AS Level Biology B (Advancing Biology)

H022/02 Biology in depth

Sample Question Paper

Date – Morning/Afternoon

Time allowed: 1 hour 30 minutes

You must have:
- the Insert

You may use:
- a scientific calculator

First name	
Last name	
Centre number	
Candidate number	

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION
- The total mark for this paper is **70**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **20** pages.

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Answer **all** the questions.

1 (a) Asparaginase is an enzyme used in the treatment of some cancers.

Asparaginase breaks down asparagine, an amino acid needed by tumour cells to make proteins.

Explain how the structure of asparaginase enables it to break down asparagine.

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…….. **[3]**

(b) Asparaginase does **not** affect normal (non-tumour) cells.

Suggest **one** reason why normal cells are not affected by asparaginase.

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…… **[1]**

(c) Suggest why enzymes such as asparaginase must be modified before being injected into the bloodstream.

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…… **[1]**

2 **Table 2.1** shows some components which can be found in phloem sap.

Component	Concentration (mg cm^{-3})
Sucrose	80 – 160
Protein	1.45 – 2.20
Amino acids	5.20
Phosphate ions	0.35 – 0.55
Potassium ions	2.30 – 4.40

Table 2.1

(a) Explain what is meant by the term *organic molecule* using an example from **Table 2.1.**

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…… **[2]**

(b) A student tested a sample of phloem sap by placing the sample in a test tube and carrying out a Benedict's test. The result of the Benedict's test was negative.

(i) Describe the appearance of the test tube when a negative result is obtained in a Benedict's test.

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…… **[1]**

(ii) The student observed that, following the Benedict's test, the tube appeared cloudy. Using your knowledge of the Benedict's test and the information in **Table 2.1**, suggest why the tube content appeared cloudy after the test.

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…… **[2]**

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

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…… **[6]**

3 (a) Scientists studying human evolution have shown that both *Homo neanderthalensis* and *Homo sapiens* were 'hunter-gatherers'. Both evolved behaviours in response to the changing environment. *Homo sapiens* made the transition to producing food.

(i) What evidence might suggest that both species hunted food?

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(ii) Suggest how **one** environmental factor may have caused a change in the behaviour of both species.

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…… **[2]**

(iii) Suggest two advantages to *Homo sapiens* of producing food rather than hunting or gathering.

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…… **[2]**

(b) The hyoid bone is a horseshoe-shaped structure found in the neck. It supports the root of the tongue and is needed for speech. Hyoid bones from *Homo neanderthalensis* were discovered in 1989.

Why is the discovery of the hyoid bone **not** conclusive evidence of the ability of *Homo neanderthalensis* to speak?

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…… **[2]**

4 Viruses are pathogens. They can infect both animal and plant cells.

Fig. 4.1 is a diagram of the human immunodeficiency virus (HIV).

