Surname	Centre Number	Candidate Number
Other Names		0

GCSE – NEW

3430UD0-1

S18-3430UD0-1

SCIENCE (Double Award)

Unit 4 – BIOLOGY 2
HIGHER TIER

TUESDAY, 15 MAY 2018 – AFTERNOON

1 hour 15 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**7**	
2.	**8**	
3.	**10**	
4.	**6**	
5.	**5**	
6.	**10**	
7.	**5**	
8.	**9**	
Total	**60**	

3430UD01
01

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen. Do not use correction fluid.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

If you run out of space, use the additional pages at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

Question **4** is a quality of extended response (QER) question where your writing skills will be assessed.

MAY183430UD0101

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Answer **all** *questions.*

1. Read the following article about diabetes.

1 In type 1 diabetes, the cells of the pancreas that make insulin are destroyed by cells of the immune system.
You are more likely to develop it, if diabetes runs in your family.
The immune system may be triggered to act on the pancreas by a virus, pollutants, or stress causing type 1 diabetes.

6 In type 2 diabetes, not enough insulin is produced or cells in the liver fail to respond to the insulin that is produced. It is more likely to occur if it runs in your family, but there are also several risk factors.

These include:

- certain lifestyle choices
- certain ethnic origins
- age

Despite a rapid rise in the incidence of diabetes, there has been a 28% fall in the number of deaths from diabetes-related conditions in Wales between 2009 and 2013. This shows there has been some success in how diabetes has been managed but early diagnosis is
16 vital.

A spokesperson for a charity promoting diabetes awareness in Wales said:

"Type 2 diabetes can be prevented, but there is no way of preventing type 1. Looking after your own health can reduce the risk of developing type 2 diabetes."

Use the above information and your own knowledge to answer the following questions.

(a) (i) Give the reason why people at high risk of developing diabetes should be tested regularly. [1]

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(ii) Does the evidence given in the article support the claim made in line 18 that *"type 2 diabetes can be prevented"* in every individual? Give reasons for your answer. [1]

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(b) Explain **one** way in which *"looking after your own health can reduce the risk of developing type 2 diabetes"* (lines 18 & 19). [2]

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(c) Explain what would happen in the body if the *"cells in the liver fail to respond to the insulin that is produced"*.

[3]

