

AS Level Biology B (Advancing Biology)
H022/01 Foundations of biology
Sample Question Paper

Date – Morning/Afternoon

Version 2.0

Time allowed: 1 hour 30 minutes

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 [].
- This document consists of **28** pages.

SECTION A

You should spend a maximum of 25 minutes on this section.

Answer **all** the questions.

- 1** Erythrocytes contain few organelles. They do **not** have mitochondria or Golgi apparatus.

Which process can be carried out by an erythrocyte?

- A** cell division
- B** aerobic respiration
- C** anaerobic respiration
- D** protein synthesis

Your answer

☐

[1]

- 2** During protein synthesis mRNA is produced by the process of 'transcription'.

Where is mRNA produced?

- A** nucleus
- B** nucleolus
- C** ribosome
- D** rough endoplasmic reticulum

Your answer

☐

[1]

- 3** Samples of normal plasma and normal urine were analysed in a laboratory. One test is described below:

STEP 1: add 2 cm³ of the test sample to a test tube containing solution **M** and mix.

STEP 2: place the test tube in a water bath at 90 °C.

OBSERVATION: the final colour was red.

Which is correct?

- A** **M** is Biuret solution and the sample is plasma.
- B** **M** is Biuret solution and the sample is urine.
- C** **M** is Benedict's solution and the sample is plasma.
- D** **M** is Benedict's solution and the sample is urine.

Your answer

☐

[1]

- 4** Carcinogen **W** can cause changes in tumour suppressor genes, **X**. This can lead to uncontrolled cell division and the formation of a tumour which may spread to other parts of the body forming **Y**.

Which of the following responses correctly identifies **W**, **X**, and **Y**?

	W	X	Y
A	Nicotine	Ras	mutations
B	Asbestos	P53	metastases
C	Tar	Ras	metastases
D	Benzopyrene	P53	mutations

Your answer

☐

[1]

- 5 DNA barcodes are genetic sequences that allow organisms to be identified. The DNA sequence of cytochrome c oxidase I is a common DNA barcode.

Which property of cytochrome c oxidase I makes it suitable for use as a DNA barcode?

- A location on mitochondrial DNA
- B slow mutation rate
- C short DNA sequence
- D long DNA sequence

Your answer

☐

[1]

- 6 The passage below outlines one method that can be used to prepare and view onion cells under a microscope. Two terms are missing.

Add a few drops of water to a microscope slide. Use forceps to remove the layer of cells from the onion tissue. Place the layer on the microscope slide and use a pipette to add a stain. Place a cover slip over the stained layer. Place the slide on the microscope stage. Adjust the magnification by rotating the microscope nosepiece to select a suitable lens.

Which are the missing terms?

- A epidermal and eyepiece
- B epidermal and objective
- C endodermal and eyepiece
- D endodermal and objective

Your answer

☐

[1]

7 **Fig. 7.1** below shows onion cells at various stages of mitosis.

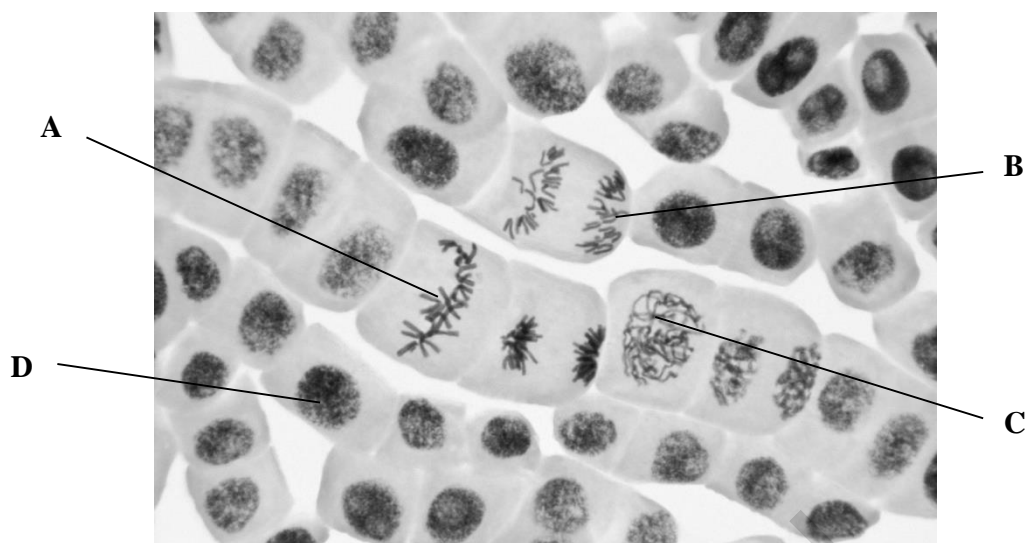


Fig. 7.1

Which cell shows the stage when the chromosomes attach to the spindle fibres?

Your answer

[1]

8 Which of the following events would **not** happen during mitosis in onion cells?

- A two nuclear envelopes will form
- B a cell plate will form
- C centrioles will move to opposite poles of the cell
- D the nuclear envelope will break down

Your answer

[1]

- 9 The genetic diversity of four species was studied by analysing a number of genes. Data from the studies are shown in **Table 9.1** below.

Species	Common name	Genome size (picograms)	Number of gene loci studied	Number of monomorphic gene loci	Number of polymorphic gene loci
A	Humans	3.50	71	51	20
B	House sparrow	1.57	15	10	5
C	American toad	6.35	14	10	4
D	Atlantic horseshoe crab	2.80	25	19	6

Table 9.1

Which species has the greatest genetic diversity?

Your answer

[1]

- 10 After a cut, the body responds by forming a blood clot. Platelets release thromboplastin and an enzyme-controlled reaction begins.

Why does this cause the rate of blood clotting to increase?

