Pearson Edexcel
International
Advanced Level

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

Tuesday 11 October 2016 – Morning
Time: 1 hour 30 minutes

Paper Reference
WBI01/01

You must have:
Calculator, pencil, 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*.

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 ▶

PEARSON

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 Mammals have a heart and circulation.

(a) The heart pumps blood.

(i) Place a cross in the box that gives the position of the heart valves during ventricular diastole.

(1)

		Atrioventricular valves	Semilunar valves
☒	**A**	closed	closed
☒	**B**	closed	open
☒	**C**	open	closed
☒	**D**	open	open

(ii) Place a cross in the box that identifies when the pressure in the left ventricle will be highest.

(1)

☒ **A** at the end of systole

☒ **B** at the start of systole

☒ **C** in the middle of diastole

☒ **D** in the middle of systole

(iii) Place a cross in the box that gives the relative concentrations of carbon dioxide in the blood.

(1)

		Highest concentration	Lowest concentration
☒	**A**	aorta	pulmonary vein
☒	**B**	aorta	vena cava
☒	**C**	vena cava	pulmonary artery
☒	**D**	vena cava	pulmonary vein

(b) The diagram shows a cross section of an aorta.
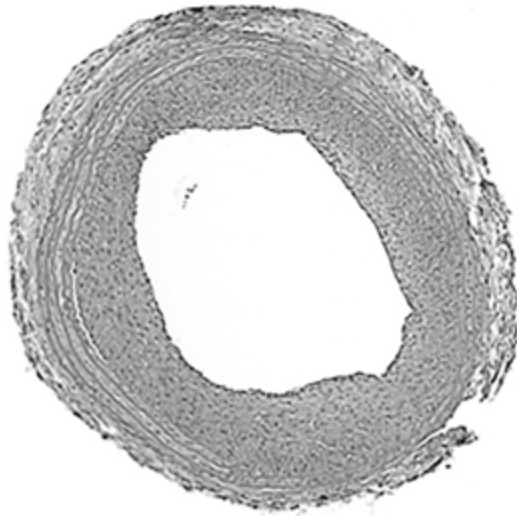
Magnification ×3

(i) Measure the maximum and minimum diameters of the lumen.

Use these measurements to calculate a mean value.

(1)

Mean diameter ....mm

(ii) Use the mean diameter to calculate the area of the lumen, using the formula

$a = \pi r^2$ where π is 3.14

(2)

Area ....mm^2

(iii) Explain how the structure of an artery is related to its function.

(3)

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(c) Explain why mammals need a blood circulation system.

(4)

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(Total for Question 1 = 13 marks)

