Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE (9–1)

Tuesday 13 May 2025

Afternoon (Time: 2 hours)

Paper reference 4BI1/1BR 4SD0/1BR

Biology

UNIT: 4BI1
Science (Double Award) 4SD0
PAPER: 1BR

You must have:
Ruler, calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is 110.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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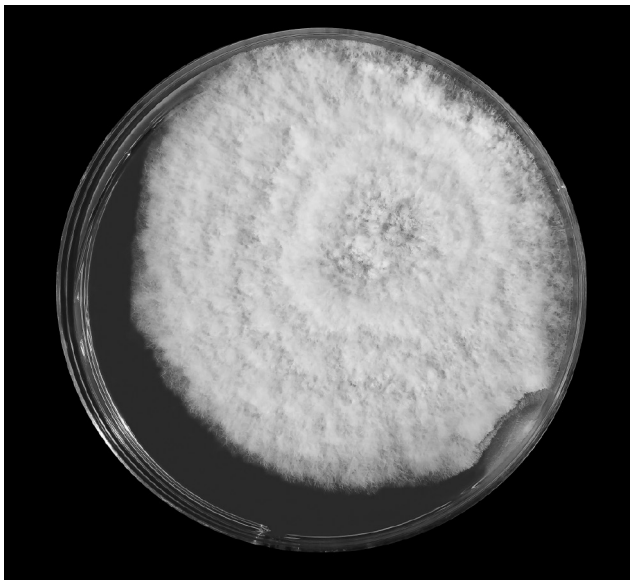
Pearson

Answer ALL questions.

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

1 The photograph shows a fungus called *Mucor* growing on an agar plate.

Cells within *Mucor* contain nuclei and mitochondria.



(Source: © Dr_Microbe/Alamy Stock Photo)

(a) (i) Which of these is a correct statement about the fungus, *Mucor*?

(1)

☒ **A** *Mucor* is a eukaryotic organism with cell walls made of chitin

☒ **B** *Mucor* is a eukaryotic organism with cell walls made of cellulose

☒ **C** *Mucor* is a prokaryotic organism with cell walls made of chitin

☒ **D** *Mucor* is a prokaryotic organism with cell walls made of cellulose

(ii) Plant cells contain chloroplasts, cytoplasm and starch.

How many of these are also present in a fungus such as *Mucor*?

(1)

☒ **A** 0

☒ **B** 1

☒ **C** 2

☒ **D** 3

(iii) The fungus in the diagram is circular with a radius of 45 mm.

Calculate the area, in mm^2, of this circle.

Give your answer to 2 significant figures.

[area = πr^2 $\pi = 3.14$]

(2)

area of circle = ... mm^2

(b) *Mucor* can reproduce using asexual or sexual reproduction.

(i) State two differences between asexual and sexual reproduction.

(2)

1 .....

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2 .....

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(ii) Explain why it is an advantage for *Mucor* to be able to reproduce using sexual reproduction.

(2)

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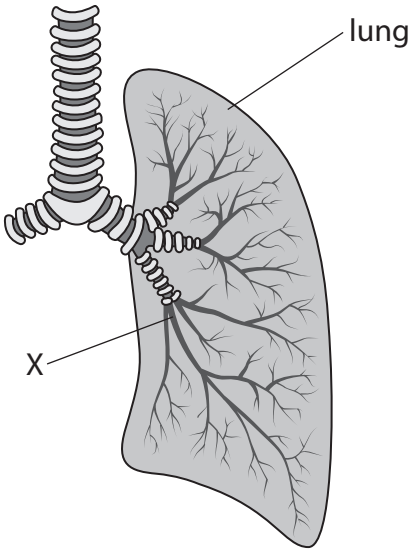
(Total for Question 1 = 8 marks)

2 The diagram shows parts of the human respiratory system with some structures labelled.



(a) (i) Which of these is the structure labelled X?

(1)

- ☒ **A** alveolus
- ☒ **B** bronchiole
- ☒ **C** bronchus
- ☒ **D** trachea

(ii) State why a lung is described as an organ.

(1)

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(iii) Explain how contraction of the diaphragm causes air to move into the lungs.

