1 Malaria kills over one million people every year, the vast majority being under the age of ten.

Adults who have survived malaria in childhood and then continue to live in an area where malaria is found, develop a limited form of immunity.

(a) **(i)** Name the parasite that causes malaria.

..... **[1]**

(ii) Name the vector for the malarial parasite.

..... **[1]**

(iii) Name a human cell in which the malarial parasite reproduces.

..... **[1]**

(b) Scientists are developing a vaccine using an attenuated (inactive) form of the malarial parasite.

The aim is to trigger an immune response without the development of the disease.

Describe the actions of the **B lymphocytes** in the immune response.



In your answer you should make clear how the steps in this part of the immune response are sequenced.

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..... **[8]**

(c) Suggest why adults who have survived malaria may lose their immunity when they **leave** a malarial area.

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..... **[2]**

(d) State **three biological** reasons why it has not been possible to produce an effective vaccine for malaria.

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..... **[3]**

[Total: 16]

2 **(a)** In his book 'On the Origin of Species', Charles Darwin made the following four observations:

W Offspring generally appear similar to their parents.
X No two individuals are identical.
Y Organisms have the ability to produce large numbers of offspring.
Z Populations in nature tend to remain relatively stable.

From these observations he made a number of deductions, which are listed below in Table 6.1.

The deductions are supported by one **or more** of the observations (**W**, **X**, **Y** or **Z**).

In Table 6.1, indicate which of the above observations supported each deduction.

You may use each letter (**W**, **X**, **Y**, or **Z**) once, more than once or not at all.

Table 6.1

deduction	supporting observation(s)
characteristics are passed on to the next generation	
there is a struggle for existence	
individuals with beneficial characteristics are among the few who survive	

[3]

(b) Resistance to antibiotics has evolved in some pathogenic bacteria, such as MRSA.

Suggest why the resistance of MRSA to existing antibiotics is of major concern to humans.

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..... **[2]**

(c) The evolution of antibiotic resistance in bacteria is evidence to support the theory of evolution.

How does **fossil** evidence support the idea that evolution has taken place?

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..... **[3]**

[Total: 8]

3 An important aspect of food production is maximising productivity. Maximum productivity can be achieved in a number of different ways.

(a) In selective breeding, humans look for variation between members of the same species and use this variation to improve productivity.

(i) State the **two** different causes of variation.

1 .....

2 ..... **[2]**

Fig. 6.1 is a scattergraph that shows the growth rate and egg productivity in a flock of chickens.

