

Write your name here

Surname

Other names

Pearson Edexcel
Level 3 GCE

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--

Biology B

Advanced

**Paper 1: Advanced Biochemistry,
Microbiology and Genetics**

Specimen Paper for first teaching September 2015

Time: 1 hour 45 minutes

Paper Reference

9BIO/01

You may need a ruler, 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 questions 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 90.
- 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 ►

S49426A

©2015 Pearson Education Ltd.

3/3/3/



PEARSON

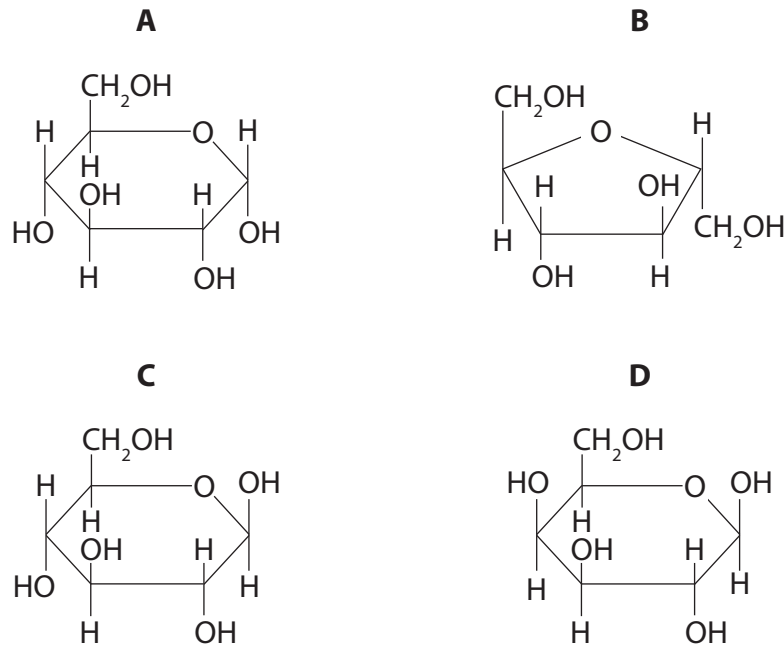
Answer ALL questions.

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 Glucose is broken down by respiration and produces ATP as a source of energy for metabolic reactions in cells.

The diagram shows the structure of four carbohydrates.



(a) Which of the structures is beta glucose?

(1)

- A
- B
- C
- D



(b) (i) Which of the following stages of aerobic respiration produces four molecules of carbon dioxide for each glucose molecule?

(1)

- A glycolysis
- B Krebs cycle
- C link reaction
- D oxidative phosphorylation

(ii) Which of the following is the approximate percentage of total ATP produced, directly from the Krebs cycle?

(1)

- A 0%
- B 5%
- C 63%
- D 100%

(iii) Describe how glucose is converted to pyruvate in glycolysis.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for Question 1 = 6 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



2 The electron carriers in chloroplasts are inhibited by detergent.

Detergents dissolve lipids.

(a) Explain how detergents inhibit the functioning of electron carriers in chloroplasts. (3)

.....

.....

.....

.....

.....

.....

.....

.....

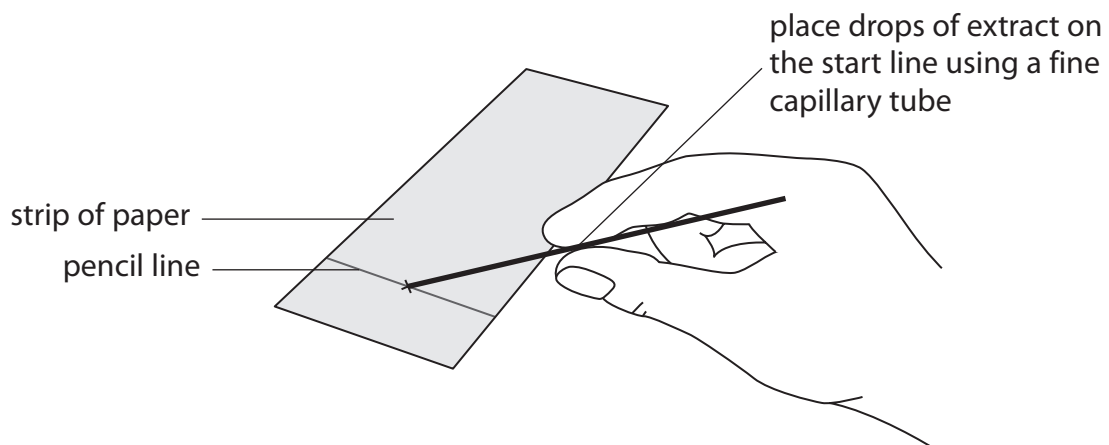
.....

