1(a) A student used an apparatus to investigate the effect of temperature on the rate of photosynthesis of the leaves of Chinese plantain, *Plantago asiatica*, at two different concentrations of carbon dioxide, **A** and **B**.

Fig. 2.2 shows the results of the investigation.

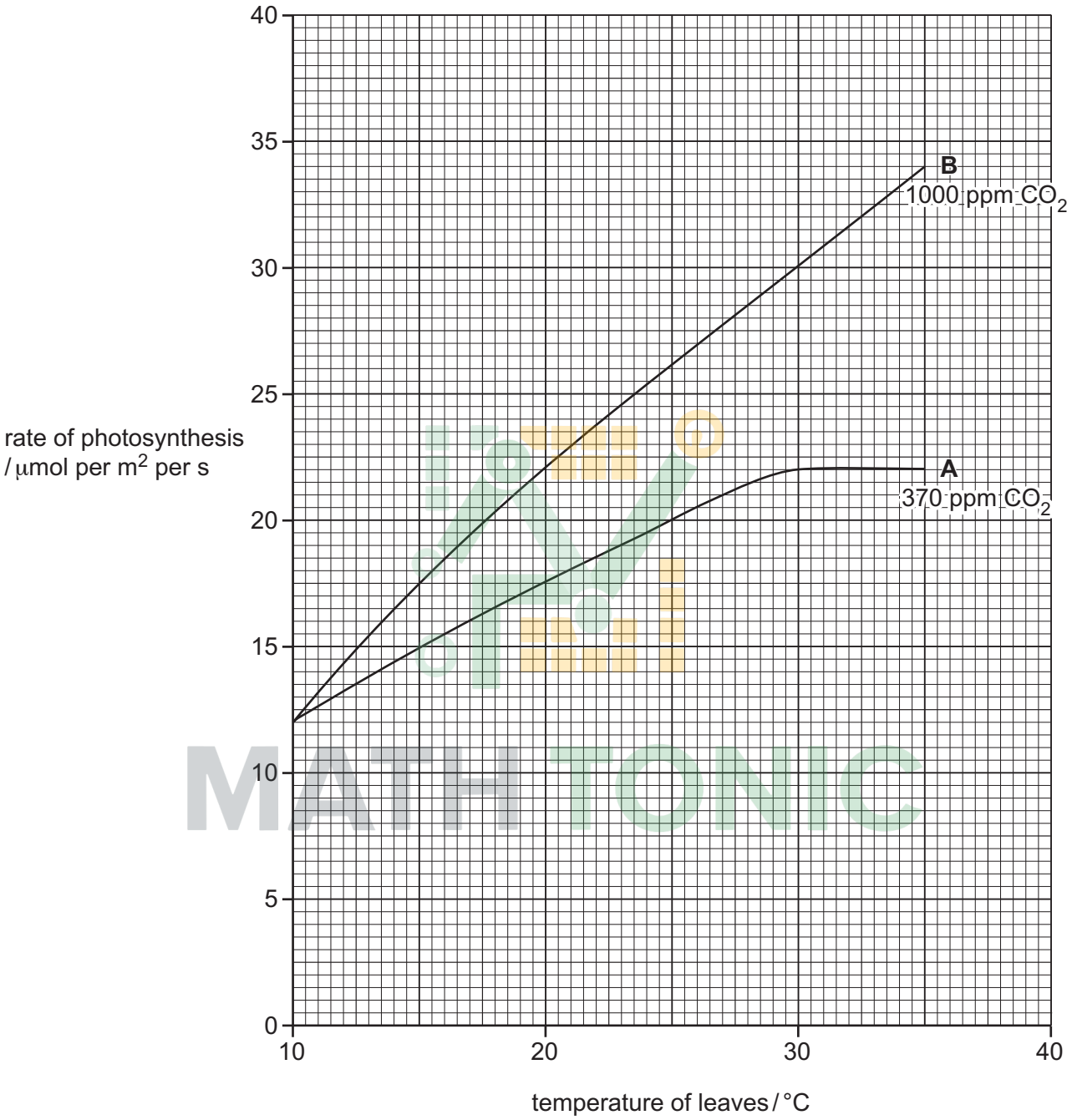

Fig. 2.2

(i) State **one** environmental factor that should have been kept constant in this investigation.

