

A Level AQA Biology

6 Mitosis and the cell cycle – answers

Question	Answers	Extra information	Mark	AO Spec reference
01.1	cell B; homologous chromosomes paired up / lined up at the equator;		2	AO1 AO2 3.2.2 3.4.3
01.2	metaphase;		1	AO1 3.2.2
01.3	Any one difference between cell A - cell B: two daughter cells AND four daughter cells;; daughter cells are genetically identical AND daughter cells are genetically different;; daughter cells are diploid cells AND daughter cells are haploid cells / gametes;;		1 max	AO1 3.2.2 3.4.3
01.4	Any two from: HER2 gene regulates mitosis / the cell cycle; a mutation that upregulates / increases the expression of HER2 gene may cause more HER2 receptors to be made / deposited onto the cell surface membrane; more growth hormones can be bound to the cell, stimulating unregulated growth/ tumour formation;		2 max	AO1 AO3 3.2.2
01.5	some tumours formed are benign, which are not cancerous; OR Many mutations silent/have no effect;		1	AO3 3.2.2
01.6	blocks HER2 receptors; prevent further binding of growth hormones; cell not stimulated to divide by mitosis/cell prevented from becoming cancerous;		3	AO3 3.2.2 3.2.4
02.1	cell wall;		1	AO1 3.2.1.2

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02.2	Any two from: circular chromosome / DNA AND human cells have linear DNA; one chromosome only AND human cells have 46 chromosomes; have plasmids AND human cells do not; DNA not associated with proteins/histones AND human DNA associated with proteins /histones;		2 max	AO1 3.4.1
02.3	binary fission AND Any three from: circular DNA molecule replicates; both DNA copies attach to the cell membrane; plasmids are replicated; cell membrane expands outwards while contracting inwards to divide / cytokinesis occurs / new cell wall is formed between the two cells; each cell has one replicated circular DNA molecule / a number of plasmids;		4 max	AO1 3.2.2
02.4	Any two from: they do not replicate by themselves; they must inject their genetic material into a host cell; the host cell uses its components / proteins to replicate the virus particles;		2 max	AO1 3.2.2
03.1	growth; repair damaged / lost cells / tissues;	Do not accept “repairing damaged cells”	2	AO1 3.2.2
03.2	(C →) E → A → D → B;		1	AO2 3.2.2
03.3	(cell A is at) metaphase AND Any two from: chromosomes are attached to spindle fibres; at the centromere; chromosomes line up along the cell equator;		3 max	AO2 AO1 3.2.2

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03.4	ends all meet; smooth lines; AND At least three correct labels added: <ul style="list-style-type: none"> • Chromosomes • Cytoplasm • Cell surface membrane • Cell wall 	Accept outline drawing of chromosomes Ignore colouring or shading Award 2 marks for three correct labels Award 1 mark for 1-2 correct labels No marks awarded if no labels added correctly	4 max	AO2 3.2.1.1
03.5	Actual size = $\frac{\text{image size}}{\text{magnification}}$ $\frac{3}{40} = 0.075 \text{ mm};$ $= 75 \mu\text{m};$	Calculation Conversion to μm	2	AO2 3.2.2
03.6	Any one <u>pair</u> from: mitosis produces two daughter cells AND meiosis produces four; mitosis produces daughter cells that are genetically identical / with the same number of chromosomes as parent cell or with each other / diploid AND meiosis produces daughter cells with half the number of chromosomes of parent cells / haploid; mitosis produces cells for growth / repair / asexual reproduction AND meiosis produces gametes / mitosis has one division, but meiosis has 2 divisions;	Must give comparable statements and points	2 max	AO1 3.3.2 3.3.4
04.1	two (identical) copies of the original DNA molecule are produced; each new DNA molecule contains one original strand and one new strand;		2	AO1 3.1.5.2

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04.2	DNA mass stays the same initially (for the first 12 hours); then increases from 2 to 4 arbitrary units (from about 12–20 h); plateaus / stays the same (from about 20–23 h); decreases to 2 a.u. (from about 23–24 h);	Two marks dependent on using correct values from the graph for at least two of the marking points	4	AO2 3.2.2 3.1.5.2
04.3	4 cells;		1	AO2 3.2.2
04.4	mitosis / nuclear division occurs; cytokinesis occurs afterwards;		2	AO2 3.2.2
05.1	89 cells during mitosis : 849 cells total; $\frac{89}{849} = 0.105$ (OR 10.5%);	Award two marks if correct answer is given without working Award one mark if correct working is shown but got an incorrect final answer	2	AO2 3.2.2
05.2	$\frac{63}{849} \times 22 \times 60$; = 98 minutes;	Award 2 marks for the correct final answer without working Award 1 mark if correct working is given without a correct final answer, or if answer is not given to the nearest integer	2	AO2 3.2.2
05.3	$\frac{760}{849} \times 100$; = 89.5%;	Award 2 marks for the correct final answer without working Award 1 mark if correct working is given without a correct final answer, or if answer is not given to 3 significant figures	2	AO2 3.2.2
05.4	the longer the distance from the root tip, the lower the mitotic index; decreases from ~12 a.u. to 1 a.u. (from 0.2 to 2 mm from the root tip);		2	AO2 3.2.2

