

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel International Advanced Level

Monday 8 January 2024

Afternoon (Time: 1 hour 30 minutes)

Paper reference **WBI11/01**

Biology

Advanced Subsidiary

UNIT 1: Molecules, Diet, Transport and Health

You must have:
Scientific calculator, ruler, HB pencil

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.*
- Calculators may be used.
- 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 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.*
- The marks available for spelling, punctuation and grammar are clearly indicated.
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points 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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Answer ALL questions.

Write your answers in the spaces provided.

Some questions must be answered with a cross $\boxtimes$. If you change your mind about an answer, put a line through the box $\boxtimes$ and then mark your new answer with a cross $\boxtimes$.

- 1** Red blood cells transport oxygen to the cells of the body.

Read through the following description of how oxygen is transported from the lungs to respiring cells.

Complete the description by writing the most appropriate word or words on the dotted lines.

Oxygen binds to inside red blood cells.

Oxygen binds to this molecule in the lungs where the partial pressure of oxygen is compared with elsewhere in the body.

The oxygenated blood returns to the heart in the blood vessel called the and is pumped to the body by the part of the heart called the

In the tissues, the ability of this molecule to bind oxygen is affected by the higher concentration of carbon dioxide.

This is called the effect.

(Total for Question 1 = 5 marks)



2 The nature of the genetic code of a gene is important in determining the sequence of amino acids in a polypeptide chain.

The diagrams show the genetic code for some amino acids and the sequence of bases in part of a gene.

Genetic code	Amino acid	Genetic code	Amino acid	Genetic code	Amino acid	Genetic code	Amino acid
AAA AAG	Lysine	CAA CAG	Glutamine	GAA GAG	Glutamic acid	TAC TAT	Tyrosine
AAC AAT	Asparagine	CAT CAC	Histidine	GAC GAT	Aspartate	TCA TCC TCG TCT	Serine
ACA ACC ACG ACT	Threonine	CCA CCC CCG CCT	Proline	GCA GCC GCG GCT	Alanine	TGG	Tryptophan

Part of a gene:



The genetic code is described as a triplet code that is non-overlapping and is degenerate.

Explain what each of these phrases means.

Use the information provided to illustrate your answer.

(a) Triplet code

(2)

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(b) Non-overlapping code

(2)

(c) Degenerate code

(2)

(Total for Question 2 = 6 marks)



3 The cell membrane determines which molecules can enter or leave a cell.

(a) Which pair of membrane transport mechanisms only involves a **solute** moving down a concentration gradient?

(1)

- ☐ A active transport and diffusion
- ☐ B active transport and osmosis
- ☐ C diffusion and facilitated diffusion
- ☐ D facilitated diffusion and osmosis

(b) Which of the following transport mechanisms involve carrier proteins in the membrane?

- active transport
- diffusion
- exocytosis

(1)

- ☐ A active transport only
- ☐ B active transport and exocytosis
- ☐ C diffusion only
- ☐ D diffusion and exocytosis

(c) Which cell transport mechanism is used to take large particles or bacteria into a cell?

(1)

- ☐ A active transport
- ☐ B endocytosis
- ☐ C exocytosis
- ☐ D facilitated diffusion

(d) Which cell transport mechanism moves small lipid-soluble molecules through the membrane?

(1)

- ☐ **A** active transport
- ☐ **B** diffusion
- ☐ **C** facilitated diffusion
- ☐ **D** osmosis

(e) Channel proteins are involved in facilitated diffusion.

Which row of the table describes the charge on the R groups on the amino acids of a channel protein?

