OCR
Oxford Cambridge and RSA

Accredited

AS Level Biology B (Advancing Biology)

H022/02 Biology in depth

Sample Question Paper

Date – Morning/Afternoon

Version 2.1

Time allowed: 1 hour 30 minutes

You must have:
- the Insert

You may use:
- a scientific or graphical 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.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- 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. **[6]**

Additional answer space if required

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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…… **[2]**

(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).

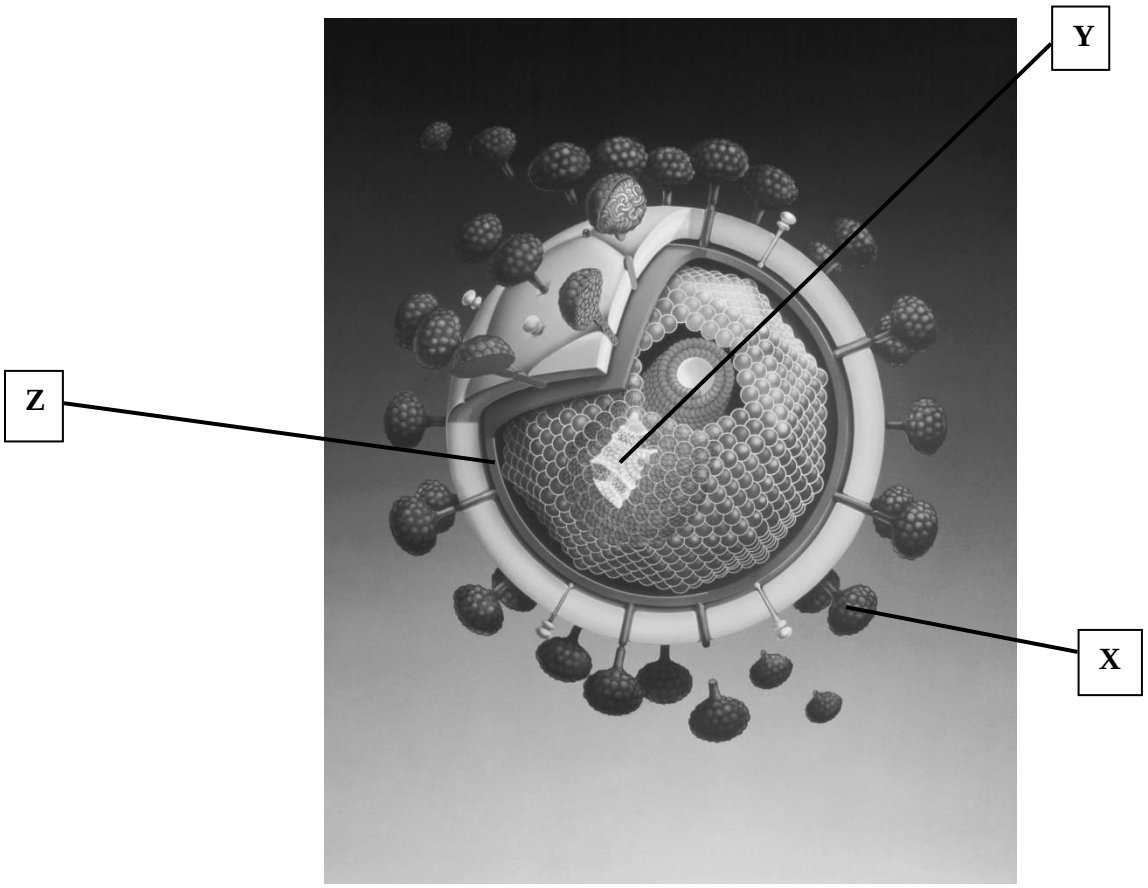

Fig. 4.1

(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. **[6]**

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Additional answer space if required.

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(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.

