Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number | Candidate Number

Tuesday 19 May 2020

Afternoon (Time: 1 hour 30 minutes) | Paper Reference **8BN0/01**

Biology A (Salters Nuffield)

Advanced Subsidiary

Paper 1: Lifestyle, Transport, Genes and Health

You must have:
Calculator, HB 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.
- Show your working in any calculation questions and include units in your answer where appropriate.
- 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.*
- You may use a scientific calculator.
- In 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 6 2 3 0 2 R A 0 1 2 4

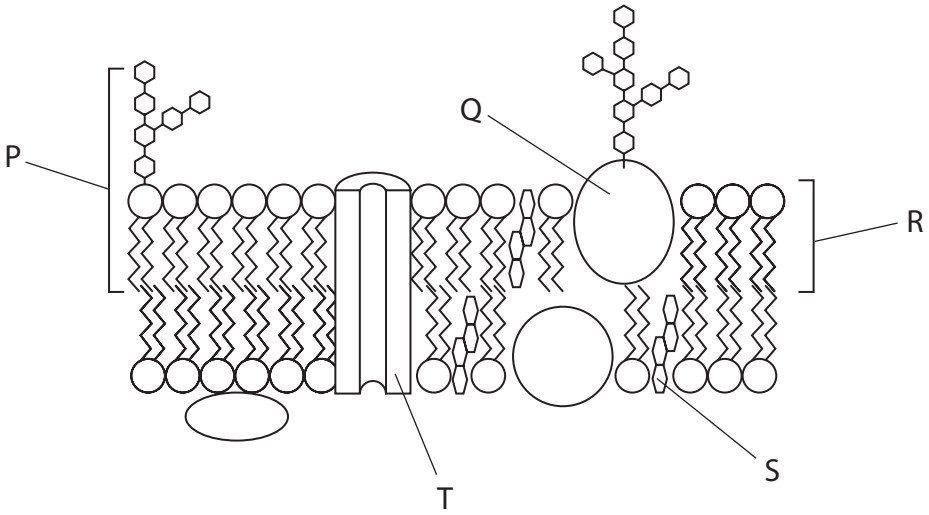
Pearson

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 The diagram shows the structure of a cell surface membrane.



(a) (i) The molecule labelled R is a phospholipid.

Give the name of the bond that joins a fatty acid molecule to a glycerol molecule in a phospholipid.

(1)

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(ii) Which of the following describes molecule P?

(1)

☒ **A** carrier protein

☒ **B** cholesterol

☒ **C** glycolipid

☒ **D** glycoprotein

(iii) Which of the following molecules is involved in cell recognition?

(1)

☒ **A** Q

☒ **B** R

☒ **C** S

☒ **D** T

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(iv) Which molecule allows ions to diffuse into a cell?

(1)

☒ **A** P

☒ **B** Q

☒ **C** R

☒ **D** T

(b) The cell surface membrane controls the movement of substances into the cell.

The concentrations of two substances inside the cytoplasm of a cell and in the fluid surrounding the cell were investigated.

The table shows the concentrations of these two substances.

Substance	Description of substance	Concentration in cytoplasm / mmol dm^{-3}	Concentration in fluid surrounding the cell / mmol dm^{-3}
sodium	small ion	140.0	9.0
glucose	large polar molecule	0.1	14.9

(i) Explain why ATP is required for the movement of sodium ions into the cell.

(2)

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(ii) Describe how glucose molecules move into the cell.

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(Total for Question 1 = 8 marks)

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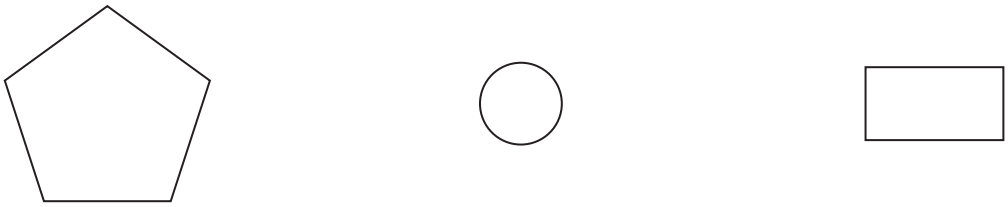
2 Genetic information is encoded in DNA. DNA is made from monomers called nucleotides.