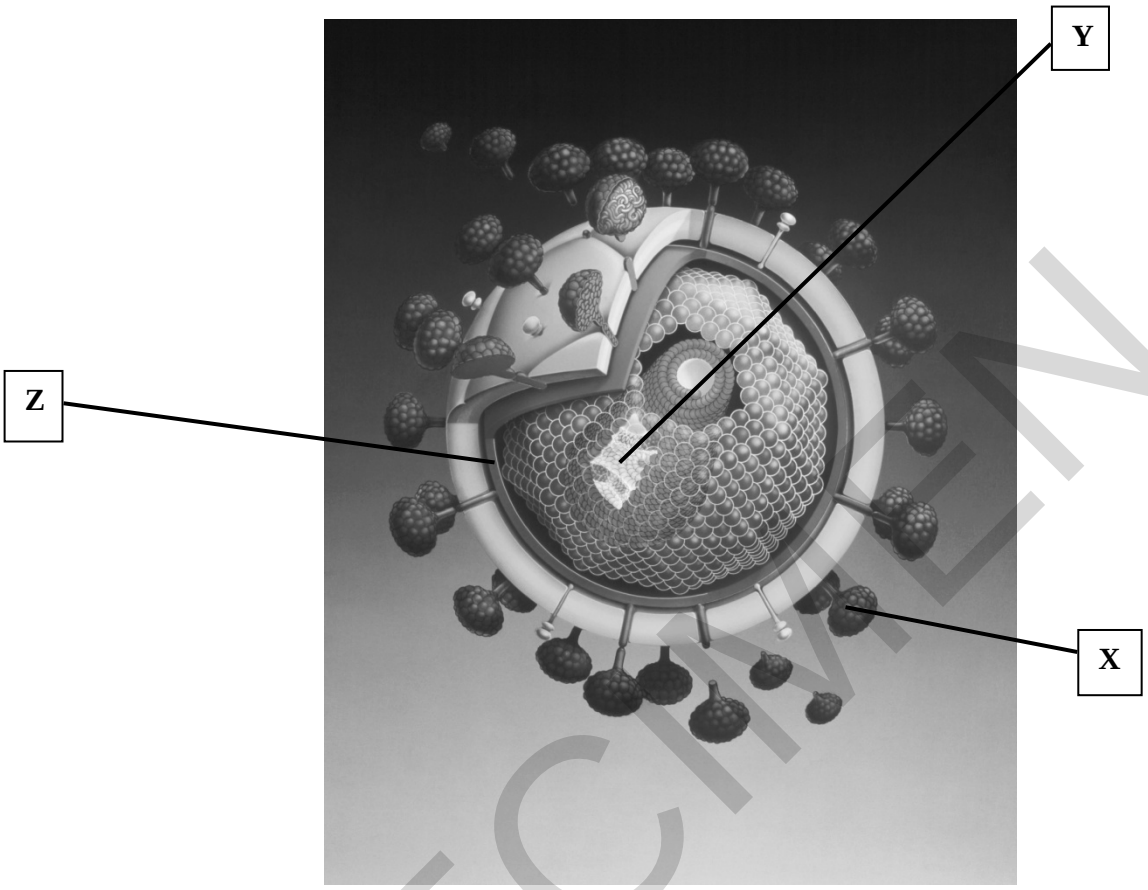

Fig. 4.1

(a) What is the role of structure **X**?

X ……..….

…… **[1]**

(b)* Describe the means of transmission of the human immunodeficiency virus (HIV) and how the spread of the virus can be controlled.

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…… **[6]**

(c) Highly active antiretroviral therapy (HAART) is a treatment used for patients infected with HIV. This therapy involves multiple drugs which reduce the viral count and prevent opportunistic infections.

(i) Explain, using an example, what is meant by the term *opportunistic infection* when related to acquired immunodeficiency syndrome (AIDS).

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…… **[2]**

Fig. 4.2 shows the trends in the incidence of AIDS, the number of AIDS-related deaths, and the prevalence of AIDS in the USA from 1985 to 2003.