2 Permethrin is a chemical used to kill invertebrate animals.

The graph below shows the results of an investigation into the effect of permethrin on the heart rate of *Daphnia*.
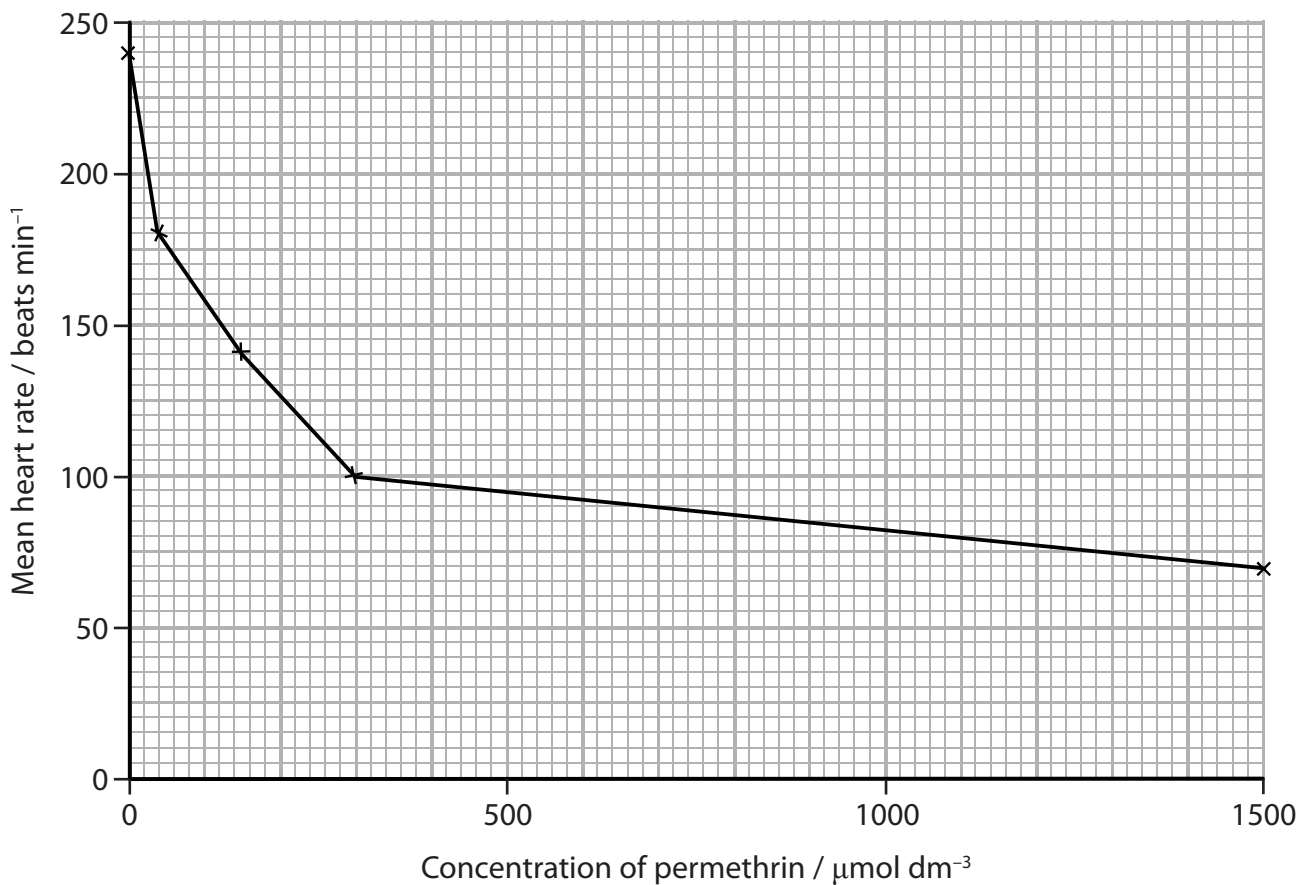
(a) Calculate the percentage change in the heart rate of *Daphnia* when the concentration of permethrin increases from 0 to 300 μmol dm^{-3}.

(2)

....%

(b) Describe how an experiment could be carried out to obtain these results.

(3)

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(c) Suggest **two** reasons why *Daphnia* were used in this investigation.

(2)

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2 ....

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(Total for Question 2 = 7 marks)

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3 Obesity is a risk factor in the development of cardiovascular disease (CVD).

(a) Pima Indians living in Arizona are genetically very similar to those living in Mexico.

The table below shows the frequency of obesity in Pima Indians in these two locations.

Location of Pima Indians	Frequency of obesity (%)
Arizona	30
Mexico	13

(i) Suggest why there is a higher frequency of obesity in Pima Indians living in Arizona than in Pima Indians living in Mexico.

(2)

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(ii) Scientists are studying Pima Indians to investigate the causes of CVD.

State **two** risk factors, other than obesity and genetic factors, associated with developing CVD.

(2)

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2 ....

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(b) Body mass index (BMI) is one way of identifying individuals that are overweight or obese.

BMI is calculated using the formula below.

$$BMI = \frac{\text{(mass in kilograms)}}{\text{(height in metres)}^2}$$

A person has a mass of 70 kg and a height of 1.65 m.

Place a cross ⊠ in the box that gives the BMI classification for this person.

(1)

		BMI	Classification
⊠	**A**	< 18.5	underweight
⊠	**B**	18.5 to 25.0	healthy
⊠	**C**	25.1 – 30.0	overweight
⊠	**D**	> 30.0	obese

(c) The results of a different study on the relationship between CVD and body mass index are shown in the graph below.