(3)

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(b) A scientist compared the rate at which oxygen is used during exercise by a person who is a non-smoker with a person who is a smoker.

The rate is measured in cm^3 per minute for each kilogram of body mass.

The table shows the scientist's results.

Human	Rate of oxygen use during exercise in cm^3 per minute for each kilogram of body mass
non-smoker	35
smoker	27

(i) Calculate the volume of oxygen used in 30 minutes by a non-smoker with a mass of 70 kg.

(2)

volume = ... cm^3

(ii) Explain the effect of cigarette smoking on the rate at which oxygen is used.

(3)

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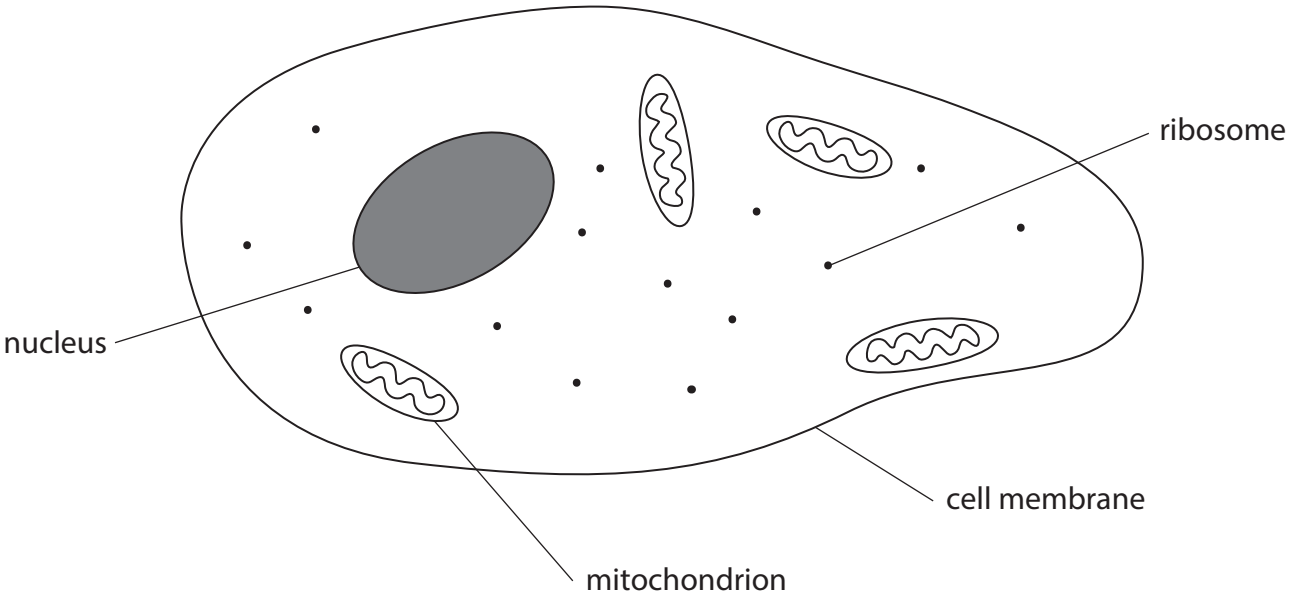
(Total for Question 2 = 10 marks)

3 The diagram shows a human skin cell.



(a) (i) In which of the labelled structures does protein synthesis occur?

(1)

- ☒ **A** cell membrane
- ☒ **B** mitochondrion
- ☒ **C** nucleus
- ☒ **D** ribosome

(ii) All cells have cell membranes.

Which of the labelled structures are also found in plant cells?

(1)

- ☒ **A** mitochondrion and nucleus only
- ☒ **B** mitochondrion and ribosome only
- ☒ **C** mitochondrion, nucleus and ribosome
- ☒ **D** nucleus and ribosome only

(b) The table shows information about the number of mitochondria in different types of human cell.

Type of human cell	Number of mitochondria in one cell	Number of mitochondria in 10 μm³ of cell	Volume of cell in μm³
skin	510	3	1700
villus	2000	8	2500
sperm	75	12	

(i) The volume of a villus cell is 2500 μm^3.

