Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

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

Tuesday 16 May 2023

Morning (Time: 1 hour 45 minutes)

Paper reference **1BI0/1H**

Biology
PAPER 1

Higher Tier

You must have:
Ruler, calculator

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.*

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 the 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.

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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P 7 2 6 2 7 A 0 1 3 2

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 bomb calorimeter is used to measure the energy content of a food sample.

Figure 1 shows a bomb calorimeter.

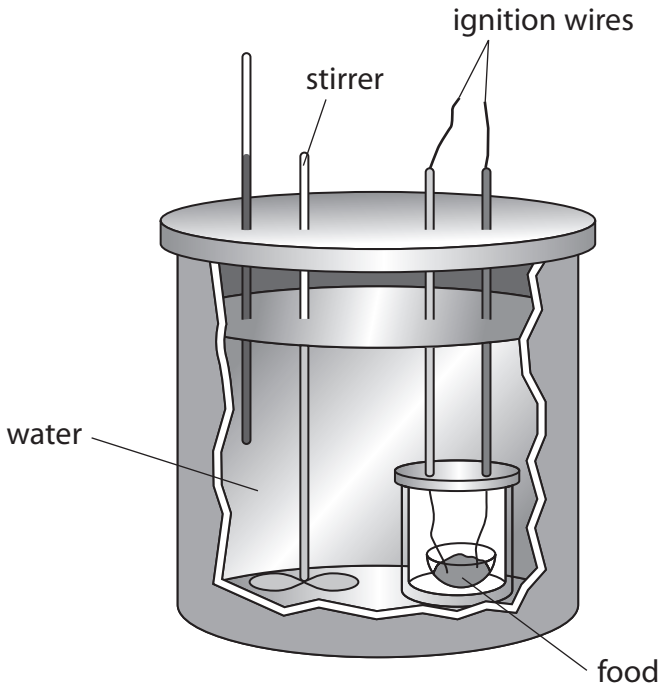


Figure 1

The mass of the food sample is measured at the start.

The food sample is burnt and the temperature rise of the water is measured.

(a) (i) Describe how the temperature rise of the water is measured.

(2)

use the thermometer
measure the start and end
temperature (of the water)

(ii) The energy content of the food is calculated using the equation:

$$\text{energy content (J/g)} = \frac{\text{mass of water (g)} \times \text{temperature rise (°C)} \times 4.2}{\text{mass of food (g)}}$$

The bomb calorimeter was used to find the energy content of a biscuit.

The mass of water was 1 000 g, the temperature rise was 69.4 °C and the mass of the biscuit was 14.7 g.

Which is the energy content of this biscuit?

(1)

☒ **A** 291 480 J/g

☒ **B** 19 829 J/g

☒ **C** 69 400 J/g

☒ **D** 4 721 J/g

(iii) A different biscuit with the same mass gave a temperature rise of 78.2 °C.

Give **one** reason why this biscuit gave a greater temperature rise.

(1)

(biscuit) contains **more** {energy / fat / protein / carbohydrate / calories}

(b) Figure 2 shows the equipment used in a school laboratory to measure the energy content of a food sample.

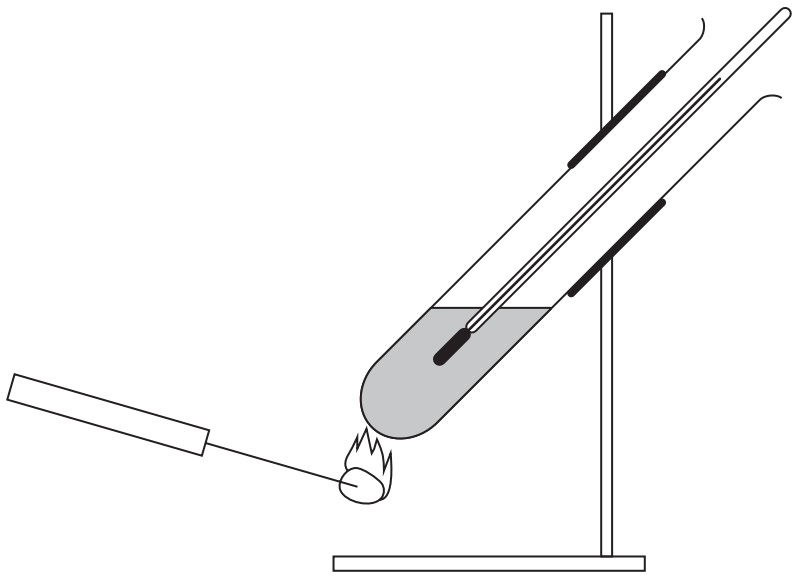


Figure 2

Explain why a bomb calorimeter gives a more accurate value than this equipment for the energy content of a food sample.