- A** there is less enzyme inhibition
- B** there are more active sites available
- C** there are more substrates to collide with the active site
- D** there is an increase in kinetic energy

Your answer

[1]

11 Which protein in the blood clotting process is indicated by line **X** in **Fig. 11.1** below?



Fig. 11.1

- A Thromboplastin
- B Thrombin
- C Fibrin
- D Fibrinogen

Your answer

[1]

- 12 A group of students were comparing electron micrographs of three different types of cell:

X a macrophage

Y a palisade mesophyll cell

Z the bacterium *Escherichia coli*

They recorded their observations in a table.

Which row, in **Table 12.1** below, shows the correct observations?

	Has a cellulose cell wall	Has a Golgi apparatus	Has a plasma membrane	Has ribosomes
A	Y and Z	X, Y and Z	X, Y and Z	X, Y and Z
B	Y and Z	X and Y	X and Y	X, Y and Z
C	Y	X	X, Y and Z	X and Y
D	Y	X and Y	X, Y and Z	X, Y and Z

Table 12.1

Your answer

[1]

- 13 The diagram in **Fig. 13.1** shows part of the plasma membrane.

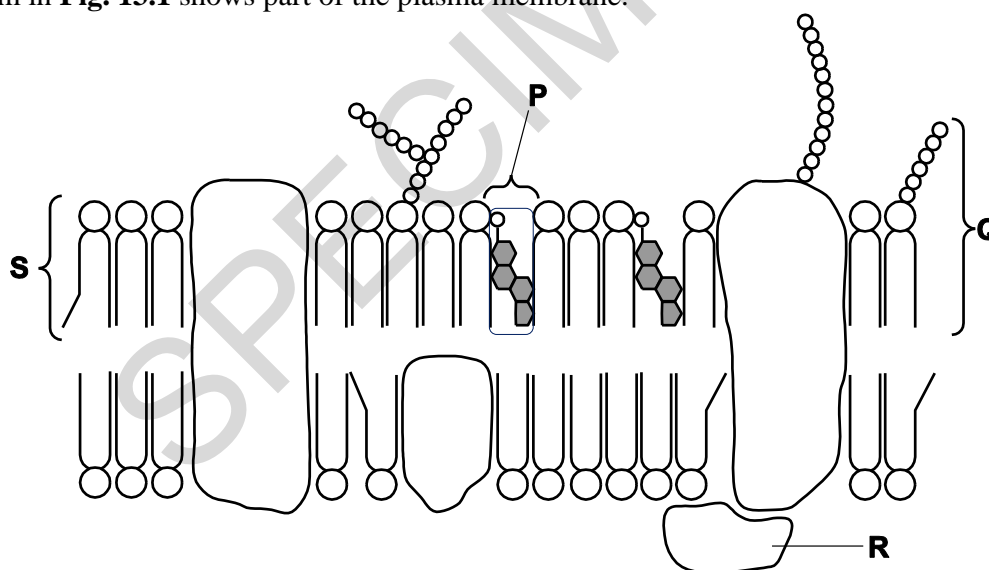


Fig. 13.1

Which components affect the fluidity of the plasma membrane?

- A** P, Q, R and S
B P and S
C P
D P, Q and S

Your answer

[1]

14 Some proteins act as hormones.

Oxytocin is a hormone which is released during labour.

Fig. 14.1 is a diagram of a molecule of oxytocin. Each circle represents an amino acid. The two molecules of the amino acid cysteine (Cys) are joined by their R groups so part of the molecule is circular.

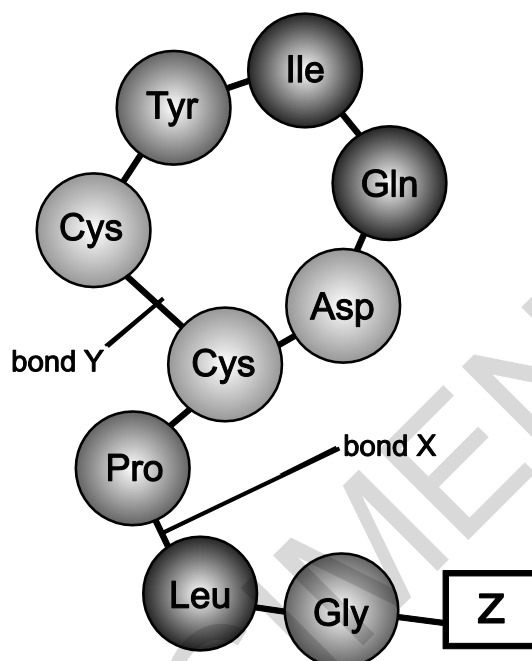


Fig. 14.1

Which row best describes the structure of oxytocin?

Row	Bond X	Bond Y	Group Z
A	peptide	disulfide	amine
B	hydrogen	peptide	amine
C	peptide	disulfide	phosphate
D	disulfide	hydrogen	phosphate

Your answer

[1]

- 15** Fig. 15.1 shows simplified models of two alveoli after exhalation is complete. One shows an alveolus from a non-smoker and the other shows the alveolus from a smoker. **X** is a tissue found in the lungs. Questions 15 and 16 both refer to this figure.