..... [1]

(ii) Describe the effect of temperature on the rate of photosynthesis when carbon dioxide concentration **A** was supplied.

Use the data from Fig. 2.2 in your answer.

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..... [3]

(iii) Calculate the percentage increase in the rate of photosynthesis at 30 °C when the carbon dioxide concentration was increased from **A** to **B** as shown in Fig. 2.2.

Show your working and give your answer to the nearest whole number.

..... %
[2]

(iv) Explain the effect of increasing temperature on the rate of photosynthesis for carbon dioxide concentration **B**.

Use the term *limiting factor* in your answer.

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..... [3]

(v) The student concluded that carbon dioxide concentration is the factor limiting the rate of photosynthesis between 30 °C and 35 °C for the results shown for **A** in Fig. 2.2.

State the evidence for this conclusion.

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..... [1]

[Total: 10]

2 (a) Tissue plasminogen activators (TPAs) are human proteins that are used as drugs to break down blood clots.

TPAs break down blood clots by activating plasminogen. Plasminogen is a protein that is always present in the blood.

When activated, plasminogen forms a protease that breaks down fibrin molecules.

(i) Plasminogen is found in the plasma.

State what is meant by the term *plasma*.

..... [1]

(ii) State the products of the action of protease on the protein fibrin.

..... [1]

TPAs can be produced by genetically-engineered bacteria.

Fig. 5.1 shows some of the stages involved in genetically engineering a bacterium to make a TPA.