(b) Photosynthetic pigments in leaves can be separated by chromatography.

A leaf extract can be made by grinding up leaves in a solvent.

The diagram shows how the extract is applied to chromatography paper.

The extract is applied one drop at a time. The paper is dried before the next drop of extract is applied.



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Explain why the paper is dried before the next drop of extract is applied.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

(c) The electron micrographs show four different organelles.



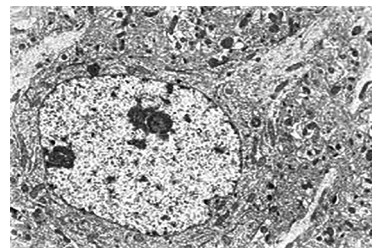
A



B



C



D

Which of these organelles contains the photosynthetic pigments?

(1)

- A
- B
- C
- D

(Total for Question 2 = 7 marks)



S 4 9 4 2 6 A 0 5 3 6

3 *Salmonella* can cause severe vomiting and diarrhoea.

Public health laboratories use the Salmonella Rapid Culture technique to confirm a *Salmonella* infection.

This can accurately identify *Salmonella* as purple stained colonies within 48 hours.

Previous methods for the identification of *Salmonella* infections took four days.



(a) Explain the advantages of using this technique in public health laboratories.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



(b) Explain why it is important that aseptic technique is used when carrying out the Salmonella Rapid Culture technique.

(2)

.....

.....

.....

.....

.....

.....

.....

.....

(c) Which of the four statements describes the *Salmonella* endotoxin?

(1)

- A lipopolysaccharide in the cell wall membrane
- B lipopolysaccharide secreted by the cell
- C polypeptide in the cell wall membrane
- D polypeptide secreted by the cell

(Total for Question 3 = 6 marks)





DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE



4 In July 2014, scientists announced that 'Tpl2-KO' knockout mice were resistant to inflammation of the spinal cord.

(a) Describe what is meant by 'Tpl2-KO' knockout mice.

(2)

.....

.....

.....

.....

.....

.....

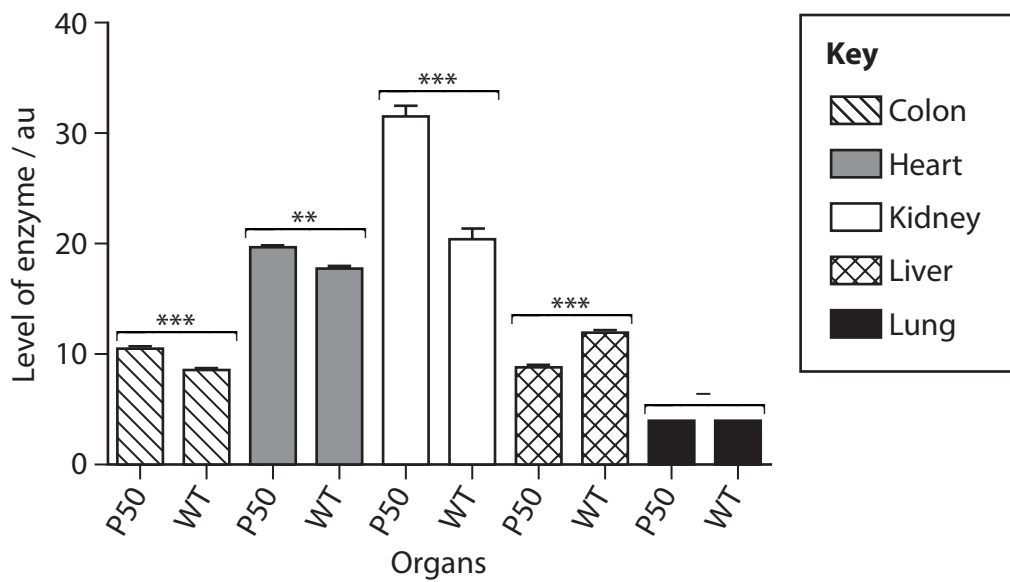
(b) A different knockout mouse strain, called P50, has also been developed.

