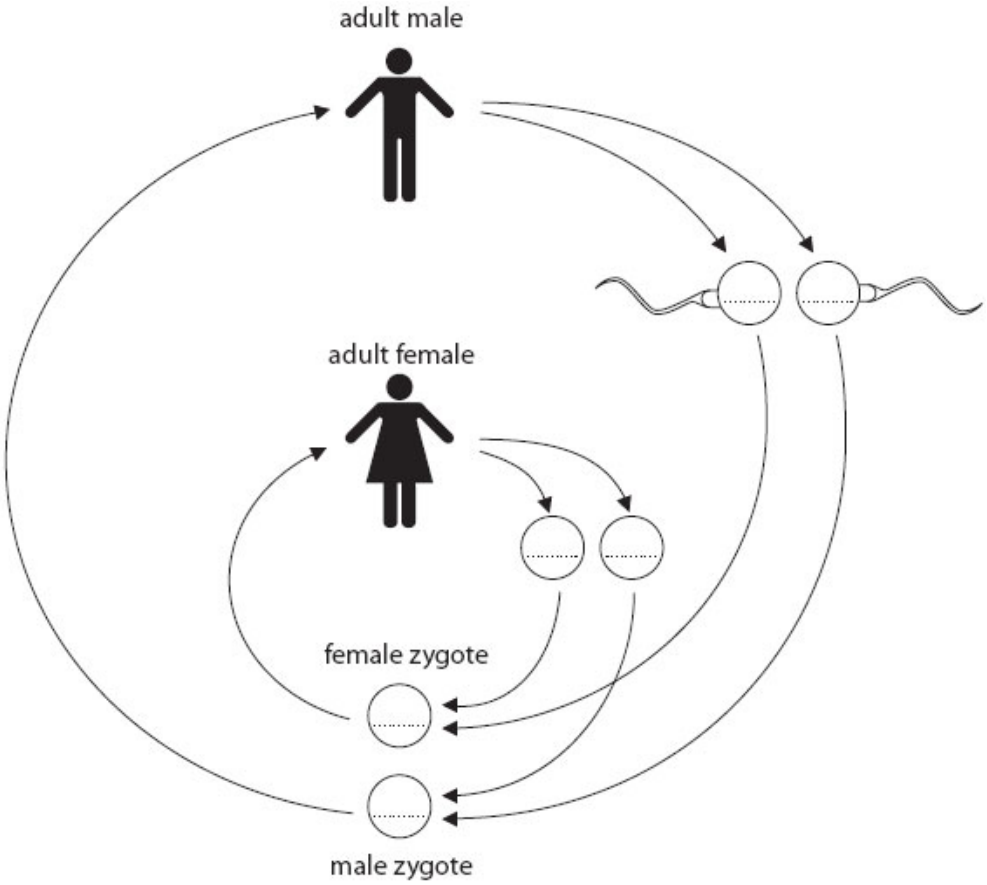
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(Total for Question = 8 marks)

Q22.

The diagram shows the human life cycle.

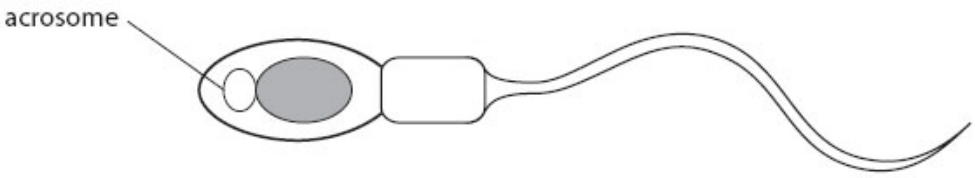
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(a) Complete the diagram by writing the sex chromosomes in the egg cells, sperm cells, male zygote and female zygote.

(2)

(b) The diagram shows a sperm cell.



Complete the sentence by putting a cross (☒) in the box next to your answer.

The acrosome contains

(1)

- ☒ **A** enzymes to help get through the membrane of the egg cell
- ☒ **B** mitochondria to supply energy to swim
- ☒ **C** muscle fibres to swim
- ☒ **D** 23 chromosomes

(c) State why egg cells have a large amount of cytoplasm.

(1)

.....

.....

(d) During ovulation an egg cell is released from the ovary.

Explain how changes in the levels of hormones result in ovulation.

(2)

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(e) Explain what happens to the uterus lining if the egg cell is fertilised.

(2)

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(Total for Question = 8 marks)

Q23.

Osmosis is one method that single-celled organisms, such as bacteria, use to obtain molecules from their environment.

Which of the following is a correct description of a process involving the transport of molecules?