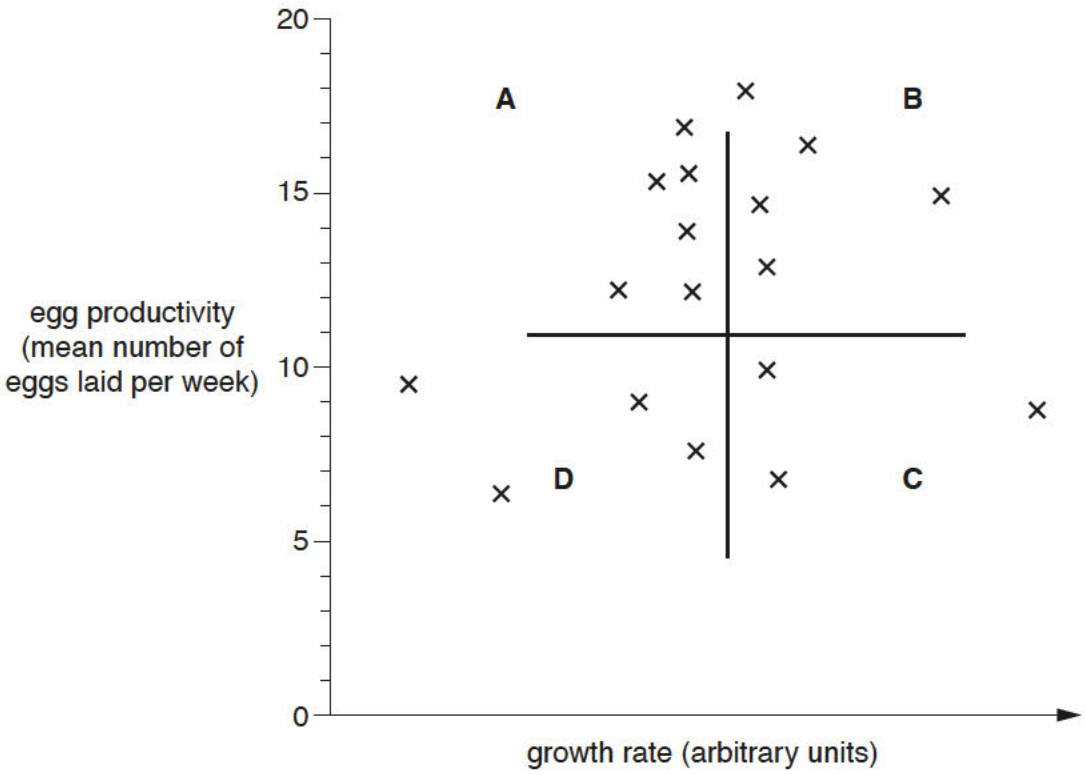


Fig. 6.1

(ii) The growth rate of the chickens in Fig. 6.1 shows **continuous** variation.

Describe **three** characteristics of this type of variation.

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..... **[3]**

(iii) A chicken breeder divides the flock into four groups, **A**, **B**, **C** and **D**, as shown in Fig. 6.1.

State which group of chickens, **A**, **B**, **C** or **D**, he should use to breed from in order to improve the growth and productivity of the flock.

..... **[1]**

(iv) Suggest **two undesirable** consequences of selective breeding in chickens.

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..... **[2]**

(v) The wild ancestor of the domestic chicken is the red jungle fowl found in the rainforests of South East Asia.

Explain why it is important to preserve the population of the red jungle fowl.

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..... **[2]**

(b) In the past, domestic chickens were given antibiotics as a growth promoter.

(i) When antibiotic growth promoters were used, it was claimed that the meat was of better quality, with less fat and increased protein content.

Suggest **two further** benefits of using antibiotics.

1 .....

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2 .....

..... **[2]**

(ii) The use of antibiotics as growth promoters in animal production was banned in the European Union in 2006.

Suggest a concern that led to this ban.

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..... **[1]**

[Total: 13]

4 **(a)** The enzyme DHPS is involved in the production of folic acid in bacteria.

- The substrate for DHPS is a molecule known as PABA.
- The enzyme DHPS is inhibited by the drug sulfonamide.

Fig. 3.1 shows the structure of PABA and that of sulfonamide.