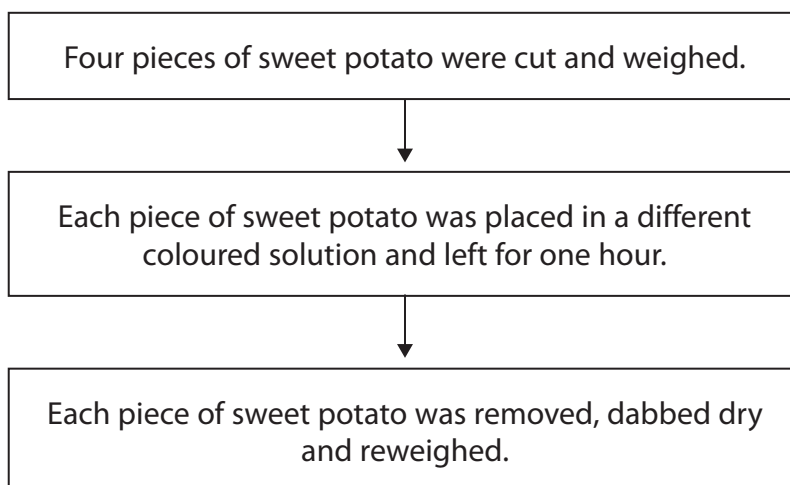
(1)

	Charge on R groups facing inside the channel are mostly	Charge on R groups facing the rest of the membrane are mostly
☐ A	polar	polar
☐ B	polar	non-polar
☐ C	non-polar	polar
☐ D	non-polar	non-polar

(f) A student investigated the effect of four different coloured solutions on the mass of pieces of sweet potato.

Dyes were dissolved in water to produce the coloured solutions.

The diagram shows the method used by the student.

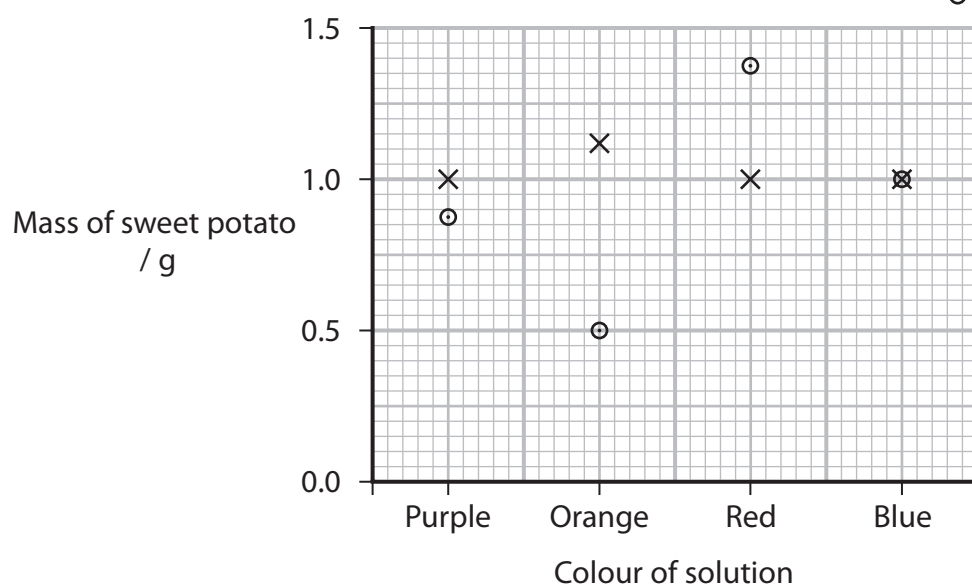


The graph shows the results of this investigation.

Key

× initial mass of sweet potato

○ final mass of sweet potato



Explain the results of this investigation.

(4)

(Total for Question 3 = 9 marks)



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4 Water is an important molecule in living organisms.

(a) Water is a dipolar molecule that forms hydrogen bonds with other water molecules.

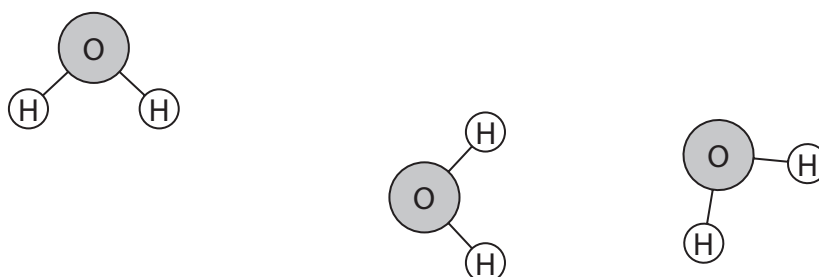
(i) Explain the dipole nature of water.