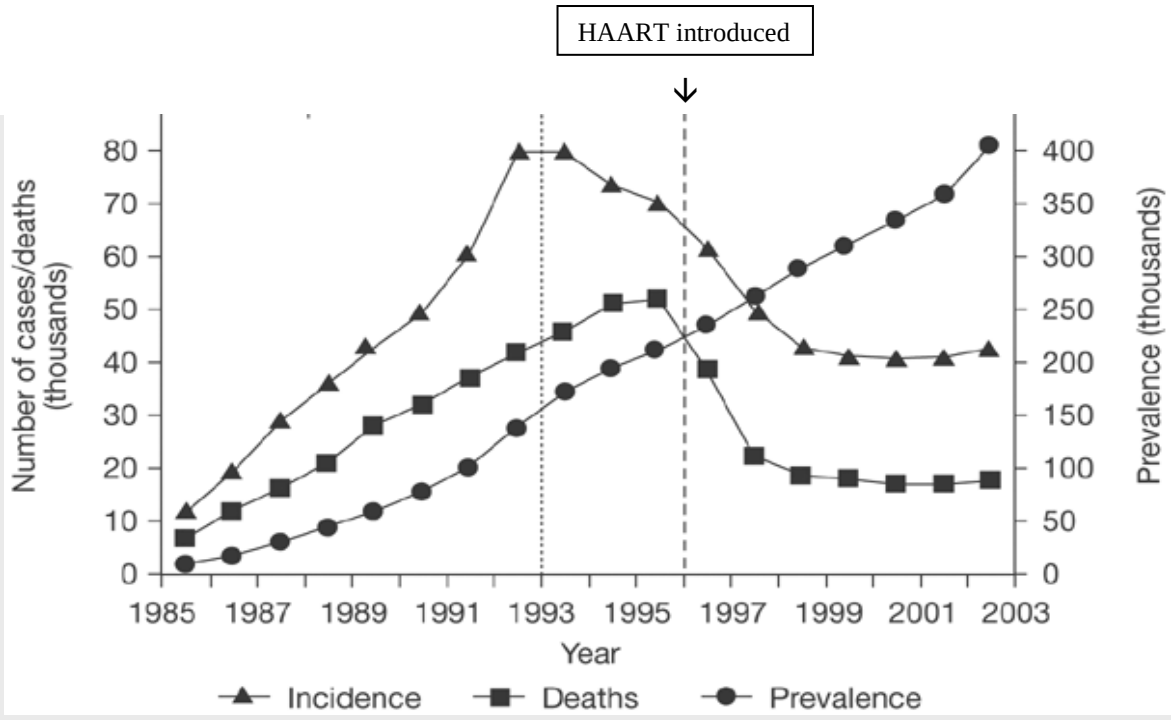

Fig. 4.2

(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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…… **[3]**

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.

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……

……

Statement 2……...

……

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.