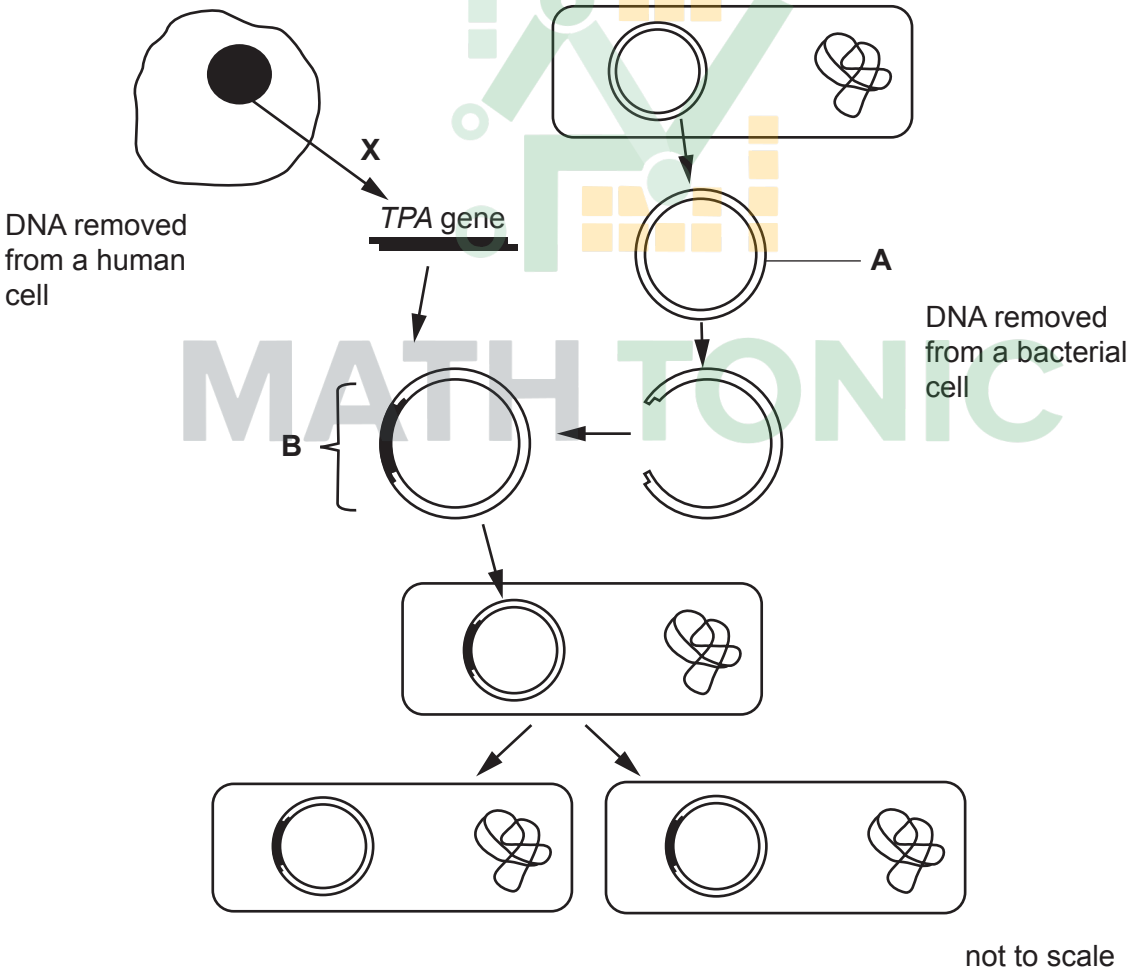

Fig. 5.1

(b) (i) State the name of structure **A** in Fig. 5.1.

..... [1]

(ii) In the flow chart, **X** represents the action of an enzyme on a molecule of DNA.

State the name of this enzyme.

..... [1]

(iii) The *TPA* gene is inserted into structure **A**.

Explain how the gene is inserted into structure **A** to form structure **B** as shown in Fig. 5.1.

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..... [3]

(iv) Before TPA was made by genetically-engineered bacteria it was only available from blood donated by people.

Suggest **one** advantage of producing TPA by genetically-engineered bacteria.

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..... [1]

(v) Discuss the disadvantages of producing genetically modified crops.

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.....[4]

[Total: 12]

3(a) A plant, *Arabidopsis thaliana*, was placed on its side in the dark. Fig. 2.2 is a series of drawings made of the plant, over seven days, as it responded to a change in its surroundings.

