Candidate surname | Other names

**Pearson Edexcel
Level 1/Level 2 GCSE (9–1)**

Centre Number | Candidate Number

Time 1 hour 45 minutes

Paper reference **1BI0/1H**

Biology
PAPER 1

Higher Tier

You must have: Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **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*.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question*.
- In questions marked with an **asterisk** (*****), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.
- Calculators may be used.

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.
- Good luck with your examination.

Turn over ▶

Pearson

Answer ALL questions. Write your answers in the spaces provided.

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 ☒.

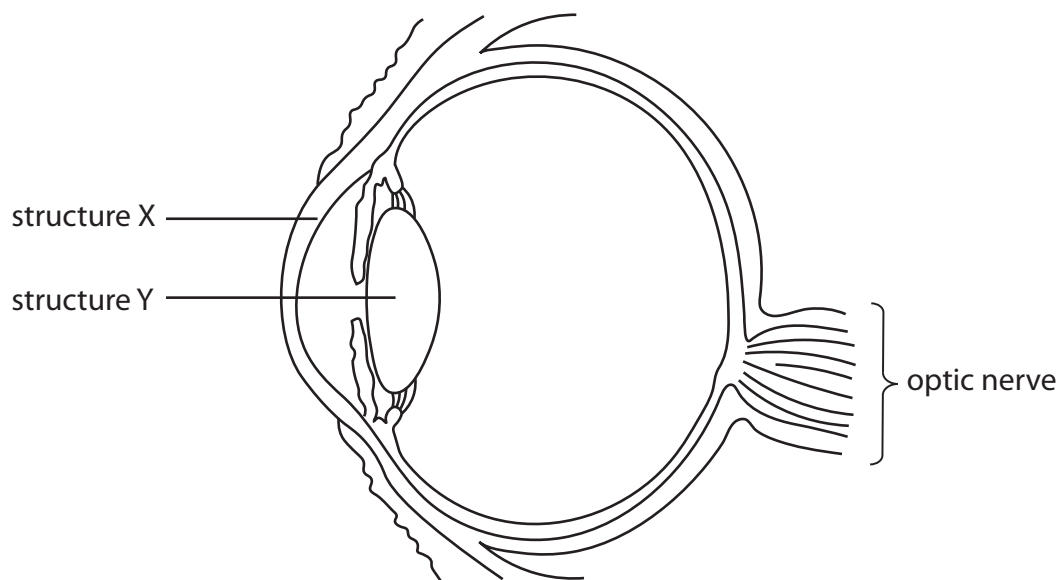**1** (a) Figure 1 shows a diagram of the human eye.

structure X ——

structure Y ——

optic nerve

Figure 1

(i) Which row in the table gives the function of structure X and structure Y?

(1)

		function of structure X	**function of structure Y**
☒	**A**	refracts light	detects light
☒	**B**	detects light	refracts light
☒	**C**	reflects light	detects light
☒	**D**	refracts light	refracts light

(ii) Describe the changes that occur in the eye when a bright light is directed into the eye.

(2)

• pupil becomes smaller (1)

• the iris changes shape (1)

(b) Eye tests can detect some brain tumours.

(i) State **one** other way that brain tumours can be detected.

(1)

{CT / PET} scanning

(ii) Describe why a brain tumour is difficult to treat.

(2)

brain is protected by skull (1)

• it is difficult to access (1

(Total for Question 1 = 6 marks)

2 (a) Figure 2 shows part of a reflex arc in the spinal cord.

