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Candidate surname				Other names			
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Tuesday 8 January 2019							
Afternoon (Time: 2 hours)				Paper Reference 4BI0/1B 4SC0/1B			
Biology Unit: 4BI0 Science (Double Award) 4SC0 Paper: 1B							
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.*
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is 120.
- 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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Answer ALL questions.

- 1 (a) Diagram 1 shows a section through an eye with parts labelled A to F.

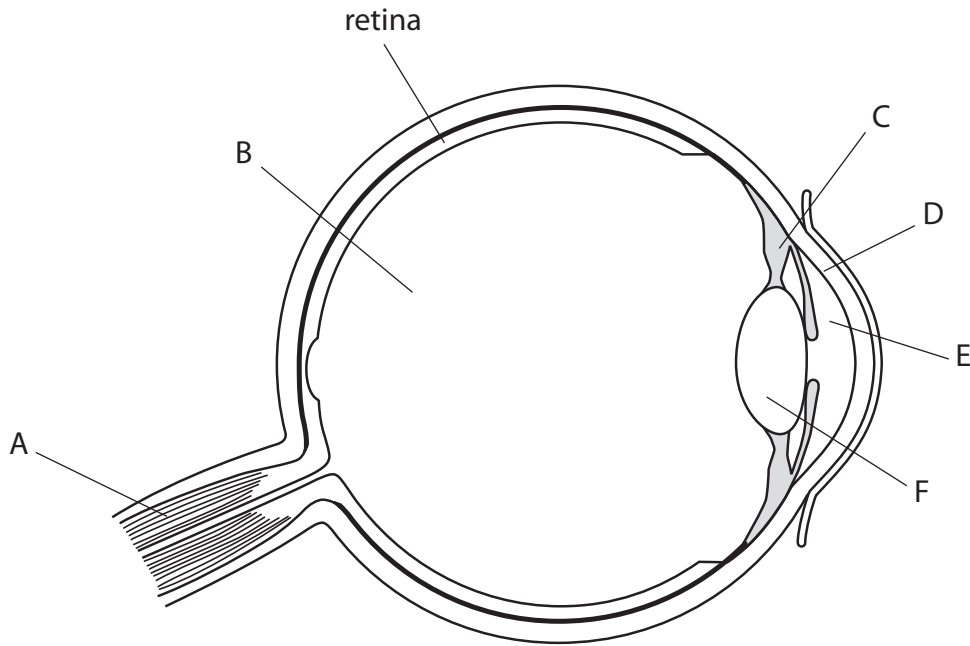


Diagram 1

- (i) Give the letter that labels the cornea.

(1)

- (ii) Give the letter that labels a jelly-like fluid.

(1)

- (iii) Give the function of part A.

(1)

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(b) Diagram 2 shows a section through the eye of a person with a detached retina.

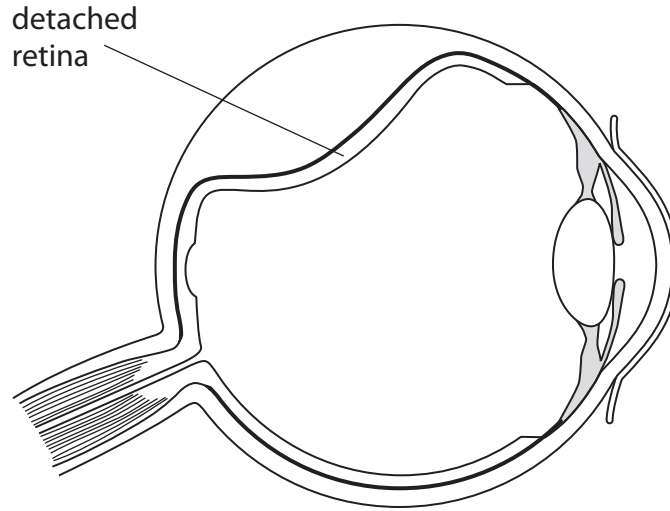


Diagram 2

Suggest how a detached retina could affect vision.