(a) A DNA nucleotide is composed of three molecules joined together in condensation reactions.

(i) These shapes represent the components of DNA.



pentose sugar phosphate group base

Draw a DNA nucleotide using these shapes.

(2)

(ii) Which row shows three components that can be found in a DNA molecule?

(1)

☒ **A**	glycosidic bond	thymine	deoxyribose
☒ **B**	glycosidic bond	uracil	ribose
☒ **C**	phosphodiester bond	thymine	deoxyribose
☒ **D**	phosphodiester bond	uracil	ribose

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(iii) In a molecule of DNA, 17% of the bases were guanine.

What percentage of the bases in the molecule were thymine?

(1)

☒ **A** 17%

☒ **B** 33%

☒ **C** 66%

☒ **D** 83%

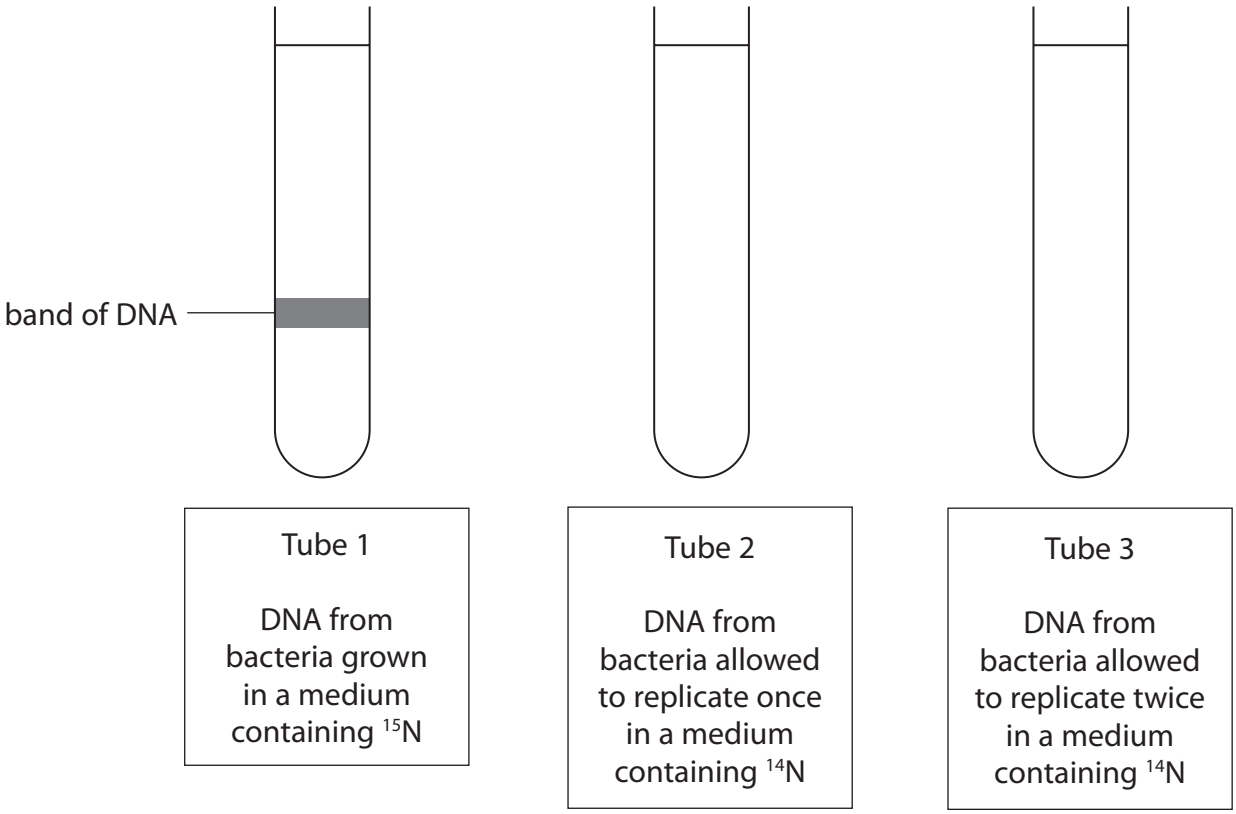
(b) Meselson and Stahl carried out an experiment that demonstrated the semiconservative replication of DNA.