sensory neurone

motor neurone
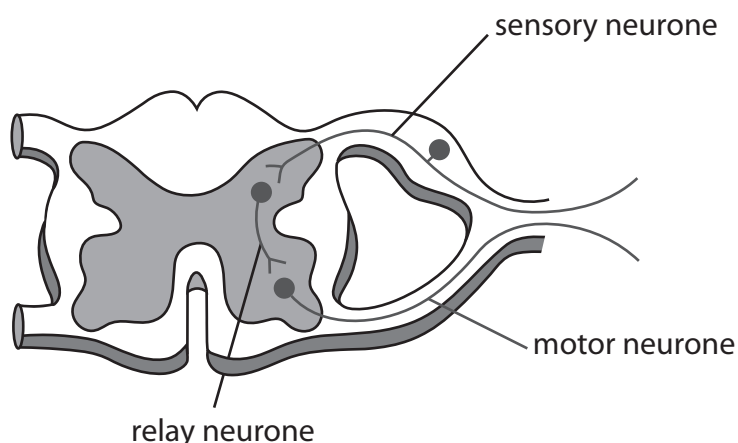
relay neurone

Figure 2

(i) Describe how an impulse passes from the relay neurone to the motor neurone.

(3)

the impulse (in the relay neurone) triggers the release of a chemical (1)

• neurotransmitter (1)

• (neurotransmitter) diffuses (1)

(ii) Explain the function of a reflex arc.

(2)

a process that occurs in response to danger (1)

• which bypasses the {brain / parts of the brain} / is an {involuntary process / subconscious process} (1)

P 6 7 0 6 4 R A 0 4 3 2

(b) A scientist investigated the reaction times of five students using a computer program.

The computer screen showed a blue square at the start.

As soon as the blue square turned yellow, each student had to press a key on the keyboard as fast as possible.

Figure 3 shows the results for the five students.

student	reaction time in milliseconds
1	245
2	200
3	210
4	215
5	225

Figure 3

(i) Which is the median result for these students?

(1)

⊠ **A** 200 milliseconds

⊠ **B** 210 milliseconds

⊠ **C** 215 milliseconds

⊠ **D** 225 milliseconds

(ii) The scientist wanted to investigate if the colours of the squares used on the computer program affected reaction time.

The computer program started with blue squares that turned into yellow squares.

Describe how the scientist could compare the reaction times of these students when they respond to red squares turning into yellow squares.

(3)

measure their reaction time using red squares (1)

• keep everything else the same (as using blue squares) (1)

• repeat measurements (for each student) (1)

(Total for Question 2 = 9 marks)

3 (a) Name the organisation which defines health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

(1)

World Health Organization / WHO

(b) Tuberculosis (TB) is a communicable disease.

(i) State **two** ways that communicable diseases are different from non-communicable diseases.

(2)

1 (communicable) is passed from person to person (1)

2 • (communicable) caused by {pathogens / example of pathogen} (1)

(ii) Explain **one** way that the spread of tuberculosis (TB) can be reduced or prevented.

(2)

{cough / sneeze} into a tissue / avoid close contact with infected people / avoid cramped living conditions (1)

• because spread of TB is airborne droplets / TB is spread through the air (1)

(iii) A student researched the number of people with TB in some countries.

Figure 4 shows the student's data.

> Belgium 1000   Portugal 2400
>
>   UK 5400 people
>
> Germany   5800 in France
> 6100

Figure 4

Complete the table to show the student's data.

(2)

suitable heading for each column, with country in the left column (1)	
• all data entered accurately (1)	

(c) Explain why people with AIDS are more susceptible to TB.

(2)

HIV destroys white blood cells / HIV weakens the immune system (1)

• so the body is unable to {destroy the TB pathogen / prevent the pathogen invading the body} (1)

(Total for Question 3 = 9 marks)

4 *Streptococcus mutans* is one species of bacteria which causes tooth decay.

A scientist tested the effectiveness of toothpaste at killing this species of bacteria.

The scientist spread the bacteria *Streptococcus mutans* across an agar jelly plate.

(a) (i) Which word describes the techniques used to prevent contamination of the agar jelly plate?

(1)

☒ **A** clinical

☒ **B** diagnostic

☒ **C** aseptic

☒ **D** lysogenic

(ii) Give **two** precautions needed to prevent contamination of the agar jelly plate.

(2)

1 keep the lid on at all possible times (1)

2 • use sterile equipment (1)

(b) The scientist placed a filter paper disc soaked in toothpaste mixed with saliva (disc A) on one half of the agar jelly plate.

