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Examiners' report

BIOLOGY B (ADVANCING BIOLOGY)

H022
For first teaching in 2015

H022/02 Summer 2018 series

Version 1

Contents

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates. The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report. A full copy of the question paper can be downloaded from OCR.

Paper H022/02 series overview

Most successful /questions	*Least successful questions*
Trend description 4a Experimental procedure 2ai, 5bii, 6bi and 6bii	Cell ultrastructure 1ai Level of response 1c and 4d Cardiac cycle 2bi and 2bii Unit conversion in calculations 3c Chemical bond formation 5a Interpretation of Benedict's test 5bi

Candidates were quite good at commenting on the reasons why particular experimental technique are used, apart from Benedict's test. However, the mathematical ability shown in the questions involving calculations suggested that more work is need in this area.

As usual candidates were often quite weak when it came to some of the biochemistry questions as shown by their lack of knowledge of glycosidic bond formation.

Candidates also need to practise answering level of response questions as it is not just a matter of stating what they know about the topic in question but using the information as they are instructed.

Question 1(a) (i)

1 The yellow fever mosquito, *Aedes aegypti*, is one of the vectors responsible for transmitting pathogenic viruses such as the Zika virus.

Fig. 1 is a diagram of a cell from *A. aegypti* during prophase of mitosis.

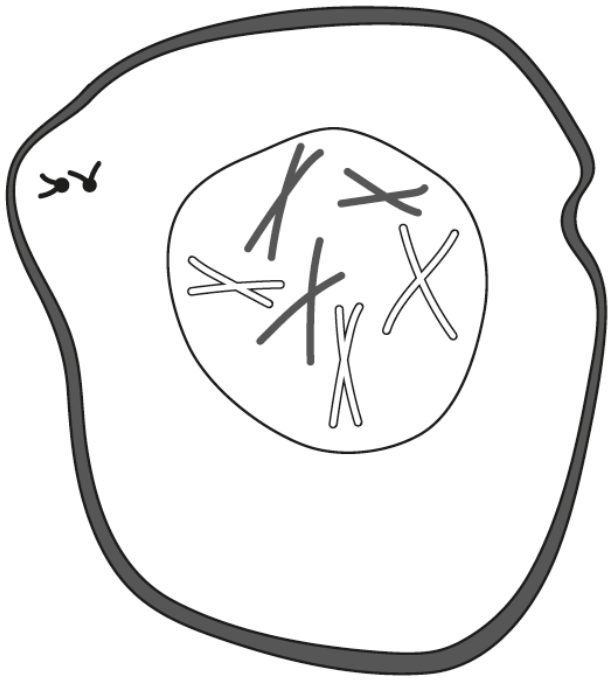
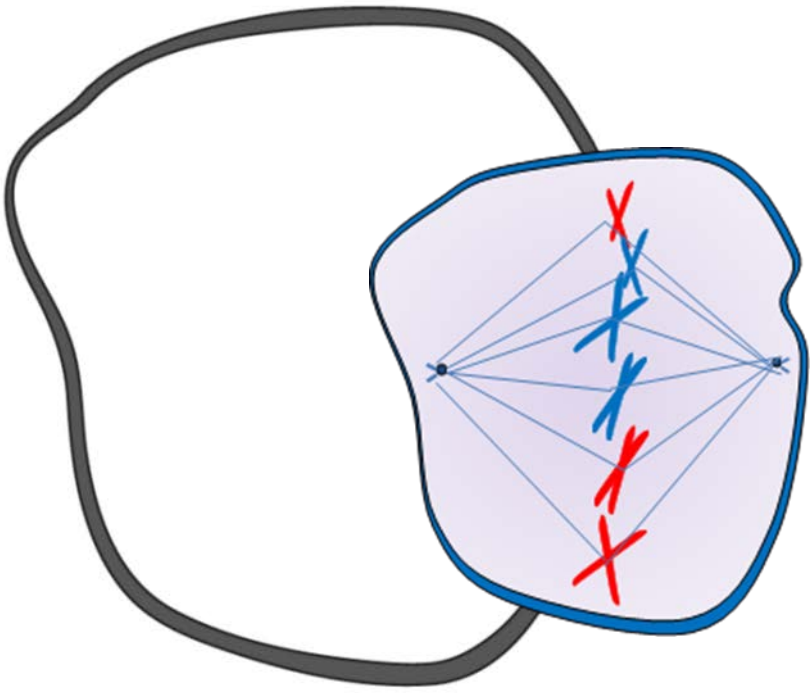


Fig. 1

(a) (i) Using the information in Fig. 1 complete and label the diagram in the space below to show the cell during **metaphase** of mitosis.