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(Total for Question 1 = 5 marks)

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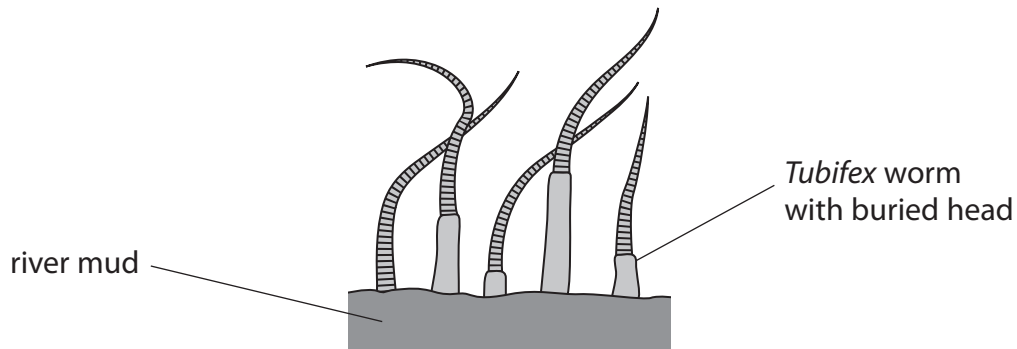
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2 *Tubifex* are worms that live in mud at the bottom of rivers and lakes.

The diagram shows some *Tubifex* worms living in river mud.



Bacteria live in the mud and feed on dead plant material.

Tubifex worms bury their heads in the mud to feed on these bacteria.

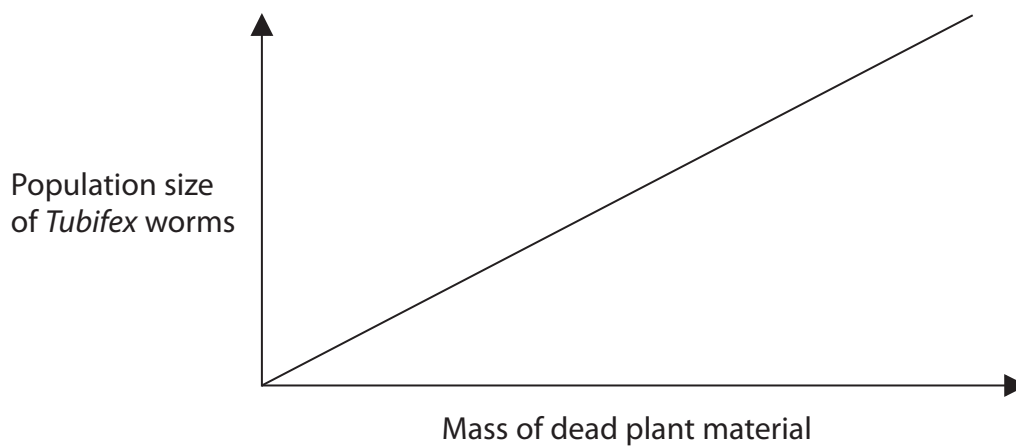
Tubifex worms are eaten by fish.

(a) Use this information to draw a food chain that includes *Tubifex* worms.

(2)

(b) A scientist investigates the relationship between the mass of dead plant material in the river mud and the population size of *Tubifex* worms.

The graph shows the scientist's results.



(i) Explain the relationship shown by the graph.

(2)

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(ii) *Tubifex* worms contain haemoglobin. Some other species of worms do not contain haemoglobin.

When the mass of dead plant material in river mud is very high, the population size of the other species decreases but the *Tubifex* population size continues to increase.

Explain why the *Tubifex* population continues to increase while populations of other species decrease.

(4)

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(c) Suggest how a scientist could measure the mass of organic material in a sample of river mud.

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(Total for Question 2 = 11 marks)

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3 Sperm cells are involved in fertilisation.

(a) The diagram shows a human sperm cell.



(i) Label the nucleus of this sperm cell.

(1)

(ii) State the number of chromosomes in the nucleus of this sperm cell.

(1)

(iii) State what is meant by the term **fertilisation**.

(1)

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(b) Dairy farmers want their cows to produce more female offspring. Scientists have developed a method to increase the percentage of female offspring from cows.

(i) Suggest why dairy farmers want their cows to produce more female offspring.

(1)

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(ii) In the scientists' method, sperm cells containing X chromosomes are separated from sperm cells containing Y chromosomes.

This is their method.

- add sperm cells to a solution of dye that stains DNA, so that the DNA reflects light
- pass the sperm cells through a cell sorter
- shine light on the sperm cells as they pass through the sorter
- separate the sperm cells into different tubes depending on the amount of light they reflect

Suggest how the scientists' method can separate sperm cells containing an X chromosome from those containing a Y chromosome.

(2)

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(c) Scientists carried out an investigation to find out how successful a cell sorter is in separating X and Y chromosomes.

(i) Sperm cells from the cell sorter produced 43 females out of a total of 44 offspring.