A filter paper disc soaked in only saliva (disc B) was placed on the other half of the agar jelly plate.

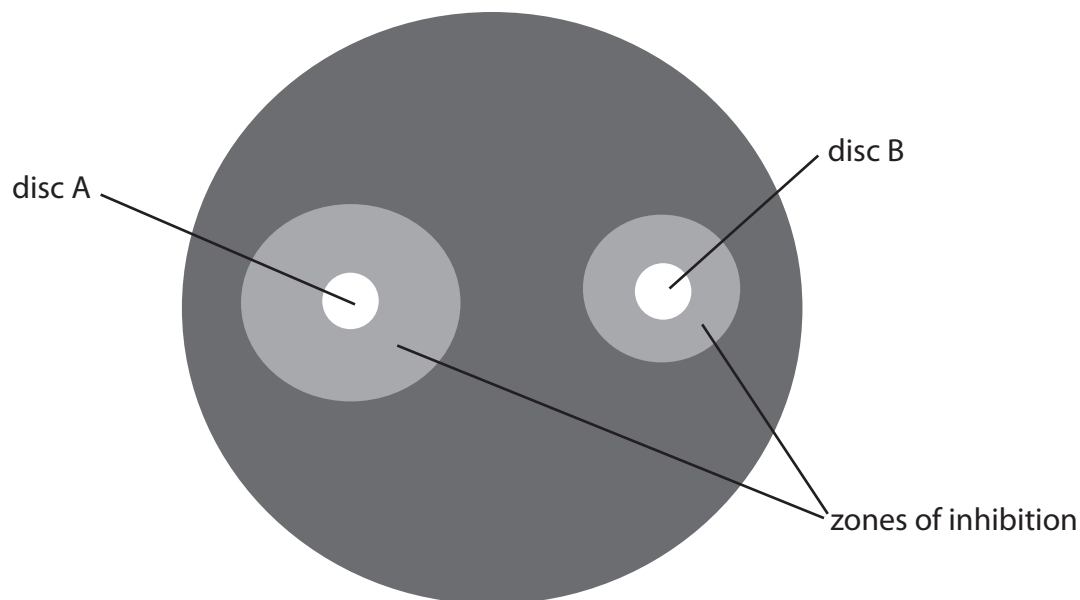The agar jelly plate was kept at 37°C for 24 hours.

Figure 5 shows the results.

disc A

disc B

zones of inhibition

Figure 5

(i) The diameter of the zone of inhibition around disc A is 9 mm.

Calculate the area of this zone of inhibition using the equation πr^2.

Use a value of 3.14 for π.

Give your answer to 1 decimal place.

(3)

radius
4.5 mm (1)
 calculation
(3.14 x 4.5 x 4.5 /
3.14 x 4.52) = 63.585 (1)

evaluation

63.6 (mm2)

.... mm^2

(ii) Give a reason why disc B, soaked in only saliva, was included in this test.

(1)

as a control / to compare

....

....

P 6 7 0 6 4 R A 0 1 0 3 2

(iii) Suggest **two** reasons why this test does not prove that toothpaste kills all bacteria on teeth.

(2)

1 the test only uses one species of bacteria (1)

....

2 • there are still bacteria on the agar plate (1

....

(c) Before a new toothpaste can be sold, the toothpaste has to be tested on cultured human cells.

Cultured human cells were placed into four identical flasks.

Saliva was added to each flask and a different brand of toothpaste was added to each of three flasks.

The human cells were left for two hours and the percentage of cells that were healthy was recorded.