Premature ageing can be caused by overactive NAD dehydrogenase. This enzyme is found in mitochondria.

This enzyme can cause a build-up of superoxides that damage the mitochondria.

The graph shows the levels of NAD dehydrogenase in different tissues of P50 mice and in wild type (WT) mice. Significance levels for p are also shown.

*** $-p < 0.001$; ** $-p < 0.01$



Use the information in the graph to predict the probability of damage occurring to the mitochondria in the organs shown.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

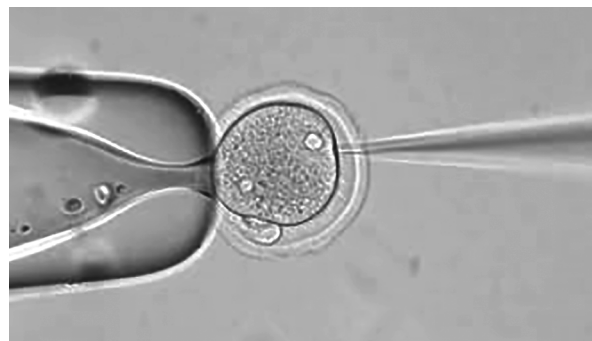
.....

.....

.....

- (c) Genetic modification of mammals can be carried out using microinjection of recombinant DNA. Microinjection of DNA has a low success rate.

The photograph shows this technique being carried out using a micropipette.



In an investigation, 275 eggs were microinjected with DNA. Eight of these resulted in the birth of a live mammal, one of which was transgenic.

- (i) Calculate the percentage success rate for producing transgenic offspring.

Give your answer to two significant figures.

(2)

Answer%

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

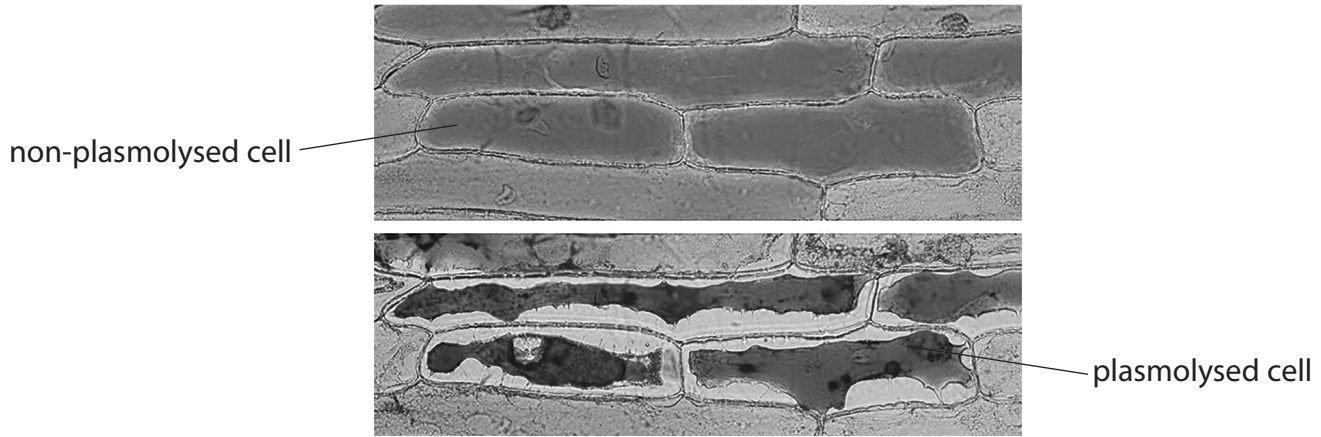


5 The cells of all living organisms contain over 60% water.

A student investigated the effect of salt solution on plant cells.

