

1)

Many insects live in freshwater habitats such as rivers and ponds for part of their life cycle.

Fig. 1.1 shows a labelled diagram of a generalised insect along with six common insects found in freshwater in the UK.

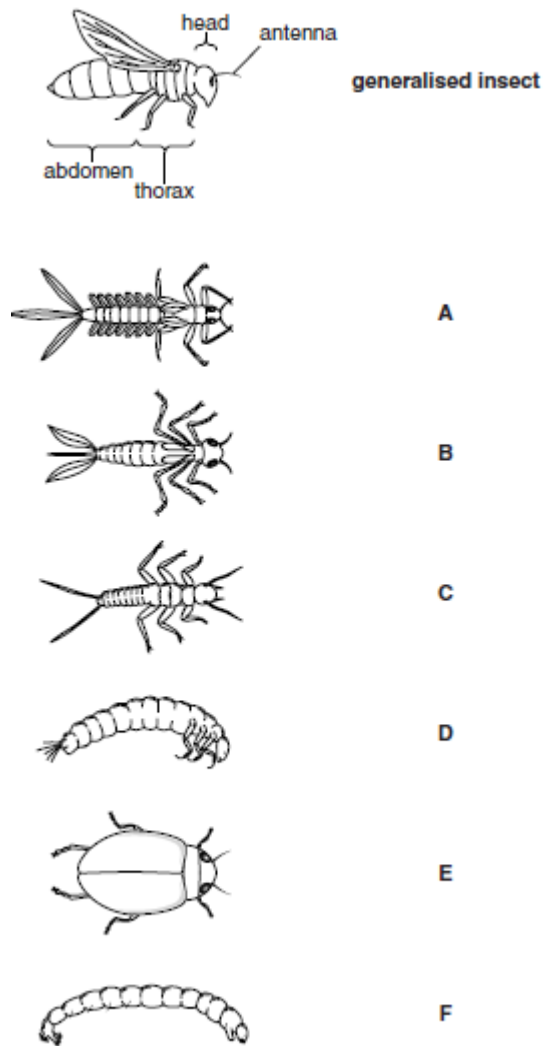


Fig. 1.1

Table 1.1 below shows a dichotomous key used for the classification of insects.

Key:			
Question 1	Does it have jointed limbs?	yes no	go to question 2 bloodworm
Question 2	Does it have an oval body shape?	yes no	diving beetle go to question 3
Question 3	Is the length of the tail greater than the length of three abdominal segments?	yes no	go to question 4 caddis fly larva
Question 4	Are gills attached to the abdominal segments?	yes no	mayfly larva go to question 5
Question 5	Does it have two narrow tails?	yes no	stonefly larva damsel fly larva

Table 1.1

(a) (i) Use Table 1.1 to identify the insects labelled A to F shown in Fig. 1.1.

- A
 - B
 - C
 - D
 - E
 - F
- [2]

(ii) Why is the key in Table 1.1 described as a *dichotomous* key? ... [1]

.....

(b) Suggest an adaptation shown by at least one of the insects in Fig. 1.1 that allows them to survive in an aquatic habitat. [1]

.....

(c) Insects belong to the animal kingdom within the domain *Eukaryota*.

(i) Suggest **one** feature of the cells of insects that would identify insects as belonging to the domain *Eukaryota*. [1]

.....

.....

(ii) State **two** features that are present in the eukaryotic cells of plants that are **absent** from the cells of insects. [2]

1

2

2)

- (a) In the UK in 2009, there was a major outbreak of a type of influenza known as 'swine flu'.

'Swine flu' was caused by a new strain of the influenza virus.

Explain why the influenza virus is usually described as a *pathogen* rather than a *parasite*.

..... [3]

- (b) When an individual is infected with a virus, an immune response is triggered.

- (i) Define the term *immune response*.

..... [2]

- (ii) One type of cell involved in an immune response is a plasma cell, which releases antibodies.

Plasma cells contain RNA.

Outline the roles of RNA in plasma cells.



In your answer you should give an account of the different roles of RNA.

..... [6]

- (iii) Outline **two** ways in which antibodies reduce the threat from pathogens.

..... [4]

- (c) (i) In an attempt to reduce the consequences of further outbreaks of influenza, the government encourages immunisation of key groups of people, such as the elderly and children that have another risk factor.

Suggest **two other** groups who should be immunised **and** explain why immunisation for them would be particularly important.

..... [4]

- (ii) Immunisation of large numbers of people costs the UK government a lot of money.

Other than the direct effects on health or reducing the number of deaths, suggest a reason why spending a large amount of money on immunisation is considered worthwhile. [1]

.....

- (iii) Much of the money spent on immunisation programmes is used to publicise the health benefits of immunisation. Despite this, some individuals are reluctant to have the immunisation.