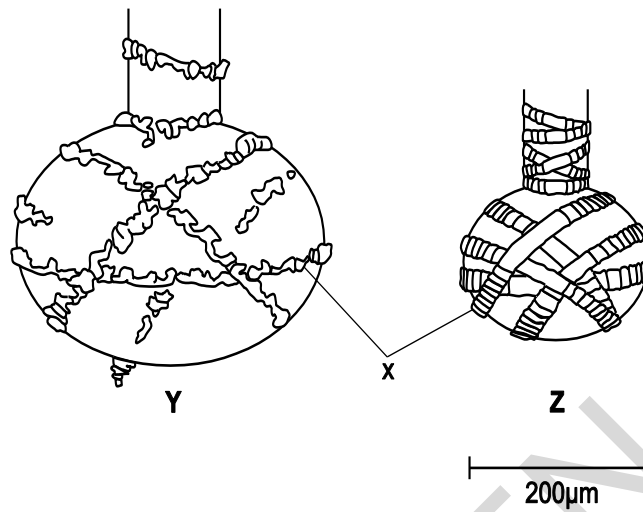


Fig. 15.1

Which of the following statements is correct:

- A** Y is from a non-smoker and **X** labels cartilage rings.
- B** Z is from a non-smoker and **X** labels cartilage rings.
- C** Y is from a non-smoker and **X** labels elastic fibres.
- D** Z is from a non-smoker and **X** labels elastic fibres.

Your answer ☐

[1]

- 16** In Fig. 15.1, the two alveoli are shown as simple spheres.

$$\text{Surface area of sphere} = 4\pi r^2$$

What is the approximate surface area for alveolus **Z**?

- A** $5.0 \times 10^5 \mu\text{m}^2$
- B** $1.3 \times 10^5 \mu\text{m}^2$
- C** $3.1 \times 10^4 \mu\text{m}^2$
- D** $4.2 \times 10^6 \mu\text{m}^2$

Your answer ☐

[1]

- 17 Glycogen is a complex carbohydrate found in the liver of mammals.

Which of the statements is/are true?

Statement 1: glycogen contains 1,4-glycosidic bonds between alpha glucose molecules.

Statement 2: glycogen contains 1,6-glycosidic bonds between alpha glucose molecules.

Statement 3: branches occur within the glycogen molecule by the formation of 1-6 glycosidic bonds.

- A** 1, 2 and 3
B Only 1 and 2
C Only 2 and 3
D Only 1

Your answer

☐

[1]

SPECIMEN

18 Fig. 18.1 shows a simplified drawing of a section through a plant organ.

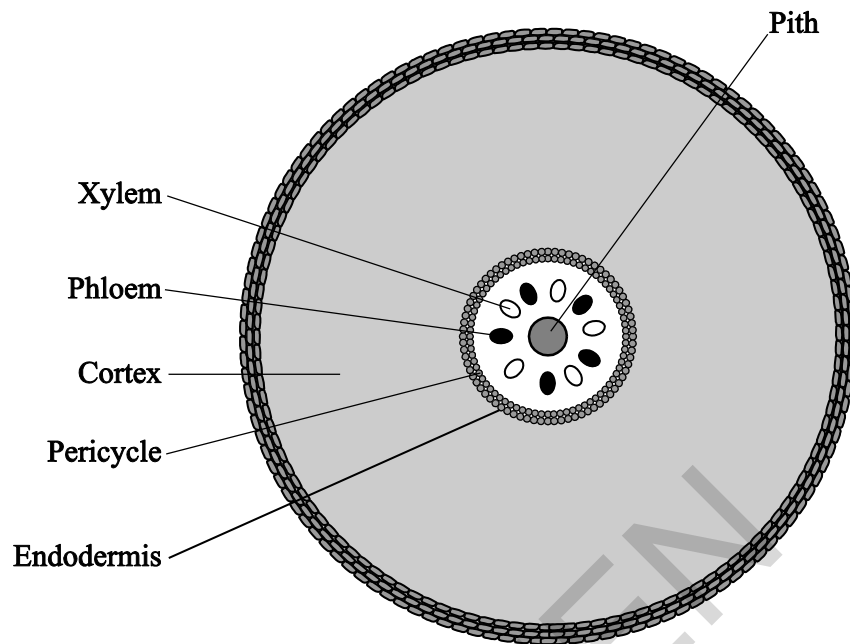


Fig. 18.1

Which organ is illustrated by Fig. 18.1?

- A a section through the stem of a wheat plant
- B a section through the stem of a cabbage plant
- C a section through the root of a wheat plant
- D a section through the root of a cabbage plant

Your answer

☐

[1]

19 Arteries contain elastic fibres.

Which of the following statements is/are true about the primary function of elastic fibres in artery walls?

Statement 1: contract to maintain high blood pressure.

Statement 2: recoil to maintain high blood pressure.

Statement 3: keep the blood moving away from the heart.

A 1, 2 and 3

B Only 1 and 2

C Only 2 and 3

D Only 1

Your answer ☐

[1]

20 Amniocentesis and chorionic villus sampling are two techniques that can be used to detect chromosomal mutations in a fetus.

Which of the following statements is/are true?

Statement 1: amniocentesis can be performed earlier in pregnancy than chorionic villus sampling.

Statement 2: amniocentesis carries a lower risk of miscarriage than chorionic villus sampling.

Statement 3: amniocentesis carries a lower risk of fetal deformities than chorionic villus sampling.

A 1, 2 and 3

B Only 1 and 2

C Only 2 and 3

D Only 1

Your answer ☐

[1]

SECTION B

Answer **all** the questions.

- 21** Xylem and phloem are tissues involved in bulk transport in vascular plants.

The structure of the two tissues is different because the mechanism of transport in the two tissues is different.

- (a) On **Fig. 21.1**, draw and label the position of xylem and phloem tissues in the stem of a dicotyledonous (broad-leaved) vascular plant. Use the letter **X** to indicate the position of the xylem tissue and **P** to indicate the position of the phloem tissue.



Fig. 21.1

[2]

- (b) How do the following differ in xylem and phloem tissue?

- (i) The type of cells present.

.....
 [1]

- (ii) The composition of the cell walls in the cells present.

.....
 [1]

- (c) Plants which are adapted to living in water are known as hydrophytes.

Two adaptations found in hydrophytes are the absence of a waxy cuticle on leaves and the absence of xylem tissue throughout the plant.

Suggest the advantage to plants living in water of:

The absence of a waxy cuticle

.....

.....

The absence of xylem tissue

.....

