

Question	Answers	Extra information	Mark	AO / Specification reference
01.1	cell is growing increasing number of sub-cellular structures / ribosomes/ mitochondria DNA is replicating / producing two copies of each chromosome		1	AO2
			1	1.2.2
			1	
01.2	cell C → cell B → cell A → cell D		1	AO2 1.2.2
01.3	cytoplasm AND cell membrane divide to form two (identical) cells		1	AO2
			1	1.2.2
01.4	$\frac{2 \times 24}{11}$ 4.4 hours	reference to 2 cells (undergoing metaphase) for 1 mark accept range 10–11 for 1 mark accept range 4.4–4.8 hours for 3 marks	3	AO2 1.2.2 MS1c
02.1	an undifferentiated cell that can give rise to / differentiate into different cell types		1	AO1 1.2.3
02.2	they could replace the cells that are being destroyed / differentiate into cells that could produce insulin		1	AO2 1.2.3
02.3	embryonic stem cells can develop into any cell type in body adult stem cells / stem cells from bone marrow can only develop into a limited range of cell types		1	AO2
			1	1.2.3
02.4	no or less risk of rejection / some people may not agree with using transplanted material		1	AO3 1.2.3

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02.5	$\frac{12}{23} \times 100 = 52\%$		1	AO2 1.2.3 Ms1c
02.6	any one from: <ul style="list-style-type: none"> • successful / effective – some / 52% of patients did not need to inject insulin (2½ years later) • unknown – as study needed to be carried out for a longer period of time • unknown – as study needed to be carried out on a larger sample size • not successful / ineffective – almost half / 48% of patients needed to return to injecting insulin (after 2½ years) 		1	AO3 1.2.3
03.1	any three from: <ul style="list-style-type: none"> • DNA is arranged into long strands called chromosomes • in body cells, chromosomes are normally found in pairs • chromosomes contain a large number of genes • genes code for characteristics 		3	AO1 1.2.1
03.2	two daughter cells form (from one parent cell) each daughter cell has identical DNA / chromosomes / the same number of chromosomes as the original cell cells differentiate to form different types of cell different types of cells are needed for different functions / specialised cells make different organs / parts of the body		1 1 1 1	AO1 1.2.2 1.1.4

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03.3	DNA replicates / two copies of the chromosomes form one set of chromosomes is pulled to each end of the cell the nucleus divides cytoplasm and cell membrane divide	full marks can be awarded for a series of labelled diagrams	1 1 1 1	AO1 1.2.2
04.1	embryonic stem cells are able to differentiate into any type of cell stem cells are transplanted into a patient with a condition stem cells differentiate into healthy version of damaged / faulty cells, so curing the condition		1 1 1	AO1 1.2.3
04.2	bone marrow		1	AO1 1.2.3

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04.3	<p>possible ethical reasons against research:</p> <ul style="list-style-type: none"> • moral status of embryo as a potential human • right to life of an unborn embryo / respect for life • research could lead to reproductive cloning • treating a potential life as a means of supporting an existing life, not as something to be protected / valued <p>possible ethical reasons for research:</p> <ul style="list-style-type: none"> • should try to relieve human suffering through any means possible • embryo has no brain and is therefore unable to feel / have an opinion • many embryos naturally do not develop into full-term babies • embryo is not a life until it is born • at present, strict government controls prevent reproductive cloning <p>development of points:</p> <ul style="list-style-type: none"> • embryos have the potential to develop into a living person; their life would be protected from the moment of birth, and this right should exist from conception • clones / 'designer babies' could be developed in other countries / may have genetic abnormalities • humans should not have the right to define what is or is not a life • Many diseases are currently untreatable; stem cell research may offer a cure / relieve suffering / remove pain 	<p>award 2 marks for two reasons against research</p> <p>award 2 marks for two reasons for research</p> <p>award 2 marks for explanations of points and development of a balanced argument</p> <p>accept other valid reasons for 1 mark each</p> <p>accept other valid expansion of arguments / explanation of points for 1 mark each</p>	6	AO3 1.2.3

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05.1	meristem		1	AO1 1.2.3															
05.2	C		1	AO2 1.2.3															
05.3	DNA replication → mitosis → elongation → differentiation		1	AO1 1.2.3 1.1.4															
05.4	<table border="1"> <thead> <tr> <th></th> <th>Animal stem cells</th> <th>Plant stem cells</th> </tr> </thead> <tbody> <tr> <td>differentiation occurs at a very early stage</td> <td>✓</td> <td></td> </tr> <tr> <td>differentiation occurs throughout life</td> <td></td> <td>✓</td> </tr> <tr> <td>differentiations produced are permanent</td> <td>✓</td> <td></td> </tr> <tr> <td>differentiation can be reversed or changed</td> <td></td> <td>✓</td> </tr> </tbody> </table>		Animal stem cells	Plant stem cells	differentiation occurs at a very early stage	✓		differentiation occurs throughout life		✓	differentiations produced are permanent	✓		differentiation can be reversed or changed		✓	allow 1 mark for first two rows correct allow 1 mark for second two rows correct	2	AO2 1.2.3
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06.1	meristems contain undifferentiated cells		1	AO1 1.2.3 1.1.4															