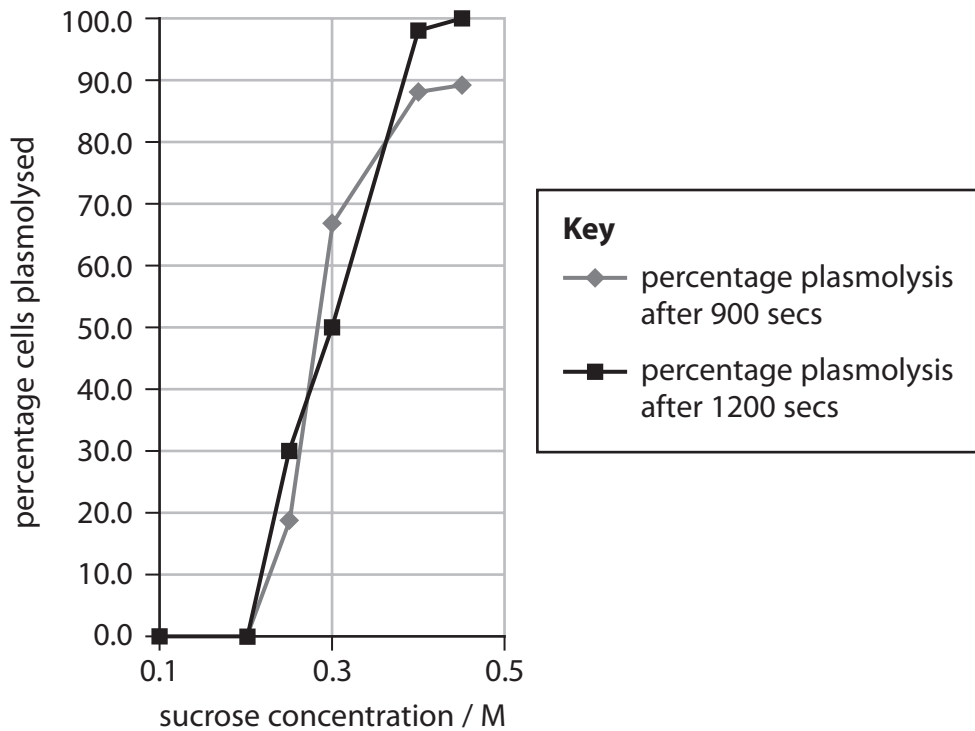
The photomicrograph shows some red onion cells that were placed in a strong salt solution in her investigation.

Some of these cells are plasmolysed because the cytoplasm has lost water, shrunk and pulled away from the cell wall.



As part of her research, the student found some data on the effect of sucrose concentration on plasmolysis in the epidermal cells of another plant species.

The graph shows the data that she found.



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



* (a) The student concluded that the osmotic potential of these cells was equivalent to 0.3 M of sucrose.

Analyse the data to explain why the osmotic potential of these cells is not necessarily equivalent to 0.3 M sucrose.

(6)

Area with horizontal dotted lines for writing the answer.

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



(b) Water is needed for the transport of mineral ions through a plant.

Farmyard manure contains many mineral ions.

(i) Calcium ions in manure promote the growth of plants by increasing

(1)

- A** amino acid synthesis
- B** the production of chlorophyll
- C** the strength of the middle lamella between cells
- D** water loss by the leaves

(ii) Which of the following is the mechanism by which these calcium ions are transported from soil water into plants?

(1)

- A** active transport
- B** exocytosis
- C** osmosis
- D** transpiration

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



(c) Water is the major component of tissue fluid in mammals.

In humans, left side heart failure can cause symptoms such as breathlessness, palpitations and a rapid pulse.

The table shows the mean blood pressure in the lung capillaries of patients with left side heart failure compared with healthy individuals.

Group	Mean blood pressure in the lung capillaries / arbitrary units
Healthy individuals	0.90
Left side heart failure	2.75

(i) Calculate the percentage increase in the mean blood pressure in the lung capillaries due to left side heart failure.

(1)

Answer%



(ii) This increased blood pressure in the capillary will cause more tissue fluid to be formed.

Analyse this information to explain the symptom of breathlessness.

(2)

.....

.....

.....

.....

.....

.....

(iii) In healthy individuals, only 80% of excess tissue fluid is reabsorbed directly into the blood stream.

Describe how the remaining 20% is reabsorbed.

(2)

.....

.....

.....

.....

.....

.....

(Total for Question 5 = 13 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE



(ii) The rate of mutation in the Ebola virus is as fast as that of the influenza virus.

The Ebola genome codes for seven proteins, one of which is the glycoprotein.

