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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)

Time 1 hour 45 minutes

Paper reference **4HB1/01**

Human Biology

UNIT: 4HB1
PAPER: 01

You must have:
Calculator, ruler

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 90.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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Q:1/1/1/1/

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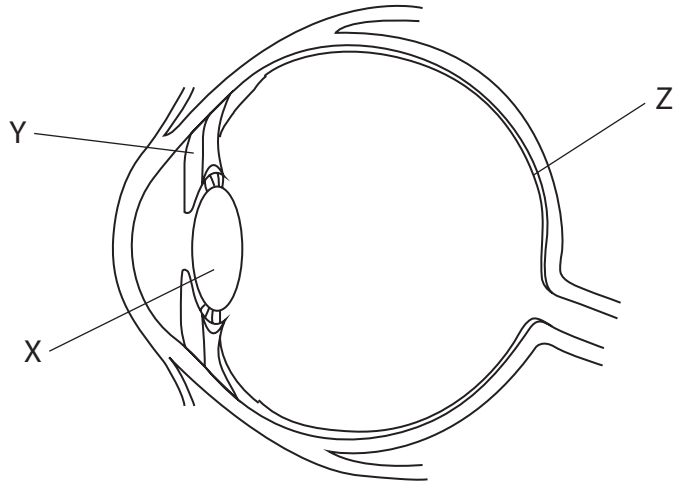
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Answer ALL questions.

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 (a) The diagram shows a human eye.



(i) Draw one line from each structure to its correct function.

(3)

Structure	Function
	transmits electrical impulses to the brain
structure X	refracts light rays
	protects the eye from pathogens
structure Y	
	detects light rays
structure Z	controls the shape of the lens
	controls the size of the pupil

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(ii) Most humans have stereoscopic vision.

Which of these statements occurs because of stereoscopic vision?

(1)

- ☒ **A** being able to judge depth
- ☒ **B** being able to see in colour
- ☒ **C** having a wide field of view
- ☒ **D** to be able to see near and far objects

(b) The diagram shows a healthy eye and an eye with a cataract.



Healthy eye Eye with cataract

(i) Describe the cause of cataracts.

(2)

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.....

.....

(ii) State one treatment for cataracts.

(1)

.....

(iii) It is estimated that 39 million people in the world are blind.

Of these people, 43% are blind because of cataracts.

Determine the estimated number of people who are blind because of cataracts.

(2)

number of people = ...

(iv) Some people are blind because of a vitamin deficiency.

Name the vitamin that is needed to prevent this type of blindness.

(1)

.....

(Total for Question 1 = 10 marks)

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2 (a) A human sperm cell has a tail, a mid-piece containing organelles and a head with a nucleus.

(i) Give the function of the tail.

(1)

.....

.....

(ii) Which of these, found in the mid-piece, release energy?

(1)

- ☒ **A** chromosomes
- ☒ **B** endoplasmic reticulum
- ☒ **C** mitochondria
- ☒ **D** ribosomes

(iii) The process of meiosis is involved in the production of sperm.

Explain the importance of meiosis in sperm production.

(3)

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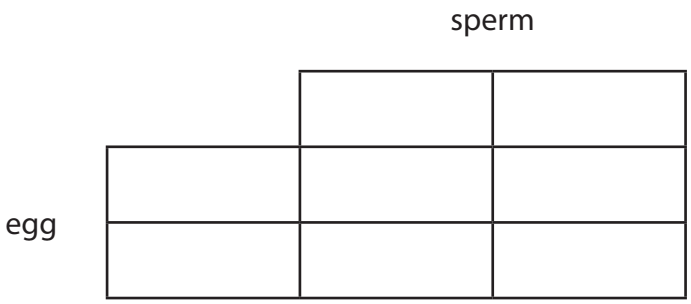
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(b) (i) Complete the genetic diagram to show how the sex of a person is determined by the chromosomes in the nucleus of the egg and the nucleus of the sperm.

(3)



(ii) The sperm head has to enter the egg cell so the nuclei can fuse.

Describe how the sperm head enters the egg cell.