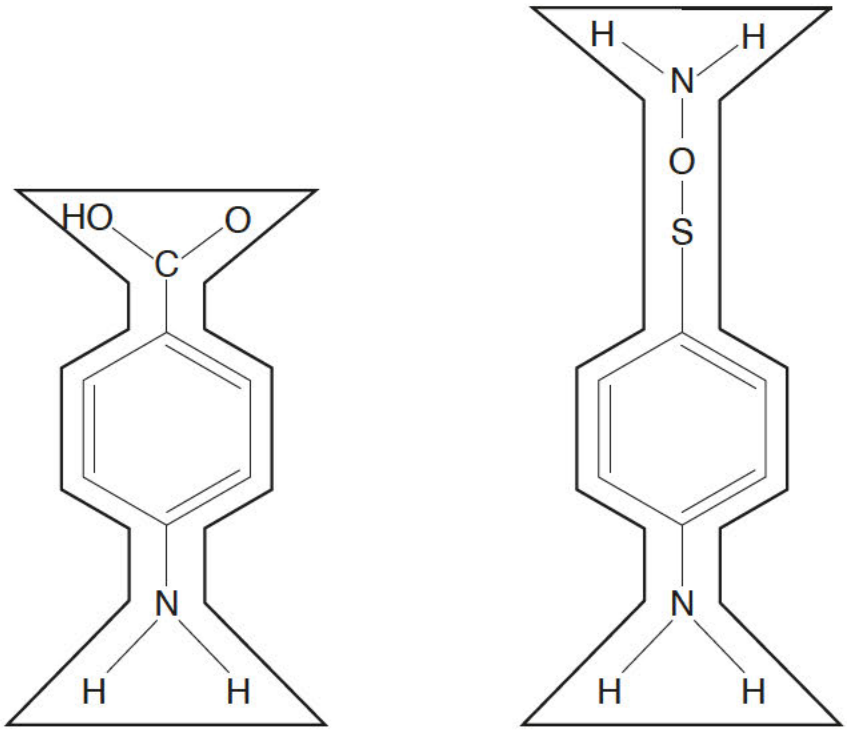
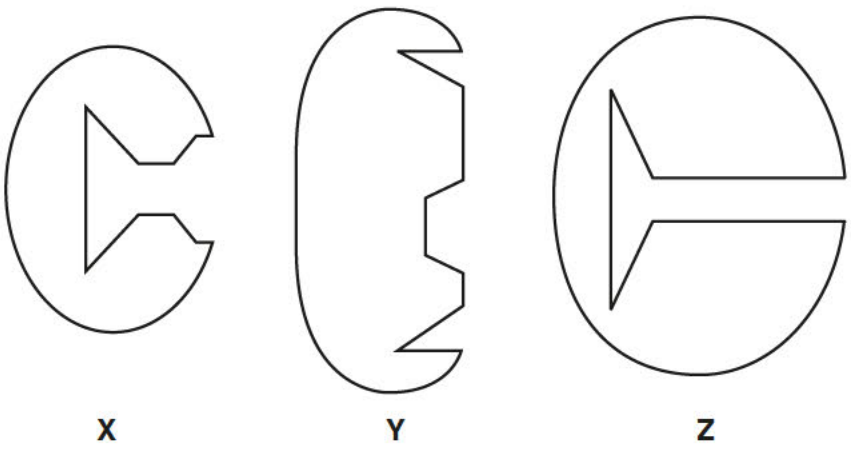


Fig. 3.1

(i) Diagrams **X**, **Y** and **Z** represent these enzyme molecules and their active sites.



State the letter, **X**, **Y** or **Z**, that most accurately represents the enzyme DHPS.

..... **[1]**

(ii) Using the information in Fig. 3.1, explain why sulfonamide acts as a competitive inhibitor of DHPS.

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..... **[3]**

(b) Fig. 3.2 shows the effect of increasing the concentration of the substrate (PABA) on the rate of reaction.

- Curve **A** shows the rate of reaction without the presence of the competitive inhibitor sulfonamide.
- Curve **B** shows the rate of reaction in the presence of the competitive inhibitor sulfonamide.

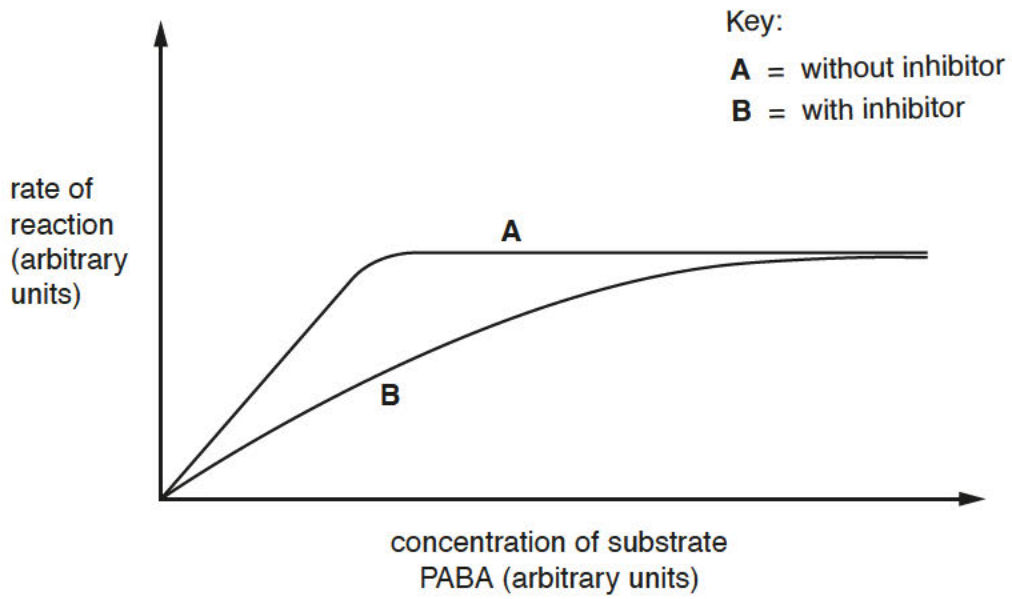


Fig. 3.2

Explain the effect of increasing the concentration of substrate on the rate of reaction;

(i) without inhibitor,

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..... **[3]**

(ii) with inhibitor.

