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) MPF triggering (paragraph 6) starts the process of mitosis. Suggest **three** events that occur at the beginning of mitosis in a plant cell that may be triggered by MPF.

(3)

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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).

Suggest how cells sensitive to pH are involved in controlling heart rate.

(4)

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

Suggest **three** reasons why Henrietta's cells are used routinely in medical research.

(3)

*(d) '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.

Explain how the structure of the cell surface membrane of a motor neurone is related to the conduction of a nerve impulse along its axon.

(6)

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

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

(3)

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(f) Scientists had studied genes by breeding animals '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 brown mouse and a white mouse, it was found that in the F2 generation (second generation of offspring), 75% of the mice were brown.

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

(4)

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(g) Monoclonal antibodies are produced by hybrid cells. These cells are made by fusing a lymphocyte with a cancer cell, such as HeLa (paragraph 37).

Suggest why cancer cells are used to form these hybrid cells.

(2)

(h) Suggest what is meant by the term **genetic engineering** (paragraph 47).

(2)

(i) Place a cross ☒ in the box that shows the number of cells present if one cell divided 50 times by mitosis (paragraph 58).

(1)

☒ **A** 2^5

☒ **B** 50^2

☒ **C** 5^{20}

☒ **D** 2^{50}

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(j) Scientists knew that 'there was a string of DNA at the end of each chromosome called a *telomere*' (paragraph 60) and they also knew that 'human cancer cells contain an enzyme called *telomerase*' (paragraph 61).

State **four** chemical elements found in both telomeres and telomerase.

(2)

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(Total for Question 1 = 30 marks)

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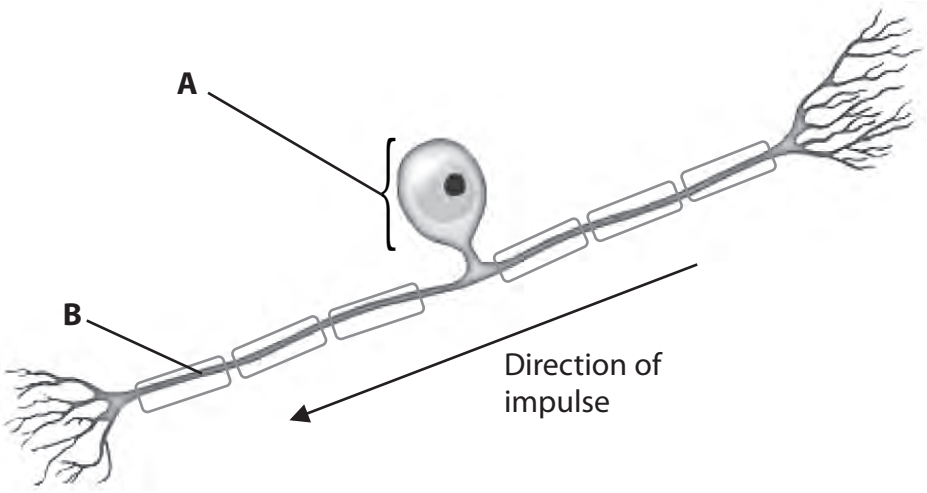
2 The diagram below shows a sensory neurone.



(a) Name the structures labelled **A** and **B**.

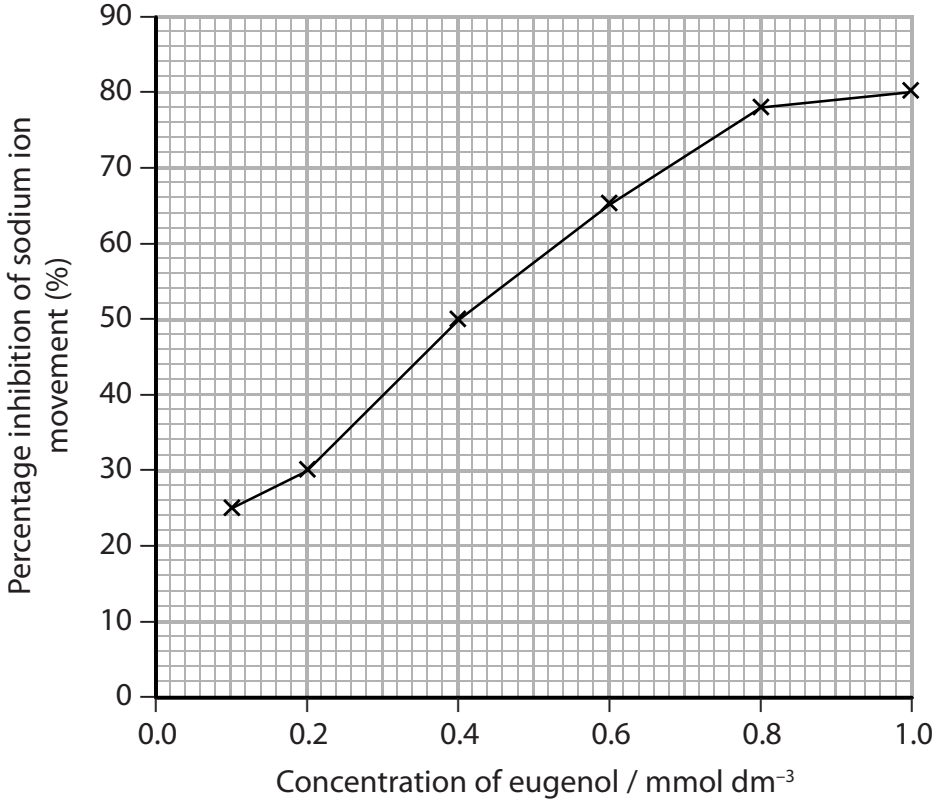
(2)

A .....

B .....

(b) Eugenol is a drug that inhibits the movement of sodium ions and calcium ions through the cell surface membranes of sensory neurones.

The graph below shows the effect of eugenol concentration on the percentage inhibition of sodium ion movement.



(i) Describe the relationship between the concentration of eugenol and the percentage inhibition of sodium ion movement.

(2)

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*(ii) Eugenol can be used to reduce pain.

Suggest an explanation for how eugenol affects the movement of calcium ions and reduces pain.

(6)

(Total for Question 2 = 10 marks)

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