(2)

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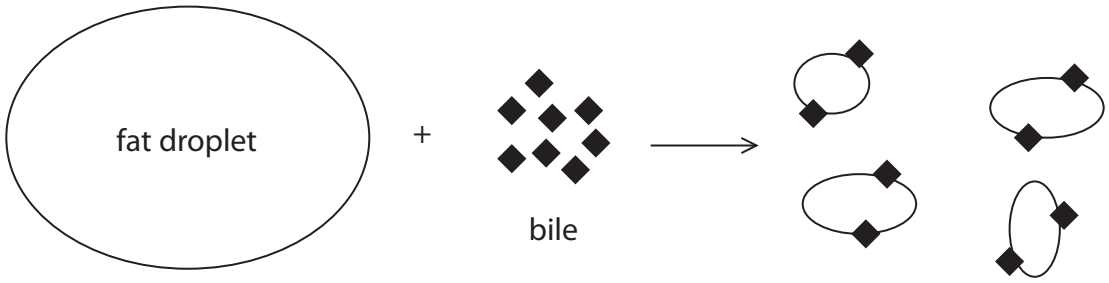
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(Total for Question 2 = 10 marks)

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3 (a) The diagram represents the effect of bile on a large fat droplet.



(i) Where is bile produced?

(1)

- ☒ **A** gall bladder
- ☒ **B** liver
- ☒ **C** small intestine
- ☒ **D** stomach

(ii) Describe the role of bile in the digestion of fat.

(3)

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(b) Three food tests are used on a solution of food.

The table shows the reagent used and the colour of the food solution after each test.

Reagent used	Colour of the food solution after the test
iodine solution	blue/black
biuret solution	purple
Benedict's solution	blue

(i) Describe what the food tests show about the dietary components in the food.

(3)

(ii) Saliva is added to a new sample of the food solution and the mixture is kept at 37 °C for 10 minutes.

The food tests are then repeated and the solution turns brick red when tested with Benedict's reagent.

Explain the effect of saliva on the food solution.

(3)

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(c) Food is digested as it moves along the alimentary canal.

This process is helped by a diet containing fibre.

Explain how food is moved along the alimentary canal and how fibre helps this process.

(5)

(Total for Question 3 = 15 marks)

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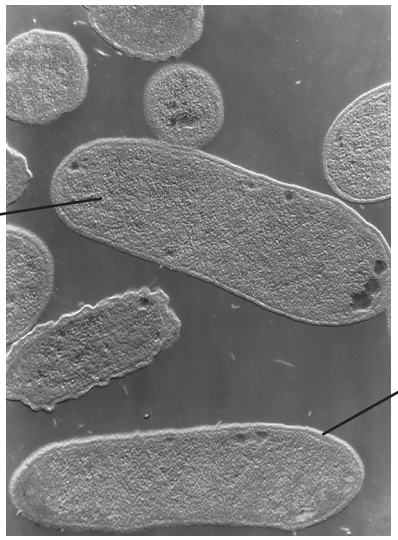
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4 Typhoid is caused by *Salmonella typhi* bacteria.

These bacteria are spread by houseflies.

(a) The photograph shows *Salmonella typhi,* magnified 30 000 times.



(Source: © CNRI/SCIENCE PHOTO LIBRARY)

(i) Each bacterium is surrounded by cell structure Y.

Identify cell structure Y.

(1)

.....

(ii) On the photograph bacterium X has a length of 55 mm.

Calculate the actual length of the bacterium in micrometres (µm).

[1 mm = 1000 µm]

(2)

actual length = ... µm

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(b) A team of scientists found that the legs of houseflies have hundreds of different species of bacteria on them.

(i) Flies in towns and cities carry more bacteria than flies that are found in the countryside.

Suggest a reason for this observation.

(1)

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.....

(ii) One species of bacterium identified is *Helicobacter pylori* which causes stomach ulcers.

Explain how houseflies could increase the transmission of *Helicobacter pylori*.