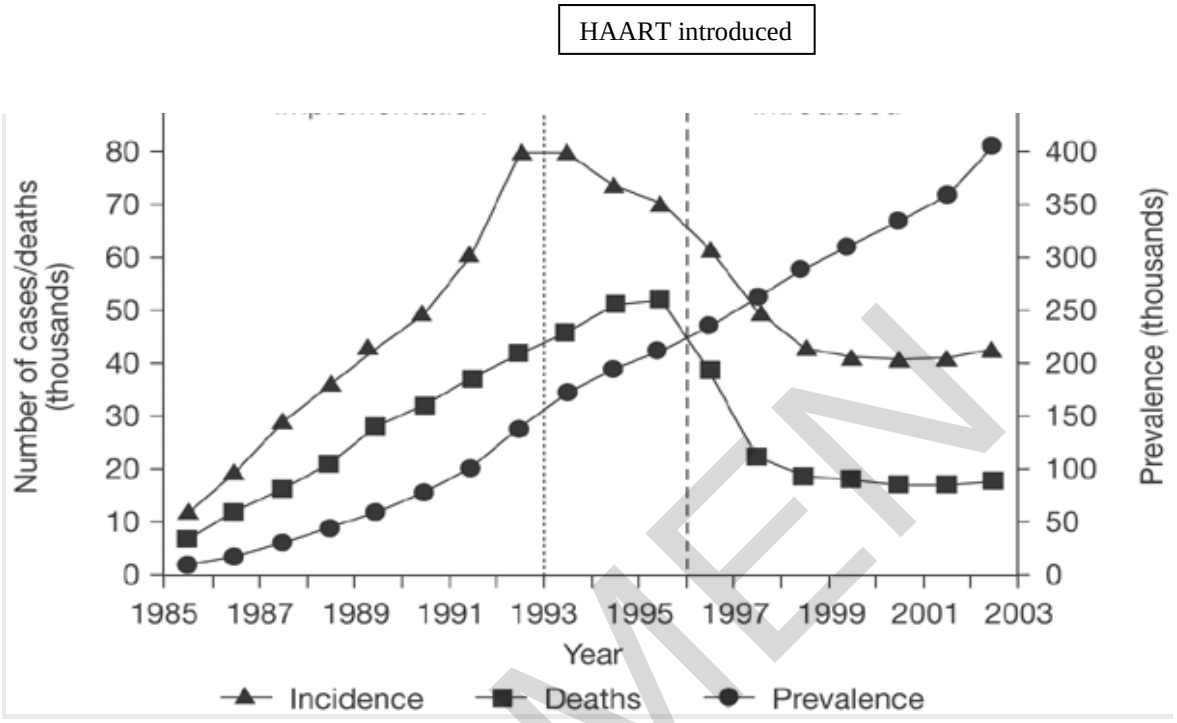

Fig. 4.2

(ii) Compare the trends in incidence of AIDS and AIDS-related deaths between 1988 and 1995.

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…… **[3]**

(iii) HAART was introduced in 1996.

Evaluate the effectiveness of the introduction of HAART on the prevalence of AIDS and the number of AIDS-related deaths.

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5 (a) When preparing cells for viewing under a microscope, the technique of differential staining may be used.

Fig. 5.1, **on the insert**, is a micrograph showing a stained section of plant root tissue.

(i) Use **Fig. 5.1** to explain what is meant by differential staining.

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…… **[2]**

(ii) Selecting the appropriate measurements from **Fig. 5.1, on the insert,** calculate the proportion of the root area that is occupied by the **stele**.

You can assume that all the structures are circular.

Show your working.

proportion of root area occupied by the stele **…….[3]**

(iii) **Fig. 5.2**, **on the insert**, shows light micrographs of the blood smears from two patients, **A** and **B**.

To prepare the samples for viewing under the microscope, health professionals must first obtain blood from the patients.

State and explain **one** safety precaution that must be taken by a health professional when obtaining and handling blood samples.

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…… **[2]**

(iv) A laboratory technician compared the stained smear from both patients, **A** and **B,** from **Fig. 5.2**, **on the insert**, and made the following statements:

Statement 1: *'The blood smear of patient **B** appears normal'.*

Statement 2: *'The same differential stain was used in preparing both blood smears'.*

Statement 3: *'The cell labelled **X** in both micrographs can be identified as a lymphocyte'.*

Statement 4: *'Patient **A** may have a type of blood cancer'.*

What evidence in **Fig. 5.2, on the insert,** supports the statements made by the laboratory technician?

Statement 1……

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Statement 2……...

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Statement 3……

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Statement 4……

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[4]

(v) The laboratory technician suggested that further blood smears for patient **A** would be needed before the diagnosis was confirmed.

Suggest why.

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…… **[1]**

(b) **(i)** Leukaemia is a type of blood cancer.

Fig. 5.3 shows how the number of cases of leukaemia varies with age at diagnosis.