(1)

☒ **A** Diffusion is used to transport molecules against the concentration gradient

☒ **B** Active transport is used to obtain molecules in a low concentration environment

☒ **C** Active transport moves substances along the concentration gradient

☒ **D** Diffusion uses energy to transport molecules into cells

(Total for question = 1 mark)

Q24.

Tropical fish excrete ammonia, which is an alkali.

The pH level of water in a tropical fish tank needs to be maintained between 6.6 and 7.4 for the fish to survive.

This is the optimum pH range for the bacteria that are responsible for the conversion of ammonia into nitrites and then nitrates.

Nitrosomonas bacteria convert ammonia into nitrites.

Nitrobacter bacteria convert nitrites into nitrates.

(i) *Nitrosomonas* bacteria are an example of

(1)

☒ **A** nitrogen fixing bacteria

☒ **B** nitrifying bacteria

☒ **C** denitrifying bacteria

☒ **D** *Helicobacter* bacteria

(ii) Explain why *Nitrosomonas* and *Nitrobacter* bacteria are needed in tropical fish tanks.

(2)

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An aquatic plant in the fish tank had a concentration of nitrates higher than the water in the fish tank.

(iii) Explain how this aquatic plant can uptake nitrates from the water in the fish tank.

(2)

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(Total for question = 5 marks)

Q25.

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

Organisms can be classified by the five kingdom or three domain method.

(i) What is the name of the domain that plants belong to?

(1)

☒ **A** Eukarya

☒ **B** Archaea

☒ **C** Monera

☒ **D** Protista

(ii) Plant cells contain chloroplasts.

What happens in a chloroplast?

(1)

☒	**A**	oxygen produced	sunlight absorbed by chlorophyll
☒	**B**	carbon dioxide produced	sunlight absorbed by mitochondria
☒	**C**	oxygen produced	sunlight absorbed by mitochondria
☒	**D**	carbon dioxide produced	sunlight absorbed by chlorophyll

(iii) Give a reason why the three domain method of classification has been suggested.

(1)

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(Total for question = 3 marks)

Q26.

Streptococcus bacteria can cause a sore throat or skin infection.

An illness called scarlet fever can also develop during an infection with this bacterium.

(i) Give **two** precautions a doctor should take when treating a patient who is infected with *Streptococcus*.

(2)

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(ii) From September 2013 to March 2014 there were 2 830 cases of scarlet fever in the UK.

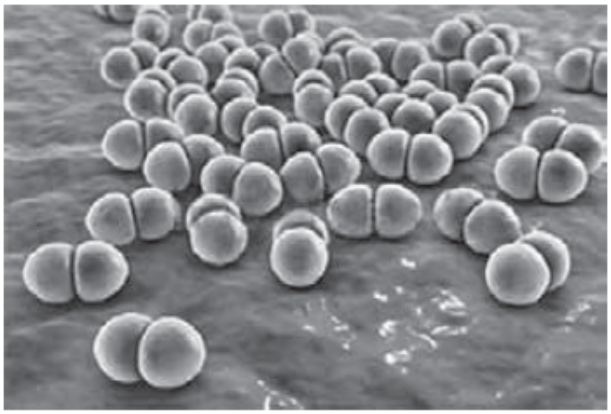
From September 2014 to March 2015 there were 5 943 cases of scarlet fever.

Calculate the percentage increase of the number of cases of scarlet fever between the periods September 2014 to March 2015 and September 2013 to March 2014.

(2)

..... %

(iii) Figure 10 shows some *Streptococcus* bacteria.



© Kateryna Kon/Shutterstock

Figure 10

Some bacteria are motile, meaning they can move themselves.

Why is a *Streptococcus* bacterium not motile?

(1)

☒ **A** it does not have flagella

☒ **B** it does not have plasmids

☒ **C** it does not have ribosomes

☒ **D** it does not have acrosomes

(Total for question = 5 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 ☒.

Lactase is an enzyme that breaks down lactose into glucose and galactose.

A student made some alginate beads containing lactase.

The student added 10 beads to 20 cm^3 of a solution of lactose, as shown in Figure 4.

The student timed how long it took for glucose to be produced.

The experiment was repeated using 15, 20 and 25 beads.