They grew bacteria in a medium containing heavy nitrogen (^{15}N) for a period of time. The density of the DNA extracted from these bacteria is shown by the position of the band in tube 1.

The bacteria were then transferred to a medium containing light nitrogen (^{14}N) and allowed to replicate.

Complete the diagram to show the positions of the DNA bands in tubes 2 and 3.

(2)



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(c) Give three differences between replication of DNA and transcription of DNA.

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(Total for Question 2 = 9 marks)

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3 Cardiovascular disease (CVD) is a major cause of death.

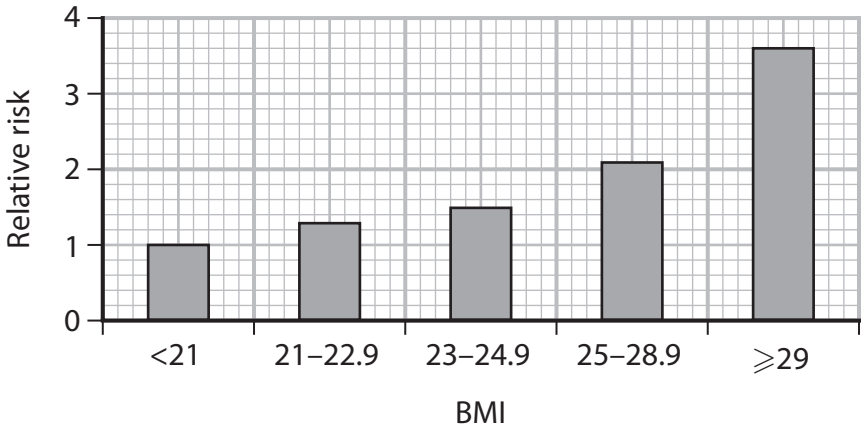
(a) Obesity and high blood pressure are two risk factors for CVD.

One way of determining if a person is obese is to calculate their body mass index (BMI).

BMI is calculated using the following formula.

$$\text{Body mass index (BMI)} = \frac{\text{mass (kg)}}{\text{height (m)}^2}$$

The graph shows the relationship between BMI and the relative risk of developing CVD.



(i) Determine the relative risk of developing CVD for a person with a height of 1.54 m and a mass of 61 kg.

(2)

Answer.....

(ii) State another method that could be used to determine if a person is obese.

(1)

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(iii) Describe how high blood pressure could be reduced by medication and lifestyle changes.

(3)

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(b) A heart attack may occur when a coronary artery is blocked with a blood clot. The risk of this can be reduced by treatment with platelet inhibitors.

Explain why platelet inhibitors would reduce the risk of a heart attack.

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(Total for Question 3 = 8 marks)

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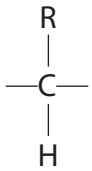
4 Blood plasma contains many different proteins. Prothrombin is a plasma protein that is involved in the blood clotting process.

(a) (i) The protein prothrombin is composed of monomers called amino acids.

Complete the diagram to show the structure of an amino acid.

(2)



(ii) Name the products formed when several amino acids are joined together.

(1)

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*(b) Mutations in the gene coding for the prothrombin protein have been identified.

These mutations have resulted in different forms of prothrombin being produced.

The diagram shows the same part of the genetic sequence for prothrombin A and prothrombin B.

Prothrombin A:

TCC CAA TAA AAG TGA CTC TCA GCG AGC

Prothrombin B:

TCC CAA TAA AAG TGA CTC TCA GAG AGC

Prothrombin A and prothrombin B were used in an investigation into blood clotting.

A sample of blood had all of the prothrombin removed.

Equal volumes of this blood were poured into test tubes.