Figure 6 shows the results.

substance added to the human cells	percentage of healthy cells after 2 hours (%)
saliva only	85
toothpaste brand 1	84
toothpaste brand 2	86
toothpaste brand 3	85

Figure 6
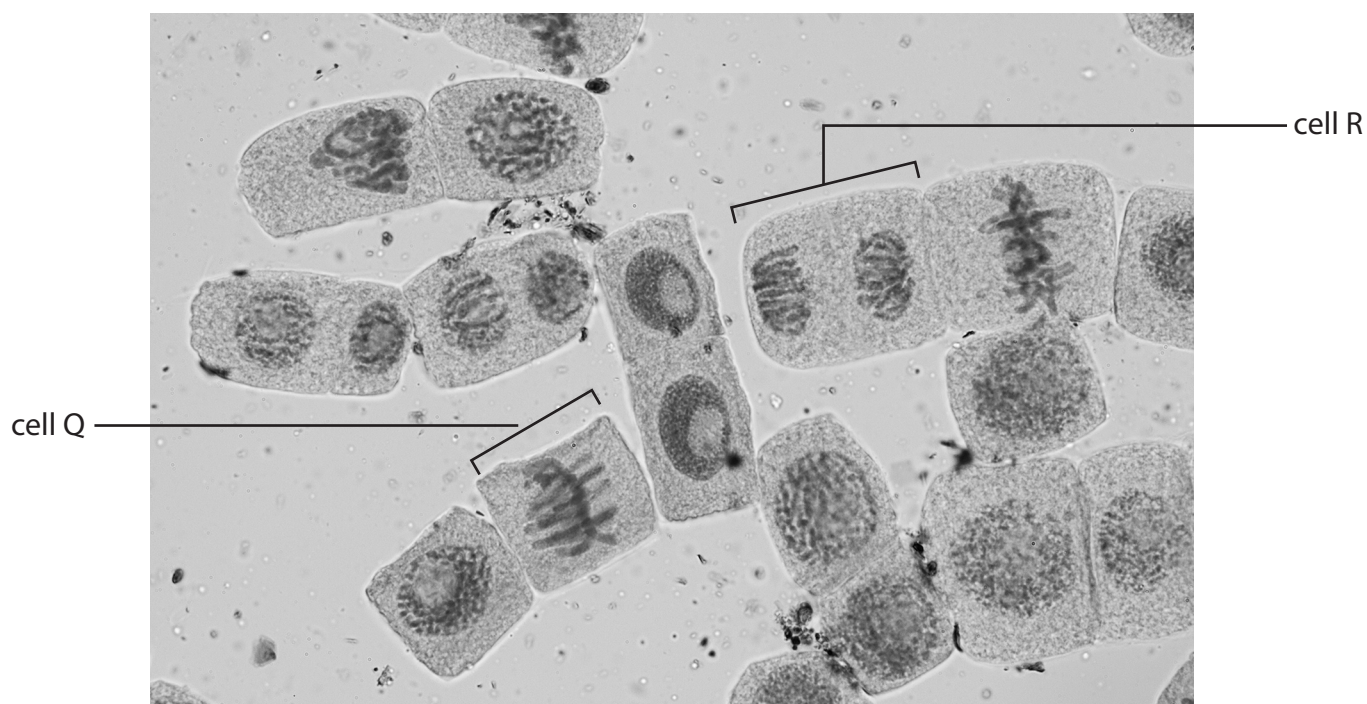
Explain the conclusion that can be made from this data.

(2)

the toothpastes were not harmful to the cells (1)

....

• because the % of healthy cells after 2 hours was similar to saliva (1)

....

(Total for Question 4 = 11 marks)

5 (a) Figure 7 shows cells from an onion root tip as seen using a light microscope.

cell R

cell Q

(Source: © Rattiya Thongdumhyu/Shutterstock)

Figure 7

(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 .... chromatids condense (1) ....

....

2 .... • identical chromatids are joined (1) ....

....

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

(1)

cytokinesis

(iv) The diameter of one cell in Figure 7 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

(b) 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)

use the x40 objective lens (1)

:

• use the x10 eye piece lens (1)

(c) Arthritis is a condition that occurs when cells in joints get damaged or destroyed.

Stem cell therapy can be used to treat arthritis.

Discuss the benefits and risks of using stem cell therapy to treat arthritis.

(4)

stem cells can differentiate /
become specialised (1)

• replace (damage) cells (1)

Risks (maximum 2 marks):

• new cells do not function
correctly (1)

• stem cells continue to divide
(1)

(Total for Question 5 = 11 marks)

6 (a) Figure 8 shows how alcohol consumption increases the risk of developing liver cancer.

