Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel Level 3 GCE

Wednesday 5 June 2024

Afternoon (Time: 1 hour 45 minutes)

Paper reference **9BI0/01**

Biology B

Advanced

PAPER 1: Advanced Biochemistry, Microbiology and Genetics

You must have:
Scientific calculator, HB pencil, ruler

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.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

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.*
- 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.

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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P 7 8 6 6 3 A 0 1 3 2

Pearson

4 Photosynthesis results in the production of GALP. This molecule is used by plants to produce glucose and other organic molecules.

(a) Glucose consists of the elements of carbon, hydrogen and oxygen.

Name the inorganic molecules that supply these elements for photosynthesis.

(2)

Carbon .....

Hydrogen .....

Oxygen .....

(b) Light is essential for photosynthesis. It is needed for photolysis and for the excitation of electrons in the photosystems.

Which row in the table shows where photolysis and the excitation of electrons occurs?

(1)

		Photolysis	Excitation of electrons
☒	**A**	stroma	stroma
☒	**B**	stroma	thylakoid membrane
☒	**C**	thylakoid membrane	stroma
☒	**D**	thylakoid membrane	thylakoid membrane

6 In a cell, DNA is found in both the nucleus and the mitochondria.

(a) Where is DNA found in mitochondria?

(1)

- ☒ **A** cytoplasm
- ☒ **B** intermembrane space
- ☒ **C** matrix
- ☒ **D** nucleus

(b) Which row of the table describes DNA found in the mitochondria?

(1)

	Shape	Ratio of phosphodiester bonds : pentose sugars
☒ **A**	circular	higher than nuclear DNA
☒ **B**	circular	lower than nuclear DNA
☒ **C**	linear	higher than nuclear DNA
☒ **D**	linear	lower than nuclear DNA

(d) Scientists have used 'knockout' mice to investigate the effect of protein G on fertility.

(i) State the meaning of the term 'knockout' mice, as used in this context.

(2)

(ii) In an investigation, female mice and 'knockout' mice were housed together.

Describe how this investigation should be designed to confirm that protein G affects fertility.

(3)

(Total for Question 8 = 15 marks)

(ii) Analyse the data to describe conclusions that can be made about globin subunit synthesis during the 14 months following fertilisation.

(4)

(iii) Calculate the rate of decrease in percentage of gamma globin subunit synthesis from 7.6 to 10 months after fertilisation.

Give your answer to **two decimal places** with appropriate units.

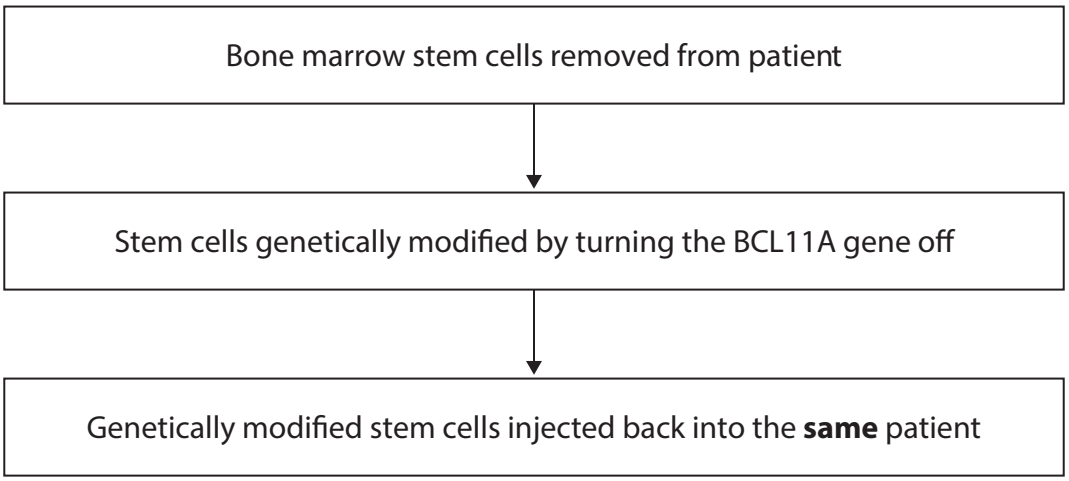
(2)

Answer .....

(b) Sickle cell disease (SCD) is an inherited disorder.

A new treatment for SCD is being developed that involves genetic modification.

The flowchart shows some of the stages in this process.



(i) There are approximately 67 million people in the UK, 15 000 of these people are affected by SCD.

Calculate the ratio of the number of people **without** SCD to the number of people **with** SCD in the UK.

Express your answer in **whole numbers**.

(2)

Answer .....

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Question Number	Indicative content	Mark
***7(c)(ii)**	**Graph 1** (volume of mitochondria) • great tits have larger volume of mitochondria than blue tits • blue tits have more mitochondria than coal tits • error bars do not overlap between autumn and winter so differences are significant • because bigger birds need to produce more ATP for flying • coal tits are smaller so need less ATP • all three birds increase their number of mitochondria in the winter • by division • because more heat needs to be generated to keep warm in the colder season • greater volume needed in winter because more leaked respiration **Graph 2** (respiration producing ATP) • coal tits respire faster than blue tits and great tits • because they have fewer mitochondria • no significant difference between blue tits and great tits • there is no difference in rate of respiration in great tits between autumn and winter • the rate of respiration decreases in winter in blue tits and coal tits • because they need to {produce more heat / switch to leaked respiration} • as they have a larger surface area : volume ratio • and therefore lose more body heat • if switch to leaked respiration is made there is a smaller proton gradient • therefore less respiration to make ATP **Graph 3** (leaked respiration) • Rate of leaked respiration is faster in all three species in winter • rate of leaked respiration is faster in coal tits than blue tits • rate of leaked respiration is similar in great tits than blue tits • there are no error bars so cannot say if any differences are significant • because leaked respiration produces more heat	(6)

Question Number	Answer	Additional Guidance	Mark
8(a)	An explanation that makes reference to the following: • if AR is too early then there will not be the enzymes available for fertilisation (1) • and it will not be able to digest through the zona pellucida/jelly coat (1) • if AR is too late then {the egg/sperm (cell) may have died / the sperm have swam past the egg (cell)} (1)		(3)

Question Number	Answer	Additional Guidance	Mark
8(b)			(4)

Event	Presence of protein G		Presence of protein G-P	
	Head region	Mid piece and flagellum	Head region	Mid piece and flagellum
Just before capacitation	✓	×	×	✓
During capacitation	✓	×	×	✓
Just before the AR	×	×	✓	✓