Write your name here

Surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number	Candidate Number

Biology B

Advanced Subsidiary
Paper 1: Core Cellular Biology and Microbiology

Specimen Paper for first teaching September 2015
Time: 1 hour 30 minutes

Paper Reference
8BI0/01

You may need a ruler, a pencil and a calculator.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Show your working in any calculation questions and include units in your answer where appropriate.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You may use a scientific calculator.
- In question(s) marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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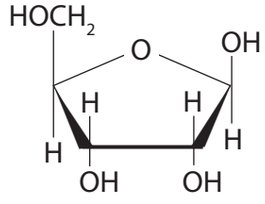
Answer ALL questions.

Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 The cells of all living organisms contain small molecules such as carbohydrates, lipids and amino acids.

The diagram shows the structure of a carbohydrate.



(a) (i) Which of the following molecules contains this carbohydrate?

(1)

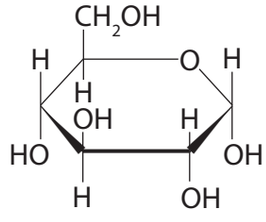
☒ **A** cellulose

☒ **B** DNA

☒ **C** RNA

☒ **D** starch

(ii) The diagram shows another carbohydrate.



The carbohydrate shown in the diagram is found in

(1)

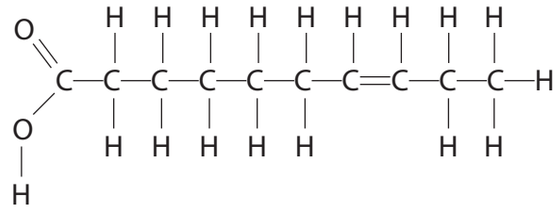
☒ **A** cellulose

☒ **B** glycerol

☒ **C** guanine

☒ **D** starch

(iii) The diagram shows the structure of a fatty acid.



This fatty acid is

(1)

- ☒ **A** cholesterol
- ☒ **B** glycerol
- ☒ **C** saturated
- ☒ **D** unsaturated

(b) A triglyceride lipid molecule is made up of over 70% carbon whereas a glucose molecule is only 40% carbon.

State why lipids are the main storage molecule in many seeds.

(1)

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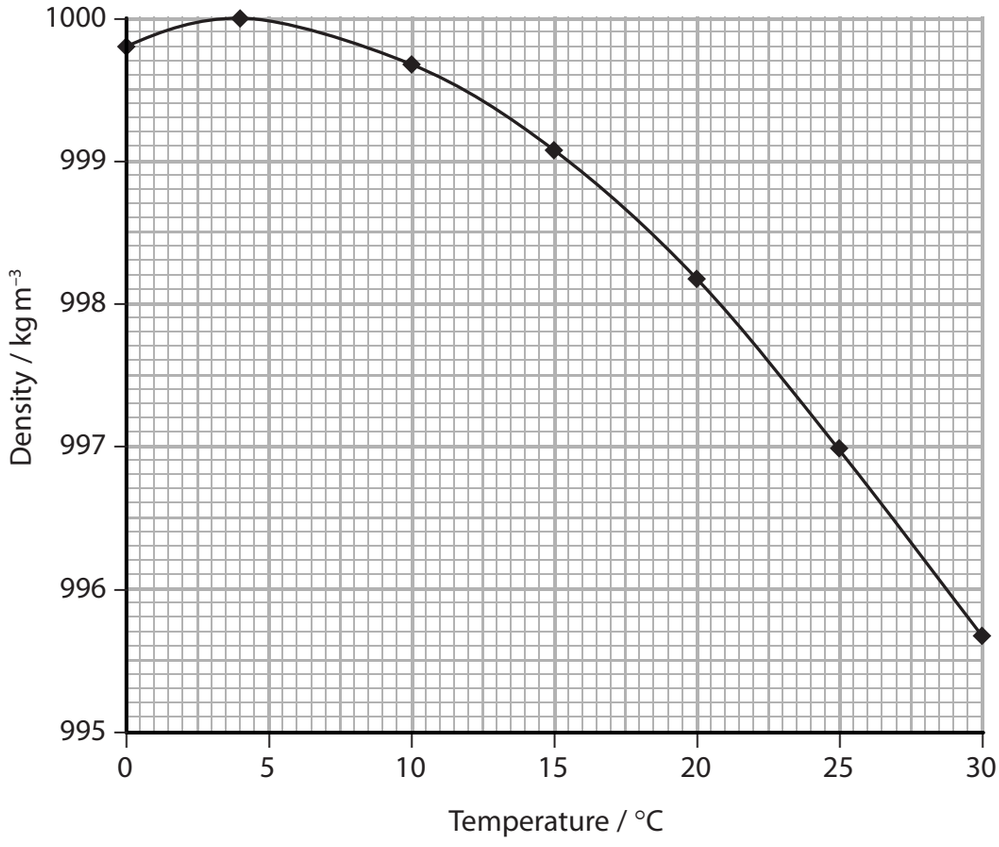
(Total for Question 1 = 4 marks)