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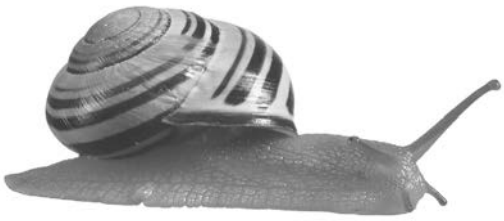
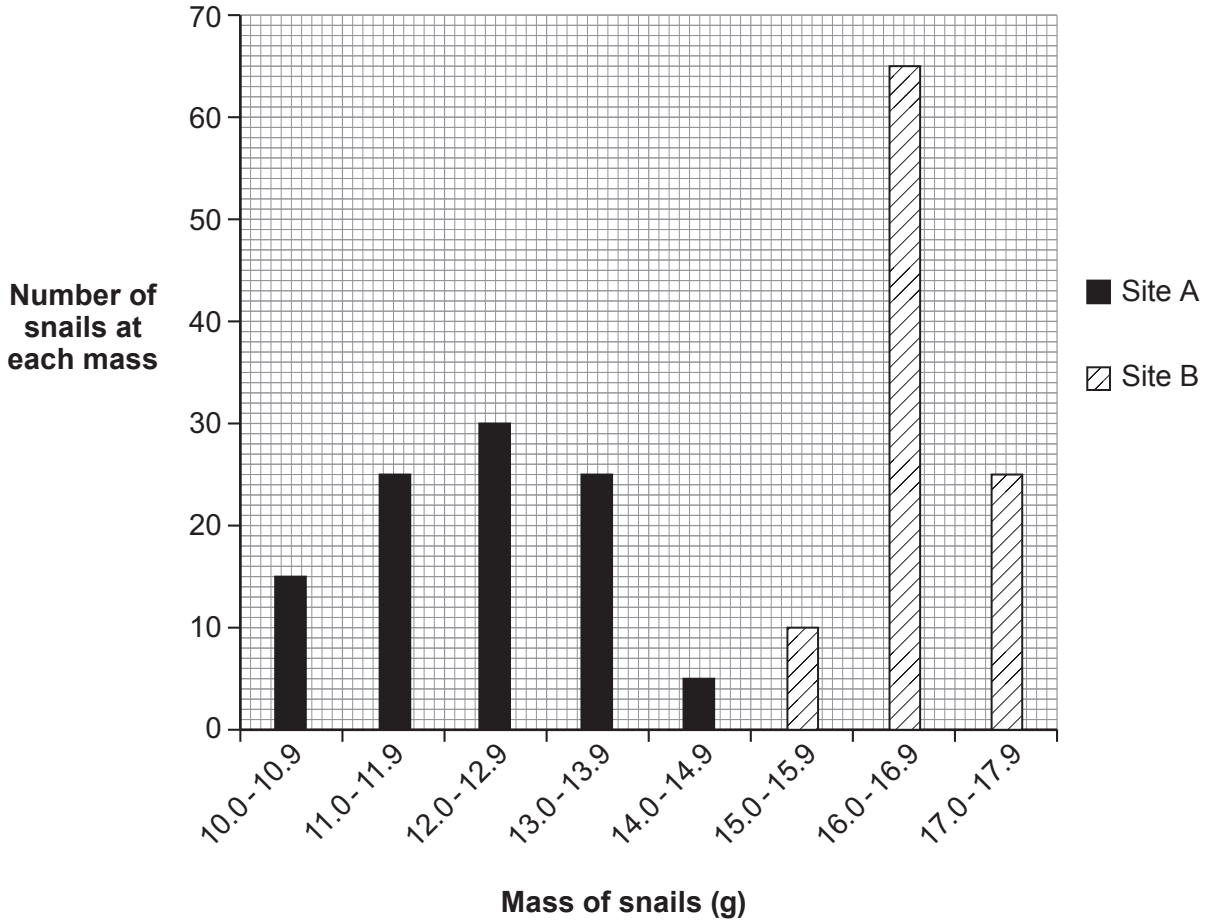
2. The photograph shows the banded snail, *Cepaea nemoralis.*



(a) Scientists investigated variation in the mass of individual snails sampled at random from two different sites, **A** and **B**. The mass of each snail was recorded to the nearest 0.1 g. The results are shown in the bar chart.



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(i) The table below shows the mean mass of snails collected at each site.

Site	Mean mass (g)
A	12.3
B	16.8

Calculate the percentage increase in the mean mass of the snails at site **B** compared to site **A**. [2]

increase in mean mass = ... %

(ii) At which of the two sites do the snails show the greater variation in mass? Give the reason for your choice. [1]

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(iii) How did the scientists reduce bias in their investigation? [1]

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(iv) Why is it important that other scientists carry out the same investigation as these scientists? [1]

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(b) *Cepaea nemoralis* shows genetic variation.

Use your knowledge of natural selection to explain the long term advantage of genetic variation to *Cepaea nemoralis* in a changing environment. [3]