(2)

(ii) The diagram shows three water molecules.

Complete the diagram to show a hydrogen bond between two water molecules.

(1)



(b) Water plays a role as a solvent.

Sodium chloride dissolves in water.

The diagram shows a sodium ion (Na^+).

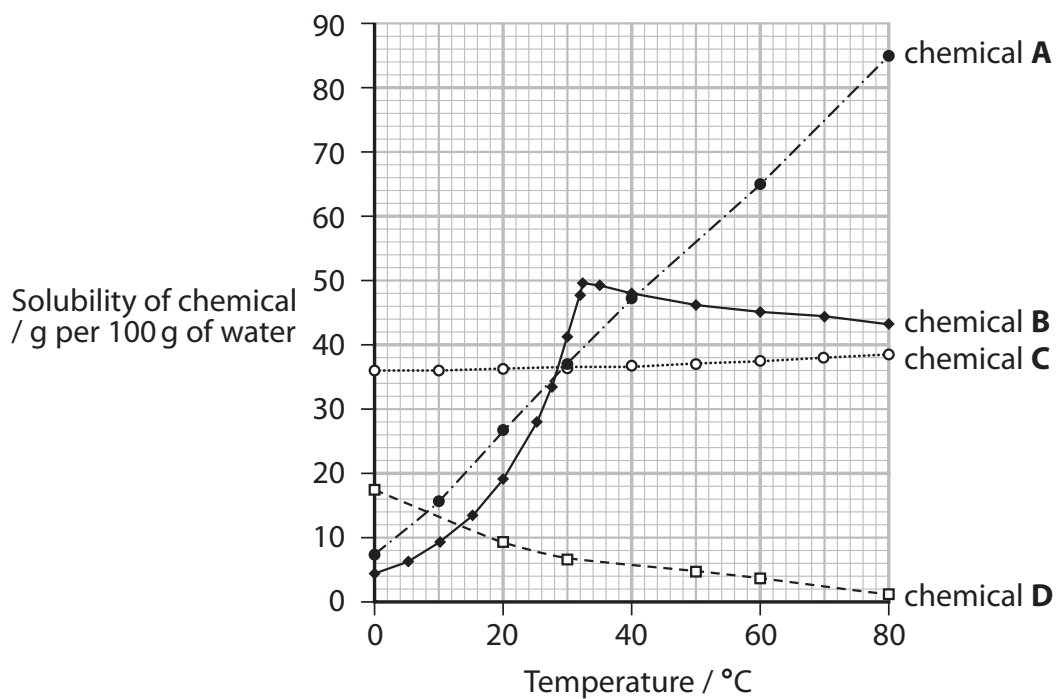
Complete the diagram to show the arrangement of two water molecules around a sodium ion when it is dissolved.

(1)



(c) Temperature affects the solubility of chemicals in water.

The graph shows the effect of temperature on the solubility of four chemicals, **A**, **B**, **C** and **D**.



Describe the effects of temperature on the solubility of these chemicals.

(4)

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(Total for Question 4 = 8 marks)



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- 5 Several factors are associated with the risk of developing cardiovascular disease (CVD).

Obesity is one risk factor associated with CVD.

The ability of a group of people to lose weight was investigated.

This investigation considered:

- the body mass index (BMI) of the person
- the levels of amylase in their saliva
- the bacteria present in their digestive system.

- (a) The BMI of a person can be calculated using the formula:

$$\text{BMI} = \text{mass in kg} \div (\text{height in m})^2$$

- (i) Name **one** other obesity indicator.

(1)

- (ii) Which of the following is the BMI of a person who has a mass of 65 kg and a height of 165 cm?

(1)

- ☐ A 23
- ☐ B 24
- ☐ C 39
- ☐ D 40

- (iii) A person's BMI is used to put them into a weight category.

A person with a BMI of 25 and above, but below 30, is considered to be overweight but not obese.

Which describes the body mass of a person who is obese?

(1)

- ☐ A BMI > 30
- ☐ B BMI $\geq$ 30
- ☐ C BMI < 30
- ☐ D BMI $\leq$ 30

(b) People who are overweight or obese are encouraged to lose weight.