[3]

This was a straightforward opening question and more candidates should have scored three marks.

Candidates often did not label their diagram. The candidates that did use labels did not label the chromatids or used the term centrosome instead of centromere. Quite a few candidates did not draw six chromosomes or missed the spindle fibres out. It should be noted that the spindle fibres connect the chromosomes to the centriole and this should obvious in the diagram, too many candidates drew vague or incomplete spindle fibres.

Question 1(a) (ii)

(ii) Using Fig. 1 state the number of chromosomes that would be found in the following cells taken from *A. aegypti*.

A stem cell .....

A sperm cell (gamete) ..... **[1]**

Quite a few candidates stated 46 and 23 for the number of chromosomes found in a stem cell and sperm cell found in the same organism. As they have just drawn a cell going through the process of mitosis found in the same organism, this suggests that they did not read the question properly.

Question 1 (c)

(c)* Stem cells removed from *A. aegypti* embryos have been used in scientific research to develop potential strategies for limiting the transmission of the Zika virus.

Discuss the potential uses for **human** embryonic stem cells taking into account any concerns that could arise by using these cells for research purposes.

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..... **[6]**

The use of stem cells is well known by candidates but the concerns arising were lacking in many cases. 'Religious belief' was the most common concern with 'potential risks' rarely are stated. The candidates should be taught that level of response questions require more than just stating facts relevant to the topic. This question required candidates to discuss the use of stem cells including references to the potential concerns such as it could lead to reproductive cloning, the potential risks and side effects are unknown, the embryos cannot give consent, religious objections, the embryo could be used in fertility treatment or they are taken from an embryo at less than 5 days old.

Exemplar 1

Human embryonic stem cells are totipotent meaning they have can differentiate into any cell and develop into a full embryo. This leads to many scientific advantages. One potential use is exposing embryonic stem cells to conditions leading them to differentiate into skin cells. They could then be used to create skin grafts and treat burns. Another potential use is using human embryonic stem cells to treat nerve damage for example in spinal cord injuries and Parkinson disease as the cells could differentiate into nerve cells to replace those damaged. Furthermore human embryonic stem cells could be used to treat cancer e.g. leukimia where mutated cells need to be replaced with normal cells.

Some concerns that may arise from using embryonic stem cells is that some people believe life begins at conception and that by using embryonic stem cells for scientific use are [6]

1 (c) destroying human life. Another concern is that a patients body may reject the stem cells if immune system detects them as foreign. In addition there are concerns that scientific use of human embryonic stem cells could lead to cloning, L3 something that is illegal worldwide. The main issue is that using human embryonic stem cells goes against many peoples cultural beliefs.

This was a good answer showing a clear understanding of what stem cells are and how they can be used. Giving a number of examples. A good appreciation was also shown of the concerns arising from using embryonic stem cells. Had there been references to an obvious lack of consent and objections due to religious beliefs and the answer would have been credited full marks.

Question 2 (a) (i)

2 A rapid heart rate reduces the volume of oxygen reaching the cardiac muscle of the heart. This can lead to chest pain known as angina.

Digoxin is a drug that can be used to treat angina by reducing the resting heart rate.

A study into the effect of digoxin on heart rate was carried out on a group of patients being treated for angina.

The resting heart rates of these patients were recorded before starting treatment and then again after eight weeks of treatment with digoxin.

(a) (i) Explain why it is important to record the resting heart rates of patients before starting treatment with digoxin.

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

Most candidates had the right idea that this was a baseline from which they needed to determine any changes due to the administration of digoxin.

Question 2 (a) (iii)

Fig. 2 shows the results for one of the patients in this study.