Question	Answers	Extra information	Mark	AO / Specification reference
06.2	it produces genetically identical offspring / genetic material in the offspring derives from the parent plant only		1	AO1 1.2.3 1.1.4
06.3	any two from: <ul style="list-style-type: none"> • quicker • cheaper • plants can be transported over a large area / reproduced in a different area • advantageous characteristics can be maintained 		2	AO1 1.2.3
07.1	any two from: <ul style="list-style-type: none"> • long axon – transmit impulses large distances in the body • lots of dendrites – make connections with many neurones • myelin sheath – insulate / speed up impulse 	allow 2 marks for named adaptations allow 2 marks for linked explanation of their role	4	AO1 1.1.3
07.2	lack of dopamine prevents signals being transmitted from neurone to neurone signals from the brain are not transmitted (correctly / effectively) to muscles		1 1	AO3 1.1.3
07.3	Stem cells could be used to differentiate into neurones / nerve cells These could be inserted into the brain Neurones in the brain produce dopamine allowing nerve cells to transmit information (correctly)		3	AO3 1.2.3

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07.4	<p>any six from:</p> <p>advantages:</p> <ul style="list-style-type: none"> many stem cells could be created stem cells could differentiate into cells / tissues of any type stem cells would not be rejected by the patient additional stem cells would be produced that could be used for research reduce waiting time for organ transplants no other treatment is available; this offers the only potential treatment for the condition <p>possible disadvantages:</p> <ul style="list-style-type: none"> shortage of donor eggs egg donation / collection painful embryo is destroyed could lead to cloning of humans in the future no guarantee the treatment would be successful unexpected side effects risk of infection from operation 	allow a maximum of 4 advantages or 4 disadvantages	6	AO3 1.2.3
08.1	an unborn foetal intestinal cell		1	AO2 1.2.2
08.2	hair follicles / skin / blood / lining of the digestive system cells need to be constantly replaced		1 1	AO1 1.2.2

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08.3	<p>any four from:</p> <p>stage 1</p> <ul style="list-style-type: none"> cell grows or increases in mass number of sub-cellular structures increases DNA replicates / doubles / is copied <p>stage 2 (mitosis)</p> <ul style="list-style-type: none"> DNA divides / nucleus divides into 2 <p>stage 3</p> <ul style="list-style-type: none"> cytoplasm / cell membrane divides two cells are formed 	to achieve full marks, 1 mark must be awarded from each stage	4	AO1 1.2.2
08.4	if chromosomes were lost you could lack vital genes / new cells would not work properly / organism might die if it has the wrong number	accept any other appropriate suggestion	1	AO3 1.2.2
09.1	<p>light microscope</p> <p>to check cell was dividing</p> <p>or</p> <p>embryo needs to be alive</p>	1 mark for light microscope, 1 mark for reason	1 1	AO2 1.2.2
09.2	embryo has not given its permission / embryo has the right to life / some religious beliefs do allow human interference with the process of human reproduction		1	AO3 1.2.3

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09.3	egg cell: $0.1 \text{ mm} = 1 \times 10^{-4} \text{ m}$ sperm cell: $2.5 \text{ }\mu\text{m} = 2.5 \times 10^{-6} \text{ m}$ order of magnitude difference: $-4 - -6 = 2$ / a factor of 100	award 1 mark for unit conversions award 1 mark for correct order of magnitude	1 1	AO2 MS2h 1.1.5
10.1	chromosomes are aligned in the middle of the cell / chromosomes being pulled apart		1	AO2 1.2.2
10.2	any four from: <ul style="list-style-type: none"> • peel off a thin layer of root tissue • using tweezers • place on a microscope slide and add a drop of stain • lower a coverslip onto the slide • use a piece of filter paper to soak up any liquid from around the edge of the coverslip 		4	AO2 1.1.5
10.3	15×40 $= 600\times$		1	AO2 MS3d 1.1.5
10.4	any one from: <ul style="list-style-type: none"> • root hair greatly increases surface area for water to diffuse into cell • large vacuole speeds up movement of water from soil into cell 		1	AO1 1.1.3 1.3.2