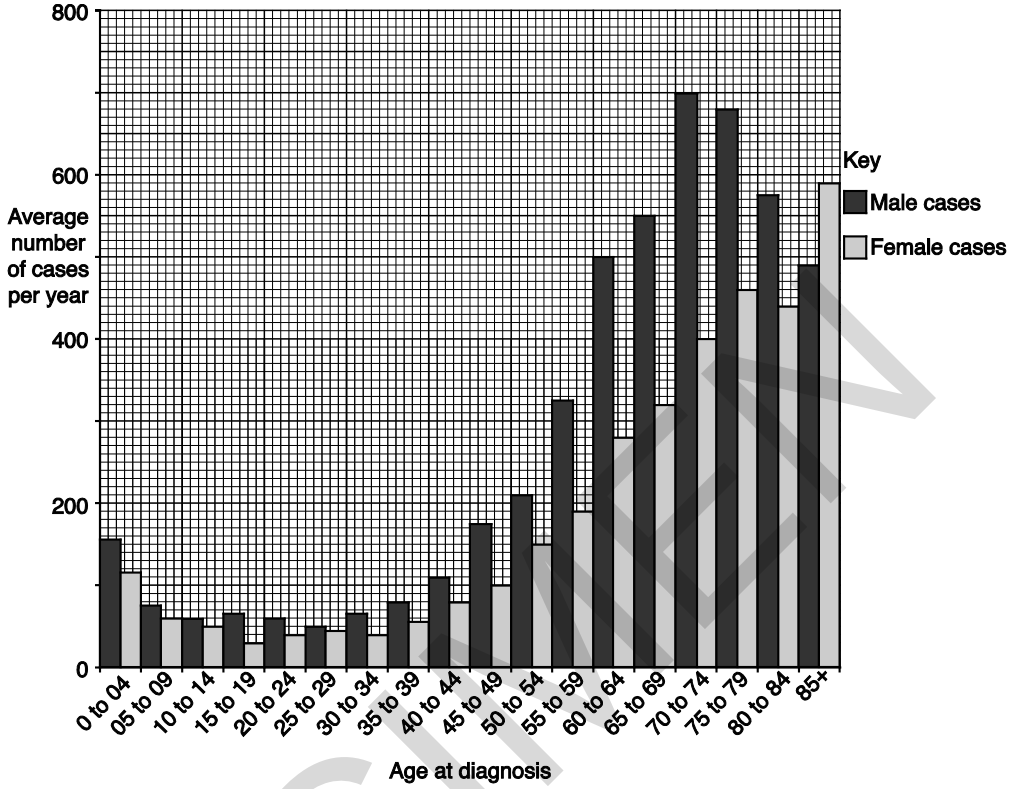

Fig. 5.3

Calculate the percentage difference in the mean number of cases per year between males and females at age 60–64 years.

Percentage difference …… **[2]**

(ii) Using **Fig. 5.3**, evaluate the effect of age and gender as risk factors for leukaemia.

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…… **[3]**

(c) **(i)** Flow cytometers can be used to analyse blood. **Fig. 5.4** outlines the process of flow cytometry.