Calculate the ratio of the volume of a villus cell to the volume of a sperm cell.

Give your answer in the form n : 1

(3)

ratio = ... : 1

(ii) Using the information in the table, comment on the importance of mitochondria to the activities of different cell types.

(4)

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(Total for Question 3 = 9 marks)

4 Fruit juice drinks contain a range of nutrients.

The table shows some of the nutrients in a fruit juice drink and the percentage of the recommended daily allowance (RDA) of these nutrients for a 16 year old.

Nutrient	Mass of nutrient in 400 cm^3 of drink in g	Percentage of RDA in 400 cm^3 of drink
starch	2.8	2
sugar	6.4	4
fat	7.0	10
fibre	9.2	35

(a) (i) Vitamins and minerals are not listed in the table.

Name one other component of a balanced diet that is not listed in the table.

(1)

.....

(ii) Calculate the RDA of fibre for a 16 year old.

Give your answer in grams and to the nearest whole number.

(2)

RDA of fibre = ... g

(iii) State the function of fibre in the human diet.

(1)

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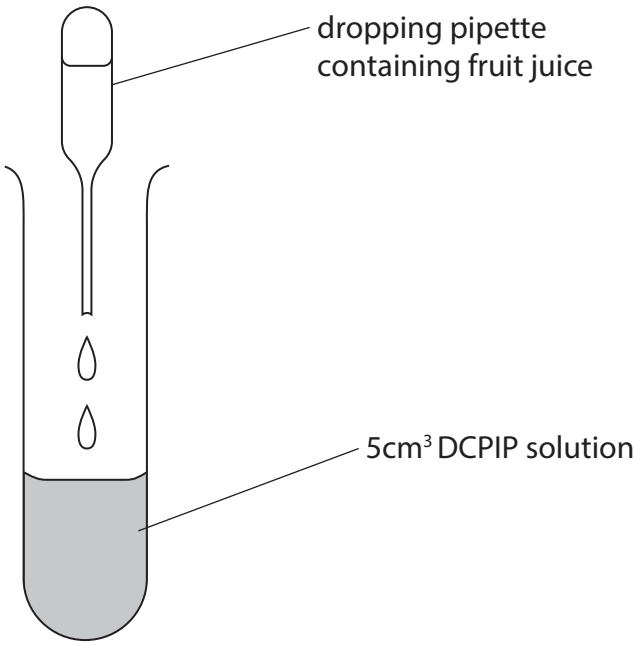
(b) Describe how starch is digested into glucose in the human alimentary canal.

(3)

(c) DCPIP is a blue solution that turns colourless when enough vitamin C is added.

A student uses this apparatus to compare the concentrations of vitamin C in different fruit juices.



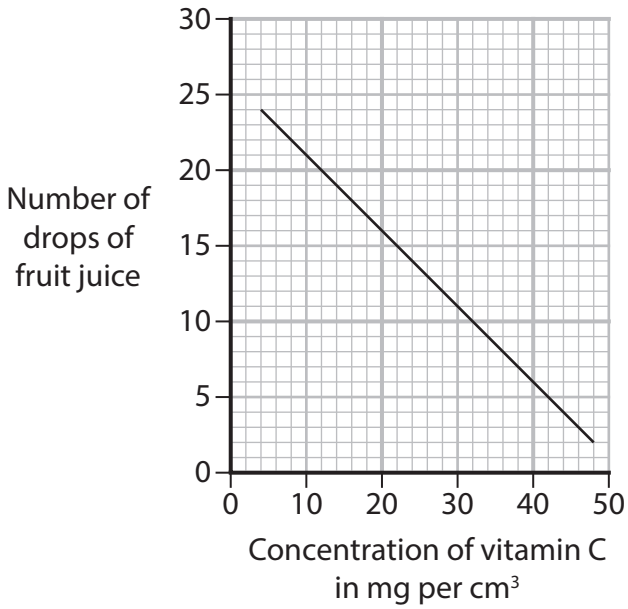
This is the student's method.

