Pearson Edexcel

Additional Assessment Materials Summer 2021

Pearson Edexcel GCE (Biology A)

Resource Set Topic 3: Voice of the Genome

Question Paper

(Public release version)

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Additional Assessment Materials, Summer 2021

General guidance to Additional Assessment Materials for use in 2021

Context

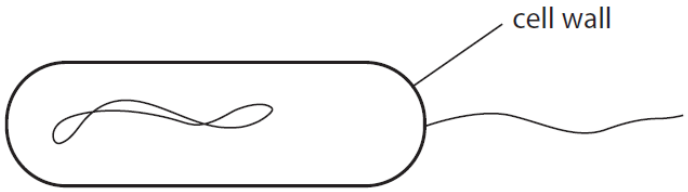
- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

1 Bacteria contain structures that are characteristic of prokaryotic cells.

The diagram shows an incomplete bacterial cell.



(a) Complete the diagram by drawing and labelling the cell membrane, a mesosome and a plasmid.

(3)

(b) In prokaryotic cells, ribosomes are

(1)

☒ **A** absent

☒ **B** larger than ribosomes in eukaryotic cells

☒ **C** smaller than ribosomes in eukaryotic cells

☒ **D** the same size as ribosomes in eukaryotic cells

(c) Some bacteria have a capsule that is located

(1)

☒ **A** between the cell wall and the cell membrane

☒ **B** in the cytoplasm

☒ **C** inside the cell wall

☒ **D** outside the cell wall

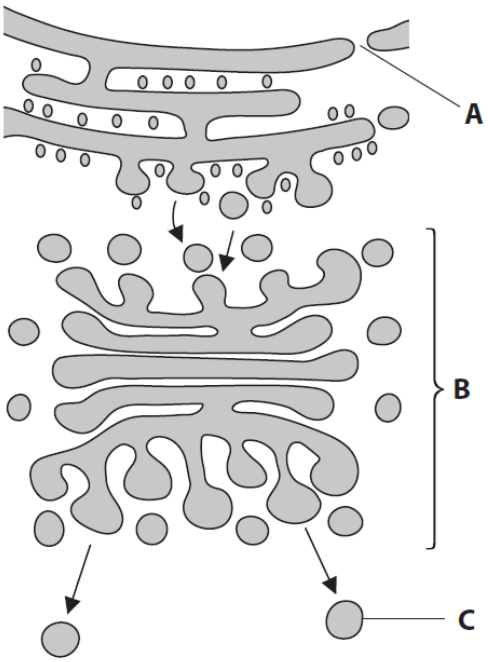
(d) Bacterial DNA is

(1)

- ☒ **A** circular and surrounded by a nuclear membrane
- ☒ **B** circular with no nuclear membrane
- ☒ **C** linear and surrounded by a nuclear membrane
- ☒ **D** linear with no nuclear membrane

(Total for Question 1 = 6 marks)

2 The diagram shows some of the cell organelles involved in the formation of extracellular enzymes.



(a) Name the parts of the cell labelled **A**, **B** and **C**.

(3)

A .....

B .....

C .....

(b) Describe the roles of parts **B** and **C** in the formation and transport of extracellular enzymes.

(4)

(c) Extracellular enzymes are produced by specialised cells.

Explain how groups of cells can produce the same enzyme.

(3)

(d) Eukaryotic and prokaryotic cells both produce enzymes.

Which of the following pairs of statements is true for eukaryotic and prokaryotic cells?

(1)

	Similarity	Difference
☒ **A**	Both possess ribosomes	Only eukaryotic cells possess plasmids
☒ **B**	Both possess pili	Prokaryotic cells do not secrete enzymes
☒ **C**	Both possess ribosomes	Prokaryotic cells do not possess endoplasmic reticulum
☒ **D**	Both possess pili	Only eukaryotic cells possess ribosomes

(Total for Question 2 = 11 marks)

1 Gametes are specialised for their role in sexual reproduction.

(a) The purpose of the cortical reaction is to

(1)

☒ **A** allow the haploid nuclei to fuse

☒ **B** attract the sperm towards the egg cell

☒ **C** cause the sperm cell membrane to fuse with the egg cell membrane

☒ **D** ensure that only one sperm fertilises the egg

(b) (i) Which adaptation allows a sperm cell to digest the zona pellucida?

(1)

☒ **A** acrosome

☒ **B** flagellum

☒ **C** haploid nucleus

☒ **D** streamlined shape

(ii) Give a reason for the high density of mitochondria found in the midpiece of a sperm cell.

(1)

.....

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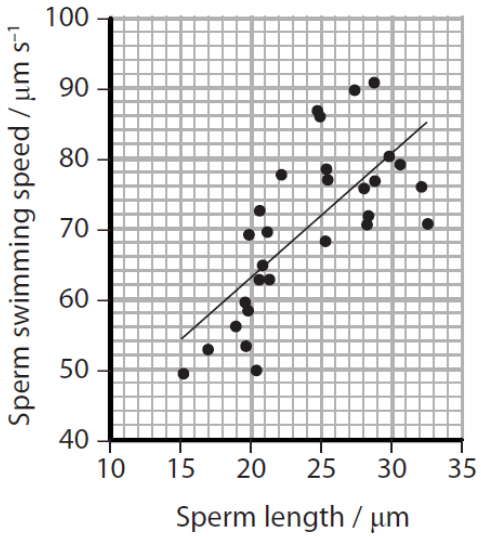
.....