2 (a) The cells of all living organisms contain over 60% water. The physical properties of water have significant effects on the cells of living organisms.

A student investigated the effect of temperature on the density of water.

The graph shows the results of her investigation.



(i) Calculate the percentage change in density of water as temperature falls from 4 °C to 0 °C.

(2)

Answer ..... %

(ii) Explain **one** advantage of this difference in density between 4 °C and 0 °C for living organisms in ponds.

(2)

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(Total for Question 2 = 4 marks)

3 (a) A student was investigating the structure of plant cells using a light microscope.

(i) Explain why iodine is used as a stain when looking at photosynthesising plant cells using a microscope.

(2)

(ii) Iodine is also used as part of the Gram staining technique when identifying bacteria.

Explain why Gram positive and Gram negative bacteria stain in different ways.

(2)

(iii) When preparing a microscope slide for viewing cells, it is important to avoid small air bubbles.

Describe how a student would avoid small air bubbles when preparing a slide of plant tissue.

(3)

(iv) State why it is important to avoid small air bubbles on a microscope slide.

(1)

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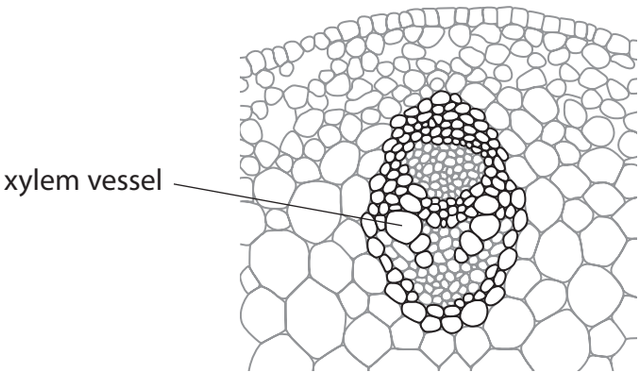
(b) The diagram shows a section of plant stem with a vascular bundle stained with phloroglucinol.



Phloroglucinol stains xylem vessels.

These xylem vessels can then be seen more easily and their size measured using a light microscope and an eyepiece graticule (micrometer).

(i) The xylem vessel labelled is 0.133 mm in diameter.
Calculate the magnification used. Give your answer to two significant figures.

(1)

Answer .....

(ii) A student cut a section of plant stem from a shoot tip and stained it with phloroglucinol. She used an eyepiece graticule (micrometer) to measure the diameter of a xylem vessel.

She found that the xylem vessel was 0.39 mm in diameter.

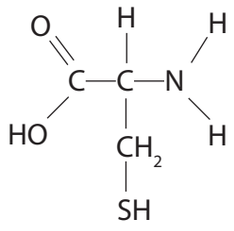
Explain how you would extend this procedure to obtain valid data showing that xylem vessels are larger in older parts of the plant.