.....

[2]

SPECIMEN

- 22 (a) A haemocytometer can be used to count the number of erythrocytes in a blood sample.

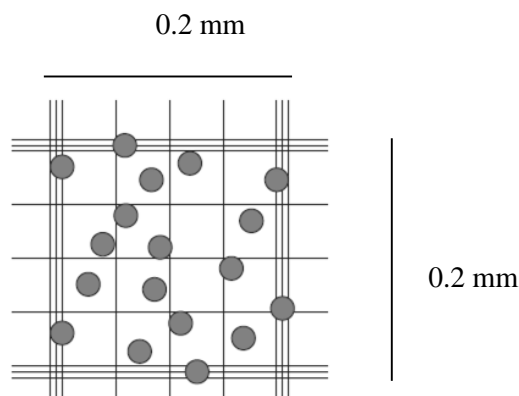


Fig. 22.1

Fig. 22.1 shows erythrocytes on a haemocytometer produced with a dilution of 1 in 200.

The volume of the haemocytometer chamber shown is $0.1 \text{ mm} \times 0.2 \text{ mm} \times 0.2 \text{ mm} = 0.004 \text{ mm}^3$.

Calculate the number of erythrocytes in 1 cm^3 of blood.

number of erythrocytes [3]

- (b) Water is the main component of blood plasma.

State **two** properties of water in blood plasma and explain their significance.

Property

Significance

.....

Property

Significance

.....

[4]

- 23** Different models can be used to investigate factors that affect the rate of diffusion of molecules into and out of cells.

Beetroot cells are a useful model for investigating the effect on diffusion rates of changes to plasma membranes. These cells contain the pigment betalain and the diffusion of betalain out of the cells can be measured using a colorimeter.

Fig. 23.1 is a simplified diagram of an intact beetroot cell.

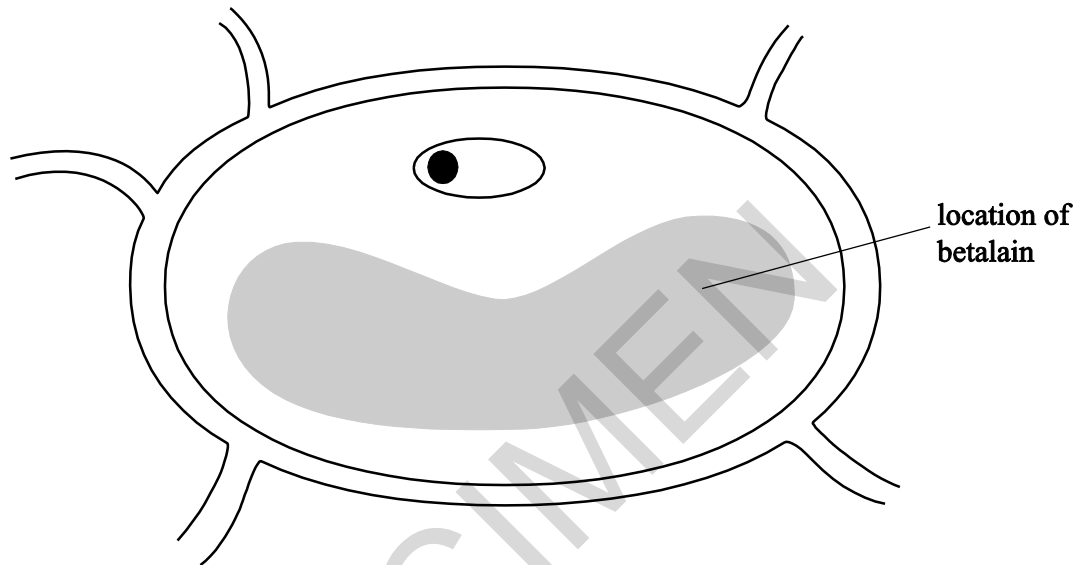


Fig. 23.1

- (a)** Describe the diffusion of betalain out of a beetroot cell under normal conditions.

.....

.....

.....

.....

[3]

- (b) Alternatively, a model cell can be made using visking tubing. A group of students investigated the effect of temperature on the rate of diffusion using visking tubing as a model cell as shown in **Fig. 23.2**.

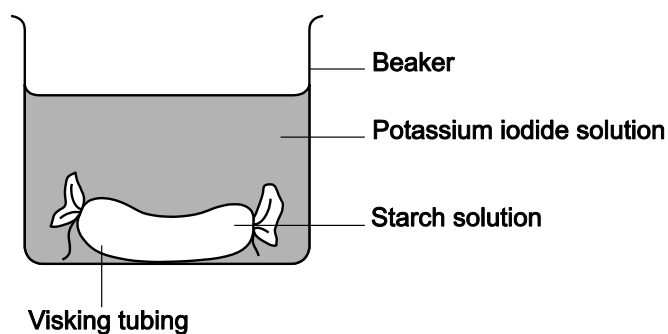


Fig. 23.2

This is the method they used:

