Gene Technology

Question Paper 2

Level	International A Level
Subject	Biology
Exam Board	Edexcel
Topic	Coordination, Response, Gene Technology
Sub-Topic	Gene technology
Booklet	Question paper 2

Time Allowed: **72 minutes**

Score: **/60**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

1 The scientific article you have studied is adapted from the book called The Immortal Life of Henrietta Lacks by Rebecca Skloot. Published by Pan Books in 2011.

(a) Explain what is meant by the term **mitosis** (paragraph 7).

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(b) The genome makes sure that cells 'do their jobs, whether that's controlling your heartbeat or helping your brain understand the words on this page' (paragraph 10).

Describe how cells in the sino-atrial node (SAN) are involved in controlling heart rate.

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(c) Henrietta's cells have 'been used to study lactose digestion' (paragraph 16).

Suggest how her cells may have digested lactose.

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(d) 'Like guinea pigs and mice, Henrietta's cells have become the standard laboratory workhorse' (paragraph 16).

Suggest **two** reasons why it is preferable to use Henrietta's cells in medical research, rather than using guinea pigs and mice.

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*(e) 'By the end of 1951, the world was in the midst of the biggest polio epidemic in history' (paragraph 19). This was caused by poliovirus which can lead to paralysis (paragraph 20).

The virus infects motor neurones which can stop skeletal muscles from working.

Suggest how an infection of motor neurones by the virus can stop the transmission of nerve impulses and lead to muscle paralysis.

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(f) Poliovirus, like Human Immunodeficiency Virus, is a retrovirus. Poliovirus was able to infect HeLa cells (paragraph 25).

Give **three** similarities between the structure of the genetic material in poliovirus and the genetic material in HeLa cells.

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(g) Scientists had studied genes by breeding plants 'then breeding their offspring to see how genetic traits are passed from one generation to the next' (paragraph 33).

When this was done using a smooth pea and a wrinkled pea, it was found that in the F2 generation (second generation of offspring), 75% were smooth.

In the space below, draw genetic diagrams to describe and explain the genotypes of the parents and their offspring in the previous **two** generations.

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(h) Explain what is meant by the term **human genome map** (paragraph 37).

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(i) Suggest how the 'p53 tumor suppressor gene' (paragraph 43) could stop a potential tumour cell forming.

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(j) Using paragraph 46, suggest what the 'specific DNA sequence from a blood cell' coded for.

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(k) A human telomere (paragraph 60) contains 10 000 nucleotides. Using information from paragraph 58, state the number of telomere nucleotides lost per cell division.

(1)

Answer ..... nucleotides

(Total for Question 1 = 30 marks)

2 The scientific article you have studied is adapted from articles in Nature and New Scientist. Use the information from the article and your own knowledge to answer the following questions.

*(a) Describe how the Krebs cycle is involved in 'burning up fuel' (paragraph 2).

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(b) The unique merger 'gave rise to all complex, or eukaryotic, cells' (paragraph 4). The presence of a nucleus is characteristic of eukaryotic cells.

Describe the structure of a nucleus.

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(c) Explain what is meant by the term **mutation** 'of mitochondrial genes' (paragraph 7).

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(d) In 2011 there were 723,913 children born in England and Wales.

Using information from paragraph 9, calculate the number of children born with Leigh syndrome in England and Wales in 2011. Show your working.

(2)

Answer .....

(e) Using information from paragraph 22, explain how cells in the pancreas would detect an increase in blood glucose concentration.

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(f) 'No controlled trials were done to show this for sure' (paragraph 37).
Suggest what the control should have been.

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(g) In MELAS syndrome (paragraph 40), a mutation can occur in a gene that codes for an enzyme involved in oxidative phosphorylation.

This causes lactate (lactic acid) to accumulate in the body.

Suggest how this mutation in MELAS syndrome causes lactate to accumulate in the body.

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(h) Preimplantation genetic diagnosis cannot 'help women whose mitochondria are all mutant' (paragraph 46).

(i) Give a reason why people may wish to use preimplantation genetic diagnosis.

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(ii) Give an ethical reason why people may **not** wish to use preimplantation genetic diagnosis.

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(i) Using information from paragraph 52 and your own knowledge, suggest which climate-related mitochondrial variant may boost athleticism. Give reasons for your answer.

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(j) Using paragraphs 53 and 54, suggest why mitochondrial genes may 'play the dominant role in natural speciation' of copepods.

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(Total for Question 2 = 30 marks)