Someone who does not drink alcohol has a 1.0 risk of developing liver cancer.
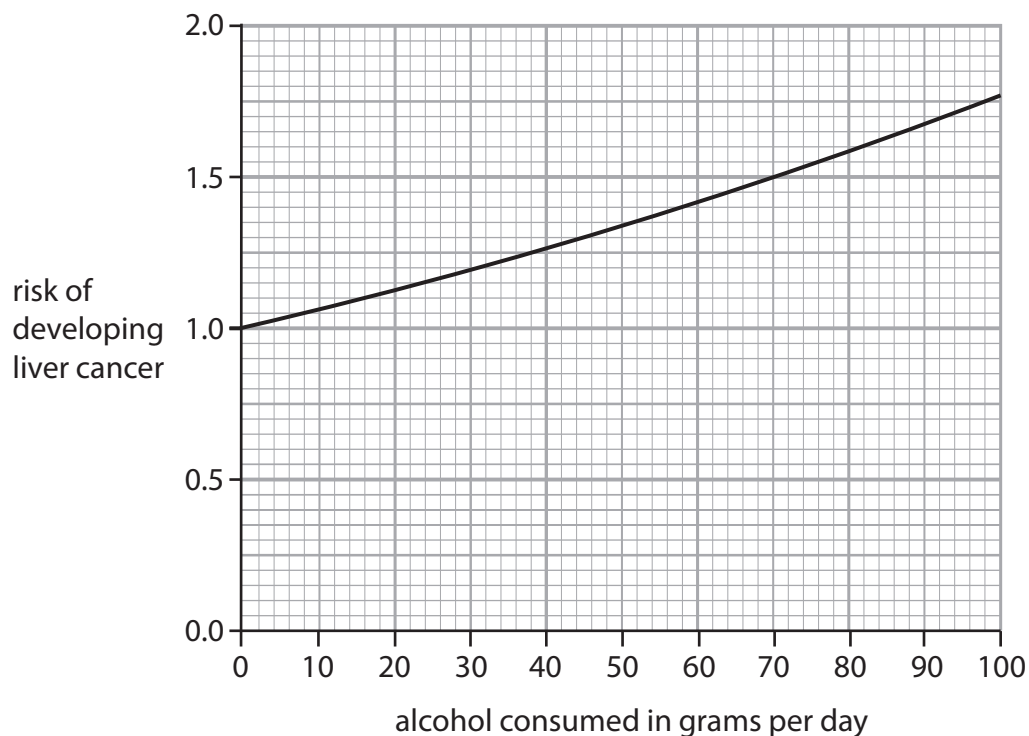

Figure 8

(i) One unit of alcohol contains 8 grams of alcohol.

Calculate the risk of developing liver cancer for someone who consumes 4 units of alcohol a day.

(2)

(8 x 4) = 32 (grams of alcohol) (1)

1.2 / 1.20 (x risk)

.... risk of developing liver cancer

P 6 7 0 6 4 R A 0 1 5 3 2

(ii) Describe how cancer develops in the liver.

(2)

mutations in DNA (1)

• cell division is uncontrolled (1)

(b) Haemochromatosis is a disease that occurs when iron accumulates in the liver.

A person with haemochromatosis is treated by having 0.5 dm^3 of their blood removed each week.

This lowers the level of iron in their blood.

(i) Give **two** safety precautions needed when blood is removed from this person.

(2)

1 wear gloves (1)

2 • clean the area of skin where blood being removed (1)

(ii) Haemochromatosis can be inherited.

Haemochromatosis occurs when a person inherits two copies of a recessive allele.

Figure 9 shows the inheritance of haemochromatosis in a family.

☐ homozygous dominant male

◼ heterozygous male

◯ homozygous dominant female

⬤ homozygous recessive female

Figure 9

State and explain the genotype of female Z.