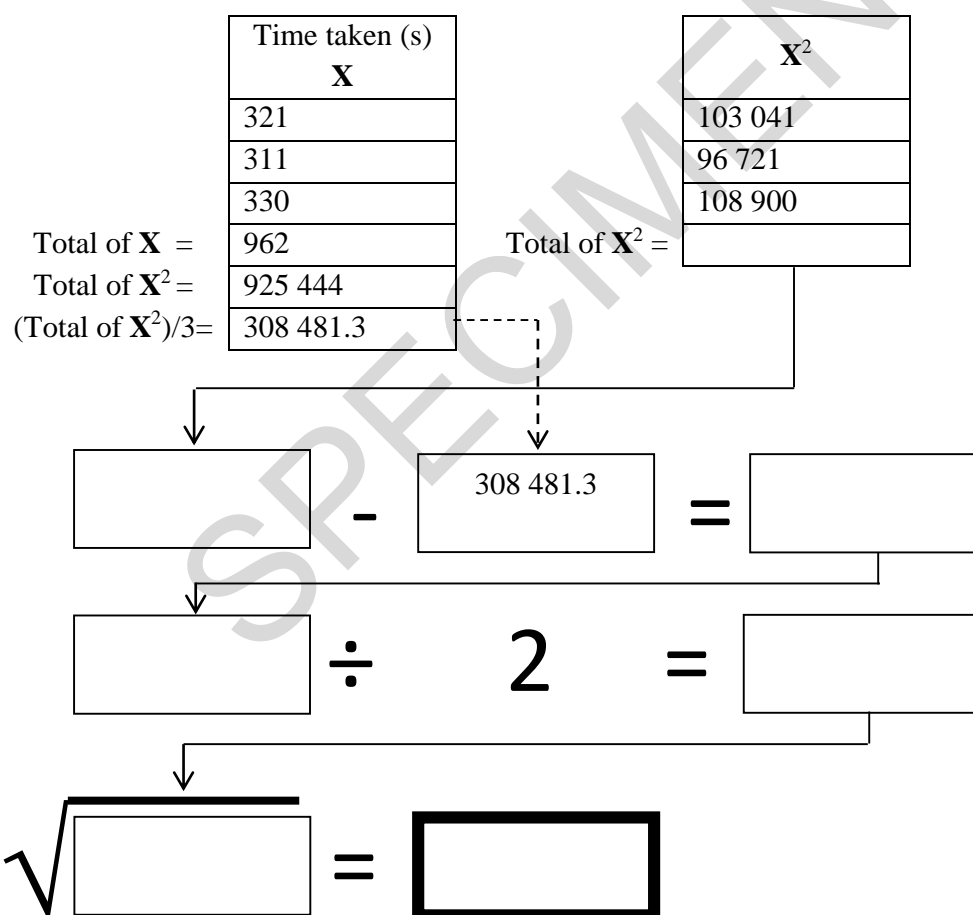
- take a piece of visking tubing approximately 6 cm in length
- tie a knot in one end of the tubing
- half fill the tubing with starch solution
- tie a knot in the other end
- blot dry the outside of the tubing
- place the 'model cell' into a potassium iodide solution at 20°C
- time how long it takes for potassium iodide to diffuse into the model cell and turn it blue-black in colour
- complete the procedure a total of three times and calculate a mean
- repeat the experiment at temperatures of 25 °C, 30 °C, 35 °C and 40 °C.

Table 23.1 shows their results.

Temperature (°C)	Time taken to turn blue-black in colour (s)				Standard deviation
	Repeat 1	Repeat 2	Repeat 3	Mean	
20	545	522	498	521.7	23.50
25	477	451	446	458.0	16.64
30	421	427	448	432.0	14.18
35	378	361	358	365.7	10.79
40	321	311	330	320.7	

Table 23.1

Complete the flowchart below to calculate the standard deviation at 40 °C **and** comment on the precision of results over the temperature range tested.



.....

.....

.....

.....

[4]

- (c) State **two** limitations to the experiment and explain how each could be improved.

Limitation

Improvement

.....

Limitation

Improvement

.....

[4]

- (d) Mammals require iodine for the function of the thyroid gland. The iodine is transported as an iodide ion.

Suggest how iodide ions might enter the cells of the thyroid gland.

.....

.....

.....

[1]

- 24 (a) The circulatory system of mammals can be described as a mass transport system.

State **two** reasons why mammals need a mass transport system.

.....

.....

.....

..... [2]

- (b) Fig. 24.1 shows a vertical section through a mammalian heart.

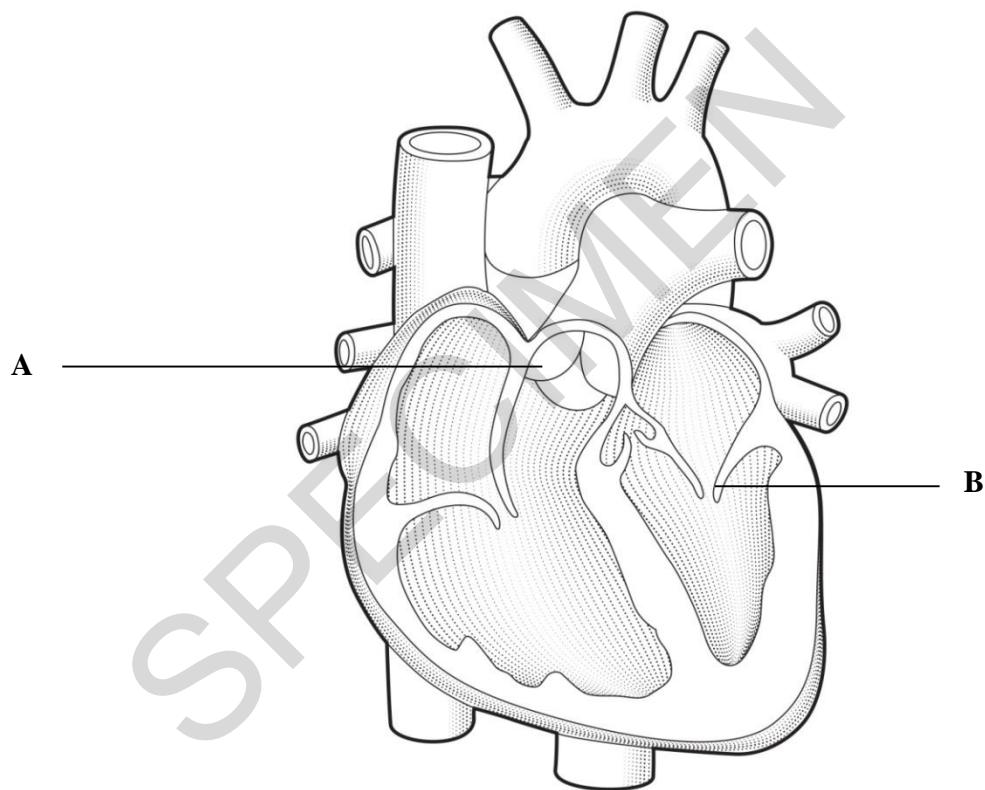


Fig. 24.1

State the roles of structure **A** and structure **B** during the cardiac cycle.