(c) The relationship between the length of a sperm cell and the speed at which it can swim was investigated.

The data collected are shown in the graph.



(i) Calculate the swimming speed of a sperm cell that is 40 μm long, as predicted by the line shown on the graph.

(2)

Answer .....

(ii) Explain the limitations of using the line on the graph to predict the swimming speed of sperm cells.

(2)

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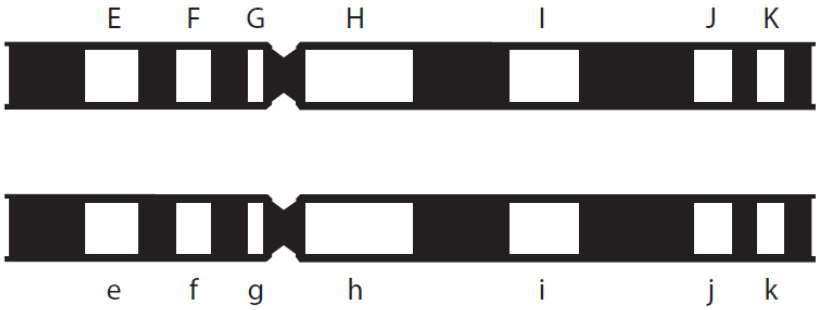
.....

(Total for Question 1 = 7 marks)

8 The diagram shows two homologous chromosomes from a man.



The white regions are the loci of seven genes involved in different phenotypic traits.
The letters E-K and e-k represent the alleles present at each locus.

(a) Alleles F and G are

(1)

☒ **A** autosomal and complementary

☒ **B** autosomal and linked

☒ **C** sex-linked and dominant

☒ **D** sex-linked and epigenetic

(b) This man produces gametes. Each gamete contains only one allele of each gene.

Describe how each gamete receives only one allele of each gene.

(2)

(c) The gametes produced by this man may have different combinations of alleles. Possible combinations of alleles are:

- E and K
- e and K
- h and i
- H and i

Assess the relative chances of this man's gametes containing these combinations of alleles.

(4)

(Total for Question 8 = 7 marks)

8 Muscular dystrophy is a group of disorders that gradually cause muscles to weaken.

(b) Duchenne muscular dystrophy (DMD) is a sex-linked disorder.

(i) Explain what is meant by the term sex-linked disorder.

(2)

(ii) Explain why the genotype frequency for males with DMD cannot be calculated using this Hardy-Weinberg equation.

(2)

(iii) Dystrophin is a protein needed to maintain the structure of muscle cells. In DMD the affected allele prevents the production of this protein, leading to symptoms that include a progressive effect on muscle tissue.

Stem cells are a potential treatment for DMD.

Explain why stem cells from a healthy donor may provide a treatment for this disorder.

(3)

(c) As pluripotent stem cells divide, epigenetic changes are passed on.

Explain how epigenetic changes affect the activation of genes in daughter cells.

(3)

(Total for Question 8 = 10 marks)

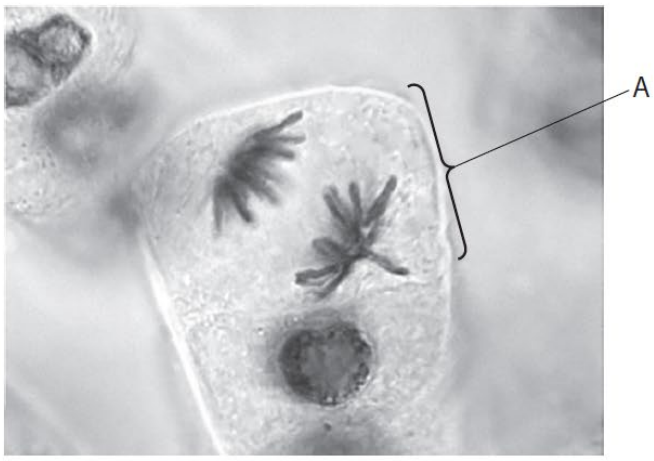
3 Plants have areas of undifferentiated cells called meristems. Cells in these areas divide rapidly during plant growth.

(a) Name this type of division.

(1)

.....

(b) The photograph shows a cell undergoing nuclear division, as seen using a light microscope.



Magnification ×800

(i) Which stage of nuclear division is shown in cell A?

(1)

☒ **A** anaphase

☒ **B** metaphase

☒ **C** prophase

☒ **D** telophase

(ii) The mean distance between the two sets of chromatids in the photograph of cell A is 1.5 cm.

Calculate the actual distance in μm.

(2)

..... μm

(iii) Devise an investigation to study the effect of temperature on the rate of nuclear division in a plant meristem.

(5)

(Total for Question 3 = 9 marks)

TOTAL FOR TEST = 50 MARKS