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Module 3: Biodiversity and Evolution
2.3.3 Evolution
June 2009-January 2013
Questions

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| (a) define the term <i>variation</i> ; |
| (b) discuss the fact that variation occurs within as well as between species; |
| (c) describe the differences between continuous and discontinuous variation, using examples of a range of characteristics found in plants, animals and microorganisms; |
| (d) explain both genetic and environmental causes of variation; |
| (e) outline the behavioural, physiological and anatomical (structural) adaptations of organisms to their environments; |
| (f) explain the consequences of the four observations made by Darwin in proposing his theory of natural selection; |
| (g) define the term <i>speciation</i> ; |
| (h) discuss the evidence supporting the theory of evolution, with reference to fossil, DNA and molecular evidence |
| (i) outline how variation, adaptation and selection are major components of evolution; |
| (j) discuss why the evolution of pesticide resistance in insects and drug resistance in microorganisms has implications for humans |

- 8 The table below shows some biological terms and descriptions that are used in topics on evolution, biodiversity and conservation.

Complete the table using the most appropriate terms or descriptions.

The first one has been done for you.

Biological Term	Description
Natural Selection	The theory proposed by Darwin on the evolution of species.
Speciation	
	Differences between individuals that cover a range of values rather than discrete categories.
Adaptation	
	A system of naming organisms that uses two scientific (Latin) names for species.
	The type of conservation of which seed banks are an example.
	A study carried out by a local planning authority in order to judge the effect of a development on the biodiversity of an area.

[6]

[Total: 6]

END OF QUESTION PAPER

8

3 Bats are the only mammals that can truly fly. Many species of bat hunt flying insects at night. Bats are able to use sound waves (echolocation) in order to help them find their prey in the dark.

(a) Suggest how the ability to use echolocation may have evolved from an ancestor that did not have that ability.

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The pipistrelle is the most common species of bat in Europe. It was originally thought that all pipistrelles belonged to the same species, *Pipistrellus pipistrellus*. However, in the 1990s, it was decided that there were two species: the common pipistrelle, *Pipistrellus pipistrellus* and the soprano pipistrelle, *Pipistrellus pygmaeus*.

Data for both species are provided in Table 3.1.

Table 3.1

species	mean body mass (g)	mean wingspan (m)	range of echolocation call (kHz)	colour
common pipistrelle	5.5	0.22	42–47	medium to dark brown
soprano pipistrelle	5.5	0.21	52–60	medium to dark brown

(b) (i) Name the genus to which the soprano pipistrelle belongs.

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(ii) Using the data in Table 3.1, suggest why pipistrelles were originally classified as one species.

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..... [1]

(iii) State **two** pieces of **molecular** evidence that can be used to identify organisms as belonging to different species.

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(iv) Describe how it is possible to confirm, over a longer period of time, whether two organisms belong to different species or the same species.

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QUESTION 3(c) STARTS ON PAGE 10

6 (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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(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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[Total: 8]

QUESTION 7 STARTS ON PAGE 20

- 6 (a) Fig. 6.1 shows two species of trilobites, a group of arthropods that became extinct about 240 million years ago. Species A is 20 million years older than species B.

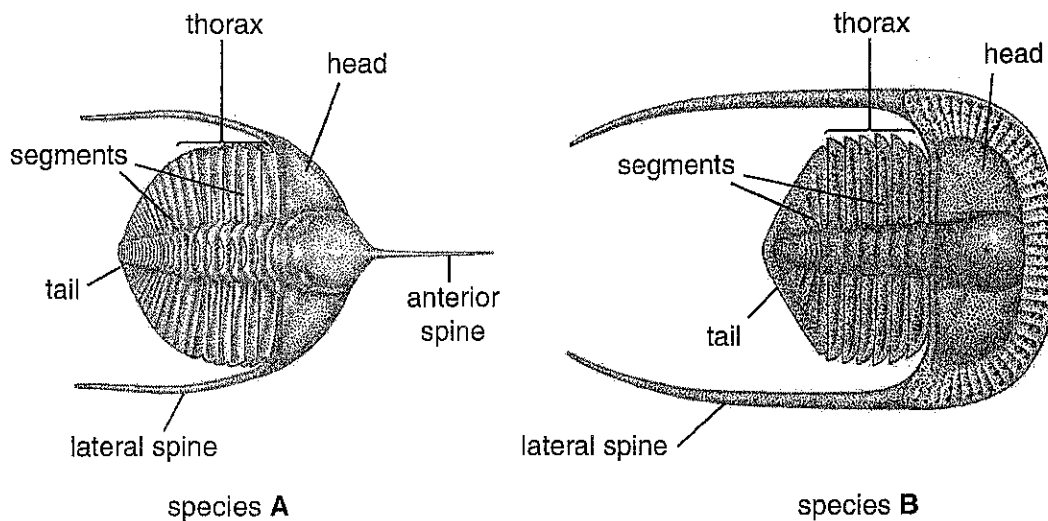


Fig. 6.1

- (i) List **three** observable features from Fig. 6.1 that suggest the two species are related.

- 1
- 2
- 3 [3]

- (ii) List **two** observable features from Fig. 6.1, **other than size**, that could suggest they are **different** species.

- 1
- 2 [2]

- (b) Explain how fossils provide evidence for the theory of evolution.

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[Total: 7]

(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.

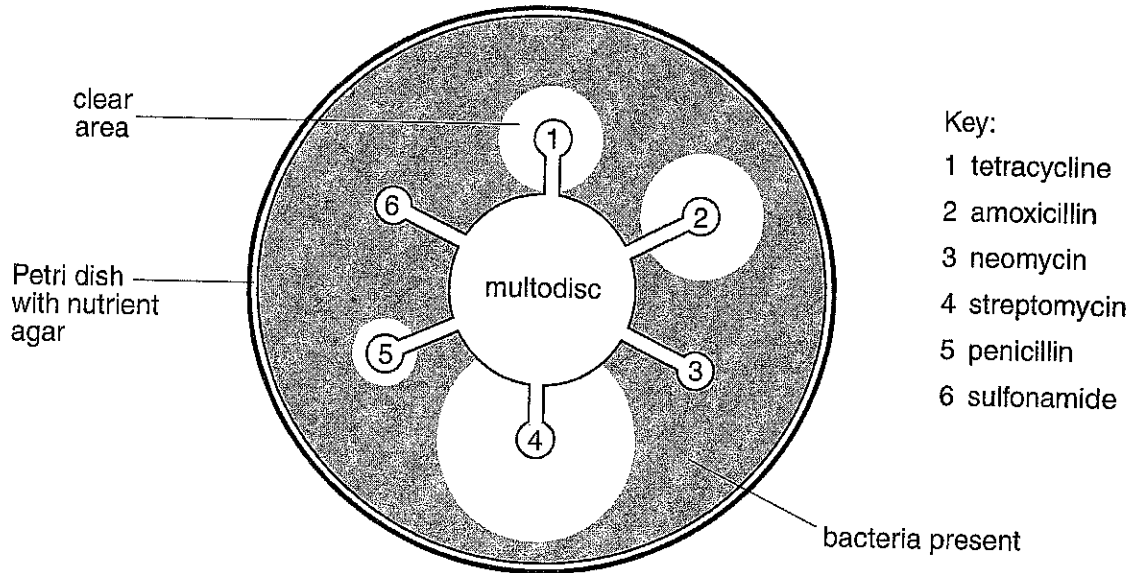


Fig. 3.3

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

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

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(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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(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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[Total: 20]