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05.5	0.2 – 0.4 mm from the root tip; has the highest mitotic index; a higher mitotic index indicates more cells are undergoing mitosis / higher level of cell replication (so more likely to produce successful clones);	Allow up to 0.5 mm from root tip	3	AO2 AO1 3.2.2
06.1	the acid stops any cellular reactions; cells would stop at different stages of mitosis / allows viewing of cells at different stages of mitosis;		2	AO2 3.2.2
06.2	to spread / squash the tissue, avoiding overlapping of cells / to have a single layer of cells; make tissue layer thin / to allow light through;		2	AO2 3.2.2
06.3	mitotic index of student A : $\frac{1233}{75} = 0.44$ or 44%; mitotic index of student B : $\frac{12}{71} = 0.17$ or 17%; student A has a higher mitotic index than student B / the cells in the root tip prepared by student A are more actively dividing than by student B;		3	AO2 3.2.2
06.4	student B ; AND (the student) cut more than 1mm away from the root tip OR (the student) used the 1mm tissue cut from the base of the root tip, rather than the top of the root tip; AND the root tip is the region where most mitosis / cell division occurs / more mitosis happens closer to the root tip OR further down from the root tip are regions of cell elongation / differentiation, with little mitosis / cell division occurring;	ECF	3	AO2 AO3 3.2.2

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07	<p>The following are suitable topic areas from the specification that could be used to describe the control of cell division and differentiation and explain the importance of these controls.</p> <p>In order to fully address the question and reach the highest mark bands students must also include at least five topics in their answer, to demonstrate a synoptic approach to the essay.</p> <table border="1"> <thead> <tr> <th>Specification reference</th> <th>Topic area</th> </tr> </thead> <tbody> <tr><td>3.1.5.2</td><td>DNA replication</td></tr> <tr><td>3.2.2</td><td>Cell division</td></tr> <tr><td>3.2.4</td><td>Immune response</td></tr> <tr><td>3.3.2</td><td>Gas exchange</td></tr> <tr><td>3.3.3</td><td>Digestion and absorption</td></tr> <tr><td>3.3.4</td><td>Mass transport</td></tr> <tr><td>3.4.2</td><td>DNA and protein synthesis</td></tr> <tr><td>3.4.3</td><td>Meiosis</td></tr> <tr><td>3.5.1</td><td>Photosynthesis</td></tr> <tr><td>3.5.2</td><td>Respiration</td></tr> <tr><td>3.6.1.2</td><td>Receptors</td></tr> <tr><td>3.6.2.1</td><td>Nerve impulse</td></tr> <tr><td>3.6.3</td><td>Skeletal muscles</td></tr> <tr><td>3.6.4.2</td><td>Control of blood glucose concentration</td></tr> <tr><td>3.6.4.3</td><td>Control of blood water potential</td></tr> <tr><td>3.8.2.3</td><td>Gene expression and cancer</td></tr> </tbody> </table>	Specification reference	Topic area	3.1.5.2	DNA replication	3.2.2	Cell division	3.2.4	Immune response	3.3.2	Gas exchange	3.3.3	Digestion and absorption	3.3.4	Mass transport	3.4.2	DNA and protein synthesis	3.4.3	Meiosis	3.5.1	Photosynthesis	3.5.2	Respiration	3.6.1.2	Receptors	3.6.2.1	Nerve impulse	3.6.3	Skeletal muscles	3.6.4.2	Control of blood glucose concentration	3.6.4.3	Control of blood water potential	3.8.2.3	Gene expression and cancer	Focus should be on the cell cycle checkpoints and their importance, G0 phase, cancer development, differentiation, specialised cells involved in various functions of the body.	25	AO1 3.1.5.2 3.2.2 3.2.4 3.3.2 3.3.3 3.3.4 3.4.2 3.4.3 3.5.1 3.5.2 3.6.1.2 3.6.2.1 3.6.3 3.6.4.2 3.6.4.3 3.8.2.3
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	<p>Students may be able to show the relevance of other topics from the specification.</p> <p>Note: other topics from beyond the specification can be used, providing they relate to the title and contain factually correct material of at least an A-level standard. Credit should not be given for topics beyond the specification which are below A-level standard.</p>			

Skills box answers

Question	Answer
1	75 μm
2	5 μm
3	0.025 μm