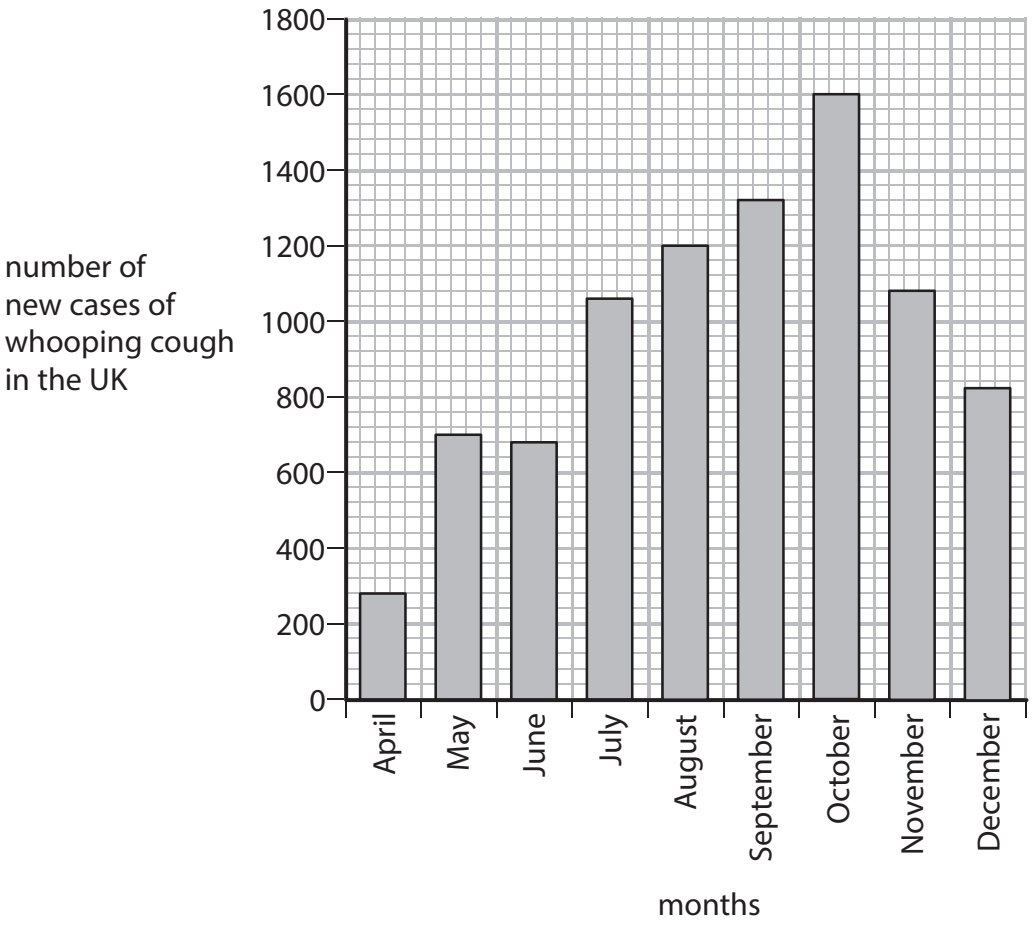
1 In 2012 there was an outbreak of whooping cough in the UK.

The graph shows the number of new cases of whooping cough in the UK from April to December 2012.



(a) (i) Describe the trend shown in the graph from April to December.

(1)

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(ii) In September 2011 there were 168 cases of whooping cough in the UK.

Calculate the difference in the number of cases of whooping cough in September 2011 and September 2012.

(2)

..... cases

(b) Whooping cough is caused by the bacterium *Bordetella pertussis*, which grows rapidly in the human body.

State the term used to describe the rapid growth of a bacterial population.

(1)

(c) Children in the UK can be immunised against whooping cough.

Suggest why outbreaks of whooping cough still occur in the UK.

(2)

(d) Describe the response of the human body to immunisation.

(3)

(Total for Question 1 = 9 marks)

2 (a) The photograph shows a housefly.