(3)

heterozygous

An explanation linking:

• affected offspring must have inherited the recessive allele (1)

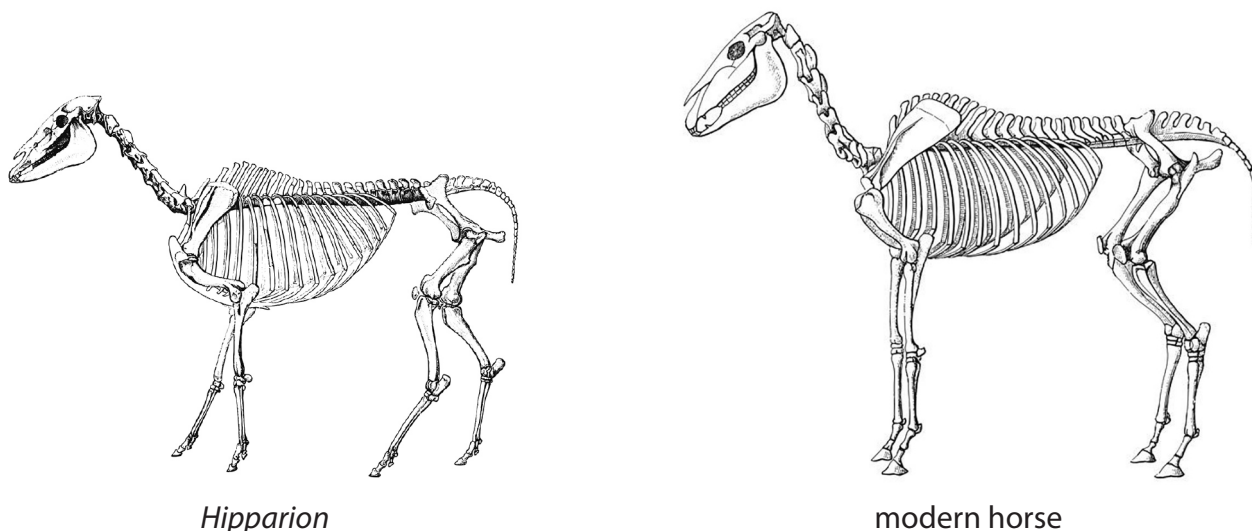• unaffected offspring must have inherited dominant allele (1)

(Total for Question 6 = 9 marks)

7 *Hipparion* is an extinct genus of horse that lived between approximately 20 million and 0.8 million years ago.

Figure 10 shows the skeletons of a *Hipparion* and a modern horse.

Hipparion   modern horse

(Sources: © Morphart Creation/Shutterstock and © Hein Nouwens/Shutterstock)

Figure 10

(a) (i) Give **one** method that can be used to date a fossil of a *Hipparion*.

(1)

location in the rock layer / age of fossils surrounding it

....

....

(ii) Give **one** reason why scientists have concluded that the modern horse has evolved from *Hipparion*.

(1)

similar (pentadactyl) limb structure / similarities in the {skeleton / bone} structure

....

....

(b) Describe how racehorses alive today have been selectively bred to run faster.

(3)

breed two animals that can run fast (1)

• selection of offspring that can run fast (1)

• repeat the process
over many generations
(1)

*(c) Discuss the advantages and disadvantages of sexual reproduction and asexual reproduction.

(6)

Sexual reproduction
Advantages
• creates variations in a species
• some organisms in a species can survive selection pressure
• allows for evolution

Disadvantages
• requires a mate to be found
• time for fertilisation / pollination means the process takes longer
• offspring can have features that are less advantageous than the parents.

Asexual reproduction
Advantages
• no requirement to find a mate
• rapid productive cycle
• organisms with beneficial characteristics of the parent can be produced

Disadvantages
• there is no variation
• a selection pressure could affect all organisms of a species.