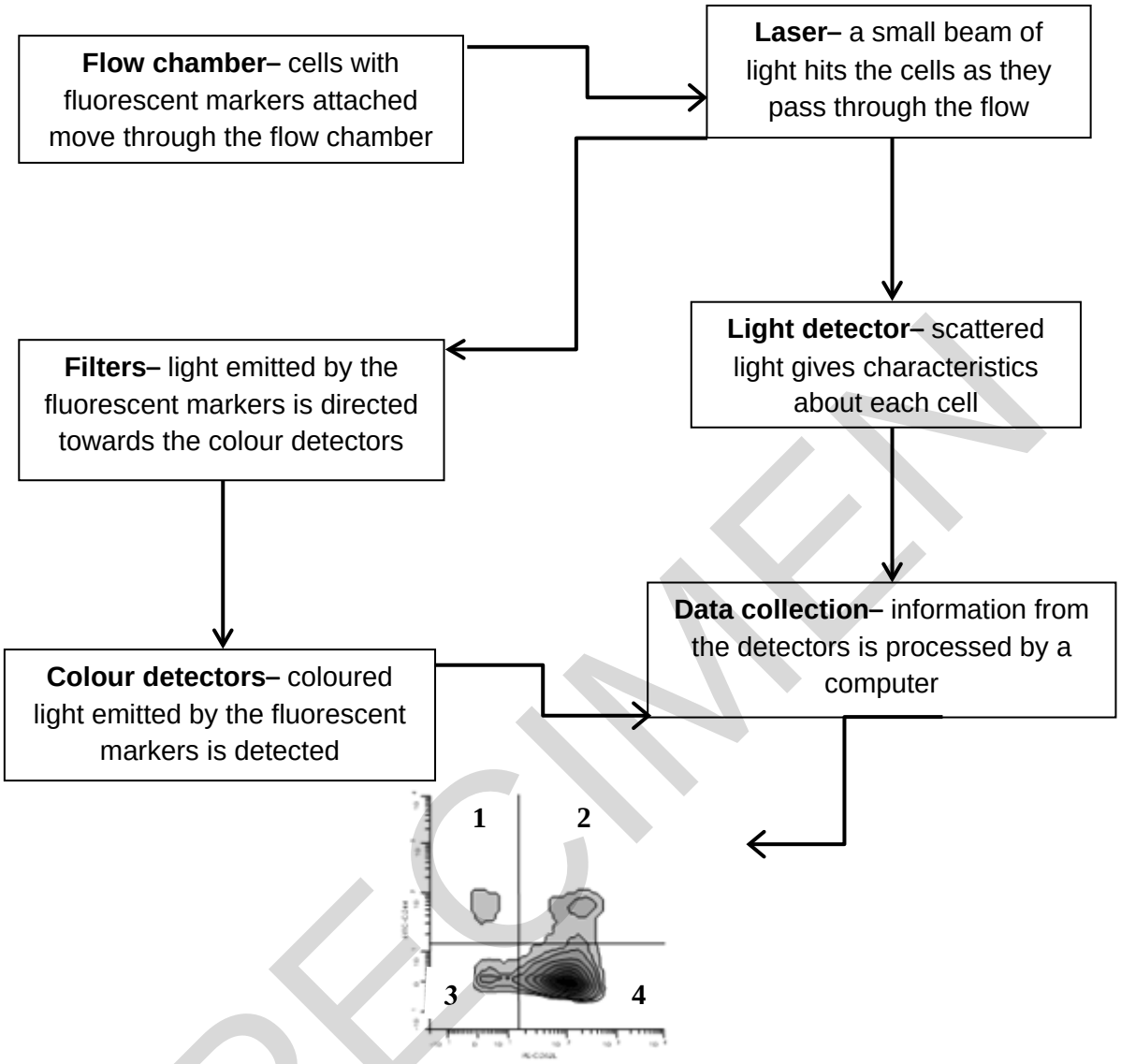

Fig. 5.4

Evaluate the use of using flow cytometry in blood analysis.

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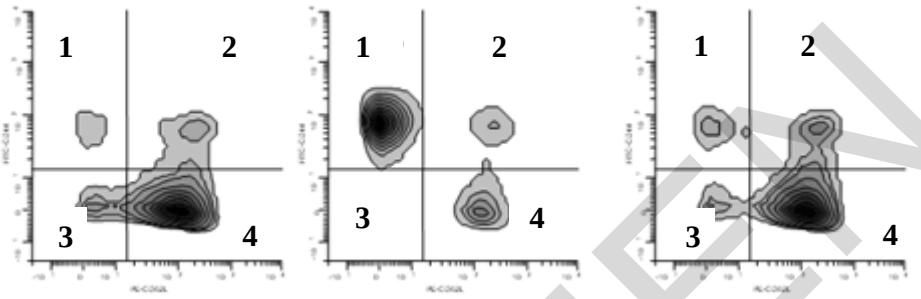
…… **[5]**

(ii) Dioxin is a chemical that has been identified as increasing the risk of developing cancer. An experiment was carried out in mice to observe the effect of dioxin on the ability of the mice to produce cytotoxic T lymphocytes.

Flow cytometry was used to measure the number of cytotoxic T lymphocytes and the results are shown in **Fig. 5.5**.

Cytotoxic T lymphocytes appear in quadrant 1 of each histogram.



A **B** **C**

Histogram **A**	Mouse was not injected with tumour cells or exposed to dioxin.
Histogram **B**	Mouse was injected with tumour cells.
Histogram **C**	Mouse was exposed to dioxin 24 hours before it was injected with tumour cells.

Fig. 5.5

Using the histograms in **Fig. 5.5**, what do you conclude about the action of dioxin on the immune system?

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…… **[3]**

6 Apoptosis is programmed cell death. It is an important process in the formation of fingers and toes of a developing fetus.

(a) Statements **A** to **E** below describe the process of apoptosis.

Put the statements in the correct order.

A 'blebbing' of the cell surface membrane occurs

B apoptotic bodies are engulfed by phagocytes

C the cell shrinks

D breakdown of the nucleus occurs

E receptors on phagocytes recognise surface phospholipids on the apoptotic bodies

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[3]

(b) (i) **Fig. 6.1** shows the hands of a fetus at two different stages in development.

