Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Biology

Advanced Subsidiary
Unit 1: Lifestyle, Transport, Genes and Health

Tuesday 6 January 2015 – Morning
Time: 1 hour 30 minutes

Paper Reference
WBI01/01

You do not need any other materials.

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 80.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*
- Candidates may use a calculator.

Advice

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

Turn over ▶

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P 4 5 0 2 8 A 0 1 2 8

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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 The nucleic acids, DNA and RNA, are involved in cell replication and protein synthesis.

(a) DNA and RNA are large polynucleotides formed by joining many mononucleotides together.

Put a cross ☒ in the box that completes each of the following statements.

(i) The sugar in a mononucleotide of RNA is

(1)

☒ **A** deoxyribose

☒ **B** glucose

☒ **C** ribose

☒ **D** ribulose

(ii) In a DNA double helix, the two strands are held together by

(1)

☒ **A** covalent bonds between bases

☒ **B** covalent bonds between sugar molecules

☒ **C** hydrogen bonds between bases

☒ **D** hydrogen bonds between sugar molecules

(iii) The base present in RNA but **not** present in DNA is

(1)

☒ **A** cytosine

☒ **B** guanine

☒ **C** thymine

☒ **D** uracil

(iv) The mononucleotides in a molecule of mRNA are joined together by

(1)

☒ **A** disulphide bridges

☒ **B** glycosidic bonds

☒ **C** peptide bonds

☒ **D** phosphodiester bonds

(v) The complementary base that pairs with guanine is

(1)

☒ **A** adenine

☒ **B** cytosine

☒ **C** guanine

☒ **D** uracil

(b) Meselson and Stahl carried out an experiment that demonstrated the semiconservative replication of DNA.

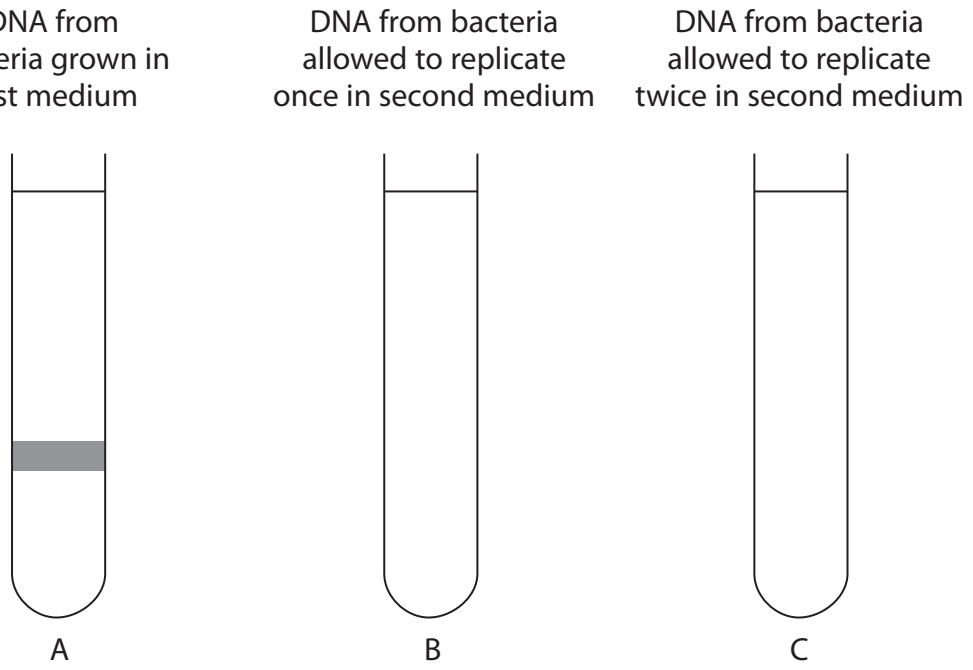
(i) Explain the meaning of the term **semiconservative replication**.

(2)

(ii) Meselson and Stahl grew bacteria in a medium containing one isotope of nitrogen. These bacteria were then transferred to a second medium containing a different isotope of nitrogen.

The DNA extracted from the bacteria was then separated according to its density.

Draw bands on tubes B and C to show the results of this experiment.



(2)

(Total for Question 1 = 9 marks)

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2 Lipids such as triglycerides and polysaccharides such as glycogen are energy storage molecules. These molecules can be used during exercise.

(a) Triglycerides are a type of lipid formed when three fatty acid chains combine with a glycerol molecule.

(i) Put a cross ☒ in the box that completes the following statement. Each fatty acid chain is joined to glycerol by

(1)

☒ **A** an ester bond formed by a condensation reaction

☒ **B** an ester bond formed during hydrolysis

☒ **C** a peptide bond formed by a condensation reaction

☒ **D** a peptide bond formed during hydrolysis

(ii) Describe how the structure of a saturated lipid differs from that of an unsaturated lipid.