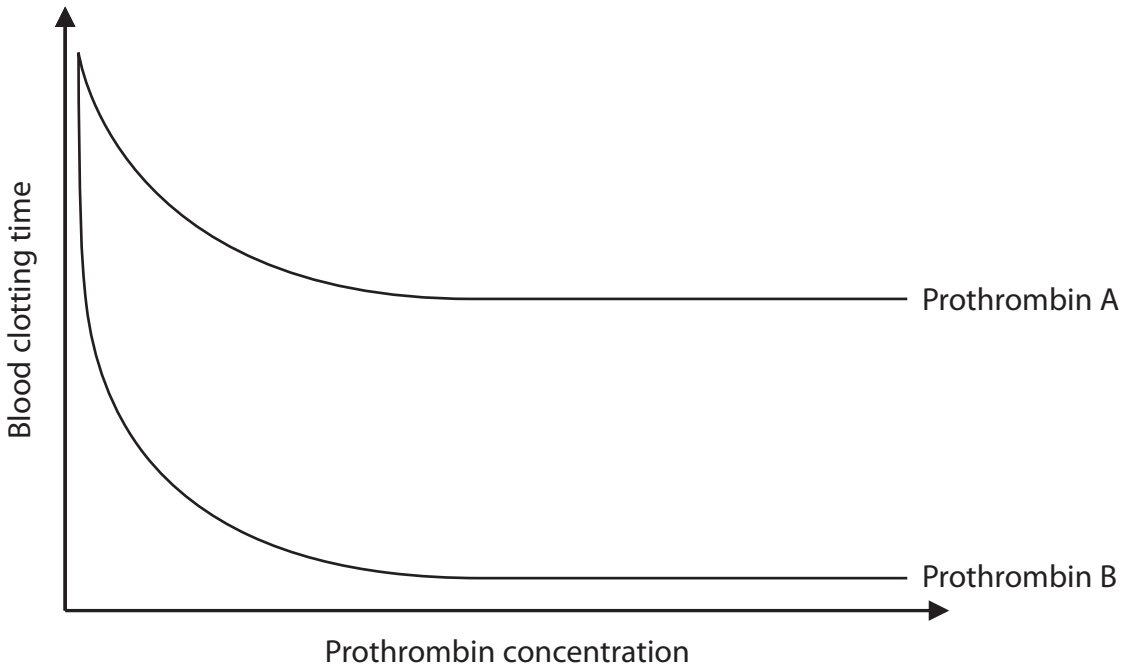
Each test tube of blood received a different concentration of prothrombin A.

The volume of prothrombin A was the same in each tube.

The time taken for the blood to clot in each tube was measured.

The investigation was repeated with different concentrations of prothrombin B.

The results are shown in the graph.



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Explain the results of this investigation.

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(Total for Question 4 = 9 marks)

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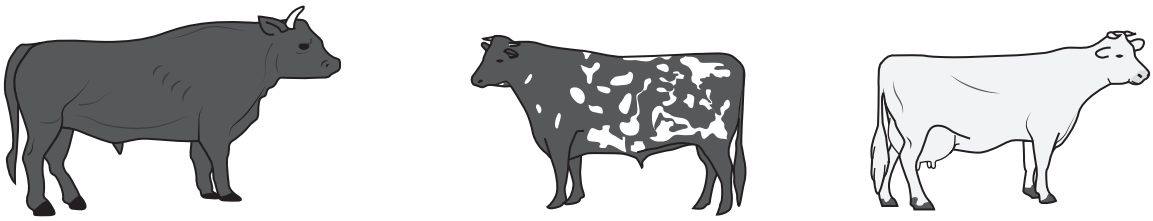
5 The phenotype of organisms is affected by their genotype.

(a) Cattle have different patterns and colours in their coats as a result of their genotype.

The image shows the genotype and phenotype of three offspring from the same parents.



pure red (RR) | roan (RW) | pure white (WW)

(Source from: http://wps.pearsoned.com.au/wps/media/objects/8476/8680015/_images_/ch3c.jpg)

(i) Name the type of inheritance shown in this example.

(1)

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(ii) What is the probability of the next offspring of the same parents being roan?