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..... **[2]**

(c) Antibiotic resistance in bacteria is becoming an increasing problem.

Describe how a sulfonamide-resistant population of bacteria could develop.

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..... **[4]**

(d) Hospitals can check to see if a strain of bacteria causing an infection is resistant to a range of antibiotics by using a **multodisc**. A multodisc contains different antibiotics.

- The bacteria are isolated from a patient.
- The bacteria are spread on nutrient agar in a Petri dish.
- The multodisc is placed on the agar.

Fig. 3.3 shows a Petri dish with the bacteria, in which is placed a multodisc containing six different antibiotics.

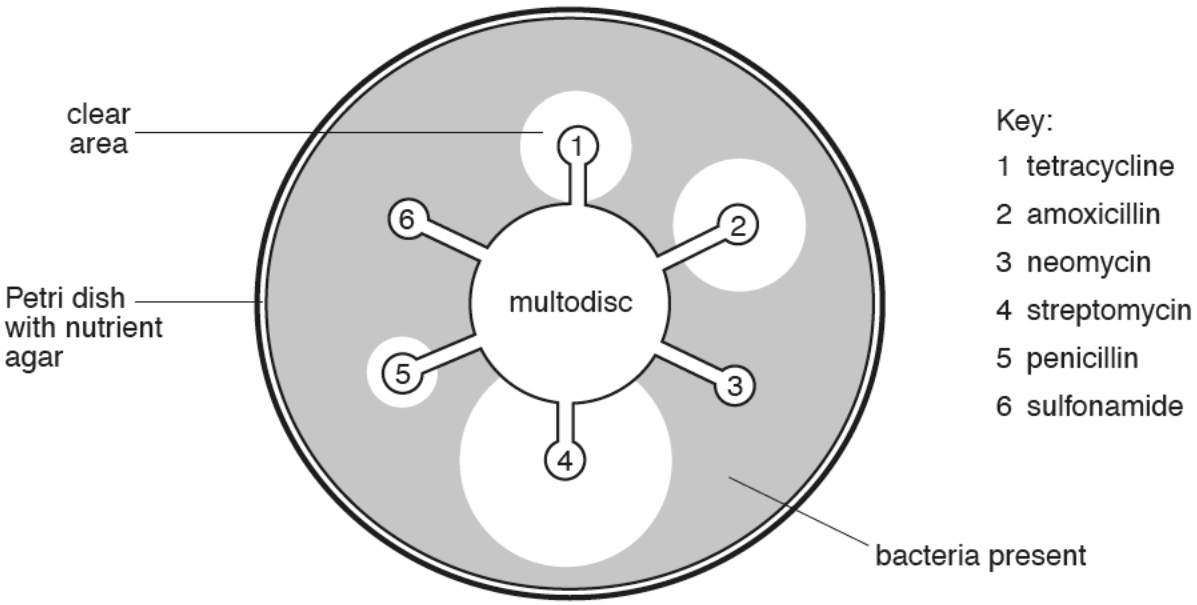


Fig. 3.3

(i) Explain why there are clear areas of agar in the Petri dish.

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..... **[1]**

(ii) Using Fig. 3.3, name the antibiotic that is most effective against the bacteria causing the infection.

..... **[1]**

(iii) Suggest **three** reasons why a hospital might use a multodisc to select the most suitable antibiotic for treating a patient.

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..... **[3]**

(e) Drugs, such as antibiotics, are often first discovered in the natural environment.

Explain why it may become increasingly difficult to discover new drugs in the future.

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..... **[2]**

[Total: 20]