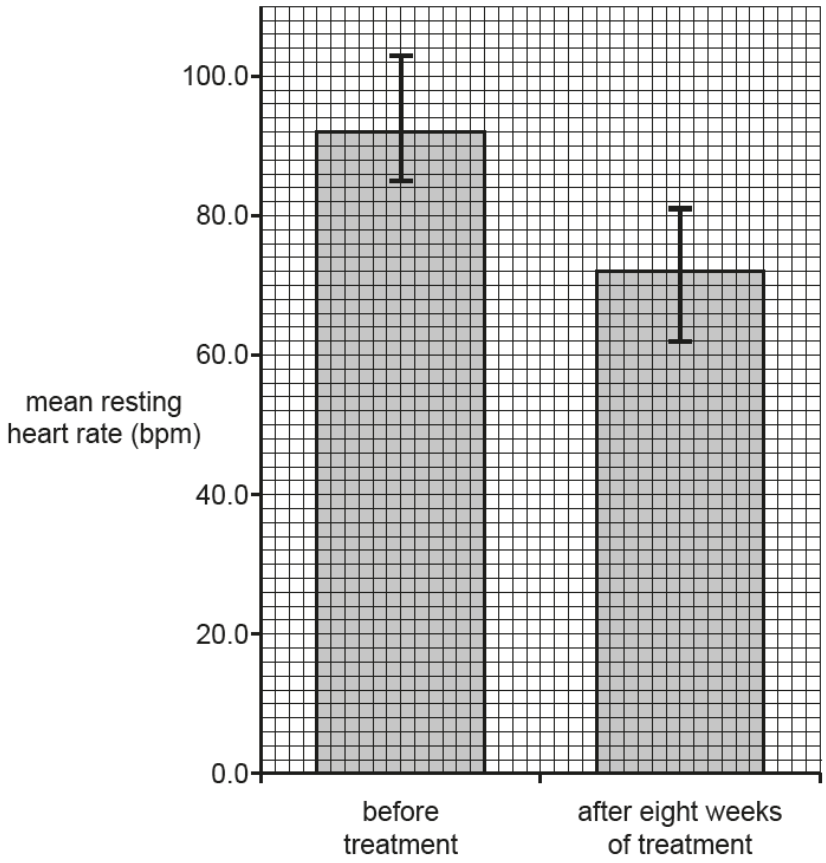

Fig. 2

(iii) Using Fig. 2, state the range in the resting heart rates for this patient before **and** after eight weeks of treatment with digoxin.

Before treatment .....

After eight weeks of treatment .....

[1]

This question was well answered, but some candidates stated 0-92 and 0-72. This suggested that they did not fully understand the term 'range'.

Question 2 (b) (i)

(b) Digoxin may reduce resting heart rate by acting on the atrioventricular node (AVN).

(i) What is the role of the AVN in coordinating the heart action?

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

Only a few candidates seemed to know that the AVN delays the impulse. Most candidates who received credit did so for 'transmitting impulse down bundle of His'.

Question 2 (b) (ii)

(ii) Suggest how the action of digoxin on the AVN could lead to a decrease in resting heart rate and how this could affect cardiac function.

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

A number of candidates thought that the AVN controlled the opening of the AV valves. This wasn't an isolated case. MP1 and MP3 were often credited but few candidates identified 'more time to fill ventricles'.

Question 3 (a) (i)

3 Quinine is a drug that occurs naturally in the bark of cinchona trees. It is used to treat malaria caused by the parasite, *Plasmodium falciparum*, which infects human erythrocytes.

- The medicinal properties of cinchona bark were first realised by the Quechua people of South America.
- The use of cinchona bark in treating fever was documented in Europe during the 17th century.
- In the 1800s, researchers isolated quinine from cinchona bark and identified it as the medicinally active compound.

(a) (i) Suggest why researchers concentrated on studying cinchona bark when looking for a treatment for malaria.

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

Candidates usually scored one mark for reference to the previously known medicinal use of the bark without developing the answer to explain why this was an advantage.

Question 3 (a) (ii)

(ii) Quinine interferes with the ability of *P. falciparum* to completely digest haemoglobin resulting in the death of the parasite.

Suggest how incomplete digestion of haemoglobin results in the death of *P. falciparum*.

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

Many candidates identified that the malarial parasite would starve. Although quite a few candidates identified that the parasite would die due to lack of oxygen because of the incomplete digestion of haemoglobin, a high proportion thought that the parasite was a virus.

Key

Misconception

Question 3 (b) (i)

(b) Quinine has been used to treat muscle cramps associated with a neurological condition known as restless leg syndrome. A clinical trial to assess the effectiveness of quinine in treating restless leg syndrome was carried out on a large number of volunteers divided into two groups. One group was given oral quinine and the other group was given a placebo.