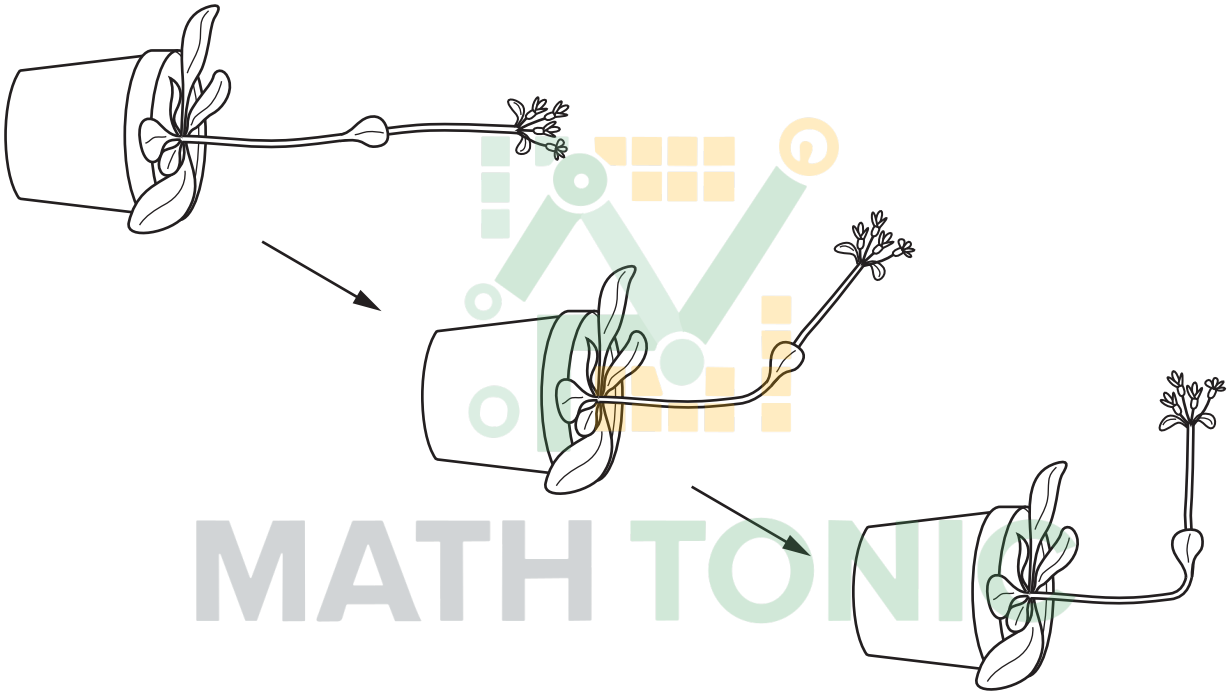

Fig. 2.2

(i) State the stimulus to which the plant responded.

..... [1]

(ii) Name the growth response shown by the plant.

..... [2]

(iii) Explain the advantage to plants of the growth response shown in Fig. 2.2.

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..... [2]

(b) Auxins control the growth responses of seedlings.

Explain how auxins control the growth response of *A. thaliana*, shown in Fig. 2.2.

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..... [4]

[Total: 9]

4 Tasmania is an island off the south coast of Australia. Sheep were introduced to Tasmania in the nineteenth century.

Fig. 3.1 shows the population of sheep in Tasmania from 1820 to 1940. The dashed line shows the trend in the population growth.

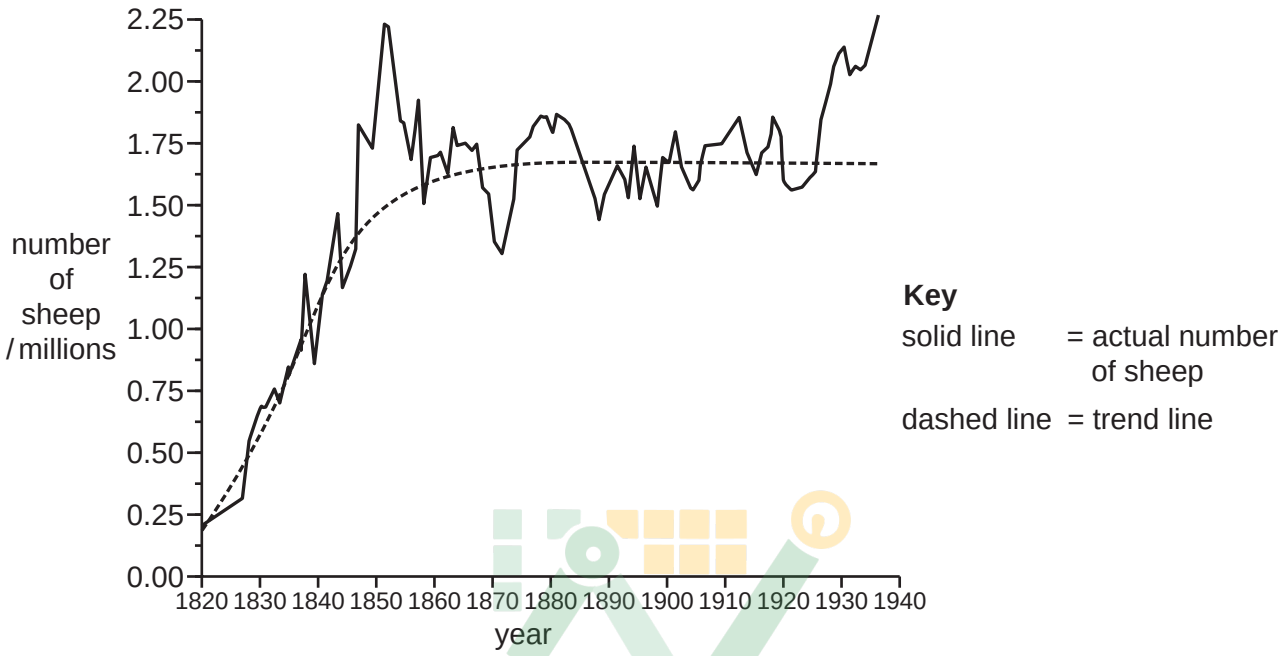

Fig. 3.1

(a) Describe the **trend** in the population of sheep in Tasmania between 1820 and 1940, using the information in Fig. 3.1.