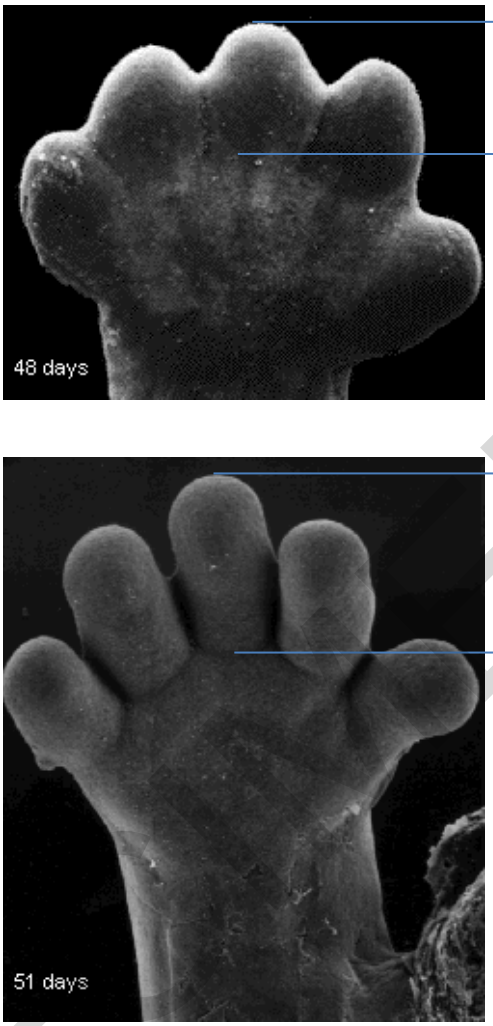

Fig. 6.1

Using **Fig. 6.1**, calculate the growth **rate** of the middle digit between 48 and 51 days.

Show your working.

growth rate ..... mm day^{-1} **[2]**

(ii) Name **one** nutrient that is required to support the growth of tissues in the developing fetus and state its role.

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…… **[1]**

END OF QUESTION PAPER

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INFORMATION

- This document consists of **4** pages. Any blank pages are indicated.

