

A Level OCR Biology

24 Cloning and biotechnology – answers

Question	Answers	Extra information	Mark	AO Spec reference
1(a)	Any three from: wear gloves / wash hands ✓ sterilise wire (inoculating) loop in flame ✓ disinfect workbench / avoid touching workbench with (wire inoculating) loop ✓ avoid touching petri dish with hands ✓ <i>idea of</i> limit the length of time that the petri dish is open ✓ hold lid of petri dish closed with tape (once inoculated) ✓		3 max	AO1 6.2.1(g)(i)
1(b)	125 ✓✓✓	$\frac{2\,500\,000}{20} = 125\,000$ $\frac{125\,000}{10} = 12\,500$ $\frac{12\,500}{100} = 125$ <p>Award 3 marks if answer is correct without working Accept errors carried forward</p>	3	AO2 6.2.1(g)(i)
1(c)	<p>Level 3 (5–6 marks) Describes differences between batch and continuous culture, with no or few omissions or errors.</p> <p><i>There is a well-developed line of reasoning, which is clear and logically-structured and uses scientific terminology at an appropriate level. All the information presented is relevant and forms a continuous narrative.</i></p> <p>Level 2 (3–4 marks) Describes some differences between batch and continuous culture, with some omissions or errors.</p> <p><i>There is a line of reasoning presented with some structure and use of appropriate scientific language. The information presented is mostly relevant.</i></p>	<p>Indicative content:</p> <ul style="list-style-type: none"> Batch culture uses a fixed volume of nutrient medium added at the start, but nutrient medium is continually added during the process in continuous culture Batch culture uses a fixed time period, but continuous culture continues indefinitely 	6	AO1 6.2.1(g)(ii)

A Level OCR Biology

24 Cloning and biotechnology – answers

Question	Answers	Extra information	Mark	AO Spec reference
	<p>Level 1 (1–2 marks) Describes aspects of batch or continuous culture, with major omissions or errors. <i>The information is communicated with only a little structure. Communication is hampered by the inappropriate use of technical terms.</i></p> <p>0 marks No response or no response worthy of credit</p>	<ul style="list-style-type: none"> • Waste builds up in batch culture, but waste is removed in continuous culture to maintain population size • Batch culture tends to be used to produce secondary metabolites, but continuous culture tends to be used to produce primary metabolites • Continuous culture is more efficient • Continuous culture requires more maintenance • Growth rate is slower using batch culture 		
2(a)	<p>A lag ✓ Explanation: (slow growth rate because) bacteria adapt to new environment / genes for important enzymes are transcribed / important enzymes are being synthesised ✓</p> <p>B exponential / log ✓ Explanation: <i>idea of</i> rate of population growth near maximum due to no limiting factors ✓</p> <p>C stationary ✓ Explanation: limiting factor of space / nutrients ✓</p> <p>D death ✓ Explanation: nutrients run out / (toxic) waste products produced ✓</p>		8	AO1 6.2.1(h)(i)