Give **one** reason why, despite being aware of the immunisation programme, some people choose not to be immunised.

..... [1]

3)

Scientists have identified approximately 1.8 million different species. The number of species that actually exist is likely to be significantly higher than 1.8 million.

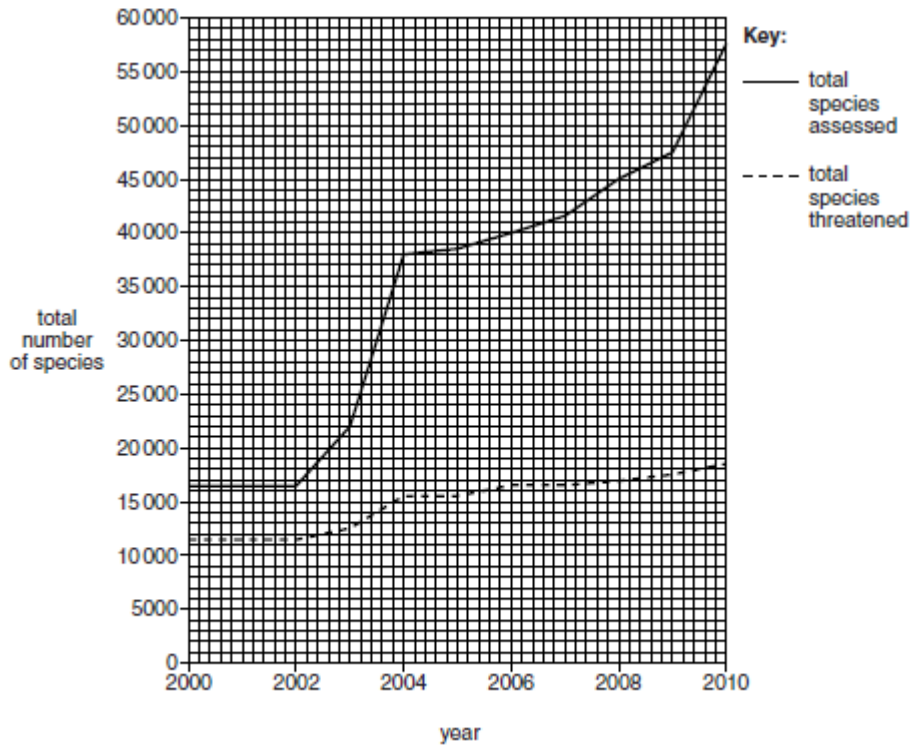
(a) Suggest **two** reasons why the number of species identified is likely to be lower than the actual number of species present on Earth.

- 1
-
- 2
-

[2]

(b) Many organisations, such as the International Union for the Conservation of Nature (IUCN), gather annual data about the number of species that are known to exist and to what extent they are considered to be endangered.

Fig. 5.1 shows the total number of species assessed by the IUCN over a 10 year period and the number of those species assessed that are considered to be threatened with extinction.



(i) Using Fig. 5.1, **compare** the changes in the total number of species assessed with the changes in the total number of threatened species over the 10 year period.

..... [3]

(ii) Using Fig. 5.1, calculate the percentage of species assessed that were threatened with extinction in **2010**.

Show your working. Give your answer to the **nearest whole number**.

Answer = % [2]

(iii) Suggest explanations for the shape of the two curves between **2005** and **2010**.

..... [2]

- (c) A study of the biodiversity of an area considers not only the total number of species but also the relative number of individuals within each species.

State **one** further factor that could be taken into account when describing the biodiversity of an area.

..... [1]

- (d) In any attempt to protect global biodiversity, cooperation between countries is important.

Two examples of such international cooperation are:

- Convention on International Trade in Endangered Species (CITES)
- Rio Convention on Biological Diversity.

Other than the conservation of biodiversity, state **two** aims for each of these conventions.

Convention on International Trade in Endangered Species

..... [4]

Rio Convention on Biological Diversity

4)

- (a) Humans have been using microorganisms to make food for over 4000 years. Yoghurt is a dairy product that is produced by the action of microorganisms on milk.

Suggest why yoghurt production relies on a plentiful supply of plants.

..... [1]

- (b) Protein known as mycoprotein is promoted as a healthy alternative to meat. Mycoprotein is made using fungal microorganisms.

Discuss the advantages **and** disadvantages of using microorganisms to produce protein for human consumption.



In your answer you should consider a range of advantages and disadvantages.

[8]

.....

- (c) Microorganisms can also be responsible for food spoilage. In order to prevent this spoilage, a range of food preservation methods are used.

Complete the table below to explain how the **three** methods of food preservation reduce food spoilage.

Method	Explanation
Freezing	
Pickling	
Irradiation	

[3]

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5)

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]

6)

In an experiment to measure the rate of diffusion, a student placed cubes of agar jelly containing an indicator into dilute hydrochloric acid. The indicator changes from pink to colourless in acidic conditions.