(Total for Question 7 = 11 marks)

8 Chymosin is an enzyme that causes milk to curdle.

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

(a) 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)

40°C is the {optimum / closer to the optimum} / there is a faster rate of reaction (1)

• because as temperature increases (kinetic) energy increases (1)

(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)

time taken would be longer / the milk would not curdle (1)

• because the enzyme is denatured / the active site has changed shape (1)

(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)

it is a control (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 *use a smaller interval between the temperatures (1)*

2 *• measure temperatures between the range of 35°C and 45°C (1)*

(b) Chymosin can be produced by genetically modified bacteria.
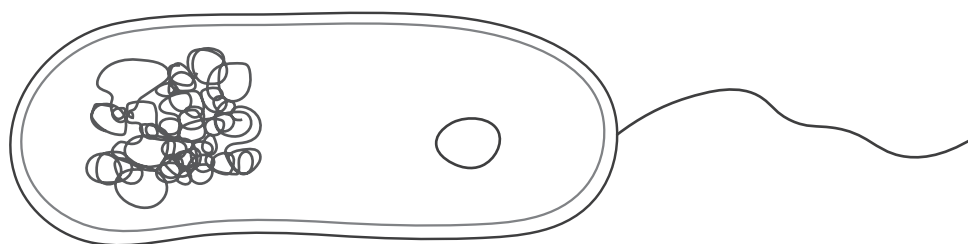
Figure 12 shows a bacterial cell.

Figure 12

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

(3)

plasmid is cut with restriction enzymes/ chymosin gene is cut with a restriction enzyme (1)
• sticky ends are complementary (1)
Additional Guidance

• ligase is used to connect the chymosin gene and the plasmid (1)

(Total for Question 8 = 11 marks)
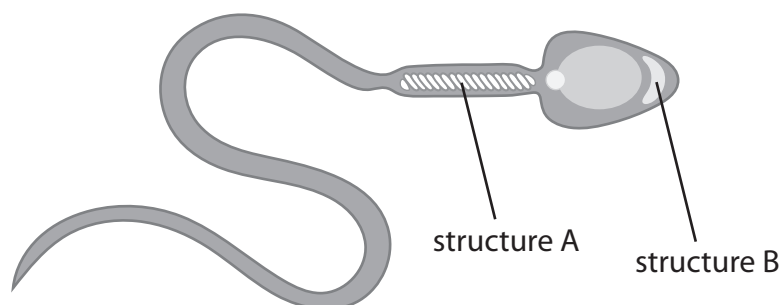
9 (a) Figure 13 shows a sperm cell.

Figure 13

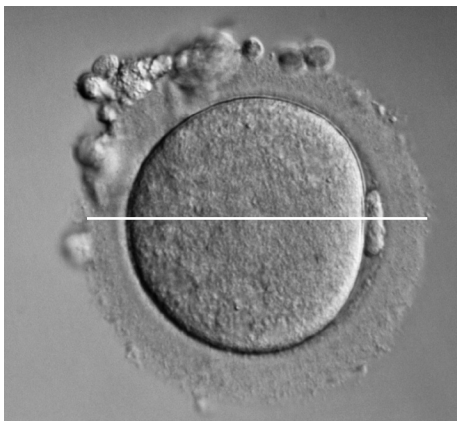Describe how structure A and structure B enable fertilisation.

(2)

structure A

....

Structure A
• the mitochondria
{release energy / for respiration} (1)

....

structure B

....

Structure B
• {acrosome / contains enzymes} to digest the egg cell membrane (1)

....

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

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)

measurement
45 (mm) / 4.5 cm (1)

calculation
(45 ÷ 700) = 0.0643 (1)

conversion into standard
form and millimetres

6.43 x 10-2 / 6.4 x 10-2

.... mm

*(c) 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 15 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 15

Evaluate the results of this investigation.

You should include calculations using the data in Figure 15.

(6)

Analysis of data
• the egg in the water has gained mass / water
• the egg in the 5% salt has no mass change
• the egg in the 10% salt has lost mass / water
• mass increase is 7 g for the egg in water
• mass increase is 0 g for 5% salt
• the mass decrease is 2g for 10% salt
• % mass change +9% / 0% / -3%

Water movement

• osmosis is the movement of water
• across a partially permeable membrane
• from a high concentration of water molecules
to a low concentration of water molecules
• 5% salt is an isotonic solution

(Total for Question 9 = 11 marks)

10 (a) One gene can have several different alleles.