(i) Explain what is meant by a placebo in this context.

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

Candidates who didn't receive credit often lacked the idea that a placebo either looks and/or tastes the same as the tested drug. An answer such as 'a drug that has no effect' was common and the term 'no effect' is far too vague and incorrect for candidates to be using at this level.

Question 3 (c)

(c) The dose required to treat a patient with malaria using oral quinine is 10 mg kg^{-1} every eight hours.

Calculate the mass of quinine required in the first four days of treatment for a patient who weighs 75 kg.

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

The most common error for those candidates that gained one mark for this question was being unable to convert 'mg' into 'g'. It is clear that candidates need to practice and become confident in using and converting the different units required on the course.

Question 4 (a)

4 Following the injection of a vaccine the antibody concentration in the blood changes.

Fig. 4 shows the concentration of antibody in the blood of an individual following a BCG vaccination for tuberculosis (TB).

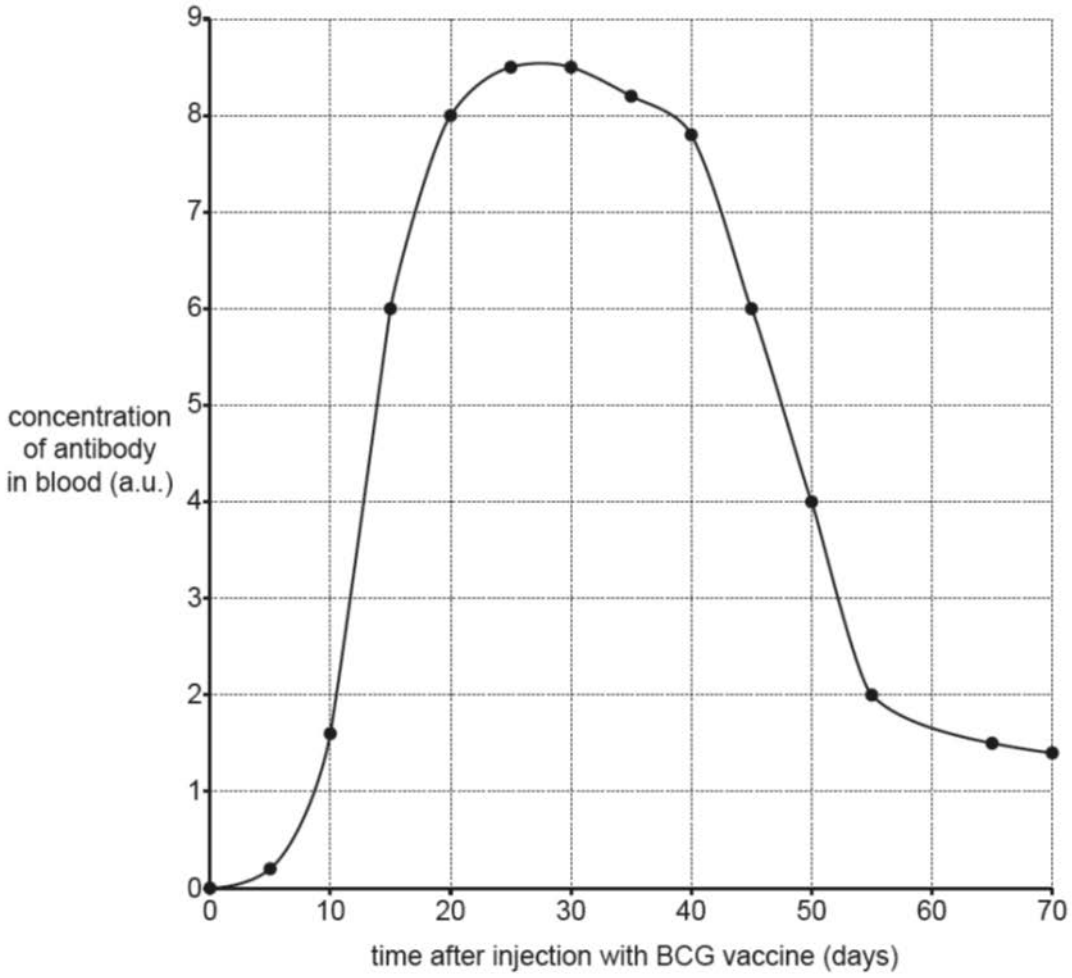

Fig. 4

(a) Describe **and** explain the pattern in the data shown in Fig. 4.