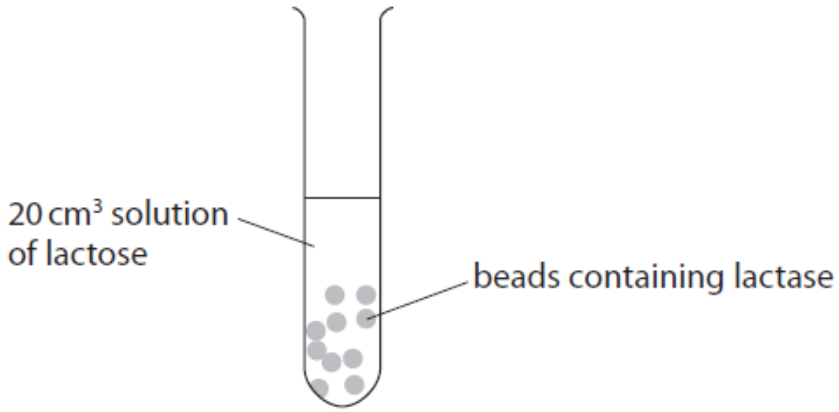


Figure 4

The results are shown in Figure 5.

number of beads containing lactase	time taken to produce glucose in seconds
10	240
15	210
20	150
25	120

Figure 5

(i) What is the rate of reaction for 25 beads?

(1)

☒ **A** 0.008 s^{-1}

☒ **B** 0.04 s^{-1}

☒ **C** 0.21 s^{-1}

☒ **D** 4.8 s^{-1}

(ii) Explain the conclusion that can be made from these results.

(3)

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(iii) Explain why the same volume of lactose solution was used for each test.

(2)

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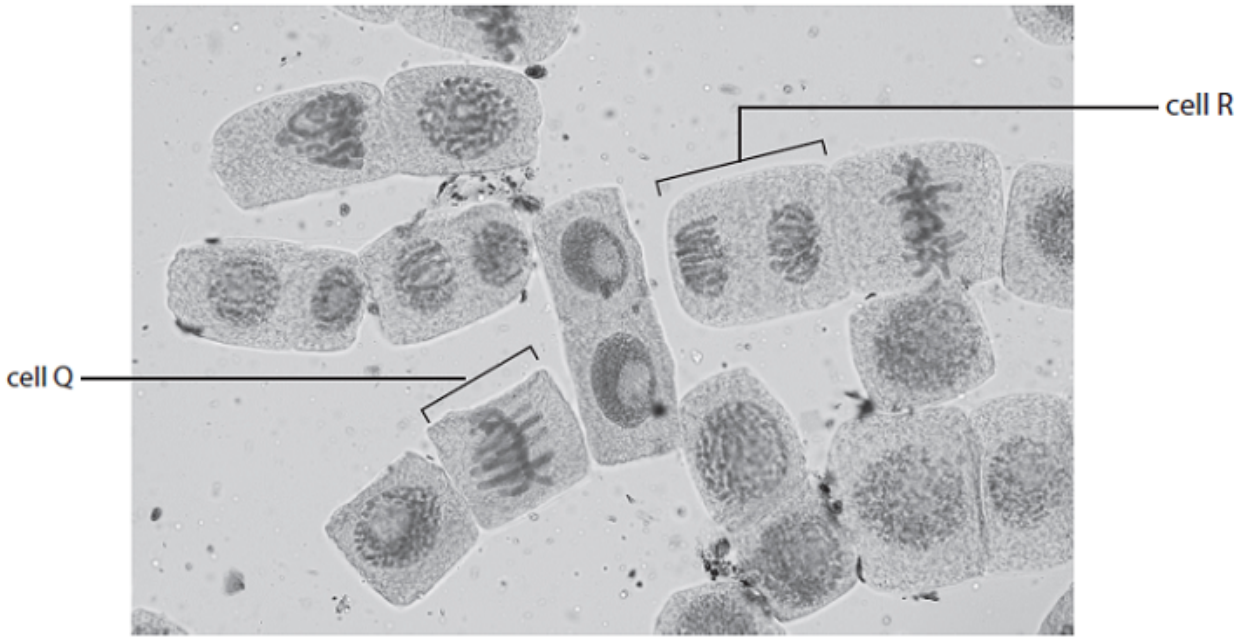
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(Total for question = 6 marks)

Q28.

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

Figure 4 shows cells from an onion root tip as seen using a light microscope.



(Source: © Rattiya Thongdumhyu/Shutterstock)

Figure 4

(i) Identify the stages of mitosis shown in cell Q and cell R.

(1)

	cell Q	cell R
☒ **A**	metaphase	anaphase
☒ **B**	telophase	anaphase
☒ **C**	metaphase	interphase
☒ **D**	telophase	interphase

(ii) Describe **two** processes that occur in cells during prophase.

(2)

1 .....

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2 .....