- place 5 cm^3 of blue DCPIP solution in a test tube
- fill a dropping pipette with fruit juice
- add drops of fruit juice to the DCPIP solution
- record the number of drops of fruit juice added until the DCPIP solution turns colourless

The table shows the student's results.

Fruit juice	Number of drops of fruit juice needed to turn DCPIP solution to colourless
apple	18
grape	22
lemon	4
lime	7
orange	3

(i) The graph shows the effect of concentration of vitamin C on the number of drops needed to change DCPIP solution to colourless.



Determine the concentration of vitamin C in lime juice.

(1)

concentration of vitamin C = ... mg per cm³

(ii) Give the fruit juices in order of increasing concentration of vitamin C.

One has been done for you.

(1)

highest concentration .....

.....

lime

.....

lowest concentration .....

(iii) Explain how the student could modify the experiment to give a more accurate measure of the concentrations of vitamin C in the fruit juices.

(2)

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(Total for Question 4 = 11 marks)

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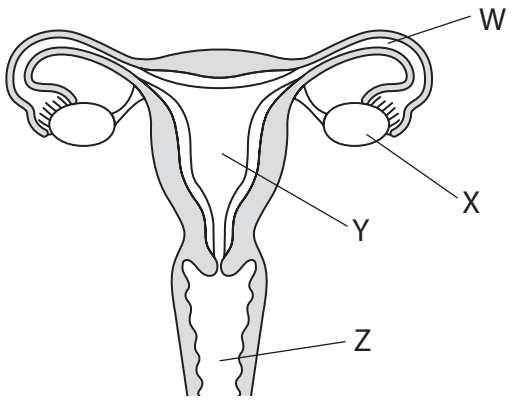
5 The diagram shows the human female reproductive system with some structures labelled.



(a) (i) In which structure does ovulation occur?

(1)

- ☒ **A** W
- ☒ **B** X
- ☒ **C** Y
- ☒ **D** Z

(ii) Explain the importance of progesterone in the menstrual cycle.

(2)

(iii) Explain how the placenta enables a developing embryo to obtain nutrients.

(3)

(b) For fertilisation to occur, a sperm needs to reach an ovum.

(i) Which of these describes the number of chromosomes in the nucleus of a human sperm?

(1)

☒ **A** diploid number of 23 chromosomes

☒ **B** diploid number of 46 chromosomes

☒ **C** haploid number of 23 chromosomes

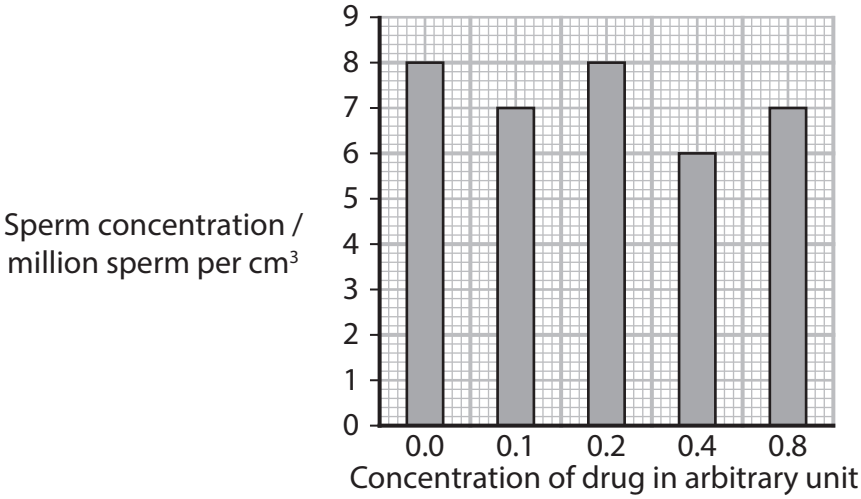
☒ **D** haploid number of 46 chromosomes

(ii) Scientists are developing a contraceptive drug to reduce fertility.