(2)

(b) Describe the structure of glycogen.

(3)

(c) The table below shows the effect of the intensity of exercise on the percentage of energy obtained from lipids and carbohydrates.

Intensity of exercise / arbitrary units	Percentage of energy obtained (%)	
	From lipids	From carbohydrates
20	60	40
40	50	50
60	30	70
80	20	80
100	0	100

Using the information in the table, describe the effect of the intensity of exercise on the percentage of energy obtained from lipids and carbohydrates.

(3)

(Total for Question 2 = 9 marks)

3 Atherosclerosis is a potentially serious condition that affects millions of people each year. There is a link between saturated fats in the diet and atherosclerosis.

(a) Read through the passage on atherosclerosis, then write on the dotted lines the most appropriate words to complete the passage.

(5)

When atherosclerosis develops, fatty deposits called ..... form.

These deposits cause affected blood vessels called ..... to

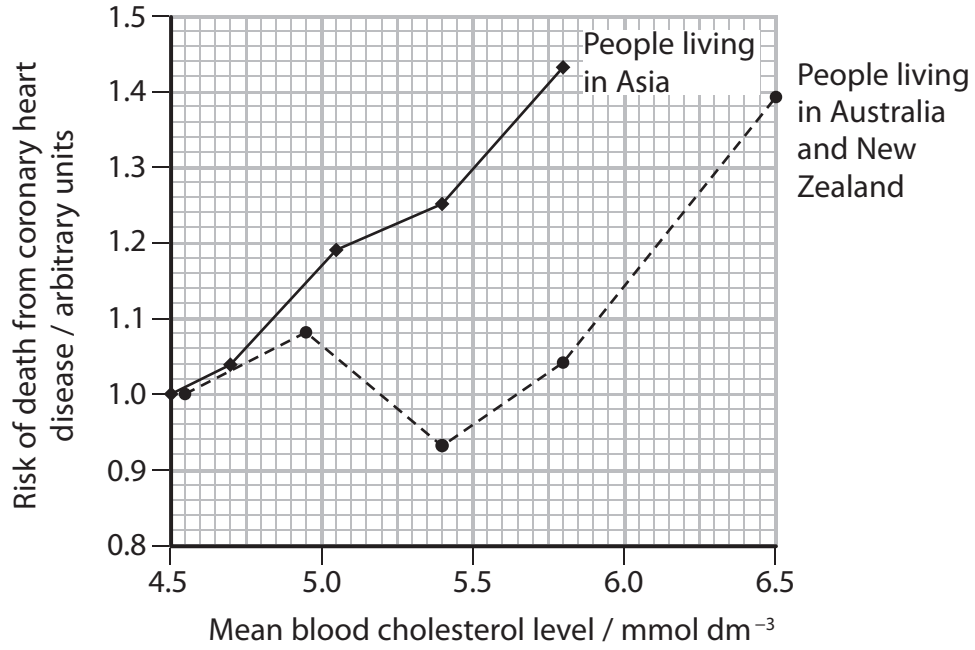
harden and ....., reducing the supply of .....

to the tissues. This can cause a heart attack or, if the .....

is affected, it can cause a stroke.

(b) It has been suggested that high blood cholesterol levels can cause cardiovascular disease (CVD). Coronary heart disease is one type of CVD.

The graph below shows the relationship between mean blood cholesterol level and the risk of death from coronary heart disease in two groups of people.



(i) Describe the relationship between blood cholesterol level and the risk of death from coronary heart disease for people living in Asia.

(1)

(ii) Describe how this relationship differs from that shown for people living in Australia and New Zealand.

(2)

(iii) Suggest **one** explanation for the difference in the relationship for these two groups of people.

(1)

(iv) Suggest how the information in the graph could be used to improve the health of people living in Asia.

(1)

(Total for Question 3 = 10 marks)

4 Phenylketonuria (PKU) is a genetic disorder. People with PKU are unable to synthesise the active form of the enzyme phenylalanine hydroxylase (PAH).

This enzyme is required to convert one amino acid, phenylalanine, into another amino acid, tyrosine.

(a) In the space below, draw the structure of an amino acid.

(2)

*(b) Describe how RNA is involved in the synthesis of proteins.