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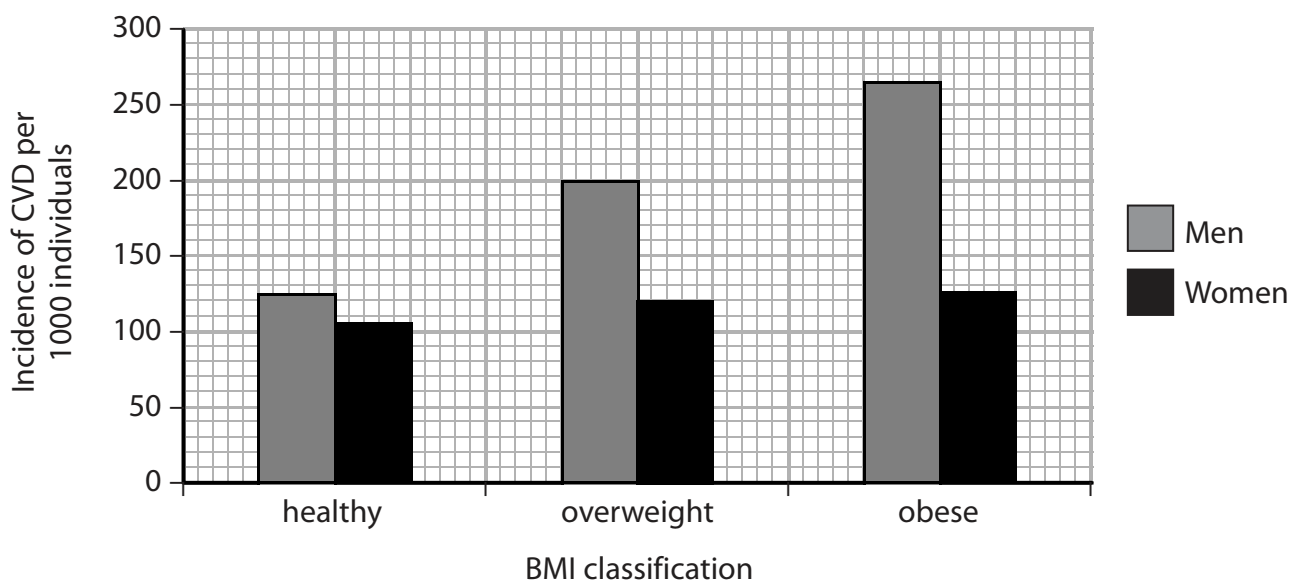
(i) Using the information in the graph, describe the relationship between body mass index and the incidence of CVD.

(2)

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(ii) Suggest why BMI was used in this study.

(2)

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(iii) Suggest why CVD is expressed as incidence per 1000.

(1)

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(Total for Question 3 = 10 marks)

4 Polycystic kidney disease (PKD) is a rare inherited childhood condition where the development of the kidneys and liver is abnormal.

The pedigree diagram below shows the inheritance pattern for one type of PKD.

Key
- ⬤ Affected female
- ◯ Unaffected female
- ◼ Affected male
- ☐ Unaffected male
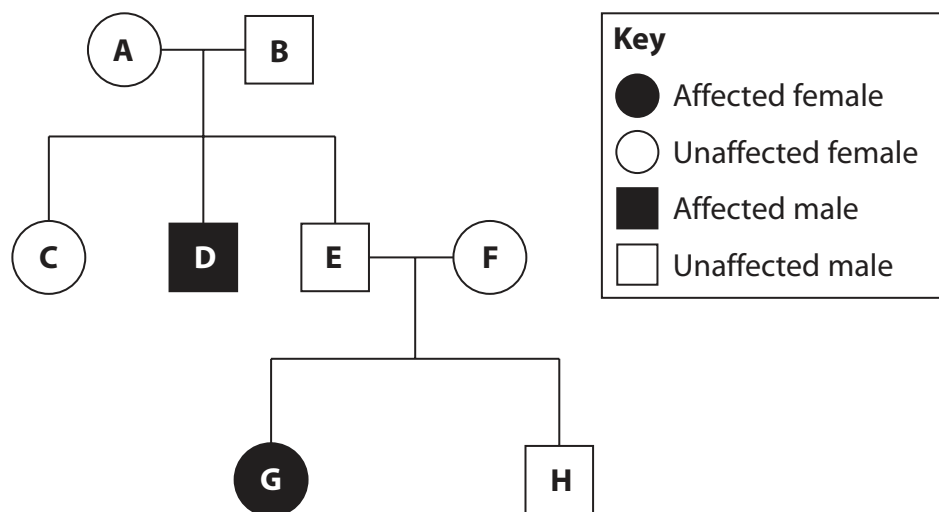
(a) Put a cross ☒ in the box next to the correct words to complete the following statement.