State **two** ways in which a person could lose weight.

(1)

1

2

(c) Amylase in saliva breaks down amylose into maltose.

(i) Which row of the table describes the action of amylase?

(1)

	Type of reaction	Glycosidic bond broken
☐ A	condensation	1 – 4
☐ B	condensation	1 – 6
☐ C	hydrolysis	1 – 4
☐ D	hydrolysis	1 – 6

(ii) People with low levels of amylase in their saliva were found to lose weight more easily.

Suggest why these people lost weight more easily.

(2)

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- (d) The bacteria in people's digestive systems replicate.

The investigation found that people with greater weight loss had bacteria with increased rates of replication.

- (i) Explain why this finding can be described as a positive correlation.

(2)

- (ii) Suggest why the rate of replication of the bacteria could affect weight loss.

(2)

(Total for Question 5 = 11 marks)



6 The cell membrane consists of phospholipids and proteins.

(a) Name the current model for the structure of the cell membrane.

(1)

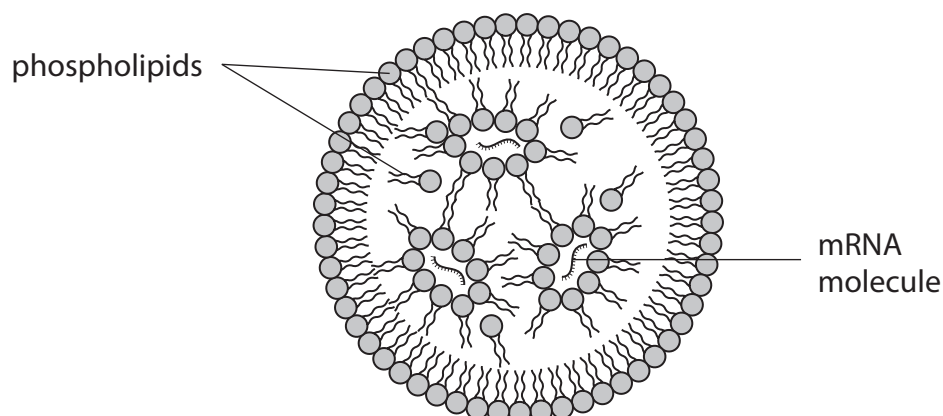
(b) Describe the arrangement of phospholipids in the cell membrane in this model.

(3)

(c) Phospholipids can be used to form lipid nanoparticles.

Lipid nanoparticles can be used to carry nucleic acids to tissues in the body.

The diagram shows a lipid nanoparticle containing messenger RNA (mRNA) molecules.



- (i) Lipid nanoparticles are very small.

Calculate the diameter of a lipid nanoparticle with a volume of $0.108 \mu\text{m}^3$.

Use the formula

$$V = \frac{4}{3}\pi r^3$$

Use $\pi = 3.0$

(3)

Answer μm

- (ii) Describe the structure of a mRNA molecule.

(3)

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(iii) Explain the arrangements of phospholipids in this lipid nanoparticle that carries mRNA to tissues in the body.

(3)

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(Total for Question 6 = 13 marks)

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7 Cystic fibrosis is an inherited disorder caused by a mutation in the gene coding for the CFTR protein.

(a) Explain how this mutation results in reduced gas exchange in the lungs.

(3)

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(b) The number of new cases of cystic fibrosis in the USA in 2015 was 964.

It is predicted that this value will have fallen to 839 by 2025.

(i) Calculate the predicted percentage decrease in the number of new cases from 2015 to 2025.

(1)

Answer %



(ii) Explain why the number of cases could fall.

(3)

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*(c) One complication of cystic fibrosis is lung disease caused by the build-up of bacteria in the airways.

This may be due to the inability of the person to clear mucus from the airways.

People with cystic fibrosis can inhale a salt solution to treat their symptoms. This gives improvements in the clearance of mucus, lung function and quality of life, for a short time.

It has been suggested that pre-treatment with drug A could extend the effects of inhalation of a salt solution.