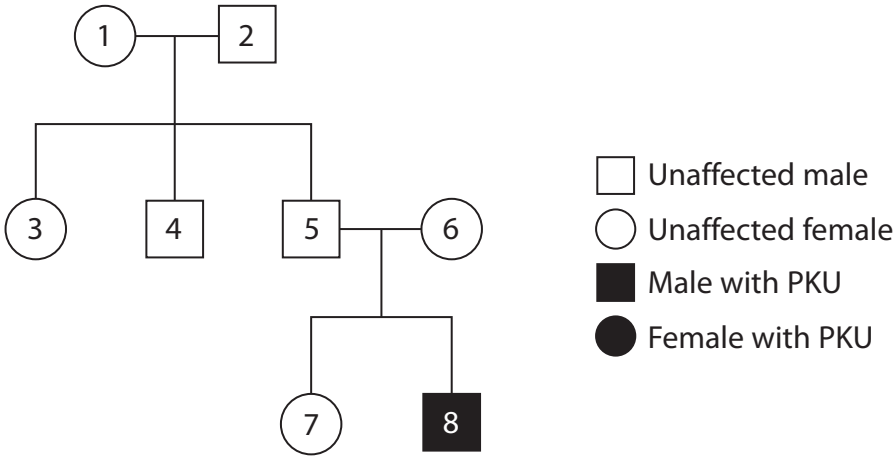
(5)

(c) Explain how a change in the DNA sequence of the PAH gene might lead to a loss of enzyme activity.

(3)

(d) Cystic fibrosis and albinism are recessive genetic disorders. PKU is also a recessive genetic disorder.

The genetic pedigree diagram below shows the inheritance of PKU in one family.



Explain why this pedigree diagram shows that individuals 5 and 6 are carriers of the PKU disorder.

(2)

(Total for Question 4 = 12 marks)

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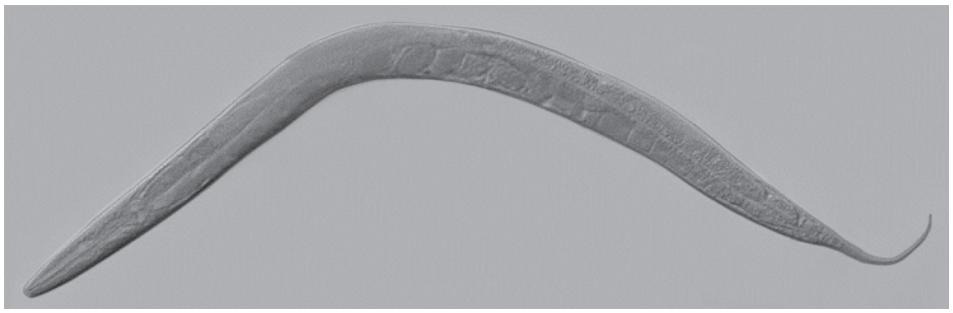
5 Living organisms exchange gases with their environment.

(a) Describe how the structure of the human lungs is adapted for efficient gas exchange.

(4)

(b) The photograph below shows *C. elegans*, a small, free-living nematode. An adult *C. elegans* consists of about 1000 cells.



Magnification ×100

Suggest why *C. elegans* does not need a specialised gas exchange system.

(2)

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(Total for Question 5 = 6 marks)

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6 Cell membranes contain a bilayer of phospholipid molecules.

(a) Explain how phospholipid molecules form a bilayer.

(3)

(b) The fluid mosaic model can be used to explain the properties of a cell membrane.

Explain what is meant by the term **fluid mosaic**.

(2)

(c) A student carried out an experiment to investigate the effect of alcohol on the permeability of beetroot cell membranes.

Beetroot cells contain a red pigment.

One cube of beetroot was placed in a tube containing 5 cm^3 of water and left for 30 minutes.

After 30 minutes the cube of beetroot was removed and the intensity of the colour of the liquid was measured using a colorimeter.

A colorimeter is an instrument that can be used to measure the intensity of the colour of a liquid.

The procedure was repeated using four different concentrations of alcohol instead of water.

The results are shown in the table below.

Concentration of alcohol (%)	Intensity of colour / arbitrary units
0	0.03
10	0.03
20	0.33
30	0.65
40	0.90

(i) Using the information in the table, describe the effect of alcohol on the permeability of beetroot cell membranes.

(2)

(ii) The temperature of the solutions and the size of the beetroot cubes should be controlled in this investigation.

Explain how each of the following would affect the results of this investigation.

(4)

An increase in temperature .....

.....

.....

.....

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.....

A decrease in size of the beetroot cube .....