(1)

☒ **A** 25%

☒ **B** 50%

☒ **C** 75%

☒ **D** 100%

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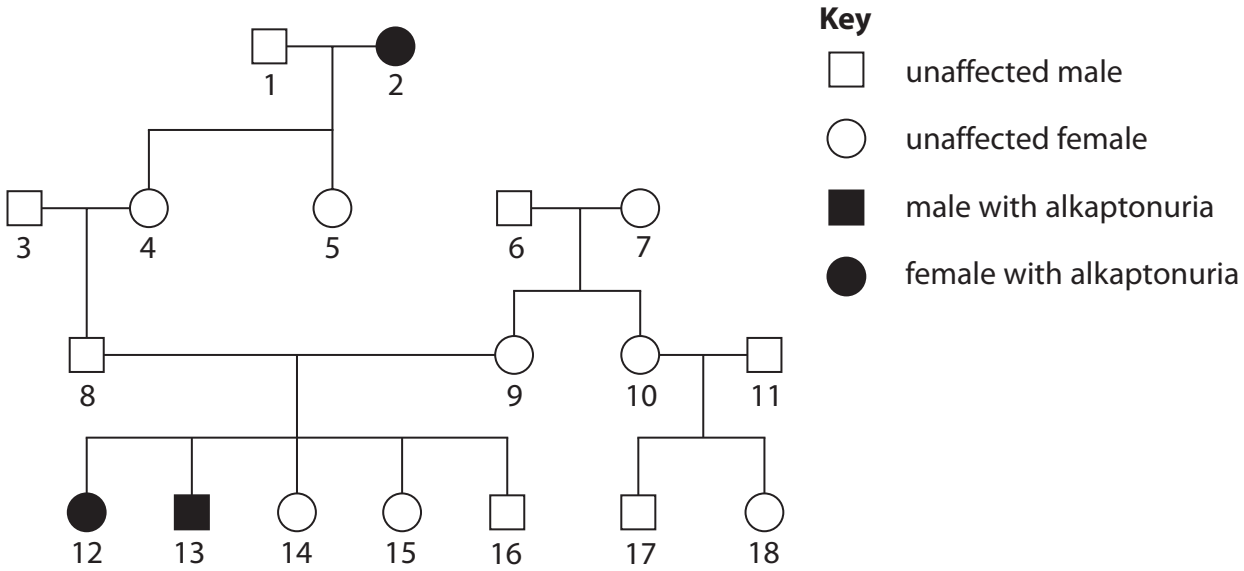
(b) Alkaptonuria is a rare condition where the body cannot break down the amino acids phenylalanine and tyrosine.

The pedigree diagram shows part of a family tree in which alkaptonuria is an inherited condition.



(i) State and justify whether alkaptonuria is caused by a recessive or a dominant allele.

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(ii) Individual 12 is pregnant and wants to know if her baby has alkaptonuria.

State and justify a suitable method of collecting cells for prenatal testing.

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(Total for Question 5 = 9 marks)

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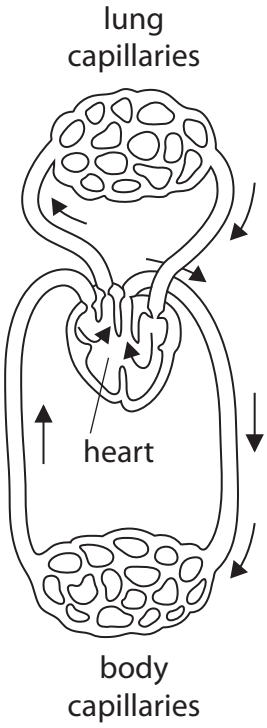
6 Many animals have a heart and circulatory system.

The diagram shows the structure of the heart and circulatory system of a snake.



(a) (i) Compare and contrast the heart and circulatory system of a snake with that of a human.

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(ii) Explain why a snake needs a heart.

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(b) The image shows a cross section of a vein viewed with a light microscope. An eyepiece lens of ×10 magnification and an objective lens of ×4 magnification were used.

(Source from: https://dissectionconnection.com.au/product/artery-and-vein-40x/)

(i) Calculate the actual thickness of the wall of the vein between points X and Y. Give your answer in µm.

(3)

Answer.....µm

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(ii) Explain how the structure of a vein relates to its function.