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

On the whole, candidates were able to describe the pattern in the graph but usually found it more difficult to explain the pattern. This was the case even with higher ability candidates that seemed to know the topic. Candidates need more practice linking their scientific knowledge to patterns and trends obtained from unfamiliar data.

Question 4 (d)

(d)* When certain types of pathogen enter the body they trigger a specific immune response.

Compare the roles of B and T lymphocytes in the specific immune response.

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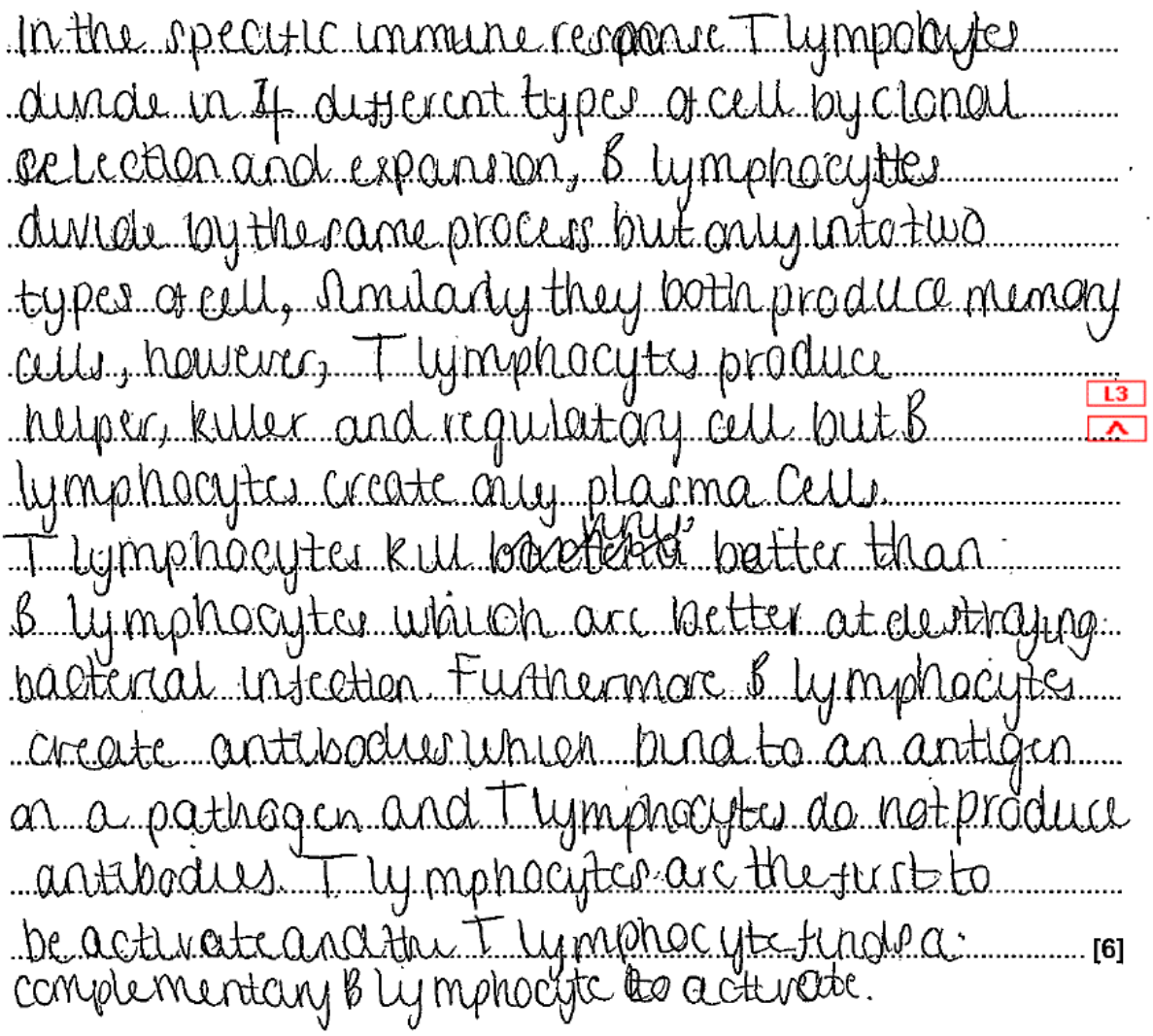
..... **[6]**

Most candidates described T and B Lymphocytes well, but didn't 'compare' which was the focus of the question meaning that they were limited to level 2.