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(iii) State the term used to describe the process which occurs after mitosis, when the cell divides into two.

(1)

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(iv) The diameter of one cell in Figure 4 is 0.075 mm.

Which is this diameter in µm?

(1)

☒ **A** 0.75 µm

☒ **B** 75 µm

☒ **C** 750 µm

☒ **D** 75 000 µm

(Total for question = 5 marks)

Q29.

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

Figure 1 shows the leaves and flowers of water lily plants (*Nymphaea odorata*) on a lake.



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Figure 1

(i) The white petals of the water lily flowers cannot photosynthesise.

Which structure in leaf cells is the site of photosynthesis?

(1)

☒ **A** nucleus

☒ **B** vacuole

☒ **C** mitochondrion

☒ **D** chloroplast

(ii) Glucose is made by photosynthesis.

Glucose is converted to another sugar to be transported in the plant.

What is the name of this sugar?

(1)

☒ **A** glycerol

☒ **B** ribose

☒ **C** sucrose

☒ **D** starch

(iii) Describe how this sugar is transported from the leaves to the flowers of the water lily.

(2)

.....

.....

.....

.....

.....

(Total for question = 4 marks)

Q30.

Diffusion, active transport and osmosis can be used to move substances into and out of cells.

A student was investigating osmosis in potato cubes.

He used the following method:

- cut a potato into equal-sized cubes
- record the mass of each potato cube
- place each potato cube into different concentrations of salt solution
- remove the potato cubes after 30 minutes
- dry the potato cubes and record the final mass of each cube.

He plots his results on a graph shown in Figure 6.

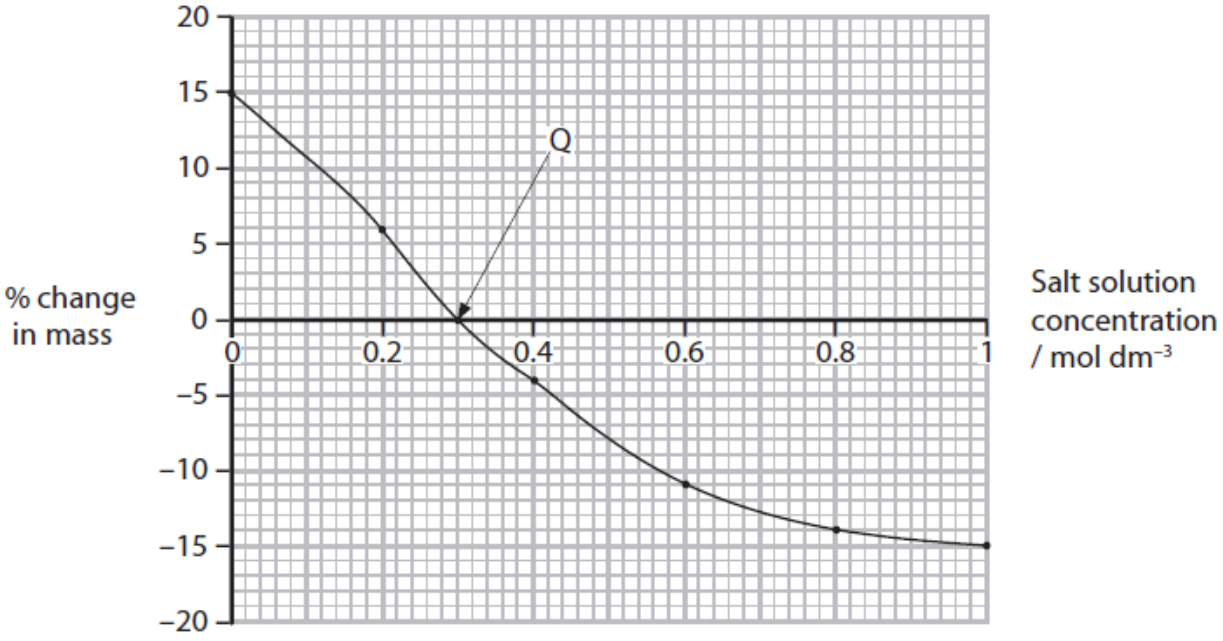


Figure 6

The method controls a number of variables.

(i) Name **one** other variable that needs to be controlled during the student's investigation.

(1)

.....

.....

(ii) Give a reason why the potato cube must be dried.

(1)

.....

.....

(iii) Explain the conclusion that can be made about point Q on Figure 6.

(2)

.....

.....

.....

.....

(iv) Give one way that the student could obtain more data to increase the accuracy of point Q.

(1)

.....

.....

(Total for question = 5 marks)