(i) Houseflies can be the animal vector for the disease dysentery.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The disease dysentery is caused by a

(1)

☐ **A** bacterium

☐ **B** fungus

☐ **C** protozoan

☐ **D** virus

(ii) Describe how a housefly can cause a person to become infected with dysentery.

(2)

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(iii) Explain how a chemical defence mechanism of the human body can reduce the chance of dysentery.

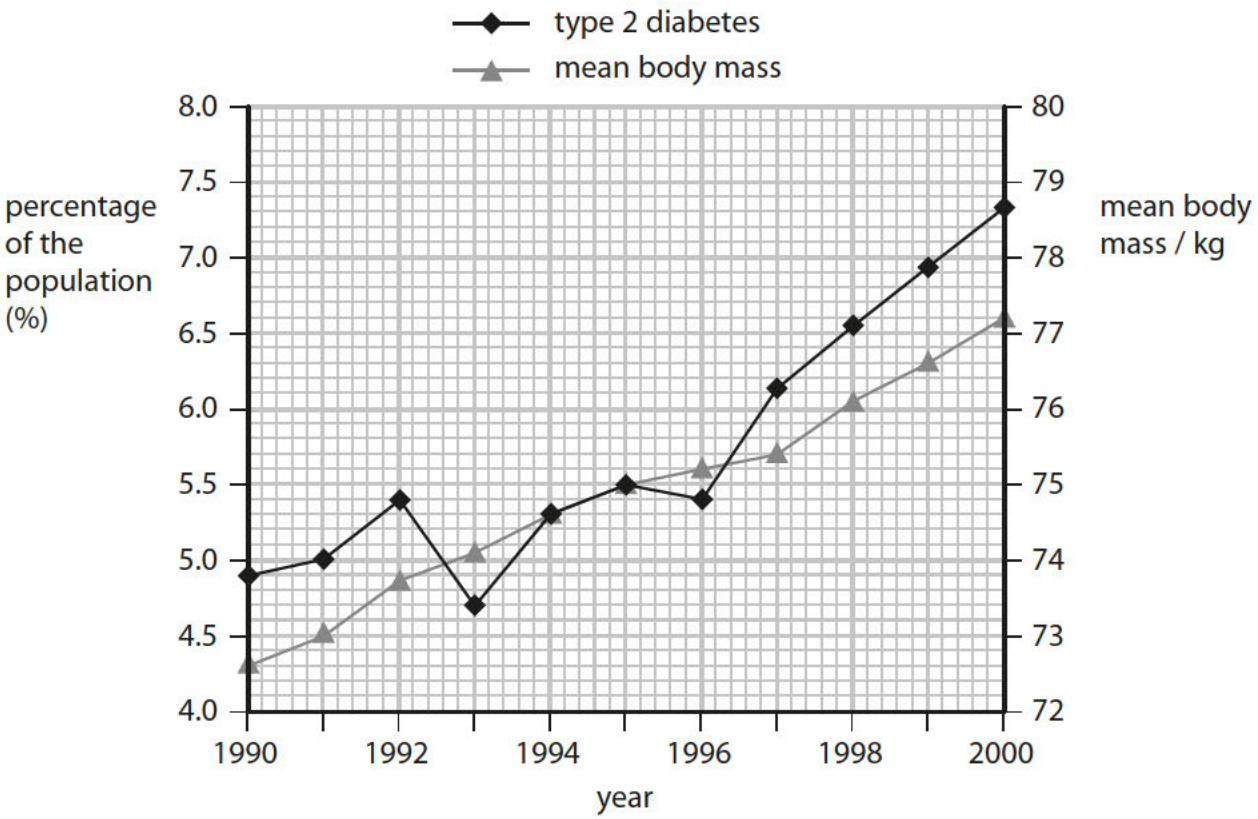
(3)

(b) Explain how the *Anopheles* mosquito can spread the disease malaria.

(2)

(Total for Question 2 = 8 marks)

3 The graph shows the percentage of the population with type 2 diabetes and the mean body mass of the population, from 1990 to 2000.