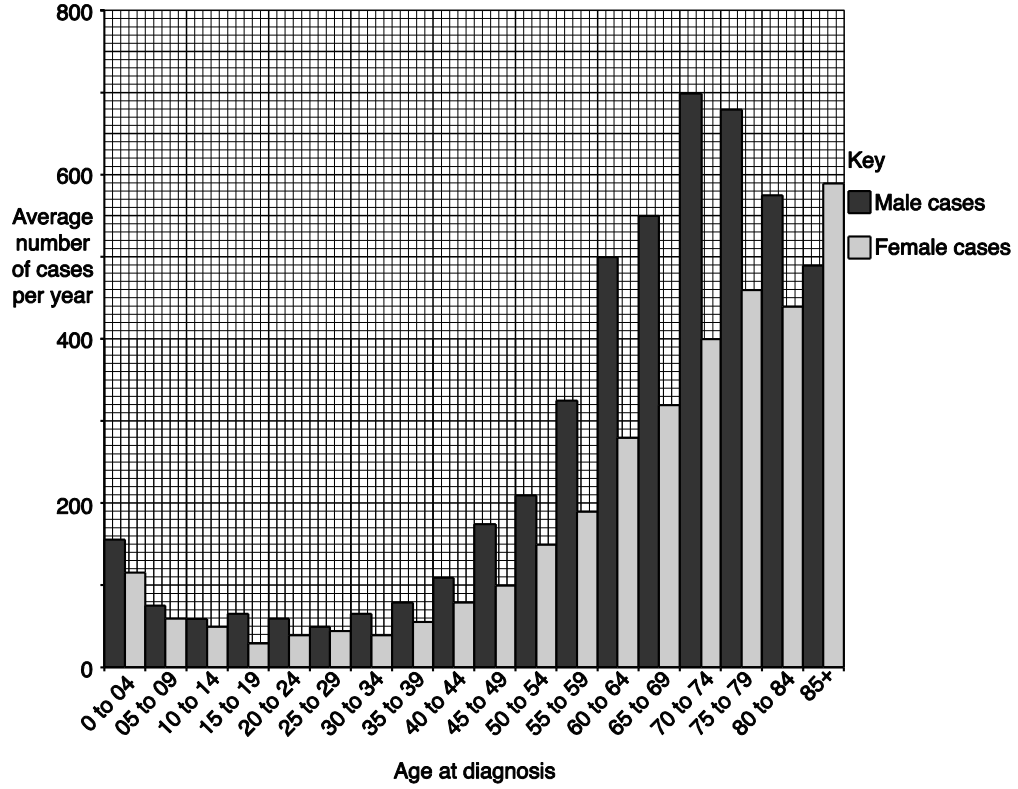

Fig. 5.3

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.

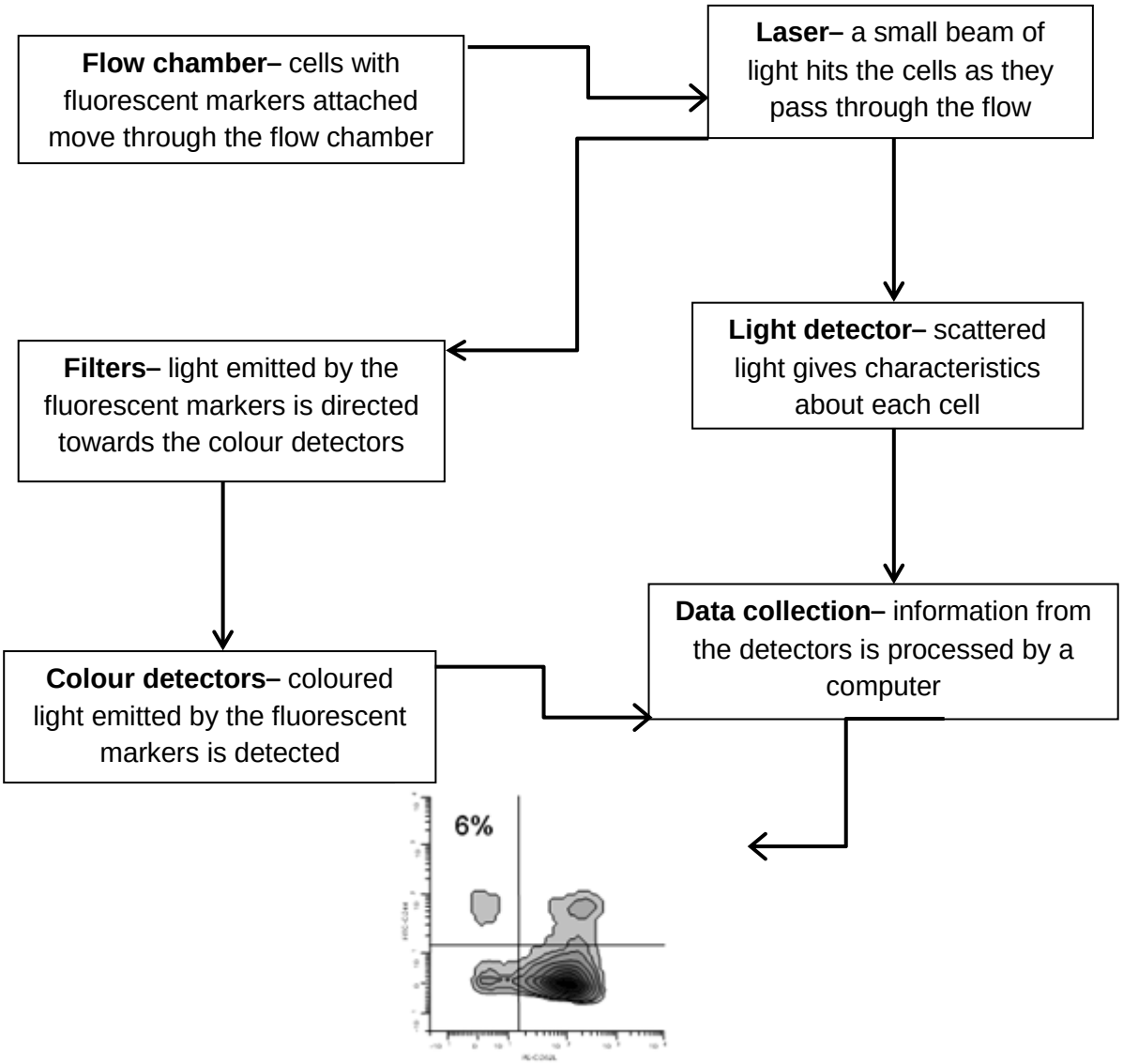

Fig. 5.4

Evaluate the use of using flow cytometry in blood analysis.