Calculate the success of producing females as a percentage of the total number of offspring.

(2)

success = %

(ii) Give the control experiment that should be used in this investigation.

(1)

(iii) Predict the results of the control experiment.

(1)

(Total for Question 3 = 10 marks)



4 Katydid is an insect that is green and looks like the leaves that it feeds on.

The photograph shows a katydid.



© 2017 The Song of Insects

(a) Explain how katydids affect the growth of the plants that they feed on.

(4)

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(b) Explain how katydids have evolved to look like leaves.

(5)

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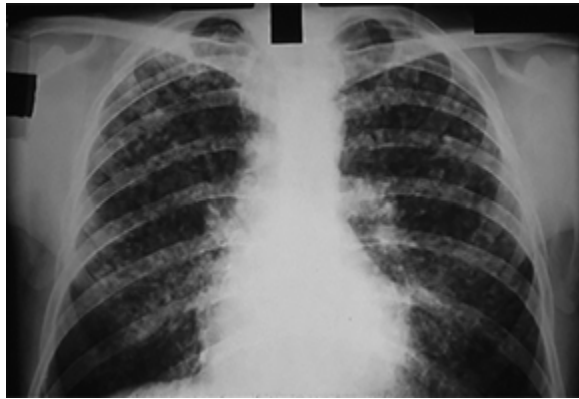
(Total for Question 4 = 9 marks)



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

5 Pneumoconiosis is a lung disease caused by breathing in coal dust particles.

The X-ray shows the lungs of a person with pneumoconiosis.



© BMJ Publishing Group 2017

Coal dust particles collect in the alveoli and cannot be removed.

Cells grow around these coal dust particles, forming tissue that traps the particles.

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

(1)

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(b) Suggest why pneumoconiosis reduces the ability of a person to exercise.

(5)

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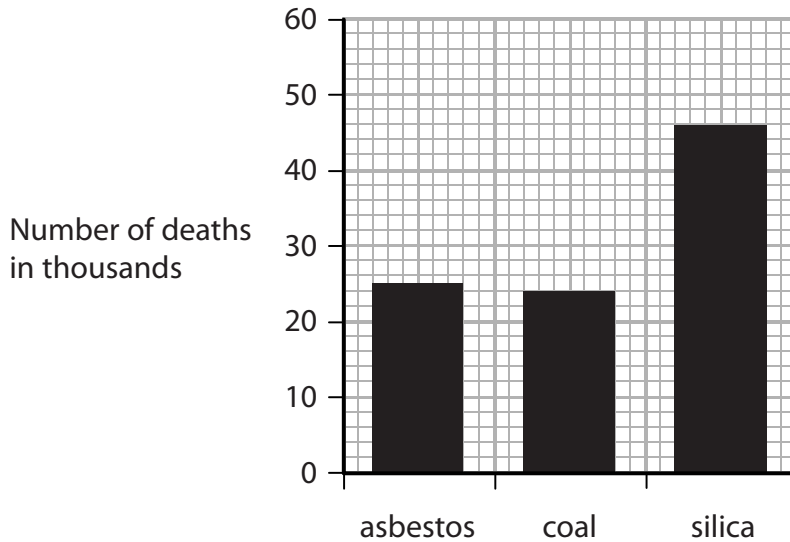
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- (c) In the UK, in 2013, breathing in dust particles resulted in diseases that caused 260 000 deaths.

The graph shows the number of these deaths caused by breathing in dust particles of asbestos, coal and silica.



- (i) Calculate the number of deaths in the UK, in 2013, caused by breathing in dust particles other than asbestos, coal or silica.

(2)

number of deaths =

- (ii) Give two conclusions that can be made from the data in the graph.

(2)

1

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(Total for Question 5 = 10 marks)



6 Yeast is a fungus used in the production of beer.

(a) (i) Name the part of a yeast cell that is made of chitin.