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(Total for Question 6 = 13 marks)

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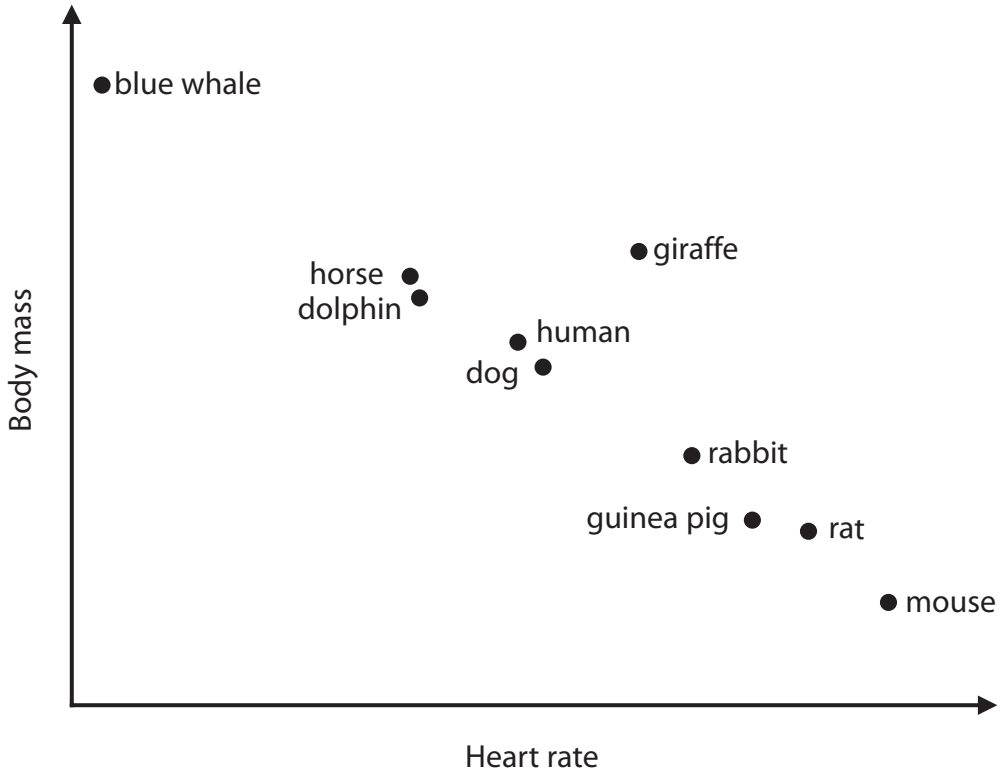
7 The heart rate of an animal often depends on its body mass.

The graph shows the mean heart rate of some animals and their mean body mass.



(Adapted from: http://www.cardio-research.com/quick-facts/animals)

(a) State the relationship between the average heart rate and the average body mass of these animals.

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(b) Some chemicals can affect the heart rate of animals.

The effects of dopamine and caffeine on the heart rate of *Daphnia* were investigated.