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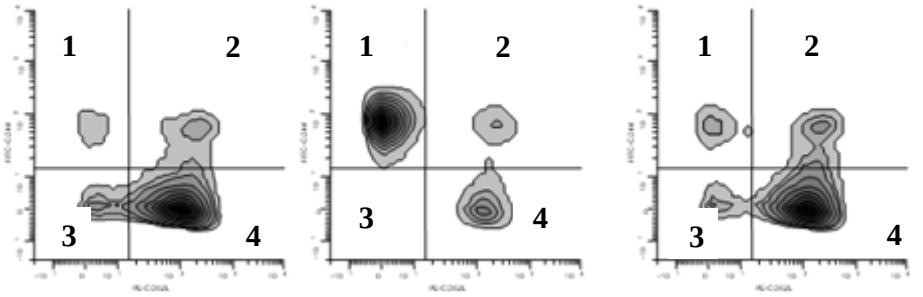
…… **[5]**

(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

…….. **…..……** **…..……** **…..……** **…..…….**

[3]

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

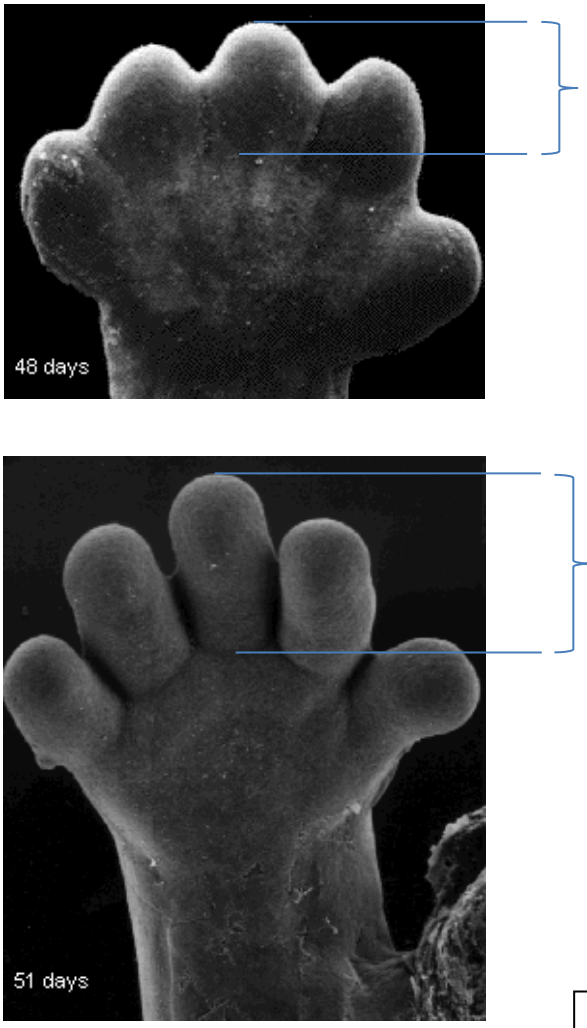

Fig. 6.1

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

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.

…….

…… [1]

END OF QUESTION PAPER

Oxford Cambridge and RSA

…day June 20XX – Morning/Afternoon

AS Level Biology B (Advancing Biology)

H022/02 Biology in depth

SAMPLE MARK SCHEME

Duration: 1 hour 30 minutes

MAXIMUM MARK 70

This document consists of 16 pages

MARKING INSTRUCTIONS

PREPARATION FOR MARKING

SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to scoris and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the scoris messaging system.

5. Work crossed out:

   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks

   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. There is a NR (No Response) option. Award NR (No Response)

   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
   - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.