A

.....

B

..... [2]

- (c) A sphygmomanometer and stethoscope can be used to measure blood pressure. The cuff of the sphygmomanometer is put around the arm and inflated to around 200 mmHg. The stethoscope is placed over the artery and the pressure in the cuff is slowly released.

Describe the role of the stethoscope in taking blood pressure readings.

.....

.....

.....

..... [2]

- (d) An epidemiological study was carried out on 614 individuals on the effects of hypotension **and** hypertension on the cardiovascular system.

The results are shown below in **Fig. 24.2**.

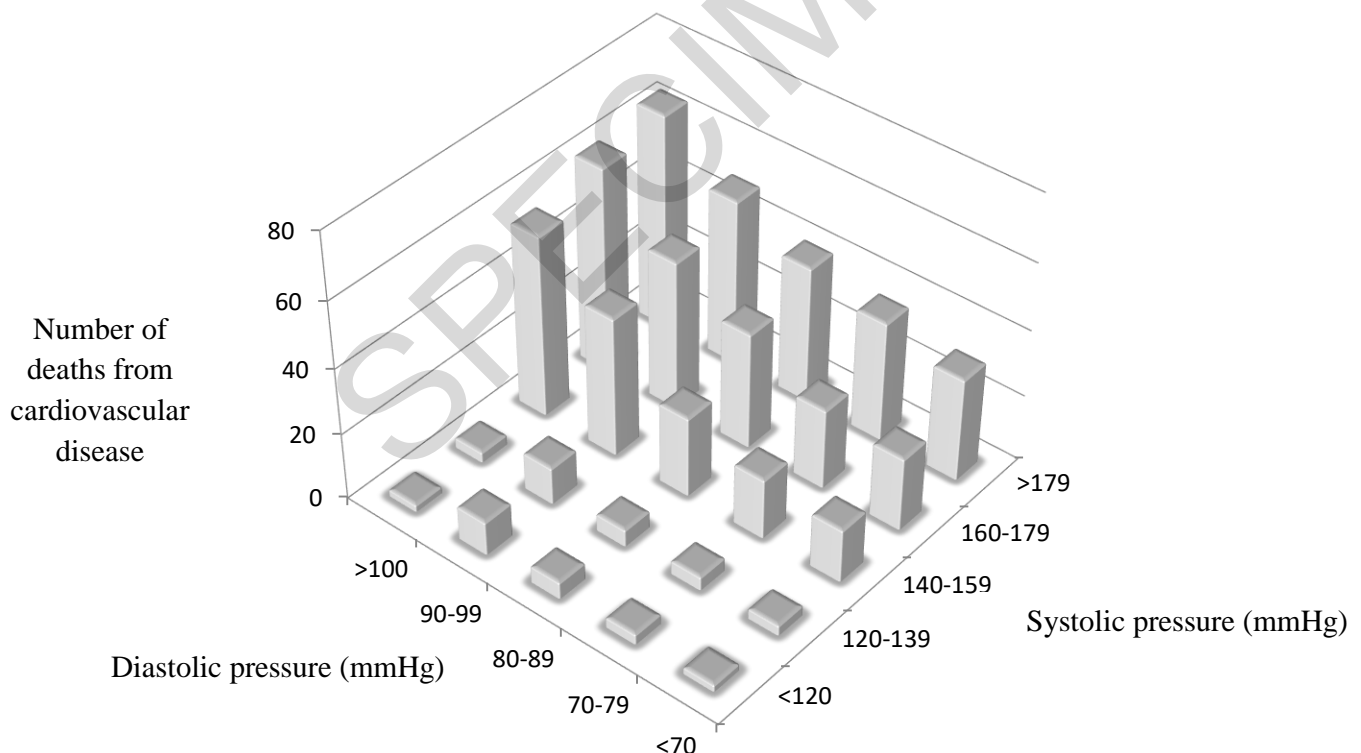


Fig. 24.2

Using the information in **Fig. 24.2**, what can you conclude about the impact of blood pressure on the number of deaths from cardiovascular disease?

.....

.....

.....

.....

.....

.....

[3]

SPECIMEN

- 25 (a) In 1958 Matthew Meselson and Franklin Stahl conducted an experiment that supported the theory that DNA replication occurred due to semi-conservative replication.

Fig. 25.1 shows semi-conservative replication of part of a DNA molecule.

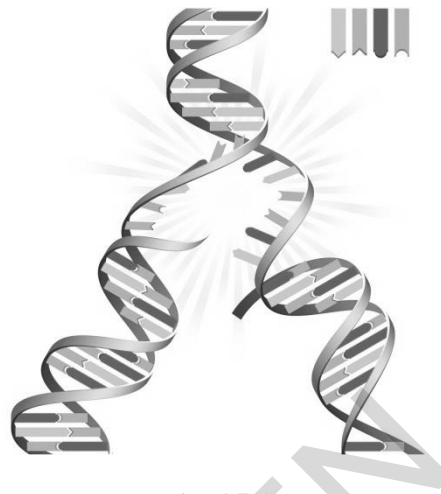


Fig. 25.1

Explain what is meant by the term *semi-conservative replication*.

.....

.....

.....

.....

..... [2]

- (b) The genome of the plant *Arabidopsis thaliana*, the mouse-ear cress, was the first plant genome to be sequenced. Its genome was found to be relatively small and contains 5 chromosomes and 135 million base pairs.