Exemplar 2


In the specific immune response T lymphocytes divide in 4 different types of cell by clonal selection and expansion, B lymphocytes divide by the same process but only into two types of cell, similarly they both produce memory cells, however, T lymphocytes produce helper, killer and regulatory cell but B lymphocytes create only plasma cells. T lymphocytes kill bacteria better than B lymphocytes which are better at destroying bacterial infection. Furthermore B lymphocytes create antibodies which bind to an antigen on a pathogen and T lymphocytes do not produce antibodies. T lymphocytes are the first to be activate and the T lymphocyte finds a complementary B lymphocyte to activate. [6]

L3
A

This was a good, well balanced answer that covered both the similarities and differences of B and T lymphocytes. A lot of candidates just listed what they knew about these different types of cells but in this answer the candidate has actually made comparisons between the cells. This is a skill many candidates do not have and should be practised, especially in preparation for this type of level of response question.

Question 5 (a)

5 Glucose is produced by plants during photosynthesis. It can be combined with fructose to form the disaccharide sucrose, which can then be transported to other tissues inside the plant.

Fig. 5 is a diagram of glucose and fructose.

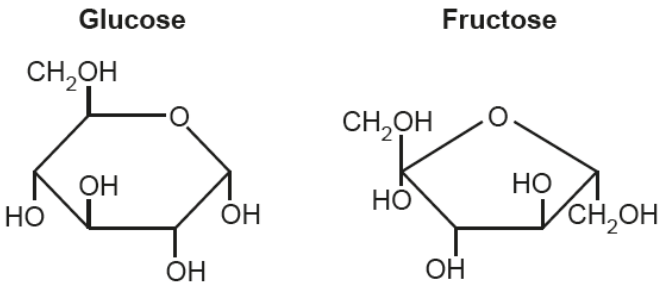
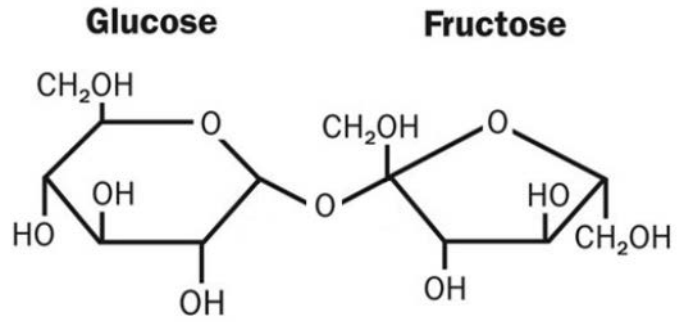


Fig. 5

(a) Using the information in Fig. 5, draw a diagram of a sucrose molecule in the space below.



[2]

Most candidates correctly identified the carbons, but a large number didn't know how to draw a glyosidic bond with an oxygen bridge.

Question 5 (b) (i)

(b) A student used the following procedure to test different organs from a tomato plant for the presence of sucrose.

1. Remove a leaf from the tomato plant and after dipping it into boiling water grind it using a mortar and pestle.
2. Add water to the ground up leaf and filter the mixture.
3. Pour a small sample of the filtrate into a test tube and add dilute hydrochloric acid.
4. Place the test tube into a water bath.
5. Remove the test tube from the water bath and add sodium hydrogen carbonate.
6. Add Benedict's reagent and then place the test tube back into the water bath.
7. Record the colour of the contents of the test tube.
8. Repeat steps 1 to 7 with stem and root samples taken from the same tomato plant.

Table 5 shows the observations recorded by the student.

Plant organ being tested	Observations
Leaf	Blue-green
Stem	Green-orange
Root	Blue-green

Table 5

(i) The student made the following statement:

My observations support the theory of translocation.

Using the information in Table 5 and your knowledge of translocation discuss the validity of this statement.

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

Most candidates had a good understanding of translocation but many did not demonstrate understanding of the colour changes seen in a Benedict's test. A number of candidates thought that water caused the colour changes.

Question 5 (c)

(c) Tomato plants are broad-leaved crop plants.

Compare the structure of a tomato plant with that of a cereal crop plant, such as wheat with regards to their transport systems.

