



QUESTION WORKBOOK

Homeobox genes, Hox genes and apoptosis

Cell cycles, reproduction and development · Unit B06

OCR A 6.1.1

15 questions · 45 marks

NAVY SCREEN EDITION

Every question in this book has a code beside its number.
Type inklearning.co.uk/q/ followed by the code to open that question online.
© 2026 Ink Learning Ltd. All rights reserved.
inklearning.co.uk/biology/ · youtube.com/@InkPhysics

SECTION A · Short, 1 to 2 marks**A1**

HG-Q7

State the length of a homeobox in base pairs, and the length in amino acids of the homeodomain it codes for. [2]

A2

HG-Q14

State what colinearity means in a Hox gene cluster, and state how many Hox gene clusters a human has. [2]

A3

HG-Q15

State the name of the gene whose protein product halts the cell cycle at a checkpoint and triggers apoptosis when DNA damage cannot be repaired, and state what type of gene this is. [2]

SECTION B · Standard, 3 to 5 marks**B1**

HG-Q1

Describe the changes that take place in a cell during apoptosis, in the order in which they occur. [4]

B2

HG-Q2

A homeobox of 180 base pairs lies within a gene 1200 base pairs long. Calculate the number of amino acids in the homeodomain, and the percentage of the gene that the homeobox occupies. [4]

B3

HG-Q8

In a fly carrying a mutation in the gene *Antennapedia*, a pair of legs grows on the head where the antennae should be, and the legs are complete and normally formed. Explain what this shows about how homeotic mutations work, and explain why this is called a homeotic mutation rather than a loss of a structure. [4]

B4

HG-Q3

Explain why a mutation in a single homeobox gene can alter the development of a whole region of an animal. [3]

B5

HG-Q4

Compare the events of apoptosis with the events of necrosis in a tissue.

[3]

B6

HG-Q5

The hand of a human embryo is at first a flat plate of tissue with no separate fingers. Explain how mitosis and apoptosis together produce five separate digits.

[3]

B7

HG-Q6

Cells in some tumours fail to undergo apoptosis even though their DNA is damaged. Suggest how this failure contributes to the growth of the tumour.

[3]

B8

HG-Q9

A homeobox sequence from a mouse gene can be inserted into a fruit fly embryo and successfully carry out the fly gene's own job, even though the two species' ancestors diverged over five hundred million years ago. Suggest what this shows about the two species, and suggest why almost no changes to this sequence have been passed on over that time.

[3]

B9

HG-Q10

Withdrawal of a growth factor from a cell can trigger apoptosis just as effectively as delivery of a cytokine can. Explain how a signal from outside a cell and a signal from inside a cell can both lead to apoptosis, giving one example of each. [3]

B10

HG-Q11

Outline how a failure of apoptosis between the developing digits can result in a baby being born with fingers joined by a web of skin, a condition called syndactyly. [3]

B11

HG-Q12

In a healthy adult, apoptosis removes cells at a rate of the order of ten thousand million cells a day, and mitosis replaces them at a matching rate. Calculate the approximate number of cells replaced in one year, and give your answer in standard form to two significant figures. [3]

B12

HG-Q13

Compare the consequence of too little apoptosis in a cell with damaged DNA with the consequence of too much apoptosis in neurones, referring to a named condition each can lead to. [3]

THIS BOOK ONLINE



Scan the code, or type the address, to open the questions in this book online:

inklearning.co.uk/biology/practise/questions/homeobox-genes-apoptosis-and-body-plan/