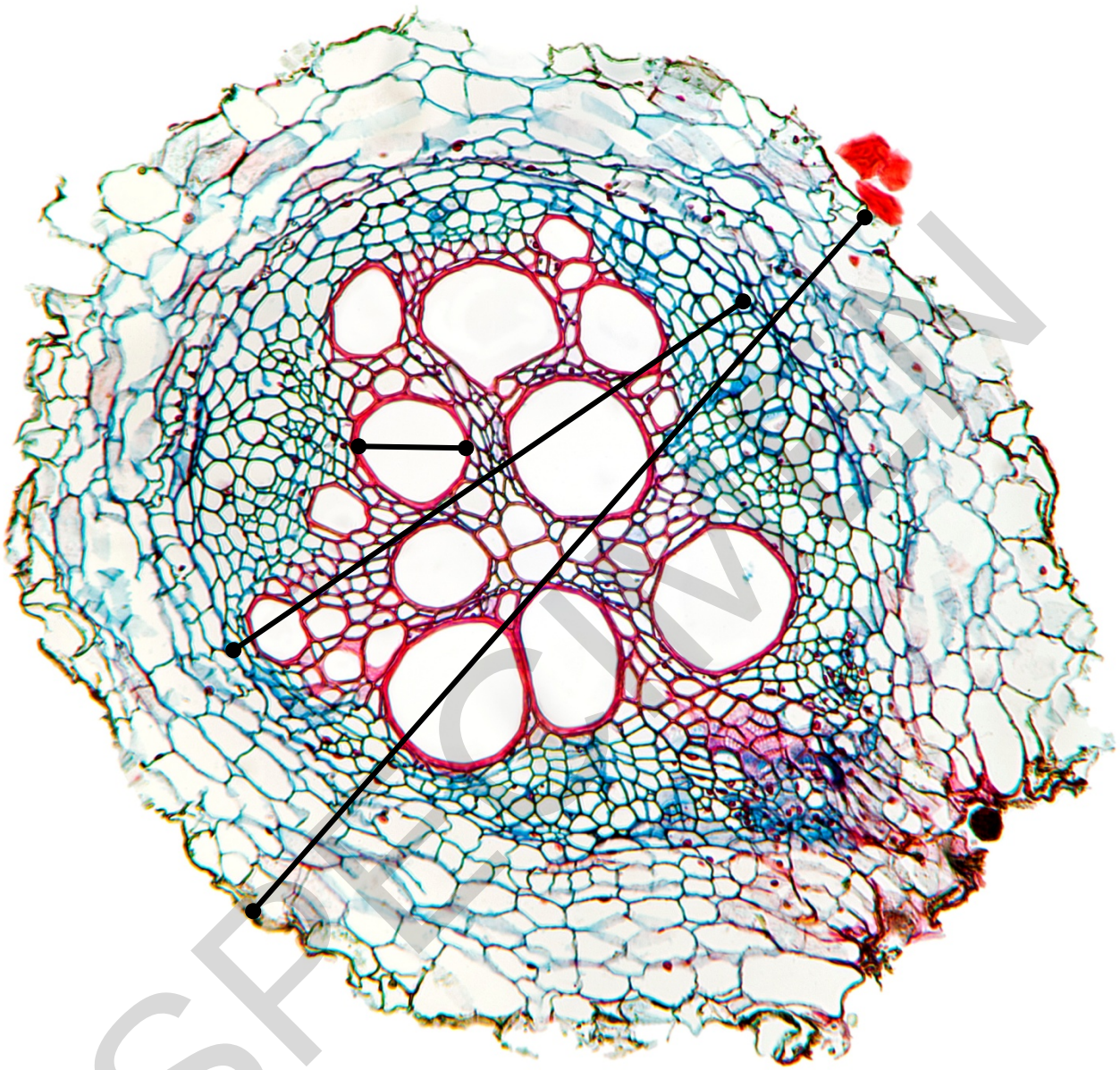
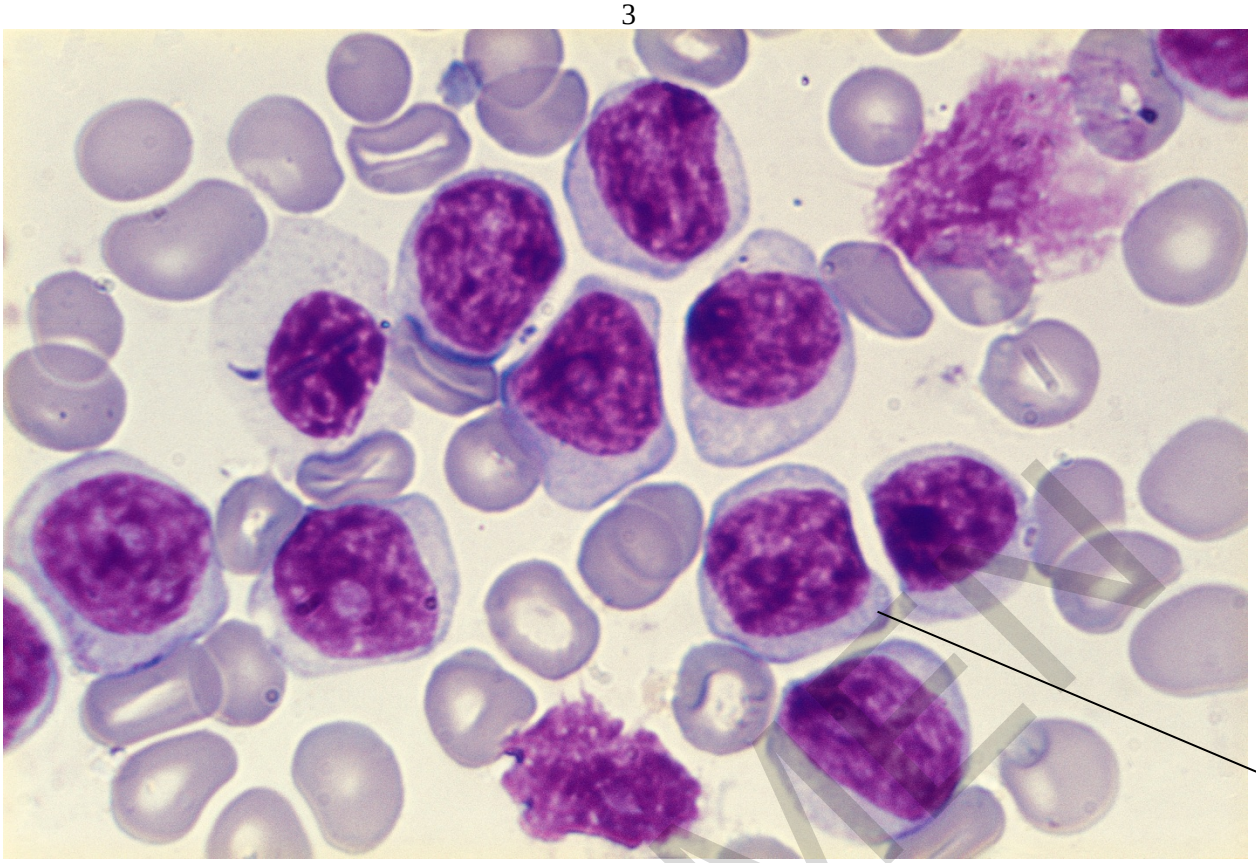