(3)

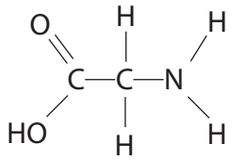
(Total for Question 3 = 12 marks)

4 The primary amino acid sequence of a protein determines its final three-dimensional structure.

The diagram shows two amino acids, cysteine and glycine.



Cysteine



Glycine

(a) (i) The chemical groups used to form a peptide bond are

(1)

- ☒ **A** $-NH_2$ and –COOH
- ☒ **B** $-CH_2$ and –COOH
- ☒ **C** –CH and $-CH_2$
- ☒ **D** $-NH_2$ and –CH

(ii) The curliness of hair is the result of disulphide bonds between hair proteins. The more bonds, the curlier the hair.

In recent years, hair straightening has become more popular.

Thioglycolate is used by hairdressers before the hair is straightened.

The process is completed using a second chemical to reverse the effect of the thioglycolate.

Explain how this method keeps the hair straight.

(2)

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(b) The protein collagen is found in tendons, ligaments and the walls of arteries.

Explain how the structure of collagen is related to its function.

(2)

(c) The protein haemoglobin carries oxygen in the blood.

An investigation into the effect of exercise on muscle in athletes found that exercise could increase muscle tissue temperature by over 2 °C.

The table shows the percentage of oxygen carried by haemoglobin at 20 °C and 38 °C.

This was carried out at oxygen levels typical of muscle tissue.

Temperature / °C	Percentage of oxygen carried by haemoglobin (%)
20	84
38	56

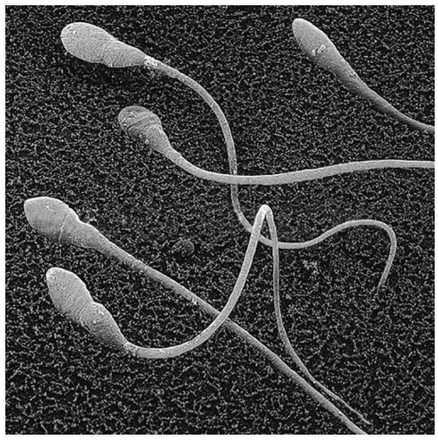
Analyse the data to explain how haemoglobin is related to its function.

(3)

(Total for Question 4 = 8 marks)

5 In animals, sperm cells and egg cells are involved in sexual reproduction.

The photomicrographs show human sperm cells and a human egg cell. They are not shown to scale.



Using an eyepiece graticule (micrometer), the head of a human sperm cell was measured as 5 μm in length and the egg cell 0.1 mm in width.

(a) (i) Calculate how many times larger the egg cell is compared to the head of the sperm cell.

(2)

Answer .....

(ii) Explain why the egg cell is much larger than the head of the sperm cell.

(2)

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(b) (i) Explain how meiosis results in genetic variation.

(3)

(ii) One primary oocyte undergoes two meiotic divisions.

State how many egg cells are produced.

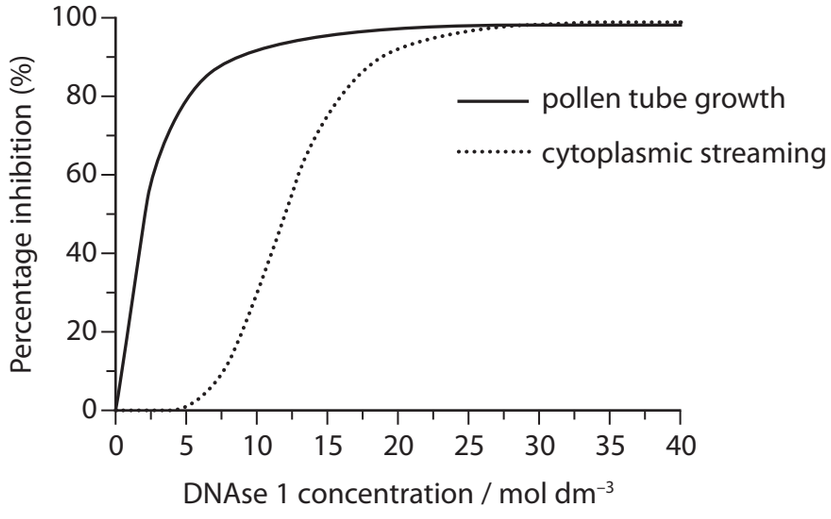
(1)