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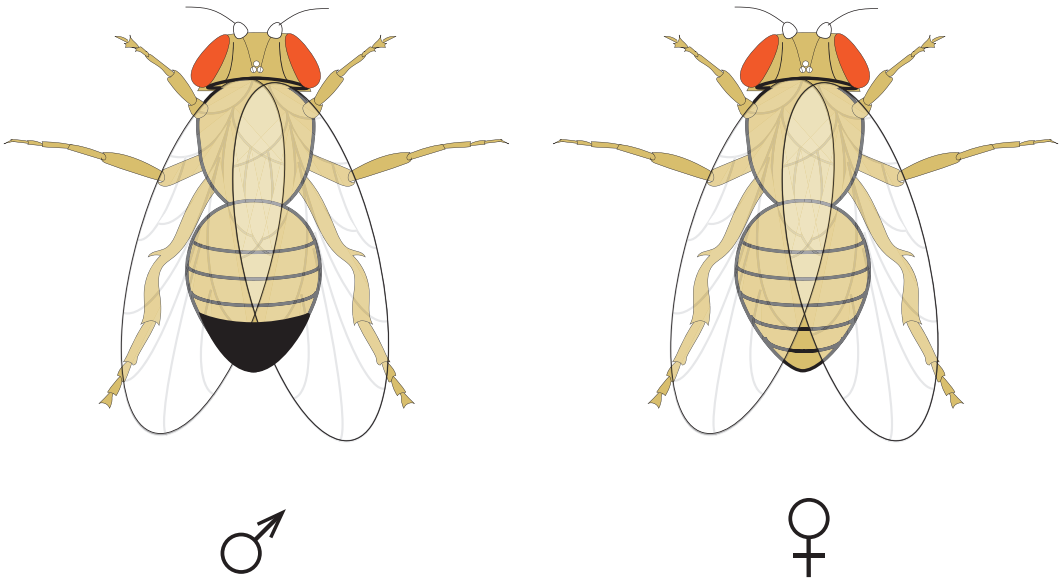
3. A class of year 11 students decided to carry out some genetics investigations on the fruit fly *Drosophila melanogaster*. Fruit flies are easily kept in school laboratories and are a good species for genetics investigations because they:

- have a short generation time (a very short time to develop from egg to adult and reproduce)
- are easy to maintain
- males (♂) and females (♀) are easy to identify
- they produce between 200 and 500 offspring per mating

The students were asked to draw a sketch of a male and a female fruit fly. A sketch is shown below.



(a) Suggest an advantage to the students, of the fruit fly:

(i) having a short generation time; [1]

.....

(ii) producing large numbers of offspring. [1]

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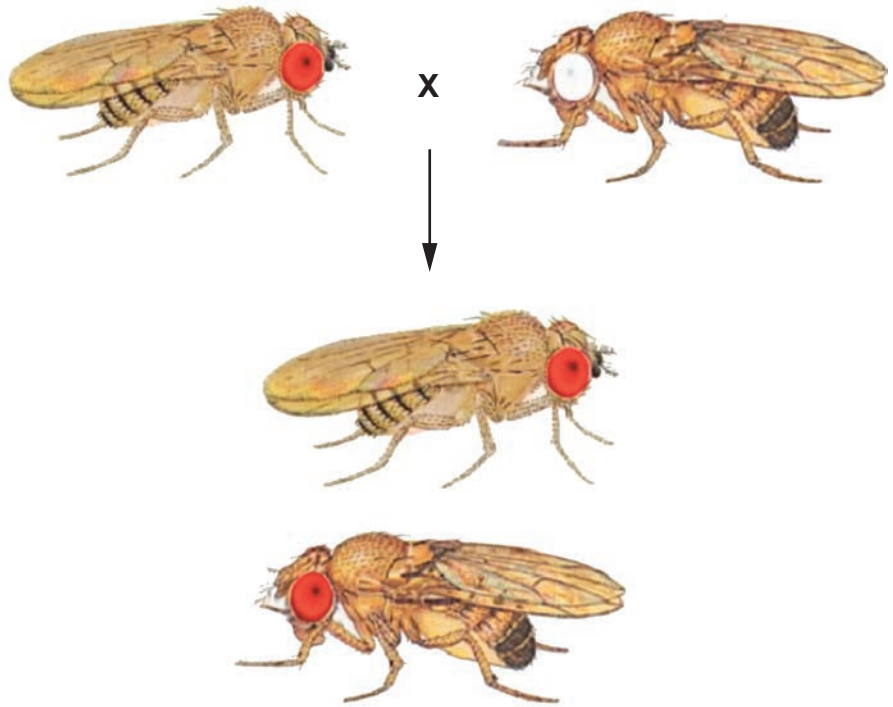
(b) The students were asked to cross a red-eyed fly and a white-eyed fly. One of each of these flies was placed in a specimen tube with some nutrients. The diagram below shows the phenotype of both the flies in this cross and some of the offspring.