(a) (i) Use information from the graph to describe the correlation between type 2 diabetes and body mass shown from 1993 to 2000.

(2)

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(ii) Suggest how a change in body mass may cause a person to develop type 2 diabetes.

(2)

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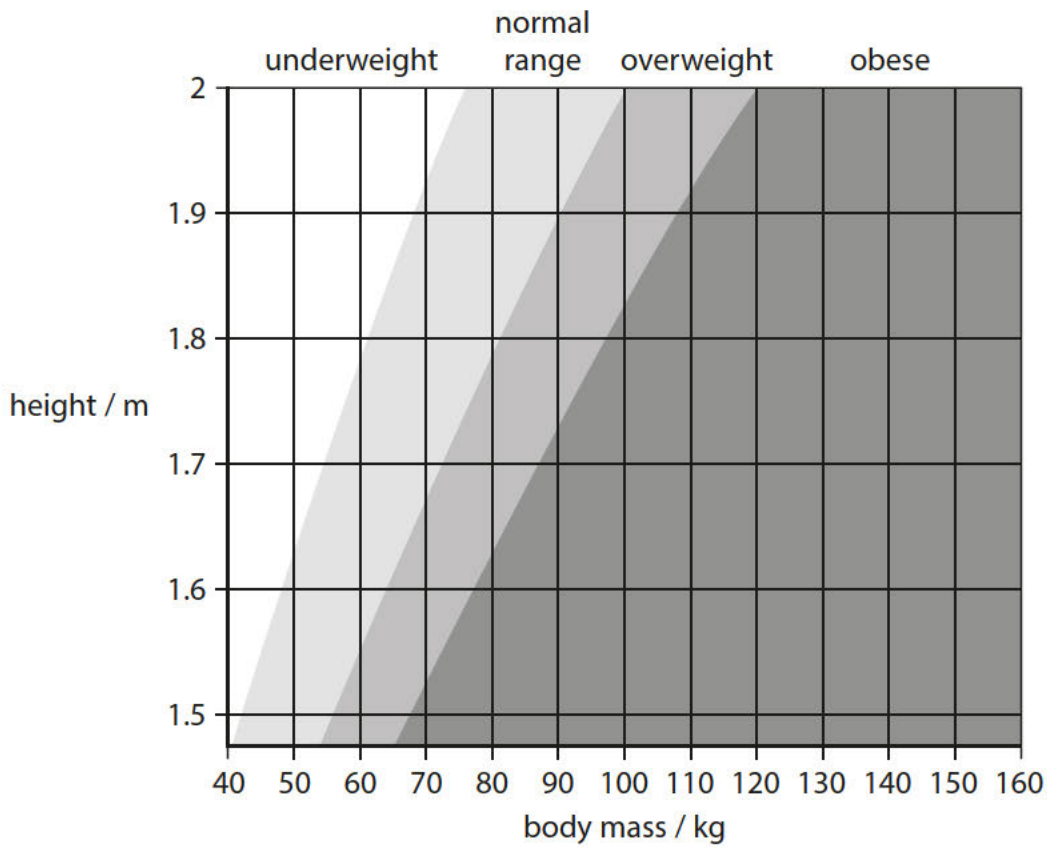
(b) (i) Use the equation to calculate the body mass index (BMI) for a person with a body mass of 78 kg and a height of 1.7 m.

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

(2)

BMI .....

(ii) Use the chart to find the BMI category for this person.



Complete the sentence by putting a cross (☒) in the box next to your answer.

The BMI category for this person is

(1)

☐ **A** underweight

☐ **B** normal range

☐ **C** overweight

(c) Describe how the human body acts in response to low glucose levels in the blood.

(3)

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(Total for Question 3 = 10 marks)

4 The ratio of waist-to-hip measurements can be used to determine the risk of a person developing cardiovascular disease.

(a) Calculate the waist-to-hip ratio for a person with a waist measurement of 830 mm and a hip measurement of 0.99 m.

Give your answer to 2 decimal places.

(2)

Answer = ...

(b) Dieting can reduce the effects of cardiovascular disease.