(c) In plants, pollen is involved in the fertilisation of the ovule.

Actin microfilaments are thought to be involved in pollen tube growth.
Cytoplasmic streaming is also thought to be involved in pollen tube growth.

The enzyme DNAase 1 is known to bind to actin microfilaments.

The graph shows the effect of DNAase 1 on pollen tube growth and also cytoplasmic streaming.

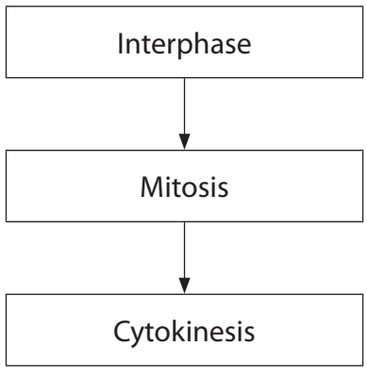


Analyse the data to explain the relative importance of actin and cytoplasmic streaming during pollen tube growth.

(3)

(Total for Question 5 = 11 marks)

6 The diagram shows stages of the cell cycle.



(a) A study of cell division in ovarian tumour cells compared the mean DNA concentration of cells in interphase with those in metaphase.

The results are shown in the table.

Stage of cell cycle	Mean DNA concentration per cell / arbitrary units
Interphase	4.01
Metaphase	7.26

Explain the difference between the mean DNA concentration of cells in metaphase and cells in interphase.

(2)

(b) After fertilisation, cell division occurs to form a blastocyst.

Give the number of cell divisions that produce a blastocyst with 256 cells.

(1)

☒ **A** 6

☒ **B** 7

☒ **C** 8

☒ **D** 9

(c) A study in 2015 showed that some tissues are far more likely to develop cancer than other tissues.

(i) Give one similarity and one difference between organs and tissues.

(2)

(ii) Some tissue types divide more quickly than others.

This study suggested that there was a positive correlation of 0.81 between the chance of developing cancer and the rate of cell division in normal cells.

Describe what is meant by this positive correlation of 0.81.

(2)

(iii) The study also found that the cells of the intestinal lining divide very rapidly.

Explain how the stages in the cell cycle for these cells would be different to cells that divide more slowly.

(2)

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(Total for Question 6 = 9 marks)

7 Saquinavir is a drug used in the treatment of HIV.

It binds very precisely to the active site of a HIV protease enzyme and inhibits its action.

Saquinavir is described as peptidomimetic because it is a small protein-like chain designed to resemble a peptide.

(a) Analyse this information to explain what sort of enzyme inhibitor Saquinavir is likely to be.

(2)

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(b) A student was investigating the effect of enzyme inhibitors on a bacterial protease enzyme.

She mixed 4 cm^3 of skimmed milk with 4 cm^3 of distilled water in a beaker.

She then added 2 cm^3 of the enzyme to start the reaction. The reaction mixture was immediately placed in a colorimeter.

The colorimeter passes a beam of light through the reaction mixture and measures the light absorbed.

The student then took absorbance readings every 5 seconds.

She repeated the experiment using 4 cm^3 of skimmed milk, 4 cm^3 of distilled water, 2 cm^3 of enzyme and 2 cm^3 of inhibitor.

The results are shown in the table.