All F1 offspring have red eyes

(i) **Label one** of the **male** flies in the diagram above. [1]

(ii) Show this cross in the Punnett square below. Use the letters **R** to represent the allele for red eye colour and the letter **r** to represent the alleles for white eye colour. [2]

	Gametes		
F1			

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(c) The students then decided to self the F1 generation. There were 8 groups of students. When they examined the F2 generation they obtained the following results.

Group number	Number of offspring in F2 generation	Number of flies with red eyes	Number of flies with white eyes	Approximate ratio of red-eyed to white-eyed flies
1	214	156	58	.....
2	139	108	31	.....
3	0	0	0	No ratio
4	276	206	70	.....
5	319	244	75	.....
6	39	28	11	.....
7	217	55	162	1 : 3
8	312	235	77	.....

(i) **Complete the table** by writing in the **approximate** ratio of red to white eyed flies for all the remaining groups. Use whole numbers only. [1]

(ii) The students in group number 3 followed the method correctly. Suggest a reason for their result. [1]

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(iii) Suggest an explanation for the anomalous result obtained by group number 7. [1]

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(iv) Complete the Punnett square below to show the expected result when the F1 were selfed. [2]

	Gametes		
F2			

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4. Describe how excessive heat applied to the skin of the hand can result in rapid withdrawal of the hand. [6 QER]
(Diagrams will not gain credit)

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5. A group of students were asked to calculate the population size of garden snails *(Helix aspersa)* in 5 different areas of similar size in the school grounds. They sampled the five areas of the school grounds early in the morning on a damp day. The students sampled each area once only and counted the number of snails they found. The shell of each snail was marked with a small spot of white ink. The snails were then released.

Garden snail marked with white ink

Approximately one week later, on a damp morning, the students sampled the same areas of the school grounds a second time. This time they recorded the number of recaptured snails (the ones that had been marked with white ink a week earlier) and the number of snails which had not been marked with white ink.

CAPTURE

↓

MARK - RELEASE

↓

RECAPTURE

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The table below shows the capture – recapture results obtained by the students.

Area of school grounds	No. of snails captured and marked in 1st sample	No. of snails in 2nd sample	No. of snails in 2nd sample previously marked	Population size
playing field	3	2	1	6
hedgerow	9	4	3	12
flowerbed	7	4	2	14
boundary wall	11	9	5	20
vegetable garden	23	17	10	.....

(a) Use the equation below to calculate the population size for the snails living in the vegetable garden. **Write your answer in the table above.** [2]

$$\text{population size} = \frac{\text{number in 1st sample x number in 2nd sample}}{\text{number in 2nd sample previously marked}}$$

Space for working

(b) State **one** way in which the students kept their investigation fair. [1]

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(c) The song thrush *(Turdus philomelos)* feeds on snails. During the week after marking the snails with white ink some of the students noticed that the number of song thrushes in the five areas of the school grounds had increased. This increase may have been due to a problem resulting from the students' method. Suggest why the number of song thrushes increased and how the students could overcome the problem. [2]

Song thrush eating garden snail

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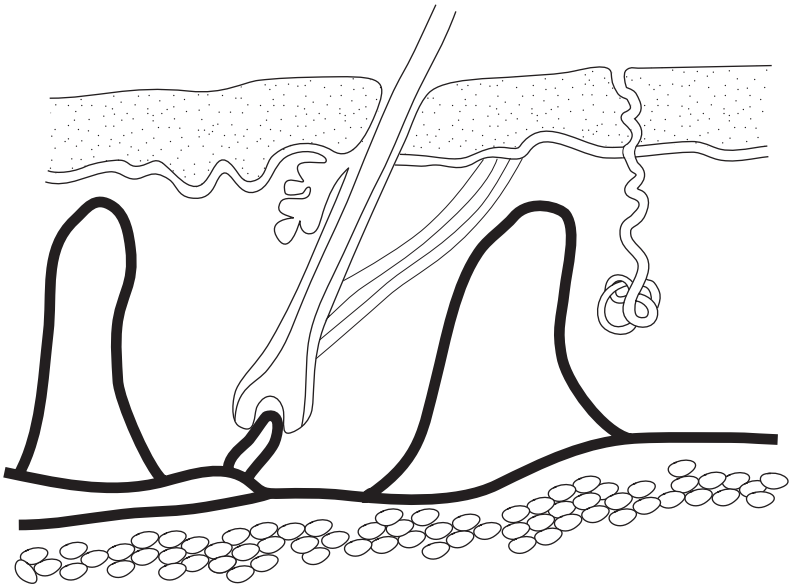
6. The diagram shows a section through human skin.