The student used cubes of different sizes and recorded the time taken for the pink colour of each cube to disappear completely.

The student's results are recorded in Table 2.1.

Length of side of cube (mm)	Surface area of cube (mm ²)	Volume of cube (mm ³)	Surface area to volume ratio	Time taken for pink colour to disappear (s)	Rate of diffusion (mm s ⁻¹)
2	24	8	3.0:1	50	0.020
5	150	125	1.2:1	120	0.021
10	600	1 000		300	0.017
20	2400	8000	0.3:1	700	0.014
30	5400	27 000	0.2:1	1 200	0.013

Table 2.1

(a) (i) Calculate the surface area to volume ratio of the cube with 10 mm sides.

Show your working.

Answer = [2]

(ii) Using the data in Table 2.1, describe the relationship between the rate of diffusion and the surface area to volume ratio.

[2]

(iii) Explain the significance of the relationship between rate of diffusion and the surface area to volume ratio for large plants.

[2]

(b) Another student used the same raw data obtained in the experiment but calculated a different rate of diffusion for each cube. This student's results are shown in Table 2.2.

Length of side of cube (mm)	Time taken for pink colour to disappear (s)	Rate of diffusion (mm s ⁻¹)
2	50	0.040
5	120	0.042
10	300	0.033
20	700	0.029
30	1200	0.025

Table 2.2

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In this student's table, the calculation of the rate of diffusion is incorrect.

(i) Suggest the method used to calculate the rate of diffusion in Table 2.2.

.....
 [1]

(ii) State why the method in (b)(i) is **not** correct. [1]

(c) In mammals, the lungs are adapted to enable efficient gaseous exchange.

The table below lists some of the adaptations of the lungs.

Complete the table explaining how each adaptation improves efficiency of gaseous exchange.

Adaptation	How this adaptation improves efficiency of gaseous exchange
squamous epithelium
large number of alveoli
good blood supply
good ventilation

[4]

7)

Fig. 4.1 shows the oxygen dissociation curves for fetal haemoglobin (A) and adult haemoglobin (B).

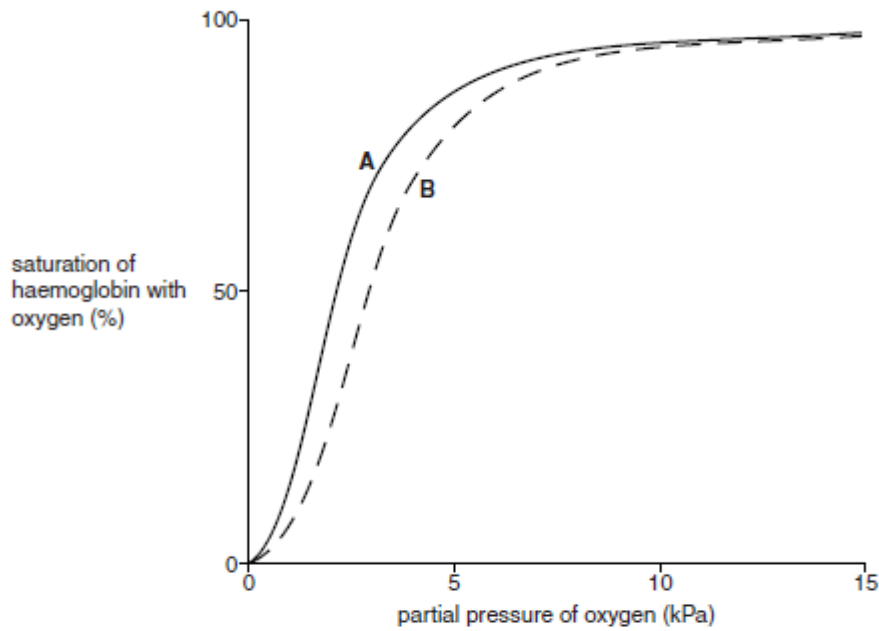


Fig. 4.1

(a) (i) Curve A represents fetal haemoglobin.

Explain why the fetal haemoglobin curve is to the left of the adult haemoglobin curve.

[3]

(ii) Sickle cell anaemia is an inherited disorder in which haemoglobin crystallises when the partial pressure of oxygen (pO_2) is low. The red blood cells change shape and oxygen transport is disrupted.

Treatment with drugs, such as hydroxyurea, can stimulate adults to produce fetal haemoglobin rather than adult haemoglobin.

Suggest why this treatment might be of benefit to adults with sickle cell anaemia.

[2]

(b) Describe **and** explain how substances that are dissolved in the blood plasma, such as oxygen or glucose, **enter the tissue fluid** from the capillaries.



In your answer you should use appropriate technical terms, spelled correctly.

[4]