Time / s	**Absorbance / arbitrary units**	
	No inhibitor (control)	**2 cm^3 inhibitor**
0 (zero time)	2.00	1.98
5	1.40	1.95
10	0.90	1.90
15	0.50	1.85
20	0.20	1.80
25	0.00	1.75

(i) Explain how the student should modify her procedure to ensure that valid comparisons of different inhibitor concentrations could be made.

(3)

(ii) Analyse the student's data to explain the appearance of the reaction mixtures for both control and inhibitor experiments at zero time and after 25 seconds.

(3)

(Total for Question 7 = 8 marks)

8 DNA is found in the cells of many living organisms. It consists of two strands and contains four different bases.

(a) (i) The bonds that hold the two strands of DNA together are

(1)

☒ **A** covalent

☒ **B** ester

☒ **C** hydrogen

☒ **D** ionic

(ii) DNA replicates semi-conservatively.

Instead of staying intact, it unzips and each of the two strands replicates itself.

The diagram shows the base sequence for one of the strands of DNA.

A	**T**	**G**	**G**	**C**	**C**	**A**	**A**	**T**	**C**

Complete the diagram to show the bases that would be on the new strand of DNA after replication.

(1)

(iii) Scientists used two isotopes of nitrogen, ^{14}N (light nitrogen) and ^{15}N (heavy nitrogen), to investigate DNA replication.

First, they grew bacteria for several generations in a medium containing only ^{15}N. This made the DNA denser than usual.

These bacteria were then grown for one generation in a medium containing only ^{14}N. The density of the DNA was half way between that found in the first experiment and DNA from other bacteria grown only in ^{14}N.

Explain how these results support the idea that DNA replicates semi-conservatively.

(3)

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(b) A DNA molecule contains 24% adenine.

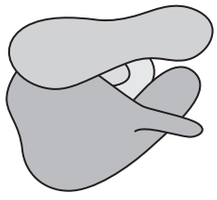
(i) Calculate the percentage of cytosine in this DNA molecule.

(2)

Answer ..... %

(ii) Which diagram represents the structure of transfer RNA (tRNA)?

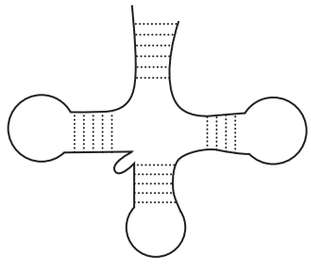
(1)



A ☒

B ☒

C ☒



D ☒

(c) The table shows part of the genetic code.

DNA triplet	Amino acid	DNA triplet	Amino acid
ATA	Tyrosine	GTA	Histidine
ATC	Tyrosine	GTC	Histidine
ATT	STOP	GTT	Glutamic acid
ATC	STOP	GTC	Glutamic acid
ACA	Cysteine	GCA	Arginine
ACG	Cysteine	GCG	Arginine
ACT	STOP	GCT	Arginine
ACC	Tryptophan	GCC	Arginine

Tryptophan has a side group that helps to hold the protein structure together.

Explain why a mutation to the triplet ACC may have a more significant effect than a mutation to other triplets.

(4)