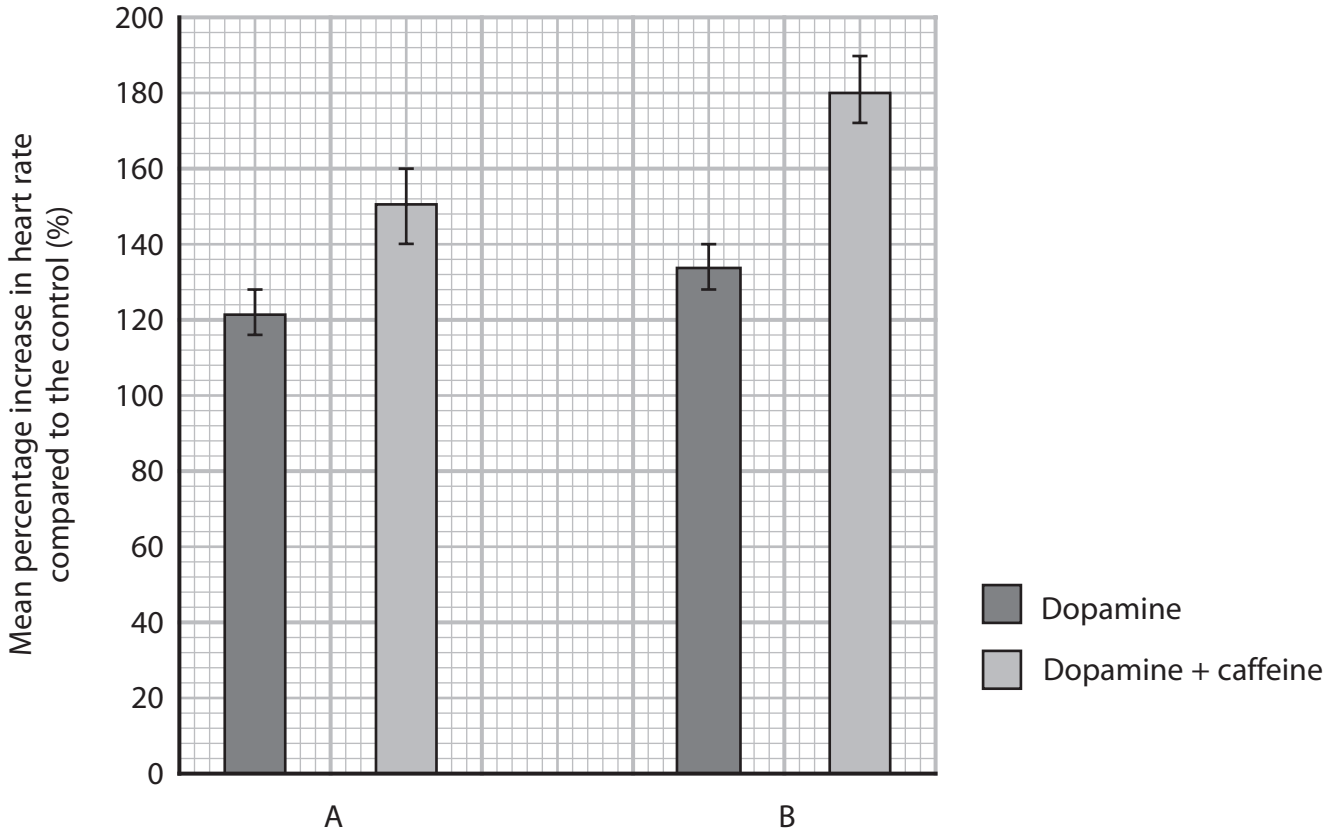
Investigation A used three different solutions:

- a control solution
- a solution containing 0.8 mg cm^{-3} dopamine
- a solution containing 80 µg cm^{-3} caffeine and 0.8 mg cm^{-3} dopamine

Investigation B used three different solutions:

- a control solution
- a solution containing 1.6 mg cm^{-3} dopamine
- a solution containing 80 µg cm^{-3} caffeine and 1.6 mg cm^{-3} dopamine

The graph shows the percentage increase in heart rate compared with the controls, for both investigations.



(Source from: https://f1000research.com/articles/7-254/v1)

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(i) Comment on the effects of dopamine alone and dopamine with caffeine on the heart rate of *Daphnia* in this investigation.

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(ii) State and justify a suitable control for these investigations.

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(iii) Devise a procedure that could have been used to produce the results shown in the graph.

(5)

(Total for Question 7 = 12 marks)

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8 Cystic fibrosis is inherited as a recessive condition. It is caused by a mutation in the CFTR gene.

(a) The CFTR gene codes for

(1)