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(Total for Question 6 = 11 marks)

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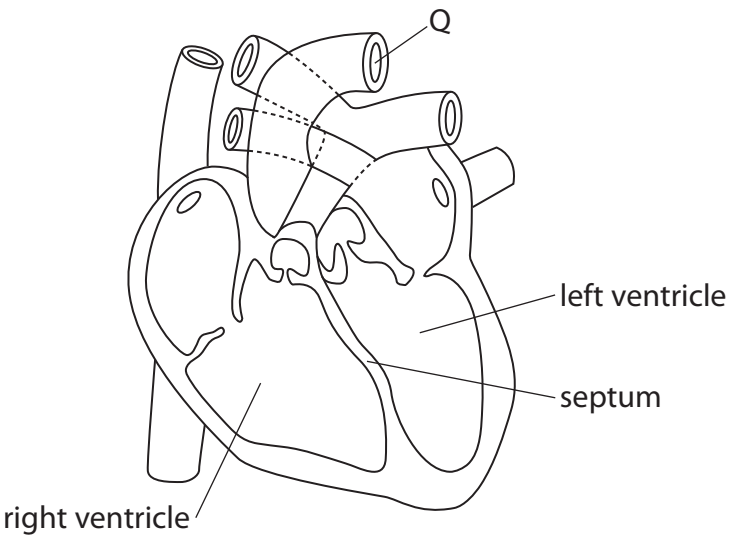
7 The heart is part of the mammalian circulatory system.

The diagram below shows a section through the human heart.



(a) Put a cross ☒ in the box that completes the following statement.
The blood vessel labelled Q in the diagram is the

(1)

- ☒ **A** aorta
- ☒ **B** coronary artery
- ☒ **C** pulmonary vein
- ☒ **D** vena cava

(b) Explain how the structure of a capillary is related to its function.

(2)

*(c) Describe the role of the heart valves in the cardiac cycle.

(6)

(d) A small number of babies are born with a hole in the septum that separates the left and right ventricles. If the hole is not repaired these babies may not survive.

Suggest why these babies may not survive.

(2)

(Total for Question 7 = 11 marks)

8 One role of the cell membrane is to control the movement of molecules and ions.

(a) In an experiment a student placed red blood cells in salt solutions of different concentrations.

When placed in solutions with a low salt concentration, the cells were observed to swell and burst.

The results of the experiment are given in the table below.

Salt concentration / g dm^{-3}	Percentage of red blood cells that burst (%)
3.0	100
3.5	98
4.0	88
4.5	25
5.0	4
5.5	0
6.0	0

(i) Suggest how the student could have made sure that the results were reliable.

(1)

(ii) Suggest how the student would modify the experiment to find the concentration of salt solution that burst 50% of the cells.

(2)

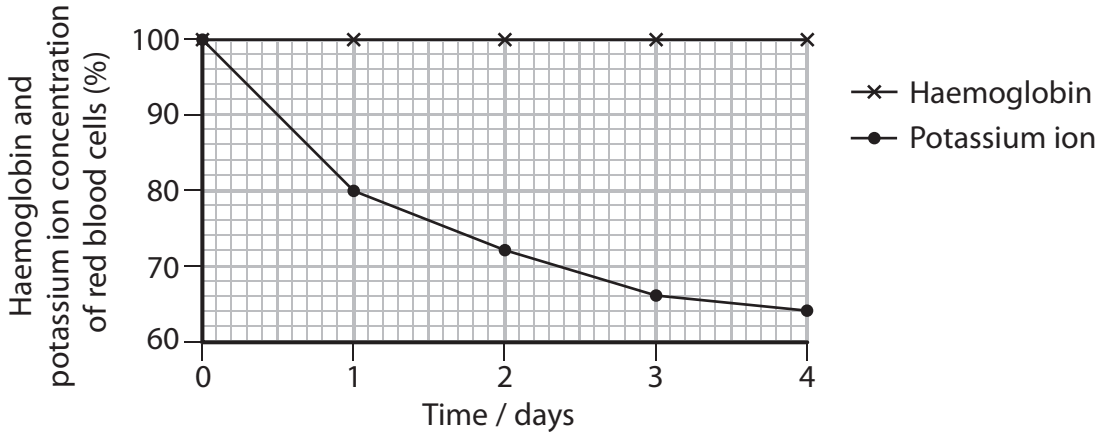
(iii) Explain why the red blood cells swell when placed in solutions with a low salt concentration.

(3)

(b) Another student investigated the haemoglobin and potassium ion concentration in red blood cells that had been stored.

Red blood cells were stored at 4 °C for four days. Each day the concentrations of haemoglobin and potassium ions were measured.

The results are shown in the graph below.



(i) Explain the effect four days storage at 4 °C has on the concentration of haemoglobin and potassium ions in the red blood cells.

(3)

(ii) After four days, glucose was added to half of the cells. Both samples of red blood cells were stored for 12 hours at 37 °C.

After 12 hours, the concentration of potassium ions in the red blood cells was measured.

The results are shown in the table below.

Treatment	Red blood cell potassium ion concentration (%)
Red blood cells only	60
Red blood cells with glucose	100

Using the information in the graph and table, explain the changes in potassium ion concentration in red blood cells.

(3)

(Total for Question 8 = 12 marks)

TOTAL FOR PAPER = 80 MARKS

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