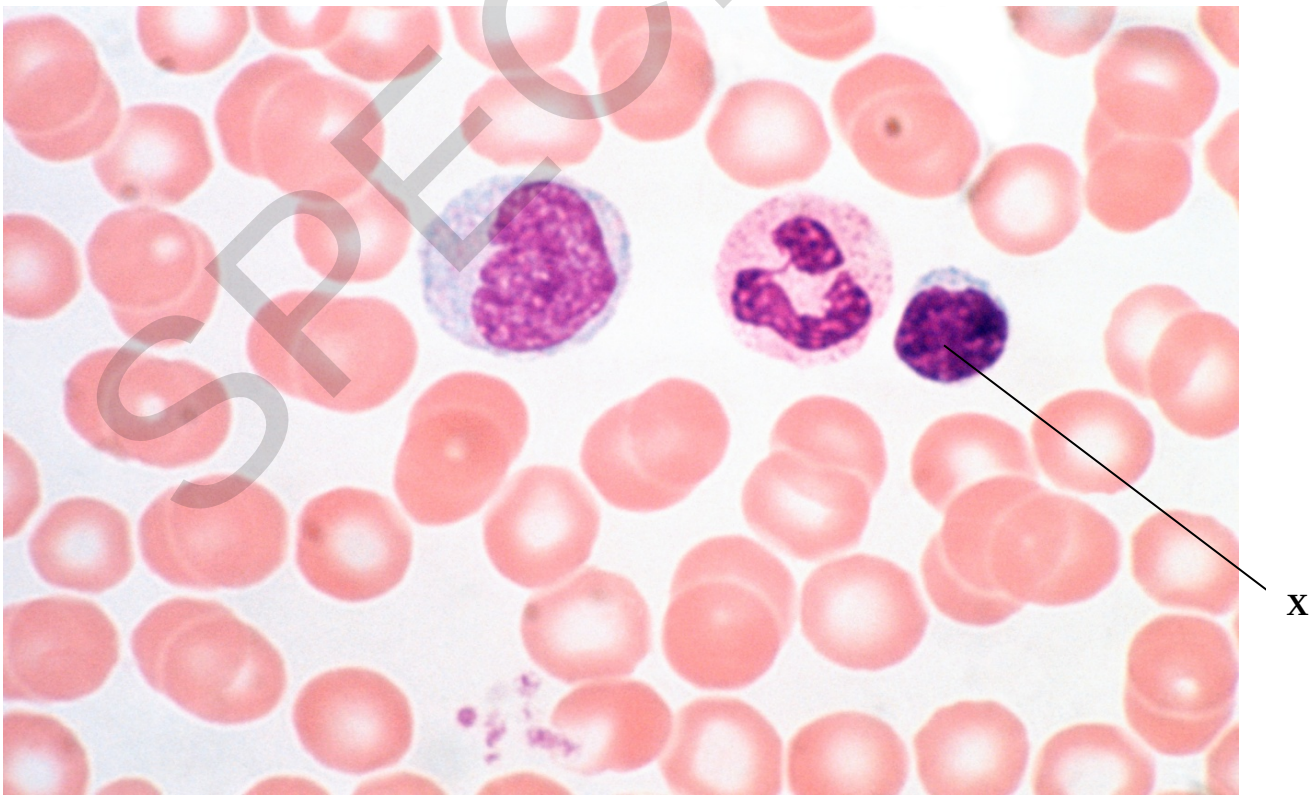


Fig. 5.1



Patient A



Patient B

Fig. 5.2