Explain why these alleles can produce proteins with different structures.

(3)

alleles have different DNA {sequences / mutations} (1)

• mRNA strand has a different sequence / triplets have different sequences (1)

• codes for a different amino acid / order of amino acids is different (1)

(b) Monoclonal antibodies are proteins.

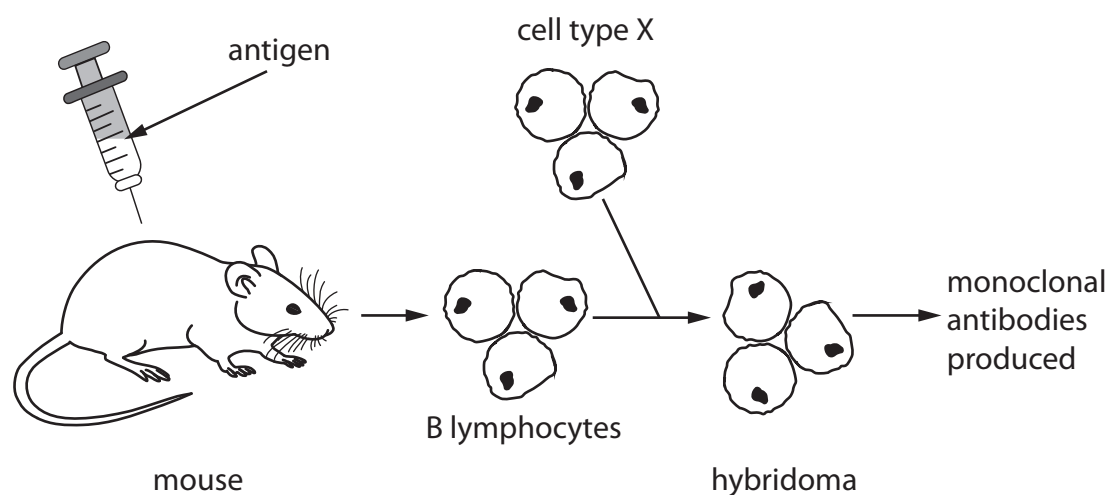Figure 16 shows the process of monoclonal antibody production.

Figure 16

(i) Which type of cell is added to the B lymphocytes to produce the hybridoma?

(1)

- ☒ **A** phagocytic cell
- ☒ **B** red blood cell
- ☒ **C** cancer cell
- ☒ **D** epithelial cell

(ii) A person with blood group A has the A antigen on the surface of their red blood cells.

Monoclonal antibodies can be used to detect the A antigen on red blood cells to determine the blood group of a person.

Explain why monoclonal antibodies, used to detect blood group A, would not react with the blood of a person with blood group B.

(3)

the shape of the antibody is complementary to the A antigen / antibodies only react with specific antigens

• the B antigen has a different {shape / structure} (1)

• (therefore) it will only bind to the A antigen / it will not bind to the B antigen (1)

(c) The allele for blood group A and the allele for blood group B are codominant.

Gregor Mendel investigated the inheritance of alleles using flowering plants.

He showed that the allele for red flowers (I^R) is codominant with the allele for white flowers (I^W).

A heterozygous plant produces pink flowers.

(i) Give the genotype for a plant producing white flowers.

(1)

IwIw / homozygous Iw

(ii) Explain the outcome if two plants that produce pink flowers are crossed.

You should complete the Punnett square as part of your answer.

(4)

	Iw	Ir
Iw	IwIw	IwIr
Ir	IwIr	IrIr

An explanation linking the following:

• correct gametes / parental genotype (1)
• correct completion of the Punnett square (1)

• 50% offspring will produce pink flowers (1)
• 25% will produce white flowers and 25% will produce red flowers (1)

(Total for Question 10 = 12 marks)

(TOTAL FOR PAPER = 100 MARKS)

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