(a) On the diagram, use arrows to label the: [2]

I. sweat gland;

II. erector muscle.

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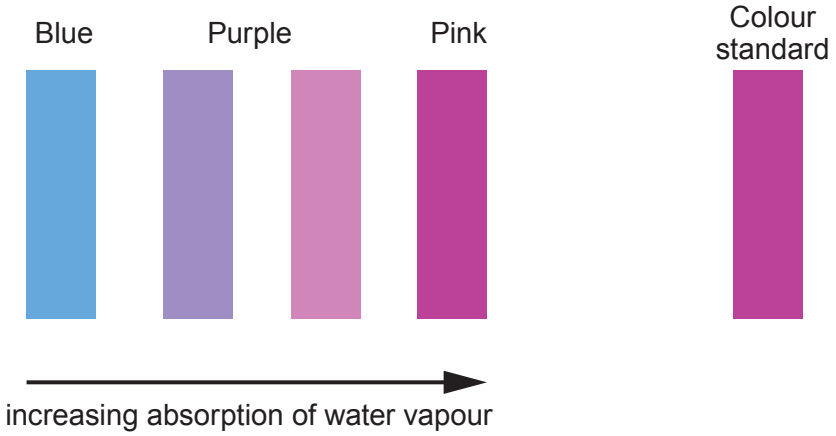
(b) Some GCSE students decided to investigate the effect of temperature on sweating.

This is their method.

Volunteers sat in a small room, the temperature of which could be finely controlled.
Strips of cobalt chloride paper were placed in small wire baskets which were held 2 mm above the surface of the skin of the arm of the volunteers.
Cobalt chloride paper turns from a blue to purple to pink colour in the presence of water vapour, as shown below.



The time taken for the cobalt chloride paper to change to the colour of the standard was recorded. The results are shown in the table below.

		Time taken for cobalt chloride paper to change to colour of standard (s)			
Volunteer No.	Room temp (°C)	Trial No. 1	Trial No. 2	Trial No. 3	Mean
1	15	363	387	376	375
2	20	321	304	309	311
3	25	287	289	265	280
4	30	221	230	202	218
5	35	187	176	167	.....

(i) **Complete the table** by calculating the mean time for volunteer number **5**. [2]

(ii) Using these results only, what conclusion can be drawn about the effect of temperature on sweating? [1]

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(iii) Alun, one of the boys in the class, said that *'we can also conclude, from the results, that the effect of temperature differs in different people'*.
The rest of the class disagreed with this. State why they disagreed. [1]

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(iv) Explain why the final colour change of the cobalt chloride paper is compared with a standard. [1]

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(c) Explain the source of the water vapour which turned the cobalt chloride paper pink. [2]

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(d) Melanoma is a type of skin cancer. Briefly describe how cancer occurs in the body. [1]