(i) Which statement gives a reason why dieting can be used to reduce weight in obese people?

(1)

☒ **A** Dieting increases metabolism and growth rate

☒ **B** Dieting reduces energy consumption

☒ **C** Dieting decreases metabolism

☒ **D** Dieting increases energy consumption

(ii) A scientist is planning to test a new diet for weight loss.

She selects 40 obese people to take part in the test.

All the obese people are between 20 and 30 years of age.

State **two** other factors the scientist should control when selecting the people.

(2)

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(iii) Devise a plan the scientist could use to test the effectiveness of the new diet using the 40 obese people.

(3)

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(Total for Question 4 = 8 marks)

5 (a) The photograph shows the common rat *Rattus norvegicus*.



State the level of classification for both parts of the binomial name *Rattus norvegicus*.

(2)

Rattus .....

norvegicus .....

(b) Some rats have a mutation which enables them to eat the rat poison Warfarin and survive.

Suggest how the use of Warfarin could lead to an increase in the number of rats with this mutation.

(2)

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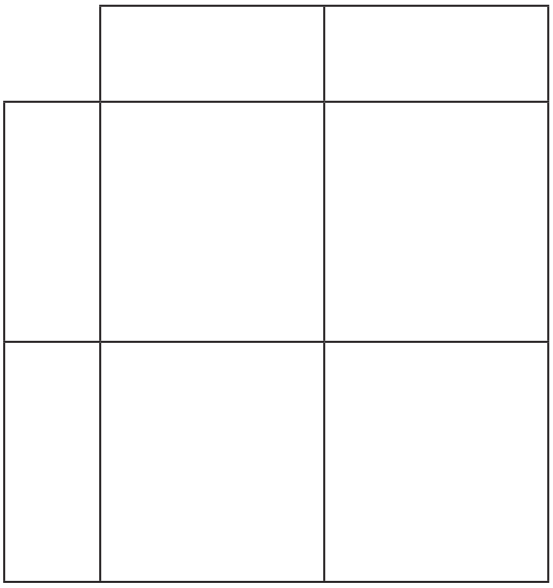
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(c) The allele for Warfarin resistance is recessive.

Complete the Punnett square to show how two rats, both heterozygous for Warfarin resistance, could produce Warfarin resistant offspring.

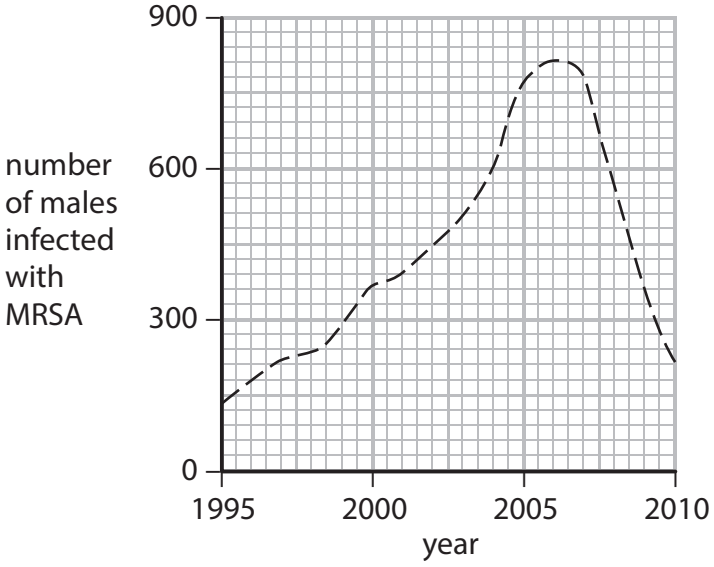
Use **R** and **r** to show the dominant and recessive alleles.

(2)



*(d) Hospitals have introduced programmes to reduce MRSA infections in patients because antibiotics have become less effective.

The graph shows the number of males infected with MRSA during their stay in hospital.



A programme of intensive use of antiseptics in hospitals has been used since 2005.

Use the information given and your own scientific knowledge to explain the trends shown in the graph.

(6)

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(Total for Question 5 = 12 marks)