(3)

all / most of} the heat energy is used to heat the water

because there is less heat loss

because the system {is sealed / is insulated / has a lid / is closed}

(Total for Question 1 = 7 marks)

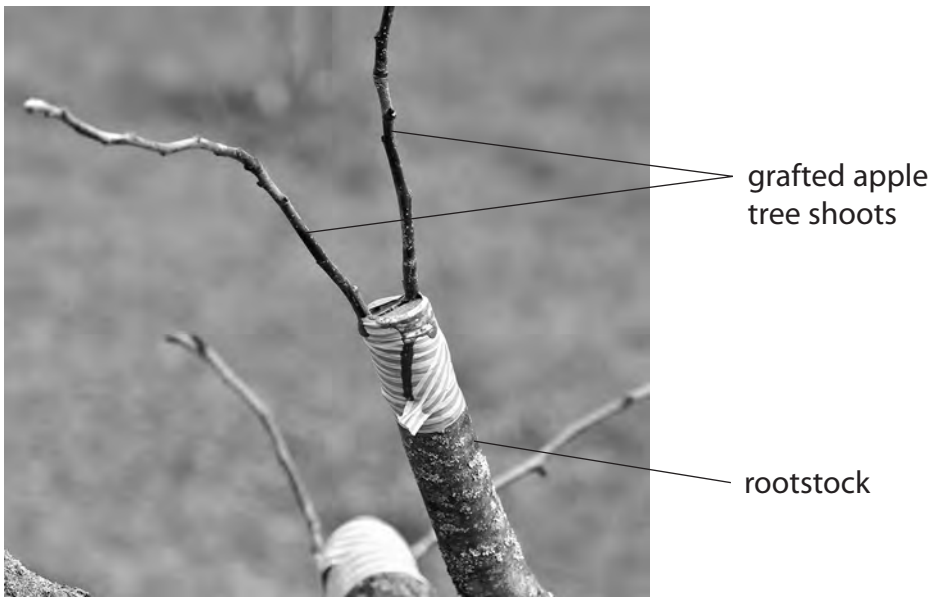
2 (a) Name the type of reproduction that produces genetically identical organisms.

(1)

exual (reproductic

(b) Grafting is a technique used to grow some varieties of apple tree.

Figure 3 shows apple tree shoots grafted on to a rootstock.



(Source: © ATTILA Barsan/Shutterstock)

Figure 3

Grafting can be used to produce apple trees that are genetically identical.

Give **one** advantage and **one** disadvantage of growing genetically identical apple trees.

(2)

advantage

(fruit) will have desired qualities

disadvantage

susceptible to a disease

(c) As apples ripen, enzymes convert starch into sugars.

Devise a method to find the optimum pH of an enzyme that breaks down starch.

You may use standard laboratory equipment and the solutions listed in the box.

starch solution	enzyme solution	iodine solution
a range of pH solutions		

(4)

mix starch, enzyme and pH (solution)
use iodine (to test for starch)
all three solutions are required
with iodine solution)
blue-black means starch is present / {orange / brown} means no starch present

(d) The optimum pH of an enzyme is pH 6.

Explain why this enzyme would not work at pH 10.

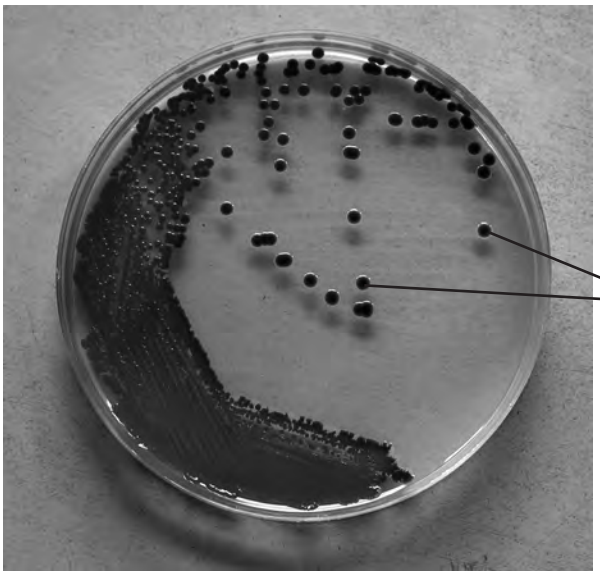
(2)

enzyme denatures

which changes the shape of the **active site**

(Total for Question 2 = 9 marks)

3 Figure 4 shows colonies of bacteria growing on an agar plate.



(Source: © Chatchouliya/Shutterstock)

Figure 4

Each colony starts as one bacterium.