Calculate the number of adenine **nucleotides** present in this genome if 20% of the nucleotides are guanine.

number of adenine nucleotides [2]

- (c) DNA sequencing is a technique that may be used to show the evolutionary relationships of organisms.

Fig. 25.2 shows some of the evolutionary relationships of *Arabidopsis thaliana* in the form of a phylogenetic tree.

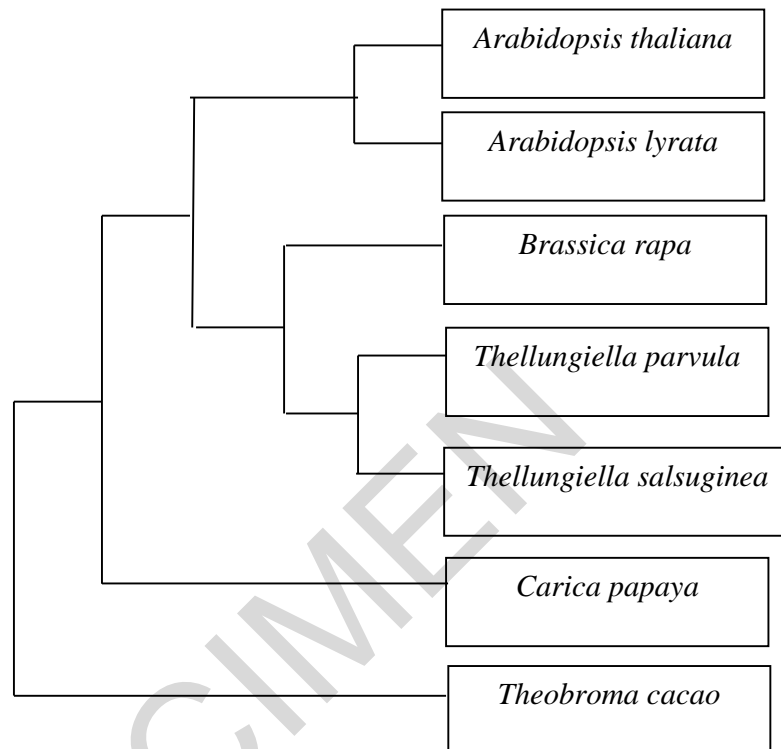


Fig. 25.2

- (i) Which species is most closely related to *Arabidopsis thaliana*?
 [1]
- (ii) Which species is most distantly related to *Arabidopsis thaliana*?
 [1]
- (iii) How many genera are there in this phylogenetic tree?
 [1]

26 (a) In 2012, 8.6 million people fell ill with tuberculosis (TB) and 1.3 million died from TB.

(i) Describe how the Mantoux test is carried out to diagnose TB.

.....
 [2]

(ii) Antibodies are produced in response to the TB pathogen. **Fig. 26.1** shows an antibody.

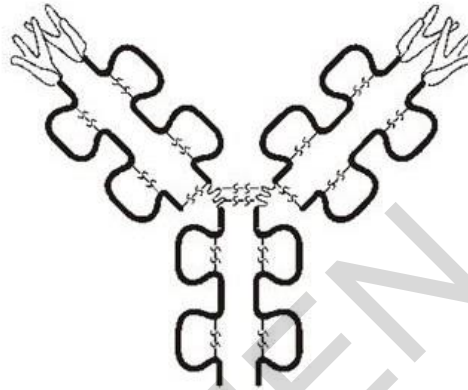


Fig. 26.1

Suggest how the structure of the antibody allows it to carry out its role as an:

agglutinin.....

opsonin.....
 [2]

(b) Scientists are conducting trials on a monoclonal antibody to treat cervical cancer by immunotherapy.

(i) Suggest how cancerous cells are targeted and destroyed by immunotherapy.

.....

 [3]

- (ii) Most cases of cervical cancer are caused by infection with Human Papilloma Virus (HPV) which is a sexually transmitted virus.

A vaccine to protect against HPV is now routinely offered to girls between the ages of 11 and 13.

For many people the vaccination is considered unethical.

Suggest **two** reasons why this vaccination programme may be considered unethical.

- 1.....
.....
- 2.....
.....
- [2]

END OF QUESTION PAPER

SPECIMEN

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Page 7, Fig. 11.1: blood clotting graph © www.ebi.ac.uk

Page 20, Fig. 24.1: image of a heart © Paul Wooton/Science Photo Library

Page 24, Fig. 25.1: DNA molecule © JackOm/www.gettyimages.co.uk/

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Oxford Cambridge and RSA

...day June 20XX – Morning/Afternoon

AS Level Biology B (Advancing Biology)

H022/01 Foundations of biology

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

11. 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.

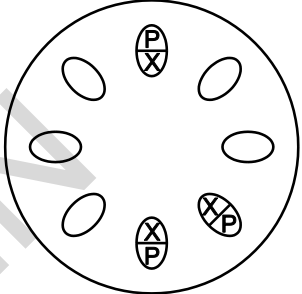
You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New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

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

SECTION A

Question	Answer	Marks	Guidance
1	C	1	
2	A	1	
3	C	1	
4	B	1	
5	C	1	
6	B	1	
7	A	1	
8	C	1	
9	B	1	
10	B	1	
11	C	1	
12	D	1	
13	B	1	
14	A	1	
15	D	1	
16	B	1	
17	A	1	
18	C	1	
19	C	1	
20	C	1	
	Total	20	