Explain what effect a mutation may have on the effectiveness of Zmapp.

(2)

.....

.....

.....

.....

.....

.....

.....

.....

(iii) Zmapp is an experimental drug. Although it has not undergone clinical trials, animal testing has shown it to be effective.

Explain why the use of Zmapp to treat Will Pooley had ethical implications.

(3)

.....

.....

.....

.....

.....

.....

.....

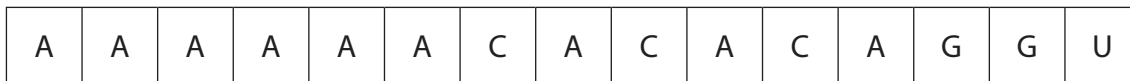
.....



(b) The Ebola virus contains RNA that cannot be translated into protein directly.

First, RNA polymerase must produce a strand of RNA complementary to the viral RNA.

The diagram shows a section of the RNA contained in the Zaire Ebola virus.



(i) Give the RNA strand that the RNA polymerase would make from this section of RNA.

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

(1)

The table shows part of the genetic code.

RNA triplet	Amino acid	RNA triplet	Amino acid
AAA	Lysine	ACA	Threonine
AAG	Lysine	GGU	Glycine
CAU	Histidine	GGC	Glycine
CAC	Histidine	GUG	Valine
CCA	Proline	UGU	Cysteine
UUU	Phenylalanine	GGG	Glycine
UGG	Tryptophan	GUU	Valine

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA





DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE



8 (a) Inflammation helps to destroy microbes.

Inflammation can be associated with high blood pressure (hypertension).

Measurement of cytokine levels in the blood may be used to assess the severity of pulmonary arterial hypertension (PAH) in patients waiting for a heart transplant.

(i) Which type of cell produces cytokines?

(1)

- A B effector cell
- B B memory cell
- C T helper cell
- D T killer cell

(ii) Which of the following is a correct statement about cytokines?

(1)

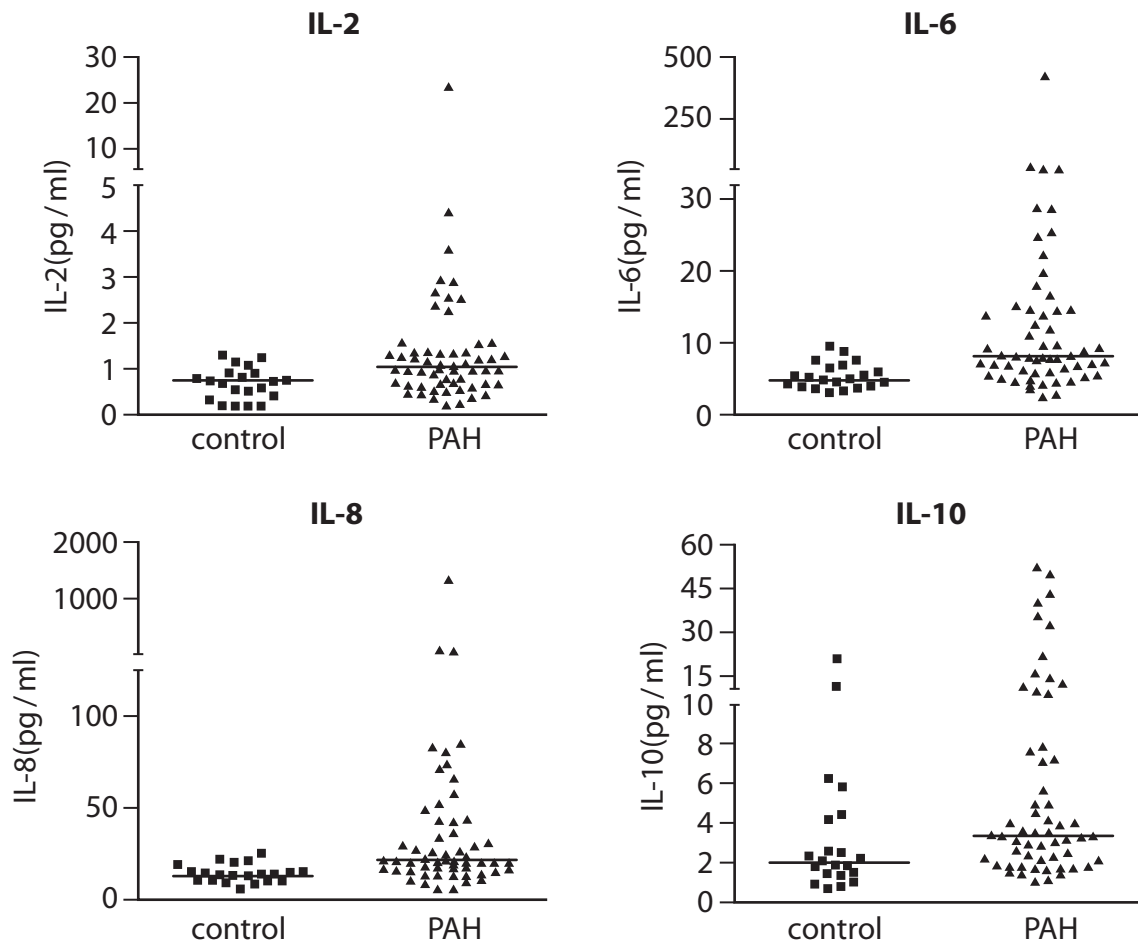
- A lipids that destroy host-infected cells
- B lipids that activate T killer cells
- C proteins that destroy host-infected cells
- D proteins that activate T killer cells