Every time bacteria reproduce, the number of bacteria in each colony doubles.

(a) Calculate the number of bacteria in a colony after five hours, if each bacterium reproduces every 30 minutes.

(2)

300 ÷ 30
1024

..... bacteria

(b) Some bacteria are pathogens.

(i) State the meaning of the term pathogen.

(1)

pathogens are organisms) that
cause disease

(ii) Explain why antibiotics can be used to treat bacterial infections.

(2)

they inhibit processes in bacteria)

so **bacteria** {are
destroyed / are killed /
growth stops / reproduction stops}

(iii) A rod-shaped bacterium is 0.005 mm long.

A student draws the rod-shaped bacterium.

The bacterium in the drawing is 80 mm long.

Calculate the magnification of this drawing.

(2)

80 ÷ 0.005
16 000

magnification = ...

(Total for Question 3 = 7 marks)

4 Figure 5 shows a chart used by opticians to test a person's vision.

The person's vision is judged by the lowest row of letters they can read.

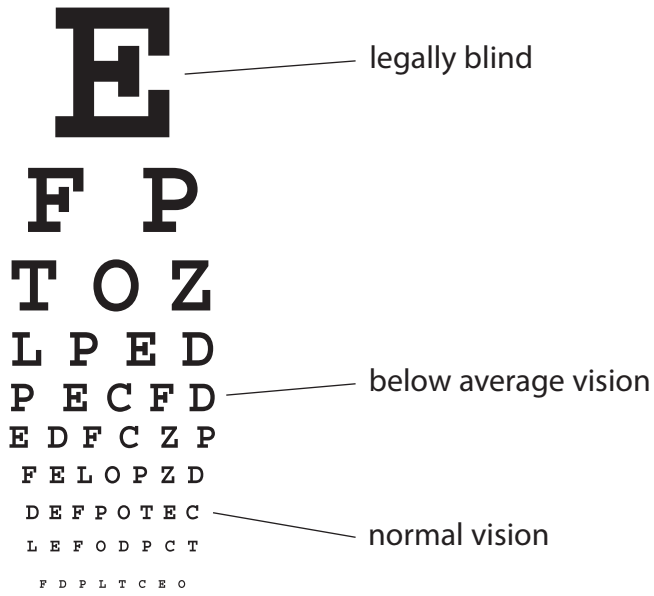


Figure 5

(a) (i) An optician tested the eyesight of 240 people.

35% of these people could read the normal vision row without wearing glasses.

The rest of the people need glasses to correct their vision.

Calculate the number of people who need glasses to correct their vision.

(3)

240 x 0.35 / 84

240 – 84

156 (people)

..... people

(ii) An optician can use the chart to diagnose short-sightedness.

Give **one** reason why people are short-sighted.

(1)

the eye(ball) is too long

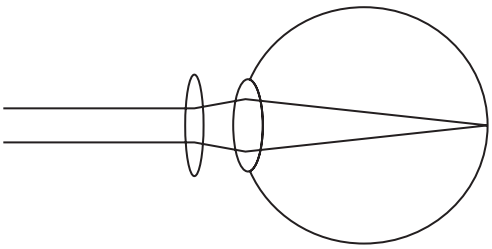
.....

.....

(iii) Which diagram shows how short-sightedness can be corrected?