(3)

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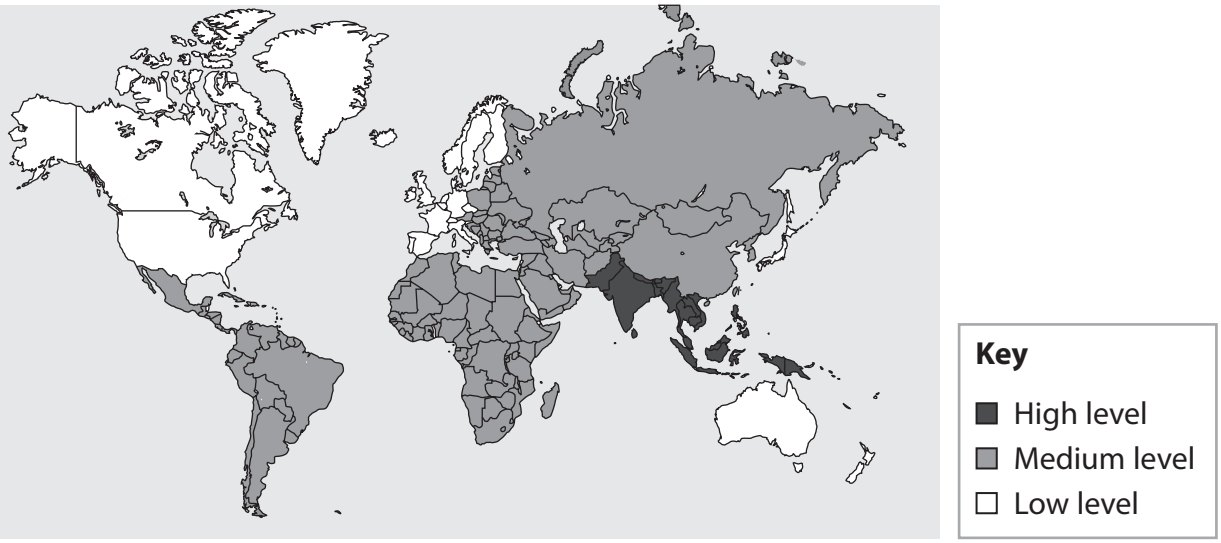
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(c) The diagram shows the levels of typhoid across the world.



(i) Give reasons for the global distribution of typhoid.

(2)

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(ii) Some strains of bacteria that cause typhoid are resistant to antibiotics.

Discuss how resistance to antibiotics develops and the effect this has on the treatment of typhoid.

(5)

(Total for Question 4 = 14 marks)

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5 (a) A student reads that as people get older their ability to hear high frequency sounds decreases.

(i) Describe an investigation a student could do to show if this is correct.

(3)

(ii) Give a reason why hearing loss occurs as people get older.

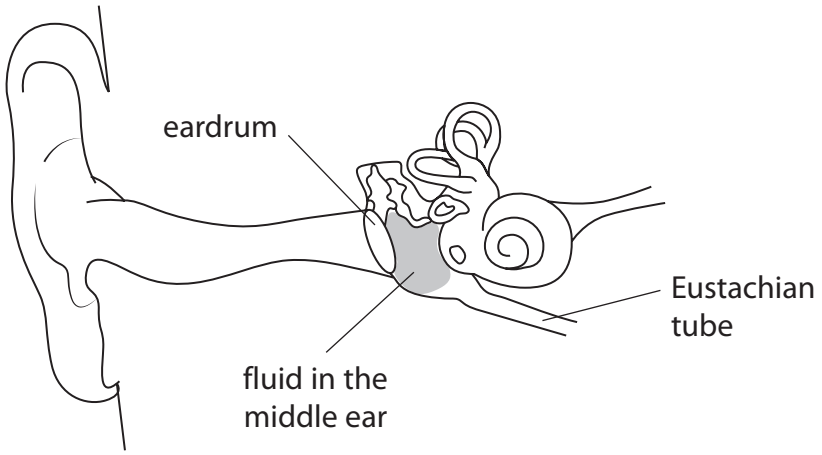
(1)

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(b) Glue ear is a condition that can affect children and causes hearing loss.

Fluid accumulates in the middle ear, as shown in the diagram.

As the child grows, the slope of the Eustachian tube increases and the fluid drains.



(i) Explain how the fluid in the middle ear causes hearing loss.

(3)

(ii) Explain why children with glue ear get more bacterial ear infections than other children.