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

Some candidates did not remember the vascular bundle arrangement in dicot roots and stems, and gave an answer that was the wrong way around. There were also a few unusual spellings of monocotyledon and dicotyledon. Transport systems were quite often referred to with no other detail and it was also stated by some candidates that monocots do not need these systems or need smaller systems.

Question 5 (d)

(d) The presence of starch in seeds can be detected using iodine-KI reagent.

When tested with iodine-KI reagent, dry seeds showed a high concentration of starch but after the seeds had been soaked in water for seven days they tested negative for the presence of starch.

Explain why the seeds tested negative for starch after being soaked in water.

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

Some candidates thought that starch moved out of the seeds down a concentration gradient into the water or that water moving in by osmosis diluted the starch to such a degree that the test would be negative.

Question 6 (a) (i)

6 Pathologists are often required to produce blood smears for analysing blood samples and determining the health of patients.

A pathologist produced a blood smear and then observed it using a light microscope.

Fig. 6 shows the image of the blood smear seen by the pathologist.

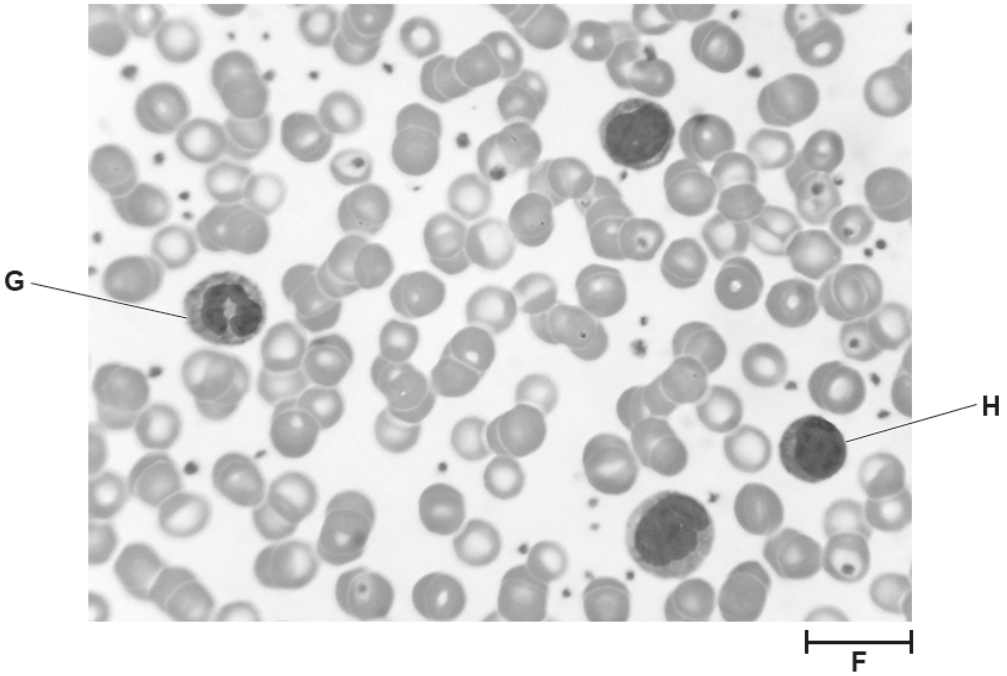

Fig. 6

(a) (i) Name cells **G** and **H** in Fig. 6.

G .....

H .....

[2]

A number of candidates got these cells the wrong way around.

Question 6 (a) (ii)

(ii) The magnification of the image in Fig. 6 is ×500.

Calculate the length represented by the scale bar labelled **F**.

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

A common error was to miscalculate conversion of units and to use the incorrect use of the magnification formula.

Question 6 (c)

(c) Flow cytometry is another technique used by pathologists for analysing blood samples.

Describe the usefulness of flow cytometry for analysing blood samples.

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

Apart from some candidates knowing that flow cytometry is used for counting cells, very little seemed to be known about this process.

Exemplar 3

Flow cytometery is very useful it's an electronic way of counting blood samples. It's useful because it's very quick and effective and can count huge amount of cells in short space of time. It can also identify the physical and chemical characteristics of the blood samples which is useful. You are also able to target/tag specific cells by using fleuresecent tag. **[3]**

An answer of this standard was rarely seen in response to this question and showed that it could be done. The three points that gained the marks credited are clearly made and could almost be straight from the mark scheme.

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