(1)

A



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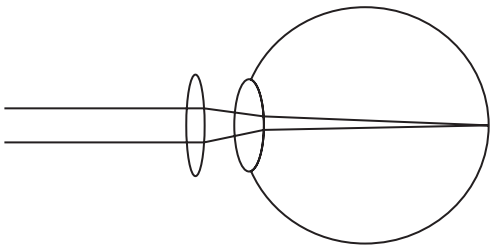

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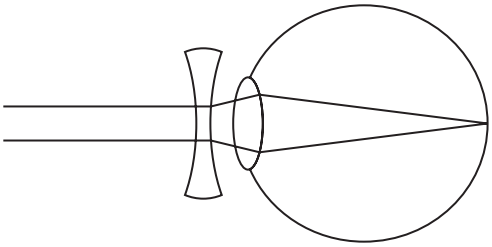

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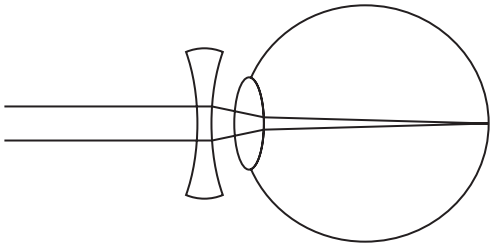

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(b) Cataracts can affect a person's vision.

Figure 6 shows what a person with normal vision and a person with cataracts can see for the top letter on the optician's chart.

person with normal vision person with cataracts

Figure 6

(i) Describe why a person with cataracts would see the image shown in Figure 6.

(2)

protein (has built up)
in the) lens

(ii) State the treatment for cataracts.

(1)

(surgery to) replace the lens / use an {artificial / plastic lens}

(c) Figure 7 shows the structure of the brain.

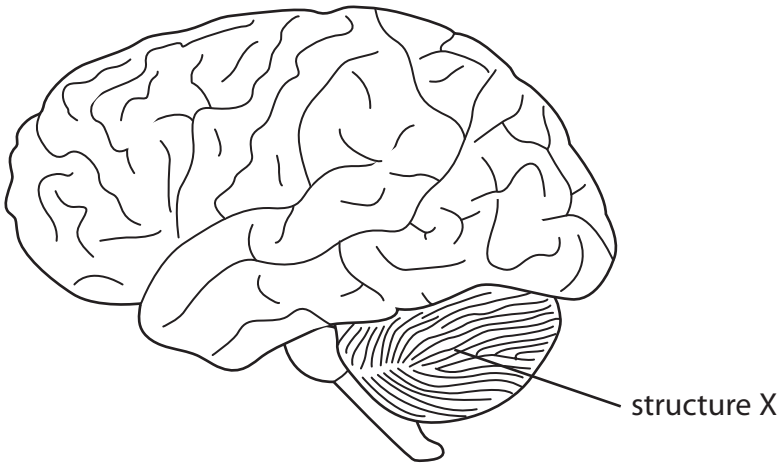

Figure 7

(i) Which region of the brain is labelled structure X?

(1)

- ☒ **A** cerebellum
- ☒ **B** cerebral hemisphere
- ☒ **C** medulla oblongata
- ☒ **D** spinal cord

(ii) When a person reacts to a stimulus, messages from the brain are sent to their muscles.

Describe how messages are sent from the brain to muscles.

(2)

by **electrical** impulses along a motor neurone (to the effector)

(Total for Question 4 = 11 marks)

5 (a) Figure 8 shows a diagram of a mouse sperm cell.

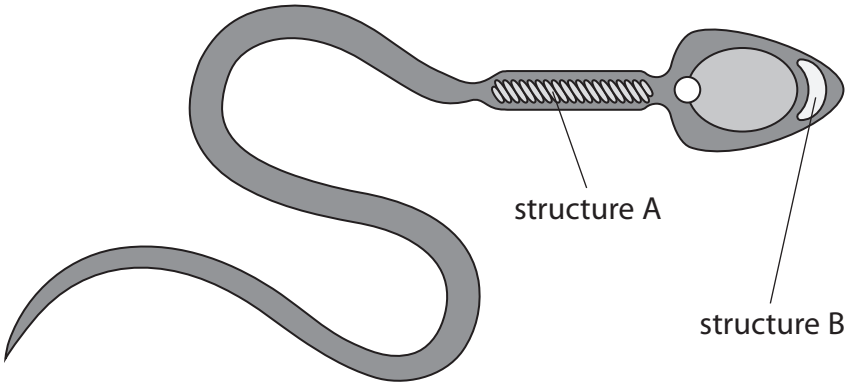

Figure 8

(i) Which row of the table shows the functions of structure A and structure B?

(1)

		function of structure A	function of structure B
☒	**A**	releases energy	contains the genetic material
☒	**B**	produces glucose	contains digestive enzymes
☒	**C**	releases energy	contains digestive enzymes
☒	**D**	produces glucose	contains the genetic material

(ii) The diploid chromosome number for a mouse is 40.