SECTION B

Question			Answer	Marks	Guidance
21	(a)		vascular bundles drawn with both tissues AND arranged in a circle just inside the circle ✓ bundle to have phloem / P on the outside and xylem / X on the inside ✓	2	 <p>Fig 21.1</p>
	(b)	(i)	xylem contains, xylem vessels (tracheids / fibres), phloem contains, sieve tube (elements) and companion cells ✓	1	ALLOW xylem has lignin, phloem does not
		(ii)	xylem has cellulose and lignin, phloem has cellulose ✓	1	
	(c)		<i>idea that</i> water can diffuse directly into the leaves ✓ <i>idea that</i> stems / AW, more flexible / can move with the currents / less likely to be broken by water movement ✓	2	IGNORE references to 'not needing' a cuticle as the question asks for the advantages IGNORE references to 'not needing' xylem as the question asks for the advantages
			Total	6	

Question			Answer	Marks	Guidance
22	(a)		$1 \text{ cm}^3 / 0.004 \text{ mm}^3 = 1\,000 \text{ mm}^3 / 0.004 \text{ mm}^3 = 250\,000 \checkmark$ $250\,000 \times 15 = 3\,750\,000 \checkmark$ $3\,750\,000 \times 200 = 750\,000\,000 \checkmark$	3	ALLOW 3 marks for the correct answer if no working shown ALLOW 750 million / 7.5×10^8
	(b)		<i>Property:</i> solvent \checkmark <i>Significance:</i> transport polar chemicals \checkmark <i>Property:</i> high specific heat capacity \checkmark <i>Significance:</i> maintenance of stable temperature \checkmark	4	ALLOW description of high specific heat capacity
			Total	7	

Question		Answer	Marks	Guidance
23	(a)	<p>down a concentration gradient / AW, between vacuole and, surroundings / AW ✓</p> <p>across tonoplast and cell surface membrane ✓ through the cell wall ✓</p>	3	ACCEPT a description e.g. ref. to a high concentration in the vacuole compared to outside the beetroot cell
	(b)	<p>9.51 ✓</p> <p>results at 40°C are the most precise and results at 20°C are least precise ✓ precision increases as temperature increases ✓ quotes data to support either statement ✓</p>	4	
	(c)	<p><i>Any 2 limitations and improvements up to maximum 4 marks</i></p> <p>approximate length of visking tubing ✓ exactly 6 cm length of visking tubing ✓</p> <p>half fill the model cell ✓ use exact volume of liquid ✓</p> <p>blot dry the outside of the tubing ✓ thoroughly dry the tubing ✓</p> <p>concentration of, potassium iodide solution / starch solution not stated ✓ use the same / known concentrations for each repeat / temperature ✓</p>	4	Improvement must be linked to limitation

Question			Answer	Marks	Guidance
	(d)		Any 1 from: facilitated diffusion ✓ active transport ✓	1	
			Total	12	

Question			Answer	Marks	Guidance
24	(a)		Any 2 from: <i>idea that</i> mammal has a small surface area to volume ratio / mass transport system provides a large surface area to volume ratio ✓ high activity levels ✓ high metabolic rate ✓ (as they are) multicellular ✓	2	
	(b)		A prevents the backflow of blood into the (right) ventricle during <u>diastole</u> ✓ B prevents the backflow of blood into the (left) atrium during <u>ventricular systole</u> ✓	2	
	(c)		Any 2 from: (nurse) listens for pulse ✓ start of sound indicates systole pressure ✓ absence of sound indicates diastole pressure ✓	2	
	(d)		Any 3 from: diastolic blood pressure has little effect on the number of deaths ✓ low systolic blood pressure (<140) has little effect on the number of deaths ✓ high systolic blood pressures (>140) significant increase in the number of deaths observed ✓ at low systolic, increasing diastolic has little effect / AW ✓ at high systolic, increasing diastolic has great effect / AW ✓ correct quotation of figures in support of any statement ✓	3	
			Total	9	

Question			Answer	Marks	Guidance
25	(a)		Any 2 from: two identical molecules / helices, (of DNA) produced ✓ (each made up of) 1, original / parent / old, strand and one new strand ✓ original / parent / old, strands, act as template / described ✓	2	
	(b)		Any 2 from: 30% adenine ✓ $(135 \text{ million} \times 2) = 270 \text{ million} / 100) \times 30$ ✓ 81 million ✓	2	ALLOW correct answer with no working for 2 marks ALLOW $270\,000\,000 \times 0.3$ ALLOW 1 mark for $(135 \text{ million} / 100) \times 30 = 40.5$ million
	(c)	(i)	<i>Arabidopsis lyrata</i> ✓	1	
		(ii)	<i>Theobroma cacao</i> ✓	1	
		(iii)	5 ✓	1	
			Total	7	

Question			Answer	Marks	Guidance
26	(a)	(i)	tuberculin is injected under the skin ✓ raised hard area after 48–72 hours ✓	2	ALLOW antigen under skin
		(ii)	<i>Agglutinins</i> <i>idea of the antigen binding site / variable region binding to the antigens and clumping the pathogens together</i> ✓ <i>Opsonins</i> <i>idea of the constant region of the antibody allows phagocytic cells to recognise and engulf</i> ✓	2	
	(b)	(i)	Any 3 from: amino acid sequence gives complementary shape to <u>antigen</u> ✓ variable region specific to <u>antigen</u> on cancer cells ✓ chemotherapeutic agent attached to antibody ✓ (Antibody Drug Conjugate) floats in the bloodstream sticking only to cancer cells ✓ once attached, the agent kills the cancer cell ✓ direct attachment of antibodies to cancer cells ✓ (monoclonal antibody) marks cancer cell for destruction ✓ antibodies attach to T cells to stimulate them to attack cancer cells (by keeping them switched on) ✓	3	ALLOW toxin/drug is attached to the antibody
		(ii)	Any 2 from: may encourage unprotected sex ✓ requires parental consent ✓	2	

Question			Answer	Marks	Guidance
			does not consider the child's point of view ✓ vaccines can have side effects ✓		
			Total	9	

Summary of updates

Date	Version	Change
January 2019	2.0	Addition to the rubric clarifying the general rule that working should be shown for any calculation questions

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