Devise an investigation to determine if pre-treatment with drug A is more effective than inhalation of a salt solution on its own.

Give reasons for your choice of method.

(6)

(Total for Question 7 = 13 marks)

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8 The types of lipid consumed in the diet can affect the health of individuals.

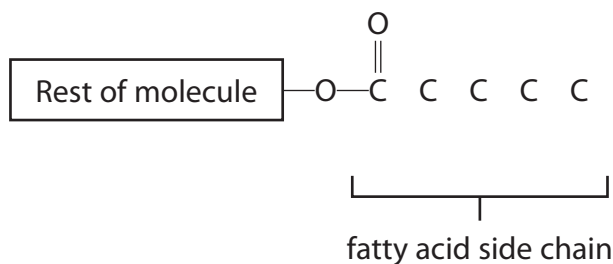
(a) Tropical sprue is a disorder that limits the absorption of nutrients into the blood.

Consumption of unsaturated lipids has been proposed as a cause of tropical sprue.

The diagram shows part of an unsaturated lipid.

Complete the diagram to show one possible structure of a fatty acid side chain of an unsaturated lipid.

(2)



(b) Consumption of high levels of cholesterol is associated with atherosclerosis.

In the development of atherosclerosis, lesions form in the coronary arteries and these develop into atheromas (plaques).

In an investigation, one group of primates was fed a diet supplemented with cholesterol and saturated fatty acids.

A second group was fed a diet supplemented with cholesterol and unsaturated fatty acids.

The primates were fed these diets from a young age and then monitored over a period of 60 months.

Primates are a higher order of mammals that include monkeys.



The results of the investigation are shown in the graphs.