State the number of chromosomes in a mouse sperm cell.

(1)

20

(b) After a mouse egg cell is fertilised, cell division produces a ball of genetically identical stem cells.

(i) Which is the correct order for the stages of one cell division?

(1)

- ☒ **A** metaphase → prophase → anaphase → telophase
- ☒ **B** prophase → metaphase → anaphase → telophase
- ☒ **C** anaphase → prophase → metaphase → telophase
- ☒ **D** prophase → anaphase → metaphase → telophase

(ii) The genetically identical stem cells produce the cells that develop into an embryo.

Describe how stem cells produce the cells of an embryo.

(2)

(stem cells divide) by mitosis
cells **differentiate** / to become specialised cells

(c) Scientific research has made many discoveries and developments allowing stem cells to be used in medical treatments.

Figure 9 shows a timeline for some of these discoveries and developments.

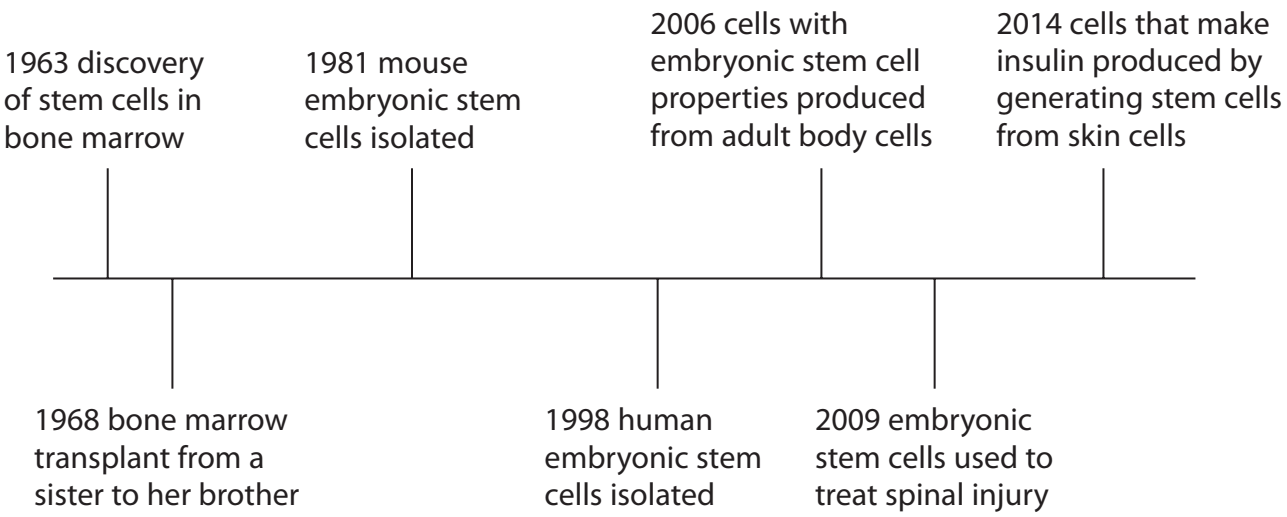

Figure 9

(i) Give **one** scientific reason why the bone marrow transplant in 1968 was from a sister to her brother.

(1)

so the tissues matched / to reduce the chance of rejection

(ii) Give **one** scientific reason why some people are opposed to the isolation of human embryonic stem cells.

(1)

they have the potential to develop into a {foetus / baby / person / life} so embryos are not {harmed / destroyed}

(iii) Stem cells, with the properties of embryonic stem cells, can be produced from a patient's own skin cells.

Discuss the benefits of using these stem cells to treat the patient.

(3)

means that embryos do not need to be used / a donor is not needed
they can {develop / differentiate / specialise} into any cell
replace damaged {cells / tissue}

(Total for Question 5 = 10 marks)

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6 (a) In the 19th century the destruction of wetland habitats caused the extinction of the bittern in the UK.

Figure 10 shows a bittern.

(Source: © Ildiko Laskay/Shutterstock)

Figure 10

Restoration of the habitats has led to the birds returning to the UK.

Male bitterns make a loud booming sound.

This allows the numbers of male bitterns to be counted.

In 1997, 11 males were counted and this increased to 221 males in 2021.

(i) Calculate the percentage increase in the number of males from 1997 to 2021.

