1)

14

(a) Distinguish between the term *transpiration* and the *transpiration stream*.

..... [3]

(b) Xerophytes are plants that are adapted to living in dry conditions.

The lists below describe four general features of leaves. From each list, select the leaf that belongs to a xerophyte.

Place a tick (✓) in the correct box. The first one has been done for you.

Presence of hairs on leaves

Leaf **A**	no	
Leaf **B**	yes	✓
Leaf **C**	no	

Mean number of stomata (cm^{-2})

Leaf **D**	30000	
Leaf **E**	23000	
Leaf **F**	13000	

Mean surface area of one leaf (cm^2)

Leaf **G**	0.2	
Leaf **H**	10.0	
Leaf **I**	23.0	

Thickness of cuticle (μm)

Leaf **J**	4.25	
Leaf **K**	8.50	
Leaf **L**	2.00	

[3]

(c) The transport system of multicellular plants consists of xylem and phloem tissue.

The table below contrasts the structure and roles of xylem and phloem.

Complete the table using the most appropriate word or words.

2)

Living organisms can be classified into five kingdoms, based on certain key characteristics.

(a) Table 2.1 shows some of the characteristics of the five kingdoms.

Complete the table.

Table 2.1

kingdom	membrane-bound organelles	cell wall	type(s) of nutrition
prokaryote	absent	present – made of peptidoglycan	
	present	sometimes present – composition varies	heterotrophic and autotrophic
fungi		present – made of chitin	heterotrophic
	present		autotrophic
animal		absent	heterotrophic

[6]

(b) An unknown species is discovered. Its cells contain many nuclei scattered throughout the cytoplasm of thread-like structures.

Suggest the kingdom to which this species belongs.

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

(c) Living organisms can also be classified into three groups called **domains**.

Outline the features of this system of classification compared with the five kingdom system.

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

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.

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

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.

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

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

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

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

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

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

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

(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.

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

(c) The soprano pipistrelle has an echolocation call that is 'high pitched' (between 52 and 60 kHz). The common pipistrelle has an echolocation call that is 'low pitched' (between 42 and 47 kHz).

Variation within and between species can be as a result of genetic or environmental factors. Whatever the causes of variation, the type of variation displayed can occur in two different **forms**.

Using the pipistrelle as an example, describe the key features of both **forms** of variation.

In your answer you should make it clear how genes and environment relate to each form of variation.

[7]

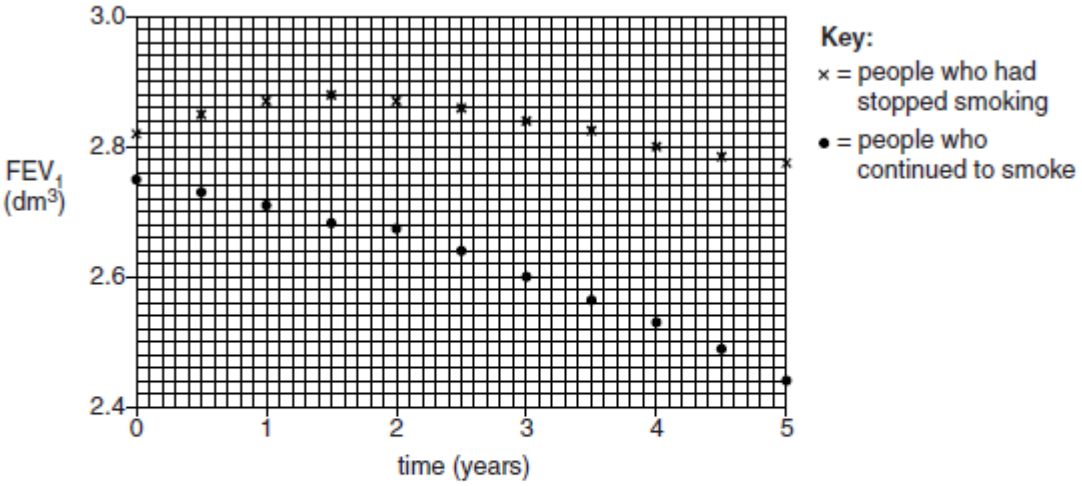
.....

4)

(a) An investigation was carried out into the effect on lung function on giving up smoking.

The investigators measured the maximum volume of air that could be exhaled in one second (FEV_1) in a group of people who had stopped smoking, and in a similar group of people who continued to smoke over a five year period.

The results are shown in Fig. 5.1.



(i) Using the information in Fig. 5.1, calculate the percentage decrease in the FEV_1 over the 5 year period for the group of people who **continued to smoke**.

Show your working. Give your answer to **one decimal place**.

Answer = ... % **[2]**

(ii) Describe the trends shown by the results in Fig. 5.1.

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

(b) (i) One of the symptoms of smoking is the development of a smoker's cough.

Explain how smoking causes a smoker's cough **and** how the cough itself can lead to further problems in the lungs over a long period of time.

In your answer you should clearly distinguish between the development of the cough and the effects of prolonged coughing.

[7]

.....

(ii) Chronic obstructive pulmonary disease (COPD) is a combination of diseases that can result in coughing, breathing difficulties and fatigue.

Name **two** specific diseases that contribute to COPD.

1 .....

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

(iii) One form of COPD develops because enzymes are released by phagocytes entering the alveoli. This enzyme action can break down elastin in the lining of the bronchioles and alveoli.

Use the example of elastin breakdown to explain the induced-fit hypothesis of enzyme action.

[5]

.....

5)

(a) The traditional English folk song, *The Derby Ram*, contains the lyric:

"As I went out to Derby, all on a market day
I spied the biggest ram, sir, that ever was fed on hay"

The song is likely to have been inspired by the successes of farmers in the eighteenth century who developed a sheep known as the 'Dishly Ram'. This ram gave rise to a breed which grew more quickly, producing more wool and meat than other varieties of sheep.

(i) Explain how it would be possible for farmers in the eighteenth century to produce a larger, more profitable variety of sheep from an existing flock of sheep.

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

(ii) Since the eighteenth century, other ways of improving productivity in sheep have been developed.

State **one** further way of improving productivity that is used by modern farmers.

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

(b) Crop yield can be improved by the use of fertilisers. In the eighteenth century, these are likely to have been organic fertilisers in the form of manure or compost.

(i) Suggest how organic fertilisers improve the yield of plant crops.

[3]

.....

(ii) Inorganic fertilisers are not directly toxic to living organisms. However, the excessive use of these fertilisers can lead to a reduction in the biodiversity of farmland.

Suggest how the excessive use of inorganic fertilisers on **farmland** can cause a reduction in its biodiversity.

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

(iii) Explain why a reduction in biodiversity may present problems for **agriculture** in the future.

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

6)

Select the most appropriate term from the list below to complete the table.

abundance	**habitat**	**Simpson's diversity index**
biodiversity	**percentage cover**	**species evenness**
biased	**quadrat**	**species richness**
community	**quantitative**	**systematic**
dichotomous	**random**	**taxon**
ecosystem	**sample**	**transect**

definition	term
sampling in which the observer does not decide when and where to take measurements	
a representative group of organisms that are selected from a population	
an area in which an organism lives	
a measure of the relative numbers of individuals in each species	
the frequency of occurrence of plants in a particular area	
the number of species present in a particular area	

[6]