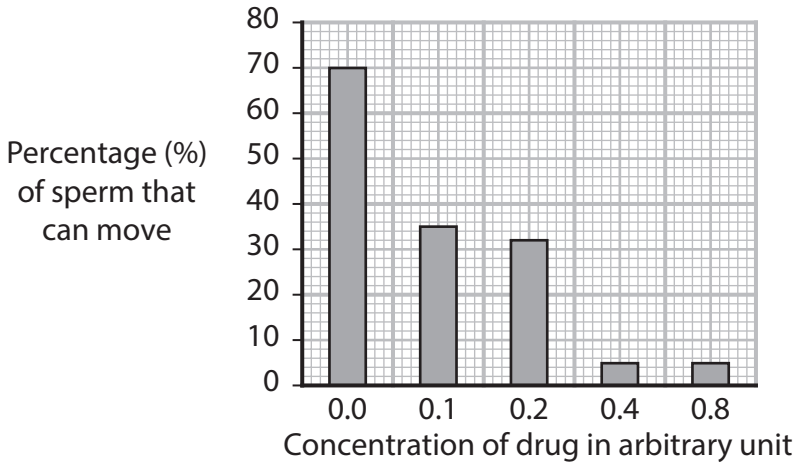
The drug is tested on 25 male mice.

Graph 1 shows the effect that different concentrations of the drug have on the mean concentration of sperm in semen.

Graph 2 shows the effect that different concentrations of the drug have on the percentage of sperm that can move.



Graph 1



Graph 2

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The scientists conclude that the drug could be used as a contraceptive to reduce fertility in humans.

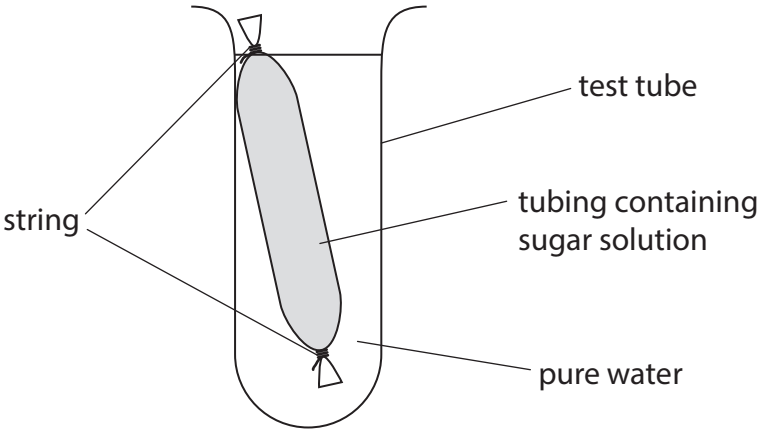
Discuss the scientists' conclusion.

Use information in the graphs and your own knowledge to support your answer.

(5)

(Total for Question 5 = 12 marks)

6 A student uses this apparatus to investigate osmosis in a non-living system.



This is the student's method.

- tie partially permeable tubing at one end with string to make a bag
- fill the bag with sugar solution
- tie the bag at the other end with string
- measure the mass of the bag, string, and sugar solution
- place the bag into a test tube filled with pure water
- after 5 minutes remove the bag and measure the mass
- return the bag to the test tube
- repeat the measurement of mass every 5 minutes for 30 minutes in total