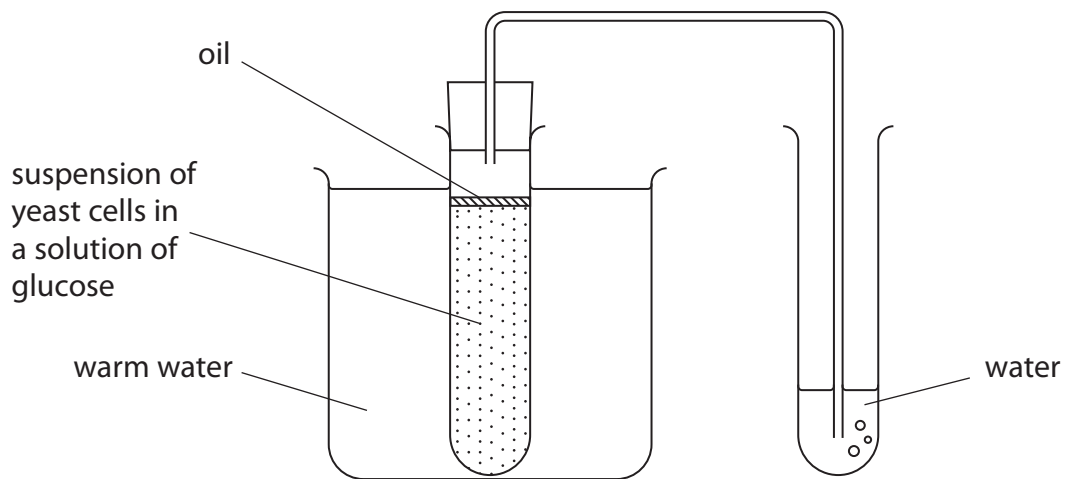
(1)

(ii) Name the carbohydrate stored in the cytoplasm of a yeast cell.

(1)

(b) In beer production, yeast releases carbon dioxide as a waste product.

A student uses this apparatus to investigate the effect of temperature on carbon dioxide production in yeast.



The student counts the number of carbon dioxide bubbles released per minute at different temperatures.

The table shows the student's results.

Temperature in °C	Number of bubbles released per minute
20	3
25	5
31	7
36	6
40	14
44	20
52	1

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(i) Describe how the student could change the temperature of the water during the investigation. (1)

(ii) Describe how the student makes sure that the yeast cells respire anaerobically. (1)

(iii) Give the independent variable in this investigation. (1)

(iv) Give three ways in which the student could improve this investigation. (3)

1

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(Total for Question 6 = 8 marks)

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7 (a) The table lists descriptions of what happens in different human organs.

Complete the table by giving the correct organ for each description.

The first one has been done for you.

(4)

Description	Organ
pumps blood	heart
forms oxyhaemoglobin	
stores urine	
secretes oestrogen	
forms sperm	

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(b) Describe the structure of the kidney.

Refer to the structure of the nephron in your answer.

(5)

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(Total for Question 7 = 9 marks)



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

8 Plants produce their own food by photosynthesis.

(a) Give the balanced chemical symbol equation for photosynthesis.

(2)