(3)

221 – 11 or 210
calculation
210 ÷ 11 x 100

evaluation
1909 (%)

.....%

The bitterns are difficult to see in the reeds of the wetland habitat.

(ii) Give **one** benefit of this to the bittern.

(1)

increased survival rate / hidden from predators / hidden from prey

(iii) There is some concern that the bitterns in the UK are all closely related. This could make them susceptible to extinction.

Explain, using your knowledge of natural selection, why being closely related could make the bitterns susceptible to extinction.

(3)

all **genetically** similar / there is less variation (if there is a selection pressure they will {be susceptible / die} (due to the selection pressure) / **no** survival of the fittest

(b) Describe how selective breeding can be used to produce a large population of animals that are not closely related.

(2)

breed animals who are {not genetically similar / genetically different}

repeat the process over many **generations**

(c) Sex determination in birds is different from humans.

Males are homozygous Z and females are heterozygous ZW.

Complete the Punnett square to show how sex is determined in birds.

(2)

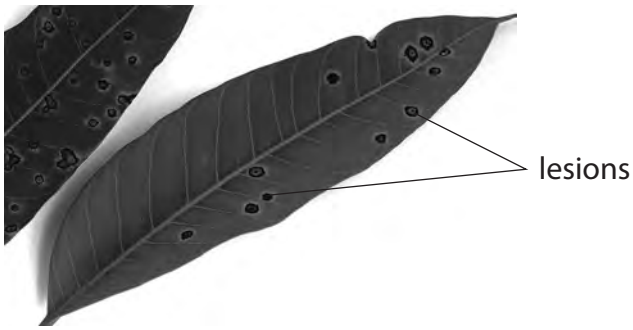
		male	
		Z	Z
female	Z	ZZ	ZZ
	W	ZW	ZW

(Total for Question 6 = 11 marks)

7 Plant growth can be affected by the environment, by pathogens, or both.

(a) A farmer found lesions on crop plants growing in one of their fields.

Figure 11 shows lesions on leaves.



(Source: © nang nang/Shutterstock)

Figure 11

*(i) Discuss how the cause of the lesions and their spread through the crops could be investigated.

You should refer to distribution analysis in your answer.

(6)

Fieldwork
check other plants in the field or other fields / find the distribution of affected plants
examine the area around the affected plants
examine the lesions on the leaf
take a sample the soil / take a sample of the plant
eliminate an environmental factor that could be causing the symptoms e.g. pollution / contamination / pests / mineral ion deficiency / pH
use of a pesticide / fertiliser to see if this clears the lesions
compare with known plant diseases
use books / internet / apps
use drones / mapping
to determine how the disease could be spread e.g. wind, animal or water spread
clustering indicating contact or soil spread
downwind indicating airborne
Testing
test the soil e.g. for pH / nutrient levels / mineral ion deficiency
test {swabs/samples} from the lesions / plant / cuttings
culture the pathogen
identify the {pathogen/bacteria/fungus/virus}
e.g. DNA analysis / microscope / monoclonal antibodies

(ii) The farmer decides to dig up the affected crop plants.

Give **one** precaution the farmer should take when digging up the affected crop plants.

(1)

ar protective footw

(b) The genetic material of some plant viruses is single-stranded RNA.

The RNA is copied by the infected host cell and acts as a mRNA molecule.

Describe how protein synthesis makes viral proteins from this mRNA.

(4)

translation occurs
mRNA {binds to the ribosome / goes to the ribosome}

three bases / triplet / codon /anticodon} codes for one amino acid
tRNA transfers the amino acid

(Total for Question 7 = 11 marks)

8 A student investigated the movement of water in potatoes.

The student used three identical cubes of potato.

The size of a cube is shown in Figure 12.

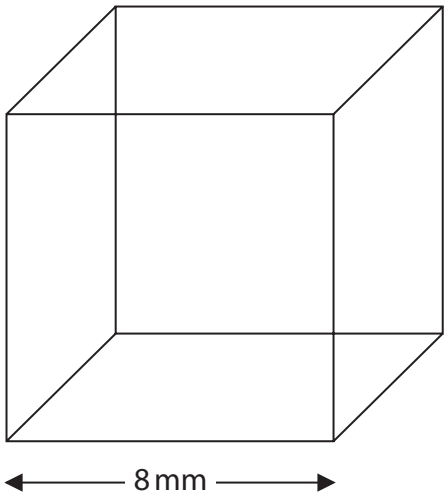


Figure 12

(a) (i) Calculate the volume of this cube.