S 4 9 4 2 6 A 0 2 5 3 6

(b) The diagram shows the levels of four different cytokines in the blood of patients with PAH.

The horizontal lines represent the means.



(i) Calculate the percentage increase in the mean levels of IL-10 in patients with PAH.

(2)

Answer%



- (ii) The mean levels of all four cytokines were higher in PAH patients. A statistical test of difference was used.

The table shows the p values obtained.

Cytokine	p value
IL-2	0.0008
IL-6	0.0001
IL-8	0.0001
IL-10	0.0140

Analyse the data in the graphs and in this table to explain the value of p for IL-10. (2)

.....

.....

.....

.....

.....

.....

.....

.....



(iii) PAH causes damage to the pulmonary arteries, leading to failure of the right side of the heart and death.

Explain how PAH leads to failure of the right side of the heart.

(2)

.....

.....

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

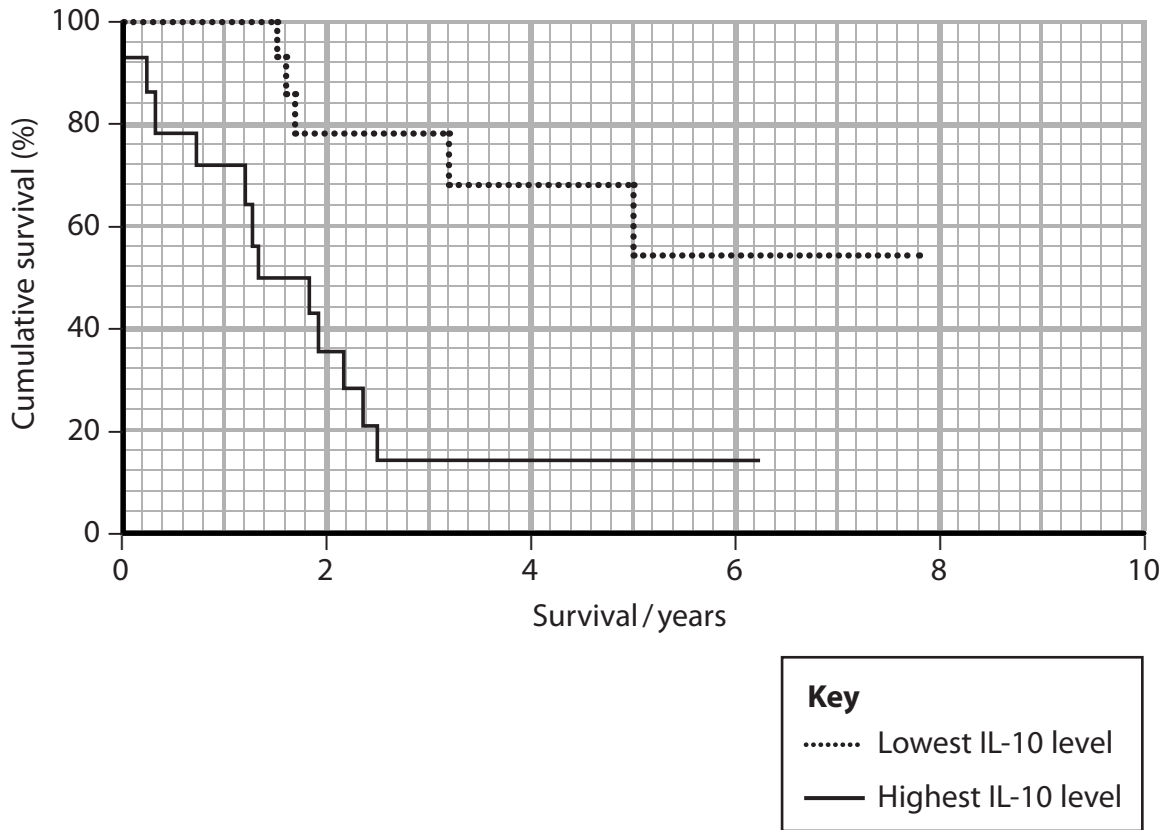
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