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.....[3]

(b) Explain the change in the **trend** of the population that you described in **3(a)**.

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.....[3]

(c) The sheep that were first introduced to Tasmania were not well adapted to the environment.

Describe how farmers can use selective breeding to improve their sheep so that they are better adapted to the environment.

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.....[3]

(d) Maintaining very large populations of farm animals is unsustainable.

Define the term *sustainable development*.

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.....[2]

(e) The introduction of sheep on the island reduced the number of tortoise drastically. Discuss the ways in which the number of tortoise can be restored.

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..... [4]

(f) Give two similarities and two differences between Artificial insemination (AI) and In- vitro fertilisation (IVF).

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....[3]

[Total: 18]

5 The kidney is one of the main excretory organs of the body.

(a) Explain role of liver in excretion.

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..... [3]

(b) One of the roles of the kidney is to filter the blood.

Fig. 1.1 shows a section of a kidney.

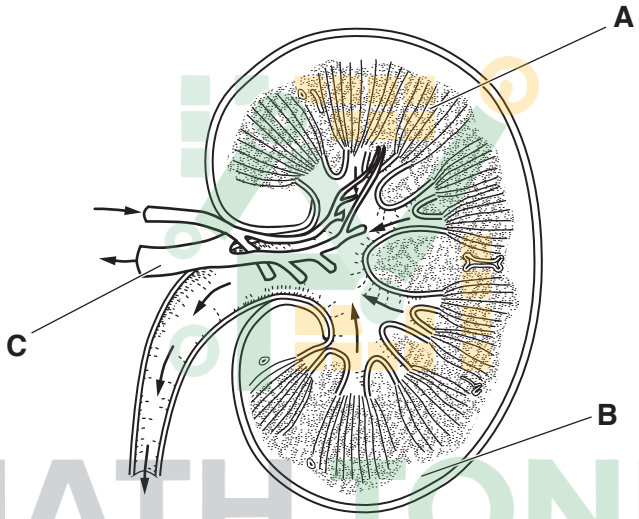

Fig. 1.1

(b) Table 1.1 shows the concentrations of four solutes:

- in the blood in the renal artery
- in the fluid in the kidney tubule
- in the urine.

Table 1.1

solute	solute concentration / g dm^{-3}		
	blood in the renal artery	fluid in the kidney tubule	urine
glucose	0.9	0.9	0.0
protein	83.0	0.0	0.0
salts	8.0	8.0	16.5
urea	0.2	0.2	20.0

Explain the difference in the concentration of constituents between the blood, fluid in the kidney tubule and urine.

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[6]

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[Total: 9]

6 Pollution is the harm done to the environment by the release of substances from human activities.

Table 4.1 shows the names of some pollutants, their sources and their effects on the environment.

Table 4.1

pollutant	source	effect on environment
carbon dioxide		enhanced greenhouse effect
	cattle and rice farming	enhanced greenhouse effect
fertilisers	crop farming	eutrophication

[2]

(a) Complete Table 4.1.

(b) When fertiliser is applied to fields, it can lead to eutrophication in lakes and rivers.

Describe **and** explain what happens in lakes when eutrophication occurs.

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..... [6]

[Total: 8]

7 Meningitis is a transmissible disease. One form of the disease is caused by the bacterium *Neisseria meningitidis*.

(a) Define the term *transmissible disease*.

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.....[2]

(b) Explain why the shape of antibody is important.

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.....[2]

(c) The spread of meningitis can be controlled by using vaccines.

(i) Explain how vaccination provides active immunity.

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(ii) If meningitis disappears from a country, explain why the vaccine should continue to be used in that country.

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(d) People who have meningitis are treated with injections of antibodies to give them passive immunity.

(i) Suggest why the antibodies must be injected rather than taking them by mouth.

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.....[2]

(ii) Explain why passive immunity does not give long-term protection against diseases, such as meningitis.

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.....[2]

[Total: 14]