(2)

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(iii) Describe the role of the ear in maintaining a person's balance.

(3)

(Total for Question 5 = 12 marks)

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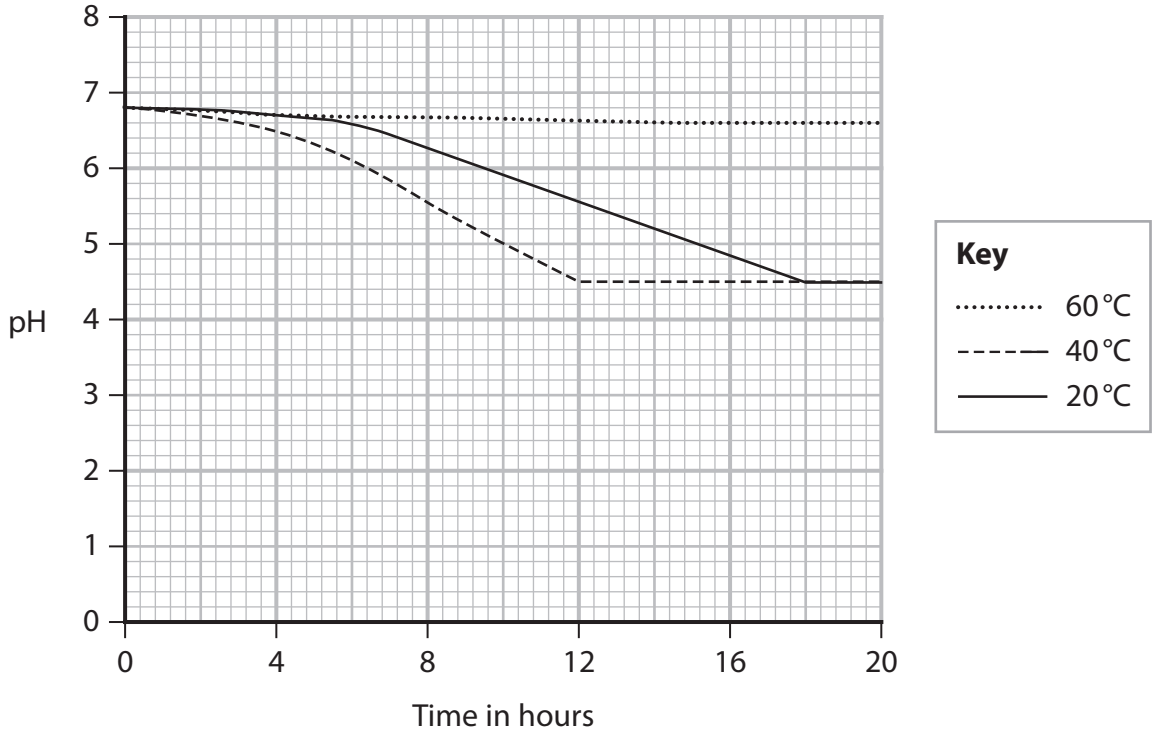
6 Yoghurt can be produced by incubating milk with a small amount of live yoghurt.

The live yoghurt contains *Lactobacillus* bacteria.

Enzymes convert lactose in the milk into lactic acid causing the pH to decrease to around pH 4.4.

In an investigation, the change in pH as yoghurt is produced was measured during 20 hours at three different temperatures.

The graph shows the results.



(a) (i) Calculate the difference in the time taken to produce yoghurt at 40 °C instead of 20 °C.

(2)

time = ... hours

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

(2)

1 .....

.....

2 .....

.....

(iii) Describe how this investigation could be improved to find the optimum temperature for the production of yoghurt.

(2)

.....

.....

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.....

.....

(iv) In some methods to produce yoghurt, the milk is boiled and then cooled before the bacteria are added.

Give the reason for boiling and the reason for cooling the milk.

(2)

boiling

.....

.....

cooling

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.....

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(b) When yoghurt reaches a pH of 4.4 the bacteria stop fermenting lactose.