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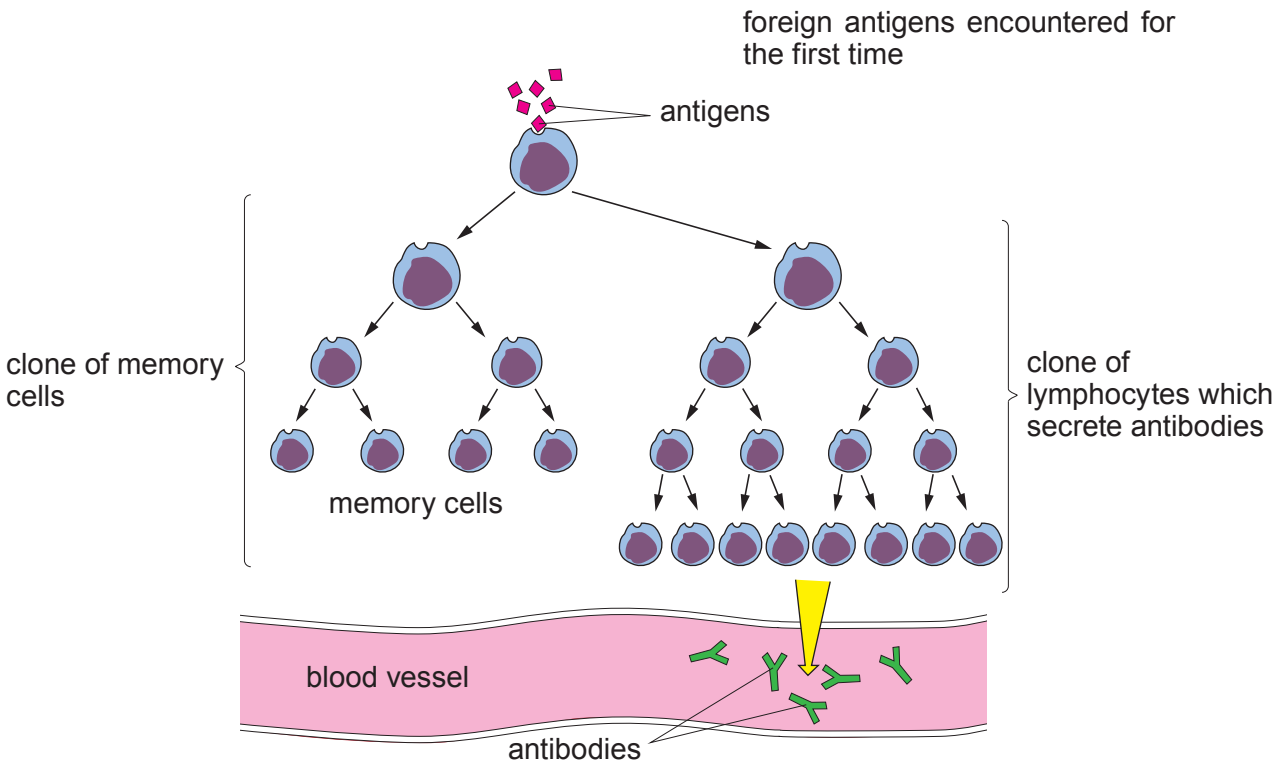
7. The diagram below shows how a lymphocyte responds to the presence of antigens in the body.



(a) Explain how the body responds to a foreign antigen the first time it is encountered and why the response is faster when the same antigen is encountered a second time. [3]