Key

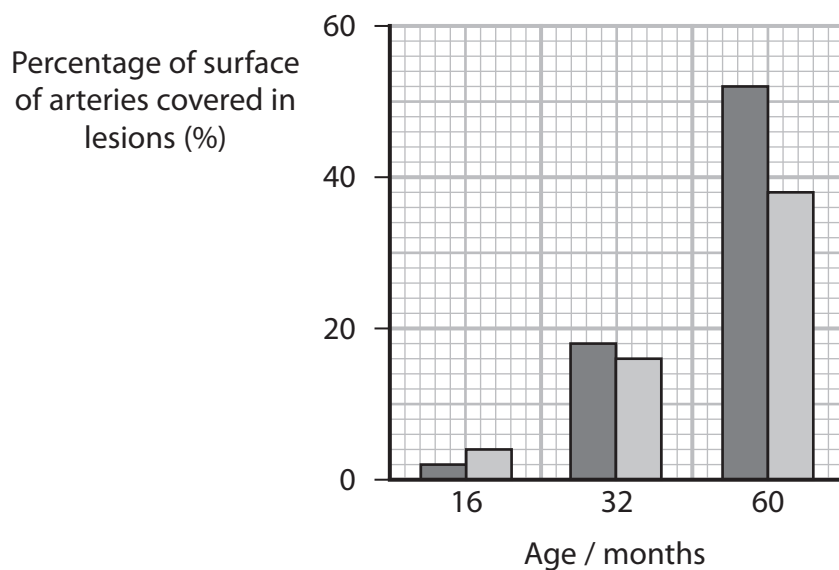


saturated lipids

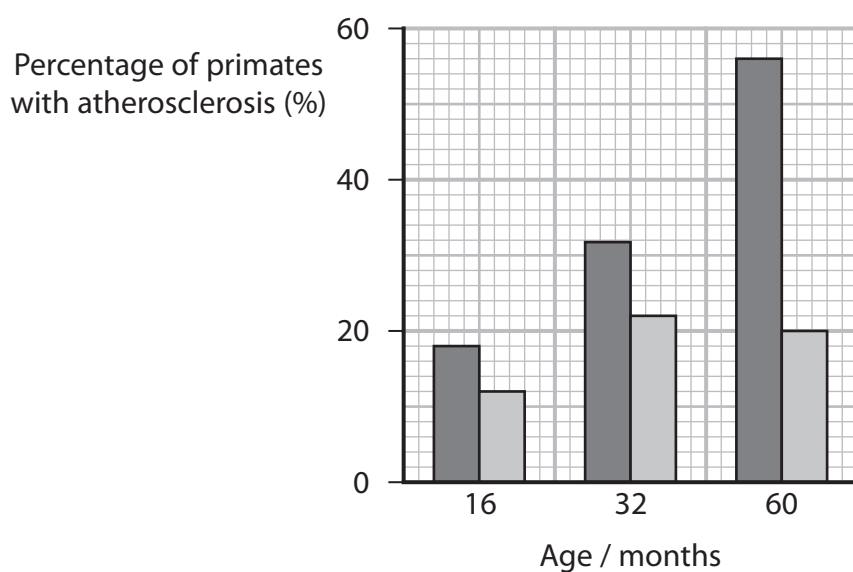


unsaturated lipids

Graph 1



Graph 2



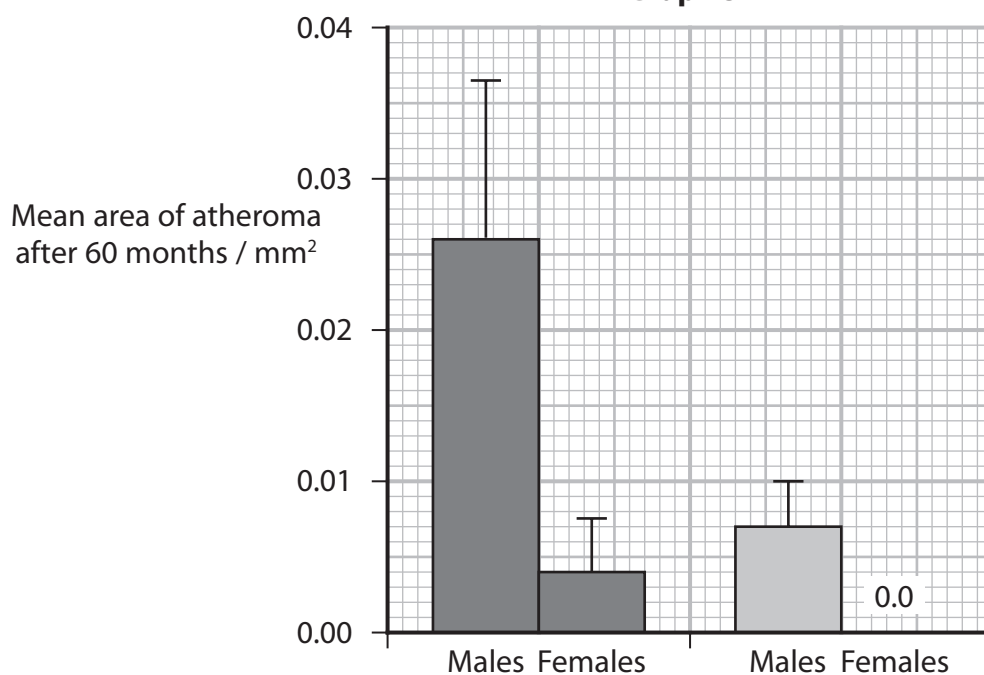
Key



saturated lipids



unsaturated lipids

Graph 3

- (i) Calculate the mean rate of increase in the surface of arteries covered in lesions from 16 to 60 months in the primates given saturated lipids (graph 1).

(1)

Answer percentage per month

- (ii) Calculate the ratio of primates with atherosclerosis given saturated lipids to those given unsaturated lipids, at 32 months (graph 2).

(1)

Answer



- (iii) Calculate the difference in the area of the atheromas in males compared with females, in primates given saturated fats (graph 3).

Give your answer in μm^2 .

(2)

Answer μm^2

- *(iv) These primates were fed a diet supplemented with cholesterol and either saturated lipids or unsaturated lipids.

Deduce the effects of these two diets on the development of lesions in the coronary arteries, atherosclerosis and atheromas.

(6)

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- (v) Discuss the ethical issues relating to the use of primates and other animals in investigations such as this one.

(3)

(Total for Question 8 = 15 marks)

TOTAL FOR PAPER = 80 MARKS



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