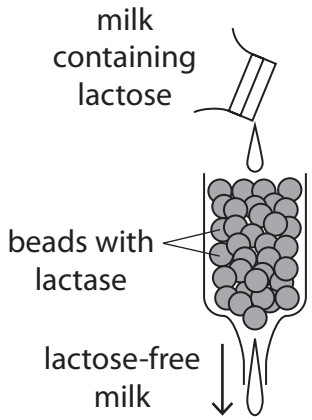
Explain why bacteria stop fermenting the lactose at a pH of around 4.4

(2)

(c) People who are lactose intolerant can drink lactose-free milk.

This can be produced using alginate beads containing lactase.

The diagram shows the equipment needed.



(i) Describe the advantages of using alginate beads containing lactase rather than a solution of lactase.

(2)

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(ii) The enzyme lactase breaks down lactose into simpler sugars.

Explain how the structure of the small intestine allows the absorption of these sugars.

(3)

(Total for Question 6 = 15 marks)

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7 People with polycystic kidney disease have cysts on their kidneys.

Cysts are sacs of fluid and they affect the functioning of the kidney.

Polycystic kidney disease is caused by a mutation of a gene.

(a) Explain how a gene mutation can affect the phenotype of an individual.

(3)

(b) Polycystic kidney disease can cause kidney failure.

Kidney failure can be treated using dialysis or a transplant.

(i) Describe the benefits of a transplant rather than dialysis as a treatment for kidney failure.

(2)

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(ii) In one year in the United Kingdom there were 4733 organ donations.

Of these donations, 3233 were kidney donations.

Calculate the percentage of organ donations that are kidney donations.

(2)

percentage = ... %

(iii) The number of kidney donations is much higher than the number of other organ donations such as heart or liver.

Give two reasons for the higher number of kidney donations.

(2)

1 .....

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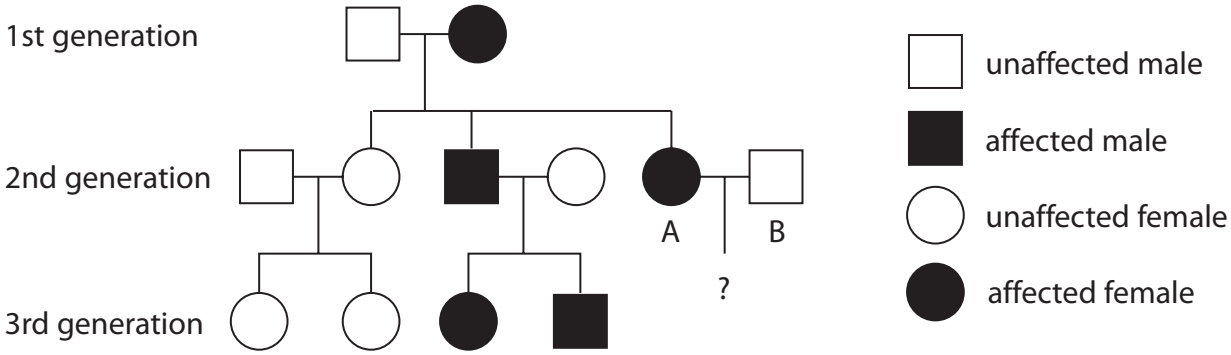
2 .....

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(c) The diagram shows a family pedigree. Some of the family have polycystic kidney disease.

This disease is caused by a dominant allele that is not sex-linked.



(i) Determine the ratio of the females shown in the 3rd generation that are affected with polycystic kidney disease.

(1)

ratio = ...

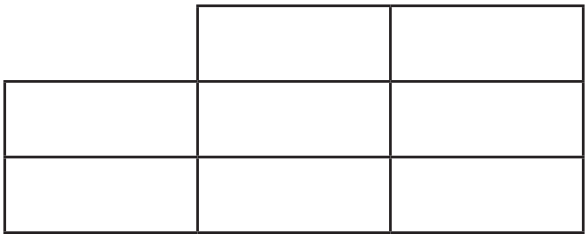
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(ii) Explain the possible genotypes and phenotypes for the offspring of individual A and individual B.

You should complete the genetic diagram as part of your answer.

(4)



(Total for Question 7 = 14 marks)

TOTAL FOR PAPER = 90 MARKS

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