   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The scoris **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**

   If you have any questions or comments for your Team Leader, use the phone, the scoris messaging system, or email.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

- Read through the whole answer from start to finish.
- Decide the level that **best fits** the answer – match the quality of the answer to the closest level descriptor.
- To select a mark within the level, consider the following:
  Higher mark: A good match to main point, including communication statement (in italics), award the higher mark in the level
  Lower mark: Some aspects of level matches but key omissions in main point or communication statement (in italics), award lower mark in the level.

Level of response questions on this paper are **2(a)** and **4(b)**.

11. **Annotations**

Annotation	Meaning
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
( )	Words which are not essential to gain credit
__	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

12. **Subject-specific Marking Instructions**

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

Question			Answer	Marks	Guidance
1	(a)		**Any 3 from:** tertiary structure gives specific shape of active site ✓ asparagine has complementary shape to active site ✓ enzyme-substrate complex can be formed ✓ lowers activation energy ✓	**3**	
	(b)		(normal cells) do not use asparagine ✓	**1**	
	(c)		**Any 1 from:** acts as antigen ✓ destroyed by cell's immune system ✓	**1**	
			Total	**5**	

Question			Answer	Marks	Guidance
2	(a)		*idea of* a molecule containing mainly carbon and a number of other elements ✓ sucrose / protein / amino acids, used as illustration ✓	2	Examples of other elements could include hydrogen, nitrogen, sulphur
	(b)	(i)	(solution remains) blue ✓	1	
		(ii)	**Any 2 from:** precipitate is produced ✓ copper oxide is insoluble ✓ high temperatures / boiling, required in the Benedict's test ✓ boiling / high temperatures, denature the protein in the phloem sap ✓	2	
	(c)*		**Level 3 (5–6 marks)** A detailed explanation of both loading and movement by mass flow, including reference to sources and sinks and the features and roles of the sieve tube elements and companion cells. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** A partial explanation of both loading and movement by mass flow. Includes reference to sources and sinks or the features or roles of the sieve tube elements or companion cells. *There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.*	6	Examples of relevant material could include the following: *Loading* • loading into companion cells • location of companion cells at a source or named source • active loading of sucrose (using ATP) • mitochondria presence in companion cells • description of mechanism of H+ gradient and co-transport • movement via plasmodesmata into sieve tube elements *Movement* • mass flow from source to sink • ref to high hydrostatic pressure at source • ref to inflow of water by osmosis at the source (creating the pressure) • ref to passage through sieve plates or cytoplasmic connections

Question			Answer	Marks	Guidance
			Level 1 (1–2 marks) An explanation of either loading or movement. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** No response or no response worthy of credit.		• ref to low hydrostatic pressure at the sink • ref to unloading at the sink **ALLOW** use of annotated diagrams
			Total	**11**	

Question			Answer	Marks	Guidance
3	(a)	(i)	evidence of tools ✓ evidence of tool marks on fossilised animal bones ✓	2	
		(ii)	factor e.g. climate change ✓ link e.g. could cause migration ✓	2	Answer should link factor to description
		(iii)	**Any 2 from:** settlements ✓ could farm animals and plants ✓ *idea that* humans could control breeding of animals ✓ increase food availability ✓	2	
	(b)		*idea that* position of hyoid bone may not be determined from fossils ✓ *idea that* further evidence would be needed e.g. tongue position ✓	2	
			Total	8	

Question			Answer	Marks	Guidance
4	(a)		**X** (surface glycoprotein) for binding to host cell ✓	1	
	(b)*		**Level 3 (5–6 marks)** The means of transmission is clearly understood and described in detail, using an example. How the spread can be controlled is discussed in detail and the learner considers more than one measure of control. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** The means of transmission is described. At least one good suggestion of how to control the spread of the virus is given. *There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.* **Level 1 (1–2 marks)** Relevant comment about the means of transmission or control of spread. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** No response or no response worthy of credit.	6	Examples of relevant material could include the following: *means of transmission* • spreads from person to person in body fluids • named example e.g. from mother to baby in uterus • once in blood virus enters T lymphocytes • may remain dormant for long period *controlling the spread* • screening donated blood • education • named example e.g. giving sterile needles to drug users • epidemiological testing • access to means of prevention e.g. condom clinics