If an individual inherits a single copy of a recessive allele

(1)

- ☒ **A** all gametes will have the same allele
- ☒ **B** all gametes will have two copies of the recessive allele
- ☒ **C** the allele has no effect on the phenotype
- ☒ **D** the genotype is homozygous for the allele

(b) Using a genetic diagram, determine the probability that individual **H** is heterozygous for PKD.

(3)

Probability ....

(c) Individual **F** is pregnant.

Prenatal testing can be used to determine if her fetus will develop PKD.

(i) Describe **one** named method of collecting cells for pre-natal testing.

(4)

Method ....

How this method is carried out ....

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(ii) State **one** ethical and **one** social issue associated with pre-natal testing.

(2)

Ethical issue ....

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Social issue ....

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(Total for Question 4 = 10 marks)

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5 Cell membranes control the movement of materials into and out of cells.

(a) 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)

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(b) Several different processes are used to control the movement of materials into and out of cells.

Facilitated diffusion and active transport are two of these processes.

Place a cross ⊠ in the box that gives a correct feature of both facilitated diffusion and active transport.

(1)

	Feature of the transport process	Facilitated diffusion	Active transport
⊠ **A**	can transport molecules against a concentration gradient	no	no
⊠ **B**	occurs only in animal cells	no	yes
⊠ **C**	requires ATP	yes	no
⊠ **D**	requires membrane proteins	yes	yes

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

(c) In an experiment, a student decided to investigate the effect of solute concentration on water transport.

A tube made from a partially permeable membrane was filled with 15 cm^3 of 0.9% sodium chloride solution and the ends tied.

This tube was weighed and then placed in a beaker containing 0.9% sodium chloride solution, as shown in the diagram below.

0.9% sodium
chloride solution

partially permeable
membrane

0.9% sodium
chloride solution
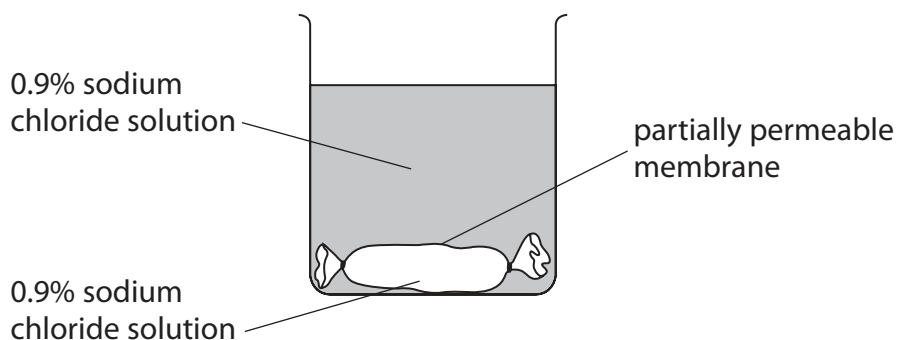
This was repeated with a second tube containing 15 cm^3 of 20% sodium chloride solution.

Every 5 minutes the tubes were removed from the beakers, dried and reweighed.

The results are shown in the graph below.

Key

———•——— 20% sodium chloride
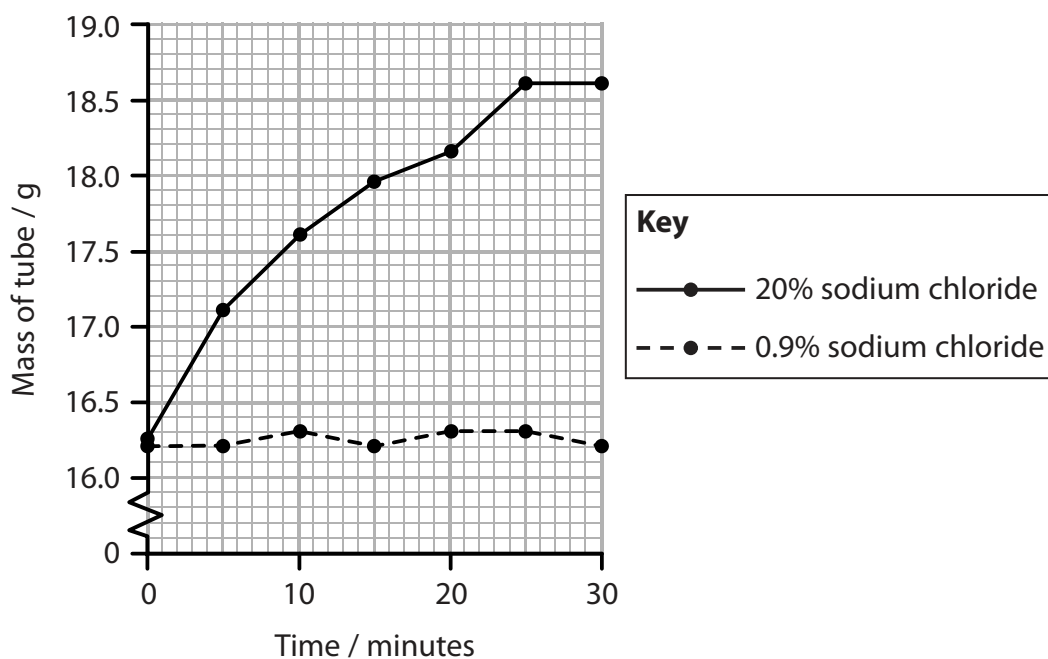
– – –•– – – 0.9% sodium chloride