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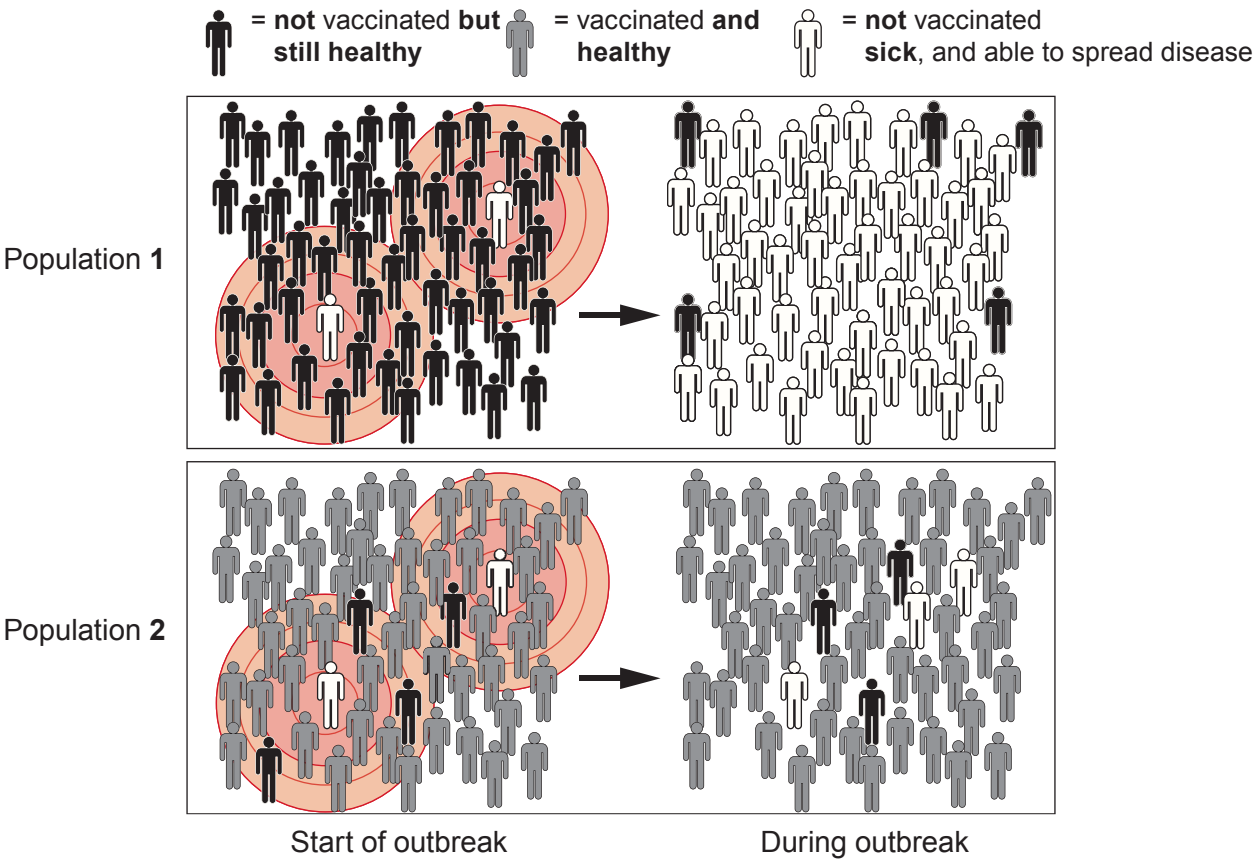
(b) Measles is a communicable disease. The diagram shows two populations of people, during an outbreak of the measles virus.



Using **only the diagram above,** explain the advantage of a vaccination programme. [2]

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8. Cardiff Bay is a 2.0 km^2 freshwater lake. The Bay is not tidal but visiting yachts, from all over Europe, can enter the Bay from the sea, through locks. The Bay is fed by two rivers, the Taff and the Ely.

The following public information notice has been posted in Cardiff Bay.

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(a) (i) Invasive species are also known as alien species. Explain what is meant by the term *invasive species* and why they are a problem. [2]

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(ii) In the public information notice opposite there is an error in the way in which the scientific name of the killer shrimp has been written. Identify the error by writing the scientific name in the correct form. [1]

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(iii) Killer shrimps feed on native freshwater shrimps, aquatic insects and small fish. State how the biodiversity of the UK will be affected by the killer shrimp. [1]