Question			Answer	Marks	Guidance
	(c)	(i)	*idea of* breakdown / lack of T lymphocytes leading to further infection ✓ example of infectious agent with the relevant disease ✓	2	
		(ii)	**Any 3 from:** incidence **and** deaths both increase between 1988 and 1992 ✓ between 1992 to 1993 incidence stays the same ✓ between 1993 to 1995 incidence decreases ✓ between 1993 to 1995 deaths continue to increase ✓ greater difference between incidence and deaths in 1995 (or 1993) than in 1988 ✓	3	
		(iii)	prevalence and deaths both increased before introduction of HAART ✓ *prevalence continued to increase after HAART* (because) more people with AIDS surviving longer ✓ *deaths decreased after HAART* (because) HIV infected people responding to treatment ✓	3	
			Total	15	

Question			Answer	Marks	Guidance
5	(a)	(i)	*idea that* multiple stains / different stains used ✓ *idea that* different stain taken up by different tissues / different tissues are stained different colours ✓	2	
		(ii)	whole root area 149.57 cm^2 ✓ stele root area 66.48 cm^2 ✓ proportion of root area that is stele – 2.25 ✓	3	**ALLOW** range 147 -153 cm^2 **ALLOW** range 66 – 69 cm^2 **ALLOW** 2.22 – 2.27
		(iii)	**Any 2 from:** sterile equipment / disposable gloves ✓ (because) blood samples, potentially hazardous / biohazard ✓ example of risk e.g. HIV ✓	2	
		(iv)	*'The blood smear of patient **B** appears normal'* *idea that* appearance and number of both erythrocytes and leucocytes is as expected ✓ *'The same differential stain was used in preparing both blood smears'* *idea that* nuclei of leucocytes in both smears are same colour ✓ *'The cell labelled **X** in both micrographs can be identified as a lymphocyte'* *idea of* large round nucleus /small cytoplasm: nuclear ratio ✓ *'Patient **A** has a type of blood cancer '* *idea of* abnormally large number of, leucocytes / lymphocytes ✓	4	

Question			Answer	Marks	Guidance
		(v)	**Any 1 from:** *idea that* the cause of the abnormal blood smear could be temporary ✓ ethical reasoning e.g. false positive ✓ blood of patient **A** may be atypical ✓	1	
	(b)	(i)	44% ✓✓	2	1 mark for calculation. 500 – 280 x 100 / 500
		(ii)	**Any 3 from:** decrease in risk with ageing from 0–9 years ✓ remains steady / age has little effect, from 10–29 years ✓ increase in risk with ageing from 30–74 years ✓ decrease in risk with ageing from 75–85 years in males ✓ after 35 years risk for males increases more than females ✓ age 85+ risk is greater for females ✓	3	
	(c)	(i)	**Any 5 from:** *advantages of flow cytometry* *idea that* large number of cells can be counted in short period of time ✓ number **and** type of cell can be counted ✓ can measure physical characteristics of the cell ✓ can determine, DNA content / protein and enzymes, in cell ✓ *disadvantages of flow cytometry* expensive ✓ flow cytometry machines are large ✓ highly trained technicians are required ✓	5	ORA for other counting methods

Question			Answer	Marks	Guidance
		(ii)	immune system of mouse **B** produces large number of T lymphocytes ✓ immune system of mouse **C** has not produced many T lymphocytes ✓ immune system of mouse **C** is prevented from producing enough T lymphocytes when injected with tumour cells ✓	**3**	
			Total	**25**	

Question			Answer	Marks	Guidance
6	(a)		**C A D E B** ✓✓✓	**3**	First correct **C** – one mark, last correct **B** – one mark, **ADE** anywhere in that order – 1 mark
	(b)	(i)	0.58 ✓✓	**2**	**ALLOW** 2 marks for the correct answer with no working **ALLOW** 1 mark for calculation without final step 24 – 17 = 7 / 3 = 2.3
		(ii)	**Any 1 from:** protein for production of new cells / enzymes / skin / bone ✓ vitamin D for production of, bones / teeth ✓ phosphorus / calcium, for production of, bones / teeth ✓	**1**	
			Total	**6**	

Summary of updates

Date	Version	Change
January 2019	2.0	Minor accessibility changes to the paper: i) Additional answer lines linked to Level of Response questions ii) One addition to the rubric clarifying the general rule that working should be shown for any calculation questions.
October 2020	2.1	Updated copyright acknowledgements.