(iv) The graph shows the survival rates for PAH patients with raised cytokine IL-10 levels.



Calculate how many times worse the survival rate is for those patients with the highest levels of IL-10 after 3 years.

(2)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for Question 8 = 10 marks)



9 The photograph shows the hand of a person with the inherited condition 'WHIM'.



This condition results in a defective immune system, warts on the skin surface and an increased risk of cancer.

A woman had WHIM but her symptoms disappeared. However, she was worried that she had passed the condition on to her children.

Bone marrow is responsible for making white blood cells.

Scientists found that the woman had a single mutation in a bone marrow stem cell. This caused 'chromosome shattering' with the loss of 164 genes, including the defective gene.

(a) (i) Explain how this mutation in a bone marrow stem cell had cured her of WHIM. (2)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



- (ii) Some people have complained about the use of stem cells from fetal cell lines in the development of Ebola vaccines.

Explain why these stem cells are being used to produce vaccines rather than bone marrow cells.

(2)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (b) Mouse embryonic fibroblasts can be converted into F-class ('fuzzy') pluripotent cells.

Scientists have shown that DNA demethylation may be involved in this conversion.

Explain how demethylation of DNA might cause this conversion.

(2)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for Question 9 = 6 marks)



10 Leukaemia is a type of cancer involving abnormal white blood cells.

In 2015, scientists announced that 1 in 5 people aged 90 or over had mutations linked to leukaemia.

The current UK population is about 64 million, of which 0.8% are aged 90 or over.

(a) (i) Calculate how many people aged 90 or over could have these mutations.

(2)

Answer

(ii) Patients with leukaemia were given injections of radioactive thymidine so that the growth rate of the leukaemia cells could be measured.

Thymidine is a molecule containing thymine and deoxyribose.

Analyse this information to explain how the radioactive thymidine could give an indication of the growth rate of the leukaemia cells.

(2)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

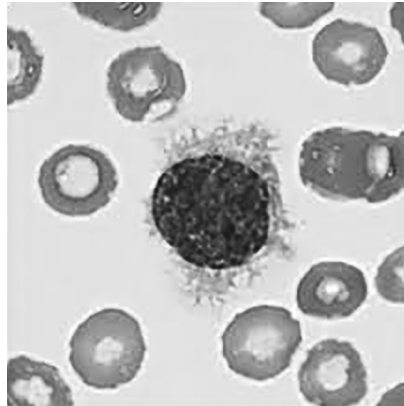
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



(b) Hairy cell leukaemia is a rare form of the disease in which there is an increase in the number of abnormal B lymphocytes.

The photomicrograph shows one of these B lymphocytes.



The hairy cell lymphocytes have an unusually large nucleolus.

State the function of the nucleolus in this hairy cell lymphocyte.

(1)

.....

.....

(c) Leukaemia cells have a rapid growth rate and they tend to be small.

The cell cycle consists of three stages, interphase, mitosis and cytokinesis.

Explain which of these three stages would be shorter in a leukaemia cell.

(2)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for Question 10 = 7 marks)

TOTAL FOR PAPER = 90 MARKS





DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE



S 4 9 4 2 6 A 0 3 5 3 6

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE