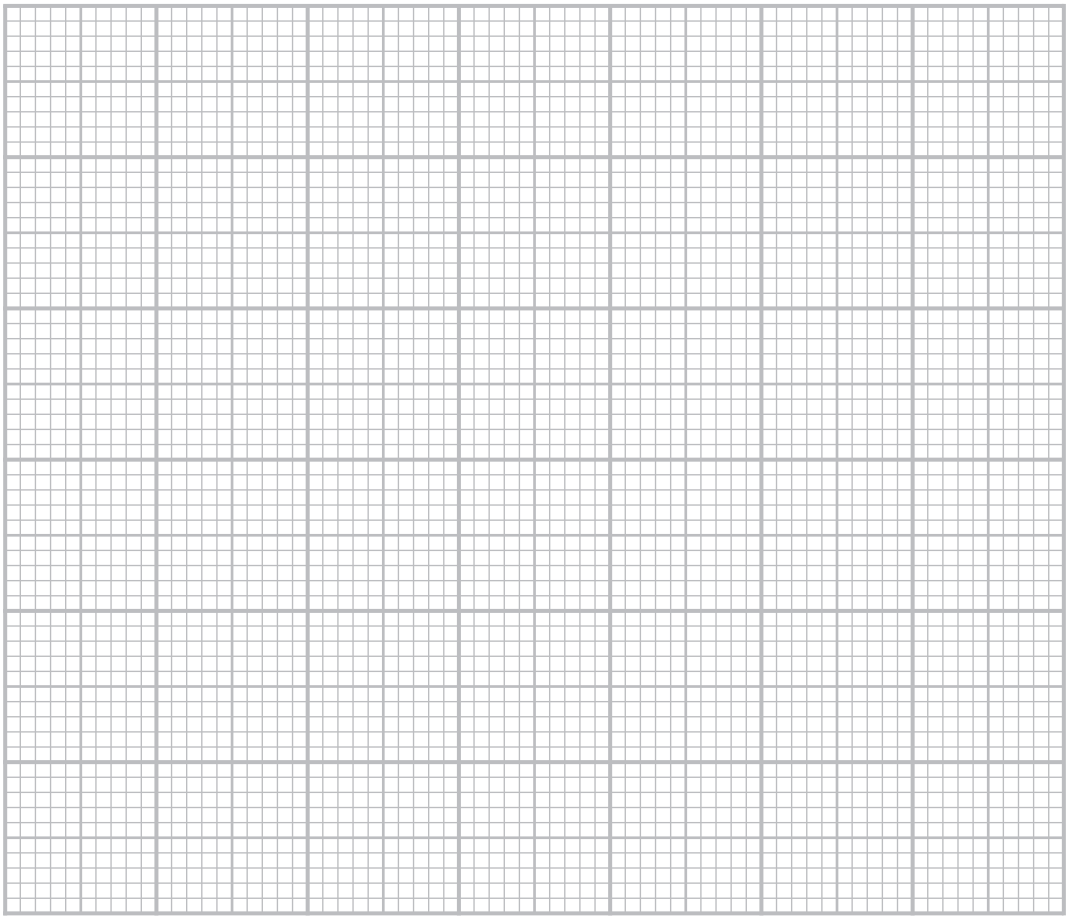
The table shows the student's results.

Time in minutes	Mass of bag in g
0	15
5	17
10	20
15	23
20	26
25	27
30	27

(a) (i) Draw a line graph to show the student's results.

Join your points with straight lines.

(5)



(ii) Describe the change in mass of the bag during the 30 minutes.

(2)

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(iii) Explain the change in mass of the bag during the 30 minutes.

(2)

(b) The student decides to investigate how increasing the temperature would affect the results.

(i) Describe how the student could repeat the experiment safely at a higher temperature.

(2)

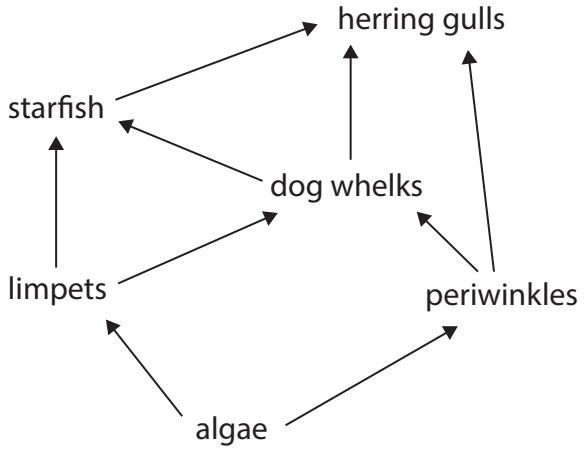
(ii) Explain how repeating the experiment at a higher temperature would affect the results.

(3)

(Total for Question 6 = 14 marks)

7 Limpets are marine animals that attach to rocks on coastal shores.

The diagram shows a food web that contains limpets.



(a) (i) Which are the trophic levels of the starfish in this food web?

(1)

- ☒ **A** primary consumer and secondary consumer
- ☒ **B** primary consumer and tertiary consumer
- ☒ **C** secondary consumer and tertiary consumer
- ☒ **D** secondary consumer only

(ii) State what is meant by the term **population**.

(1)

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(iii) Explain why only 1% of the energy in the algae is transferred to the starfish.

(3)

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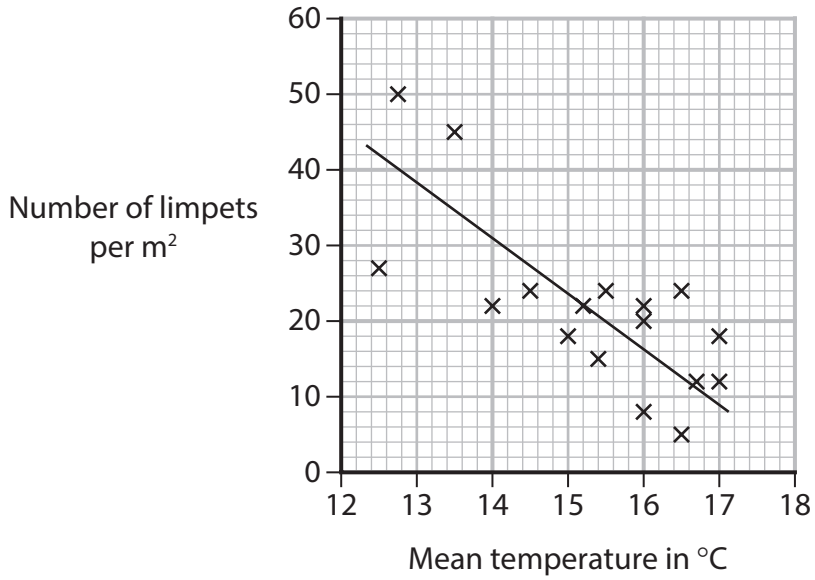
(b) Some scientists think that food webs on rocky shores are at risk from an increase in greenhouse gases.

The scientists record these two factors during August every year for 17 years.

- the number of limpets per m^2 on a rocky shore
- the mean temperature at the same rocky shore

The graph shows the scientists' results.



(i) Describe how the scientists could determine the number of limpets on the rocky shore.

(3)

(ii) Give one factor the scientists should control when comparing the number of limpets per m^2 each year.

(1)

(iii) The scientists conclude that the combustion of fossil fuels is a risk to the food web.

Discuss the scientists' conclusion.

Use the information in the graph and your own knowledge to support your answer.

(5)

(Total for Question 7 = 14 marks)

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8 Golden rice is an example of a genetically modified plant.

Golden rice has been given a gene to make a substance called carotene.

This gene was taken from daffodil plants.

(a) (i) State the term for a genetically modified organism that has been given a gene from a different species.

(1)

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(ii) Describe how named enzymes are used to transfer a gene from one species to another species.

(3)

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(b) Carotene is converted into vitamin A after being consumed by humans.
Non-genetically modified rice does not usually contain carotene.

(i) Vitamin A deficiency is common in some countries.

Explain why growing golden rice may benefit people in these countries.

(2)

(ii) Suggest why some people may not agree with growing genetically modified crops such as golden rice.

(2)

(c) Chemical pesticides can be used in rice fields to kill insect pests.

Scientists investigate the effect that spraying pesticides in a rice field has on three types of organism.

The three types of organism investigated are:

- insect pests
- carnivorous beetles (predators of insect pests)
- lizards (higher trophic level predators)

The scientists count the number of each type of organism in the rice field.

The scientists then spray the field with pesticide.

The number of each type of organism in the field are then counted every three months for a year.

The table shows the scientists' results.

These are the scientists' results.

Time in months	Number of each type of organism		
	insect pests	carnivorous beetles	lizards
0 (before spraying)	490	310	26
3	25	175	12
6	30	45	6
9	175	20	2
12	280	25	2

(i) Comment on the effects on the numbers of different organisms of spraying pesticides in a rice field.

(4)

(ii) State two reasons why using biological control is better for the environment than using chemical pesticide.

(2)

1 .....

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2 .....

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(Total for Question 8 = 14 marks)

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9 The ability of humans to taste a chemical called PTC is controlled by a single gene.

The ability to taste PTC is coded for by a dominant allele, **T**.

Not being able to taste PTC is coded for by a recessive allele, **t**.

(a) State what is meant by the term **recessive allele**.

(1)

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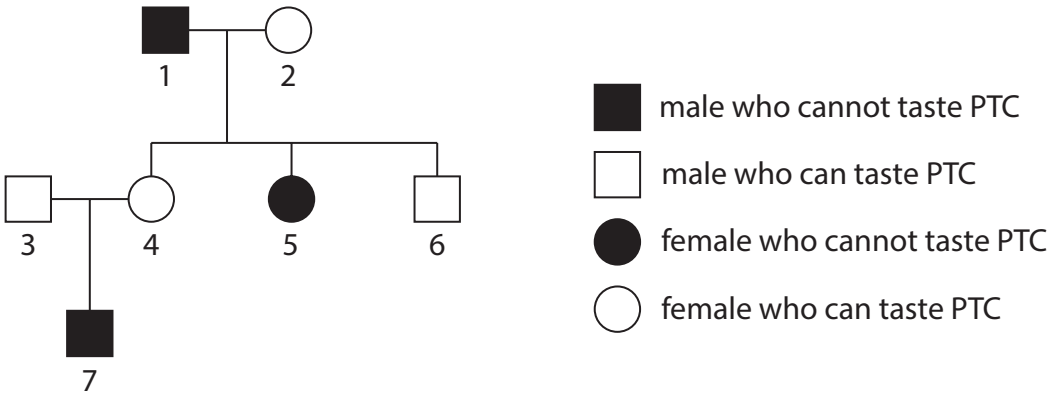
(b) The pedigree diagram shows the individuals in a family who can taste PTC and those who cannot taste PTC.



(i) What are the genotypes of individuals 1 and 2?

(1)

☒ **A** TT and TT

☒ **B** Tt and TT

☒ **C** tt and Tt

☒ **D** tt and tt

(ii) Determine the probability of individuals 3 and 4 having another child that can taste PTC and is male.

Use a genetic diagram to show your working.

(4)

probability .....

(c) People who can taste PTC say that it tastes bitter.

Many poisonous plants also taste bitter.

(i) Explain why there are many people who can taste PTC in areas where there are many poisonous plants.

Refer to natural selection in your answer.

(4)

(ii) People who can taste PTC often find the taste of vegetables very bitter.

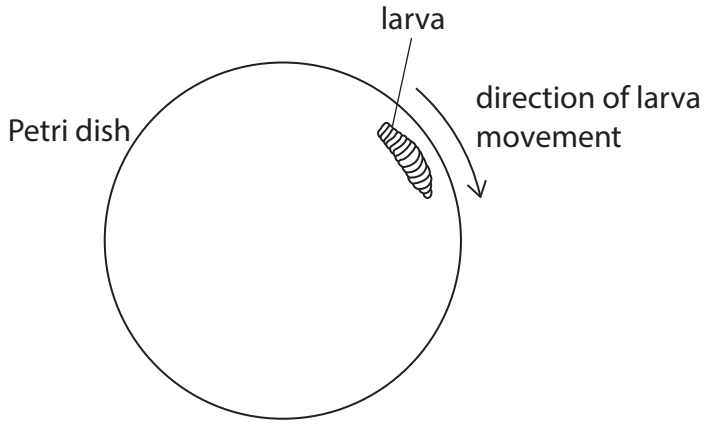
Suggest why the recessive allele for not tasting PTC still exists in human populations.

(2)

(Total for Question 9 = 12 marks)

10 Fly larvae will continuously move around the edge of a Petri dish when placed under a lamp.

The diagram shows a fly larva in a Petri dish.



Design an investigation to find out if changing the colour of light from the lamp affects the speed that the larvae move.

Include experimental details in your answer and write in full sentences.

(6)

(Total for Question 10 = 6 marks)

TOTAL FOR PAPER = 110 MARKS

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