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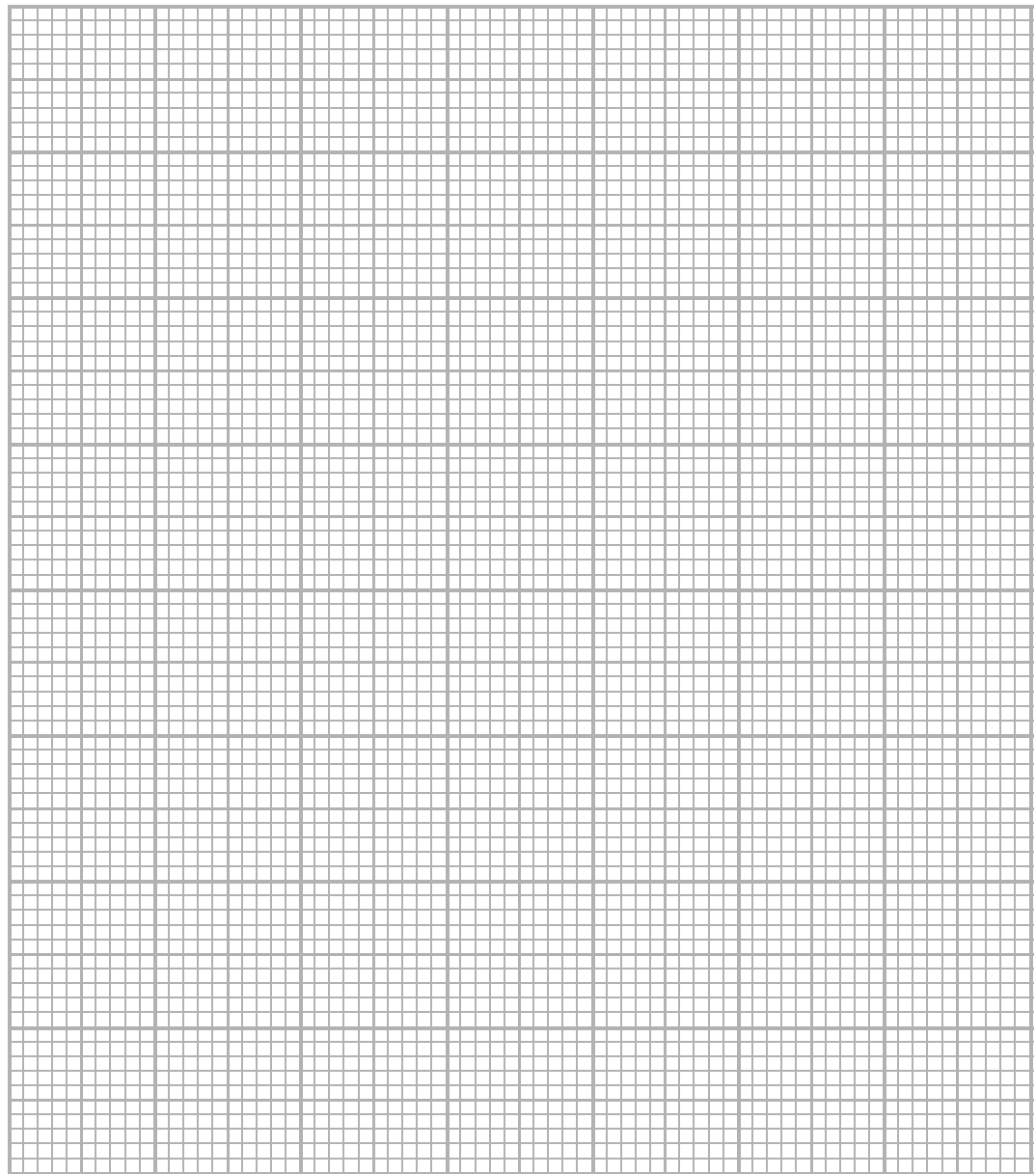
(b) The table gives data from an investigation that measured the mass of carbon dioxide (CO₂) released globally between 1990 and 2014.

Year	Mass of CO ₂ in millions of tonnes
1990	6000
1994	6200
1998	6600
2002	7000
2006	8300
2010	9100
2014	9900



- (i) Plot a line graph to show the mass of CO₂ released globally between 1990 and 2014.
Use a ruler to join your points with straight lines.

(5)



- (ii) Calculate the percentage increase in the mass of CO₂ released globally between 1990 and 2014.

(2)

percentage increase = %

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(c) Give three negative effects of increased levels of CO₂ in the atmosphere.

(3)

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(d) The concentration of CO₂ in the atmosphere has increased.

Explain how plants may limit this increase.

(2)

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(Total for Question 8 = 14 marks)



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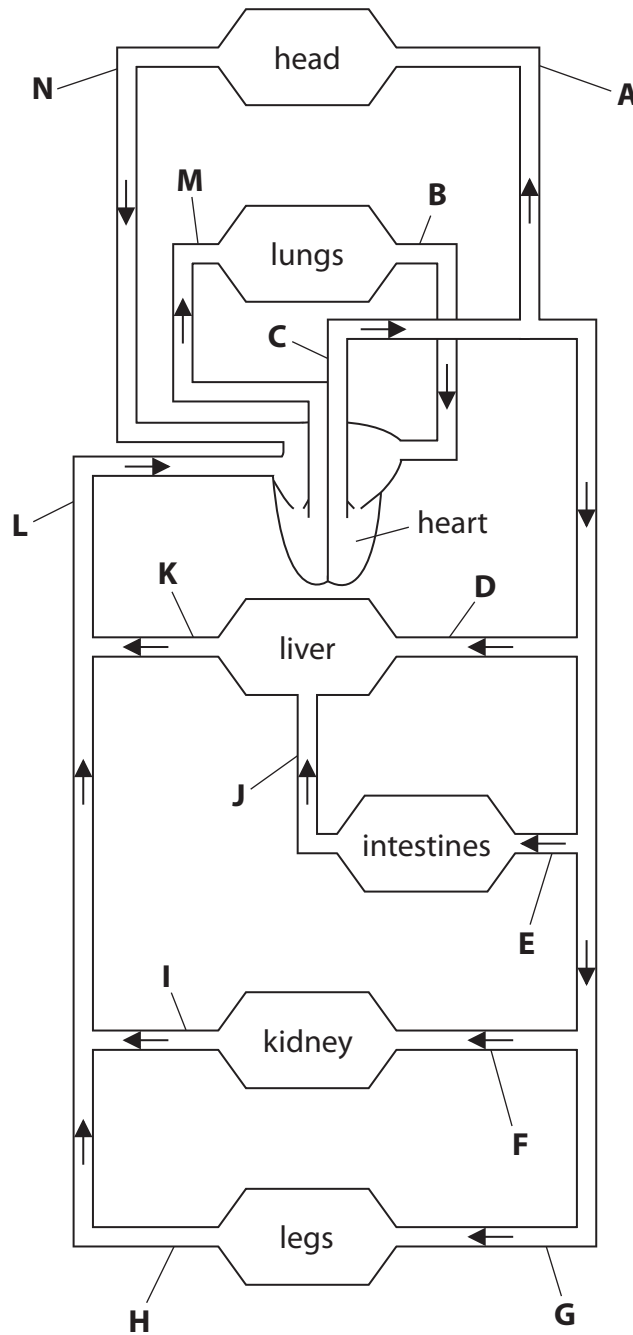
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9 The diagram shows the human circulatory system, with blood vessels labelled A to N.