(i) The tubes were made from a partially permeable membrane.

Explain what is meant by the term **partially permeable**.

(2)

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(ii) Explain the change in mass of the 20% sodium chloride tube during this experiment.

(4)

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(iii) Suggest an explanation for the changes in the mass of the 0.9% sodium chloride tube during this experiment.

(2)

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(Total for Question 5 = 11 marks)

6 Cystic fibrosis is a genetic condition caused by mutations in the CFTR gene.

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

(1)

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(b) Cystic fibrosis can be classified according to the effect of different gene mutations on the CFTR protein.

The table below shows three different mutations and their effects on the CFTR protein.

Mutation	Effect on the CFTR protein
I	no CFTR protein is made
III	non-functioning CFTR protein is present in the cell membrane in normal quantities
V	functioning CFTR protein is present in the cell membrane in reduced quantities

(i) Explain how **mutation III** results in reduced gas exchange in people with cystic fibrosis.

(4)

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(ii) The CFTR gene is transcribed in people with mutation III and mutation V.

Describe how the CFTR gene is transcribed.

(3)

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(c) Suggest how somatic gene therapy could be used to treat people with cystic fibrosis.

(3)

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(Total for Question 6 = 11 marks)

7 Thrombophilia can be caused by major surgery. The blood of a person with thrombophilia has an increased tendency to clot.

*(a) Suggest how major surgery could cause thrombophilia and why this might be a dangerous complication after surgery.

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(b) Several anticoagulants are available to reduce the risk of thrombophilia in major surgery.

One anticoagulant drug, METHRO II, developed for the treatment of thrombophilia, has been tested on patients.

Each patient was randomly placed in one of four groups receiving a different dose of METHRO II.

Some results from the trial are shown in the table below.

Dose of METHRO II / a.u.	Percentage of patients (%)	
	With serious clotting	With excessive bleeding
1.0	37.8	0.8
1.5	24.1	1.2
2.3	23.7	3.5
3.0	15.1	5.5

(i) Describe the effect of METHRO II on thrombophilia.

(1)

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(ii) Using the information in the table, suggest why a dose of 1.5 a.u. of METHRO II should be given to patients undergoing major surgery.

(2)

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(Total for Question 7 = 8 marks)

8 The DNA of an organism carries its genetic code.

(a) The diagram below shows part of the DNA of a gene.

| C | C | A | T | T | C |

(i) Place a cross ⊠ in the box next to the mRNA produced from this DNA.

(1)

⊠ **A** | C | C | A | T | T | C |

⊠ **B** | G | G | T | A | A | G |

⊠ **C** | G | G | T | U | U | C |

⊠ **D** | G | G | U | A | A | G |

(ii) Place a cross ⊠ in the box next to the sugar found in mRNA.

(1)

⊠ **A** deoxyribose

⊠ **B** glucose

⊠ **C** ribose

⊠ **D** sucrose

(b) The genetic code is a triplet code.

Explain why a triplet code is required for the synthesis of protein.

(3)

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*(c) Explain how Meselson and Stahl's experiment provides evidence for the accepted theory for the replication of DNA.

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(Total for Question 8 = 10 marks)

TOTAL FOR PAPER = 80 MARKS

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