Include the units in your answer.

(2)

8 x 8 x 8= 512
units
mm^3

One cube was placed in water and each of the other two cubes were placed in solutions with different concentrations of salt.

The cubes were left for 20 minutes.

Figure 13 shows the student's results.

	starting mass in grams	final mass in grams
water	0.95	1.08
dilute salt solution	0.95	0.98
concentrated salt solution	0.94	0.88

Figure 13

(ii) Give **one** way the student could ensure the measurement of the mass of the cubes is accurate.

(1)

dry the cube / check the balance is on zero

(iii) Explain the mass change in the cube in the concentrated salt solution.

(3)

mass has decreased
water has moved out (of the cube)
water moves by osmosis

(iv) The student wanted to find the concentration of salt solution where the potato cube did not change mass.

Describe how the student could modify this investigation to find this concentration.

(3)

(repeat with) different salt concentrations between the dilute and the concentrated solution

make repeated readings **at each concentration**

(b) Explain why potato cells do not burst when placed in water.

(2)

(potato cells) have a cell wall

which provides {structure / support} / which contains cellulose

(Total for Question 8 = 11 marks)

9 (a) A person's mass is partially influenced by the alleles they inherit from their parents.

Give **two** other factors that can influence a person's mass.

(2)

environmental factors

diet / food intake

(b) Figure 14 shows the data obtained from a patient by a doctor doing a health check.

The guidance used by the doctor is also listed in Figure 14.

measurement	data	guidance
BMI	28	18–25 healthy 26–30 overweight 30+ obese
waist : hip ratio	0.85	<0.9 healthy >0.9 abdominal obesity
alcohol units	3–4 units per day	<14 units per week
number of cigarettes smoked	0	do not smoke or vape

Figure 14

Comment on the data and the health risks to this patient.

(4)

BMI is in the overweight range
waist:hip is in the healthy range
suggesting that the fat is not
around the vital organs / the
patient may have a high
percentage of muscle
patient is consuming too
much alcohol which {affects
the liver / causes liver
damage}
not smoking reduces the risk
of {cardiovascular disease /
lung disease / stroke}

*(c) The doctor also tested the reaction time of the patient.

Describe the structure and function of a reflex arc.

(6)

Structure
stimulus detected by a receptor
receptor transfers the signal to the sensory neurone
sensory neurone transfers the signal to the CNS / brain / spinal cord / relay neurone
signal is transferred to a motor neurone
myelin sheath speeds up the transmission of the electrical impulse
the motor neurone transmits the signal to the effector
the effector produces the response
Function
rapid response
to protect the body / response to danger
involuntary automatic response

(Total for Question 9 = 12 marks)

10 (a) Haemophilia is a sex-linked genetic disorder caused by a recessive allele on the X chromosome.

(i) Describe the phenotype of a male with the genotype X^hY.

(1)

the male is affected / has haemophilia

(ii) Complete the Punnett square to show the genotypes of a male who is not affected by haemophilia, a female who is a carrier of the haemophilia allele and their possible offspring.

Use the letters H and h for the alleles.

(3)

	male	
female	X^H	Y
X^H	X^{HH}	X^HY
X^h	X^{Hh}	X^hY

(b) Some genetic disorders occur because the body does not produce enough of a protein.

(i) Describe how a mutation in the non-coding region of a gene can lead to the production of less protein.

(2)

RNA polymerase {binds less well / cannot bind}
less mRNA (is produced)

(ii) Which describes the cause of a protein folding incorrectly?

(1)

- ☒ **A** a mutation in the coding region of a gene changes the sequence of the amino acids.
- ☒ **B** a mutation in the non-coding region of the gene changes the sequence of the amino acids.
- ☒ **C** a mutation in the coding region of a gene changes the shape of the tRNA molecule.
- ☒ **D** a mutation in the non-coding region of the gene changes the shape of the tRNA molecule.

(c) Monoclonal antibodies can be used in the diagnosis of genetic disorders and pregnancy testing.

Describe how a pregnancy test uses monoclonal antibodies to show that a woman is pregnant.

(4)

(pregnancy test detects) a **hormone** in **urine** hormone/antigen) binds to the antibody (on the test) which have a coloured (bead) attached to them a line appears because) there are immobile antibodies (in the test window)

(Total for Question 10 = 11 marks)

TOTAL FOR PAPER = 100 MARKS

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