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(a) The table lists some of the blood vessels in the human circulatory system.

Complete the table by giving the correct letter for each blood vessel.

The first one has been done for you.

(4)

Blood vessel	Letter
aorta	C
hepatic vein	
pulmonary artery	
renal artery	
vena cava	

(b) Use letters from the diagram to answer these questions.

(i) Which blood vessel contains blood with the highest concentration of oxygen?

(1)

(ii) Which blood vessel carries blood at the highest pressure?

(1)

(iii) Which blood vessel is an artery that carries blood with a high concentration of carbon dioxide?

(1)



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(c) Scientists have developed a synthetic material that can be used to replace damaged arteries.

State two properties that this synthetic material should have so that it can act as a suitable replacement for damaged arteries.

(2)

1

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(Total for Question 9 = 9 marks)



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10 The body controls its internal environment.

One example of this is control of the concentration of the blood.

(a) (i) Give the name for controlling the internal environment.

(1)

(ii) Give the name for controlling the concentration of the blood.

(1)

(b) A person entering a warm environment may become dehydrated as the concentration of the blood changes.

Explain how the concentration of their blood is restored.

(4)

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(c) A person's response to a changing environment involves communication by nerves and by hormones.

State three differences between communication by nerves and communication by hormones.

(3)

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(Total for Question 10 = 9 marks)



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

11 Machado-Joseph disease is a rare genetic condition that affects the nervous system.

The condition is caused by a dominant allele and results in lack of control of motor coordination, reflexes and eye movements.

(a) (i) Explain what is meant by the term **dominant allele**.

(2)

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(ii) The symptoms of Machado-Joseph disease do not become obvious until the person is more than 40 years old.

Suggest why the late development of symptoms makes it difficult to reduce the number of people born with the condition.

(2)

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(b) A man who is heterozygous for this condition has a child with a woman who is homozygous recessive.

Use a genetic diagram to show the genotypes of these parents, the gametes they produce and the genotypes and phenotypes of any possible offspring.

Use the letter D for the dominant allele and d for the recessive allele.

(4)

Genotypes of parents

Gametes

Genotypes of offspring

Phenotypes of offspring

(c) Machado-Joseph disease may have originated from a mutation in one person.

Explain what is meant by the term **mutation**.

(2)

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(Total for Question 11 = 10 marks)



12 The passage describes carbohydrates used in different organisms.

Complete the passage by writing a suitable word in each blank space.

(10)

Carbohydrates contain the elements carbon, hydrogen and

Plant cell walls are made of the carbohydrate,

Plants store carbohydrate as starch. The starch in plant cells is

so it has no osmotic effect on the cell. The simple test for starch is to add a few drops

of solution to a sample. If the test is positive, the solution

changes colour from to

The storage carbohydrate in animals is, which is found

mainly in the muscles and in the If the blood glucose

concentration increases then the hormone,, is released

by the This causes the conversion of blood glucose

into the storage carbohydrate.

(Total for Question 12 = 10 marks)

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13 Micropropagation (tissue culture) is a method in which small pieces of plants (explants) are grown *in vitro* using nutrient media.

Design an investigation to find out if adding more amino acids to the nutrient media increases the growth of the plants.

Your answer should include experimental details and be written in full sentences.

(6)

Area with horizontal dotted lines for writing the answer.

(Total for Question 13 = 6 marks)

TOTAL FOR PAPER = 120 MARKS



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