☒ **A** a carrier protein

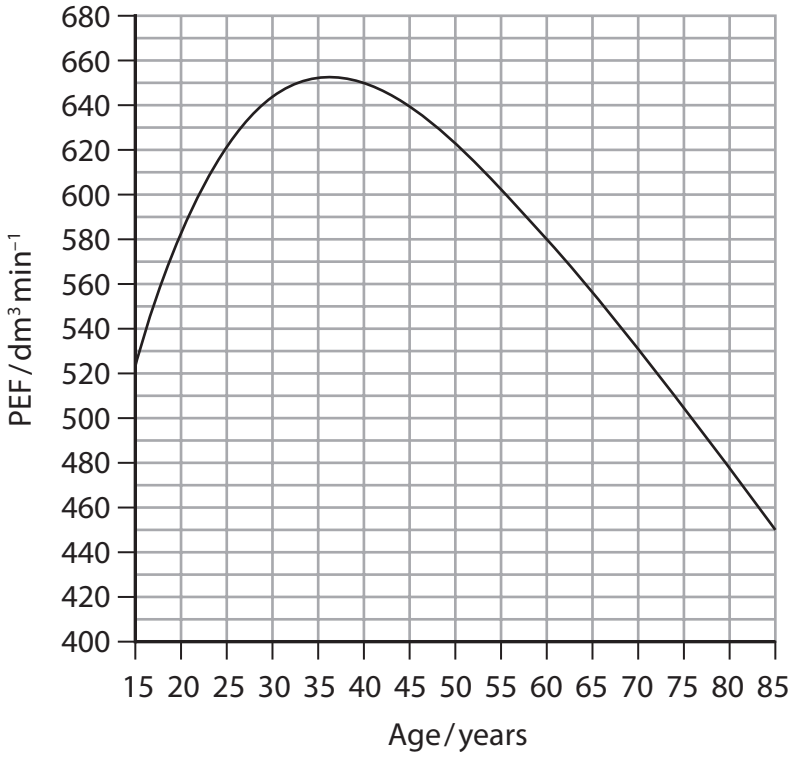
☒ **B** a channel protein

☒ **C** an enzyme

☒ **D** a glycoprotein

(b) A peak flow meter is used to measure the maximum rate at which air can be exhaled. This is called the peak expiratory flow (PEF).

The graph shows the normal PEF for men. The PEF values for men with cystic fibrosis would be 45% lower.



(Source from: https://www.activ8rlives.com/support/data-collected/cardiovascular-and-respiratory/normal-peak-expiratory-flow-pef/)

Calculate the PEF for a 25-year-old man with cystic fibrosis compared with a man of the same age without cystic fibrosis.

(2)

Answer.....

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(c) Explain the effect of a reduced PEF on gas exchange.

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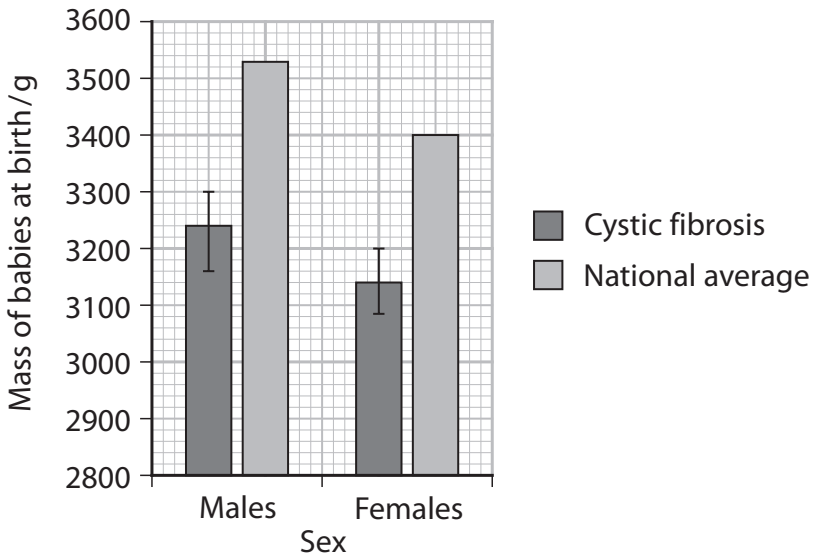
(d) The graph shows the mean mass of newborn babies with cystic fibrosis and of newborn babies without cystic fibrosis.



(i) How many of the following statements are correct?

- male babies always have a larger birth weight compared to female babies
- there is a significant difference between the birth weight for males and females born with cystic fibrosis
- on average female babies born with cystic fibrosis have a birth weight 260g less than the national average

(1)

☒ **A** none

☒ **B** one

☒ **C** two

☒ **D** three

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(ii) Doctors give dietary supplements and digestive enzymes to children with cystic fibrosis.

Dietary supplements include carbohydrates, proteins and lipids, as well as vitamin and mineral supplements.

Explain why these children would be given dietary supplements and digestive enzymes.

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(Total for Question 8 = 12 marks)

TOTAL FOR PAPER = 80 MARKS

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