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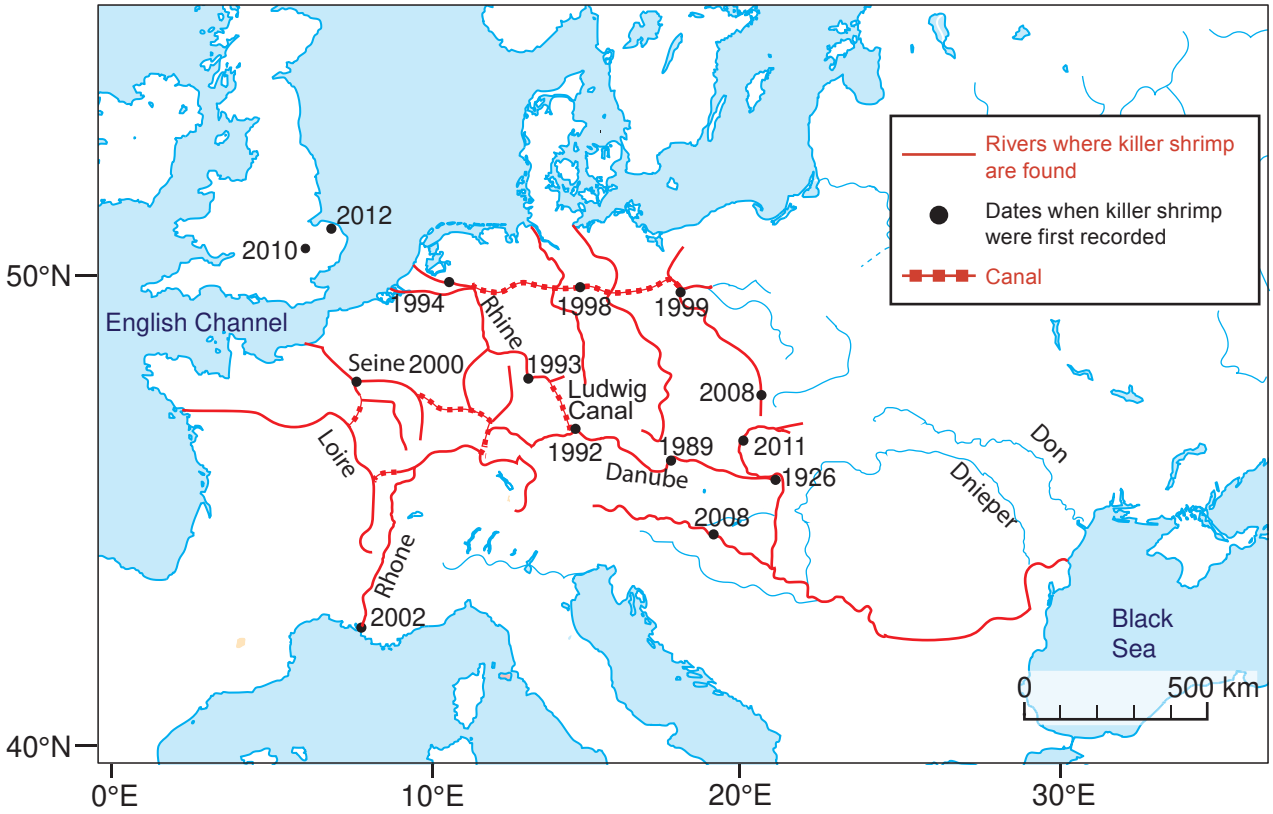
(b) Killer shrimp fact file:

Environment	Freshwater reservoirs and lakes in UK. Cannot live in water with a salt content > 2.5 %
Native range	Black Sea, Russian Far East
Invasion pathway into UK	Unknown
Feeding	Predator
Status in UK	Established
Date of first record in UK	2010
Speed of spread	Downstream 124 km/year Upstream 35 km/year
Predators	Trout, perch, aquatic birds
Body length of adult	Up to 30 mm
Reproduction	Females lay about 50 eggs which hatch into young about 1.8 mm in length

The map below shows the spread of the killer shrimp westwards along the rivers and canals of Europe. It also shows the dates at which the killer shrimp was first recorded at various points.



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(i) Use the map to suggest the route by which the killer shrimp travelled from the River Danube to the River Rhine and state the date when this occurred. [1]

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(ii) The salt content of the English Channel is 3.4–3.5 %. State why the killer shrimp could not have travelled to Great Britain through the waters of the English Channel. [1]

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(iii) As a trainee research biologist working for Natural Resources Wales you have been asked to study all the information in detail. Suggest **one** way by which the killer shrimp could have arrived in Great Britain. [1]

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(iv) The River Taff rises in the Brecon Beacons and flows through Merthyr Tydfil to Cardiff Bay. Travelling along the River Taff, Merthyr Tydfil is 55.1 km from Cardiff Bay. If the killer shrimp were to travel up the River Taff from Cardiff Bay, calculate, to **two** significant figures, how long it would take to reach Merthyr Tydfil. [2]

time taken to reach Merthyr Tydfil = ... years

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END OF PAPER

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