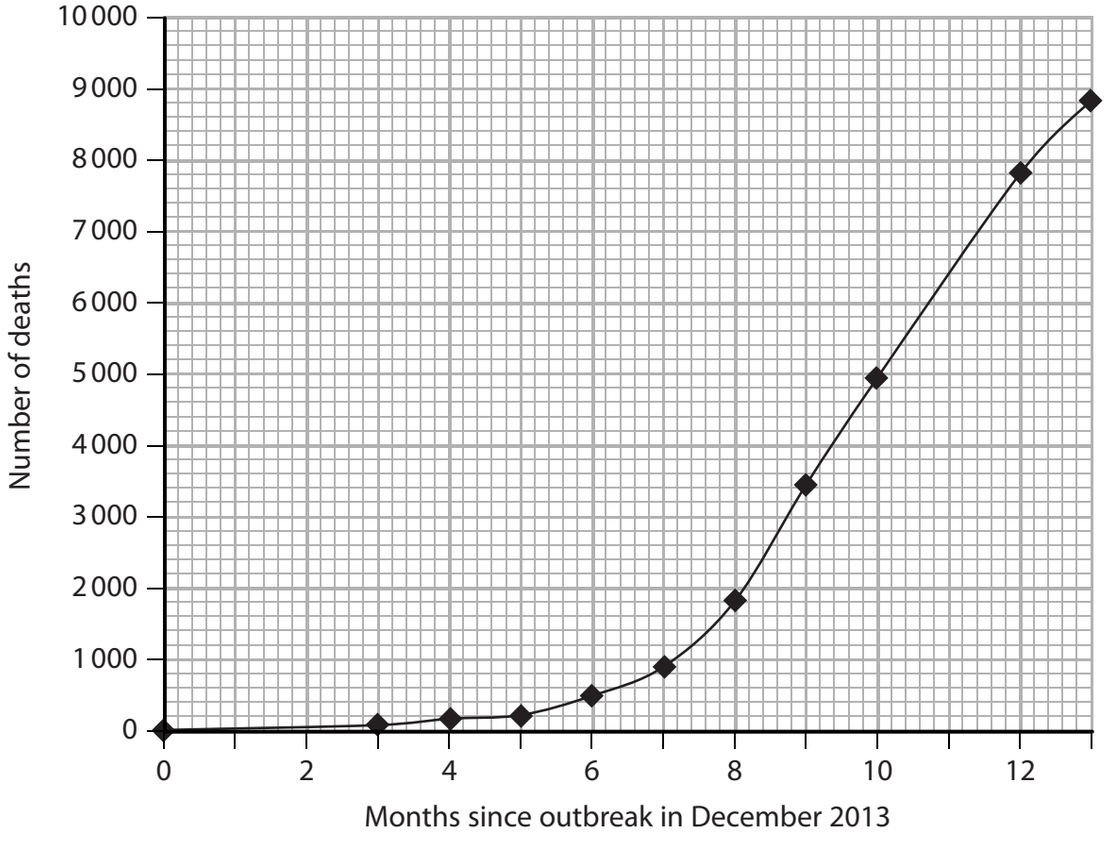
(Total for Question 8 = 12 marks)

9 In December 2013, a boy died of Ebola Virus Disease (EVD) in Guinea, West Africa.

However, it was not until March 2014 that health officials reported a mysterious haemorrhagic fever that 'strikes like lightning'.

By the end of 2014, an estimated 20 000 cases had been reported.

The graph shows the number of deaths reported in the months following the outbreak in December 2013.



(a) (i) Give an estimate of the percentage of reported cases who had died by the end of 2014.

(1)

Answer ..... %

(ii) Analyse the data for July to August 2014, and December 2014 to January 2015, to explain whether the measures taken to control the spread of Ebola have been effective.

(2)

(iii) The table shows the number of reported cases and deaths from Ebola in three different countries by March 2015.

Explain the difference between the percentage of reported cases who had died in these three countries.

Country	Reported cases	Deaths
Guinea	3420	2261
Liberia	9593	4296
Sierra Leone	11829	3742

(2)

(b) Control measures may include the use of antiviral drugs.
Which of the following describes how antiviral drugs work?

(1)

- ☒ **A** disruption of the cell membrane
- ☒ **B** inhibition of aerobic respiration
- ☒ **C** inhibition of replication
- ☒ **D** interference with cell wall production

*(c) In many remote areas of West Africa, dead bodies are washed by hand before burial.

Discuss the ethical dilemmas and practical problems for the foreign health workers when trying to control the spread of EVD.

(6)

(Total for Question 9 = 12 marks)

TOTAL FOR PAPER = 80 MARKS

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