A Level OCR Biology

24 Cloning and biotechnology – answers

Question	Answers	Extra information	Mark	AO Spec reference															
2(b)(i)	Any two from: temperature ✓ pH (of growth medium) ✓ volume / area of growth medium ✓ concentration of (named) minerals / amino acids (in growth medium) ✓		Max 2	AO2 6.2.1(h)(ii)															
2(b)(ii)	4.5×10^5 ✓ ✓ ✓ ✓	$18 \times 100 = 1800$ $1800 \times 10 = 18000$ $18000 \times 25 = 450000$ Standard form = 4.5×10^5 Award 4 marks for correct answer with no working Accept errors carried forward	4	AO2 6.2.1(h)(ii)															
2(b)(iii)	Any three from: <i>idea of initially slow growth because (appropriate) enzymes are being produced</i> ✓ glucose / one sugar used for first 3 hours ✓ enzymes for xylose / other sugar produced between 3 and 5 hours ✓ xylose / other sugar used between 5 and 8 hours ✓ <i>idea of both sugars depleted by 8 hours</i> ✓		3 max	AO2 6.2.1(h)(i)															
3(a)	<table border="1"> <thead> <tr> <th>Feature</th> <th>Embryo splitting</th> <th>Somatic cell nuclear transfer</th> </tr> </thead> <tbody> <tr> <td>offspring are clones of body cells</td> <td></td> <td>✓</td> </tr> <tr> <td>embryos can be implanted into a surrogate mother</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>uses <i>in vitro</i> fertilisation</td> <td>✓</td> <td></td> </tr> <tr> <td>uses enucleated eggs</td> <td></td> <td>✓</td> </tr> </tbody> </table>	Feature	Embryo splitting	Somatic cell nuclear transfer	offspring are clones of body cells		✓	embryos can be implanted into a surrogate mother	✓	✓	uses <i>in vitro</i> fertilisation	✓		uses enucleated eggs		✓	One mark per correct row	4	AO1 6.2.1(d)(i)
Feature	Embryo splitting	Somatic cell nuclear transfer																	
offspring are clones of body cells		✓																	
embryos can be implanted into a surrogate mother	✓	✓																	
uses <i>in vitro</i> fertilisation	✓																		
uses enucleated eggs		✓																	

A Level OCR Biology

24 Cloning and biotechnology – answers

Question	Answers	Extra information	Mark	AO Spec reference
3(b)	<p>Level 3 (5–6 marks) Discusses the arguments for and against animal cloning, with a balance between the two, and no/few errors.</p> <p><i>There is a well-developed line of reasoning, which is clear and logically-structured and uses scientific terminology at an appropriate level. All the information presented is relevant and forms a continuous narrative.</i></p> <p>Level 2 (3–4 marks) Discusses the arguments for and against animal cloning, with some omissions or errors.</p> <p><i>There is a line of reasoning presented with some structure and use of appropriate scientific language. The information presented is mostly relevant.</i></p> <p>Level 1 (1–2 marks) Discusses aspects of animal cloning, with major omissions or errors.</p> <p><i>The information is communicated with only a little structure. Communication is hampered by the inappropriate use of technical terms.</i></p> <p>0 marks No response or no response worthy of credit.</p>	<p>Indicative content:</p> <p><i>For</i></p> <ul style="list-style-type: none"> • More desirable offspring can be produced from the best farm animals • SCNT has the potential to reproduce specific animals (e.g., pets) • Less controversial than genetic engineering in the opinion of some • Credit specific examples <p><i>Against</i></p> <ul style="list-style-type: none"> • SCNT is inefficient (high failure rate) • Cloned animals can have health problems and shortened lifespans • Raises ethical issues • Credit specific examples 	6	AO3 6.2.1(d)(ii)
3(c)	Any two from: mitosis producing clones of an adult ✓ in invertebrate species ✓ monozygotic / identical twins ✓ through embryo splitting ✓		2 max	AO1 6.2.1(c)
4(a)(i)	propagation ✓ runners ✓ tubers ✓		3	AO1 6.2.1(a)(i)

A Level OCR Biology

24 Cloning and biotechnology – answers

Question	Answers	Extra information	Mark	AO Spec reference
4(a)(ii)	undifferentiated ✓ totipotent ✓ retain the ability to divide ✓		3	AO2 2.1.6(j) 6.2.1(a)(i)
4(a)(iii)	<i>mitosis because</i> cloned plant must contain genetically identical cells (to original) ✓ cloned cells remain diploid ✓ no fertilisation / sexual reproduction needed ✓		2 max	AO2 2.1.6(e) 6.2.1(a)(i)
5(a)(i)	auxin(s) ✓		1	AO1 5.1.5(b)
5(a)(ii)	to produce warm / moist conditions (to reduce transpiration rate and encourage growth) ✓	Accept to increase humidity	1	AO2 6.2.1(a)(ii)
5(b)	F A E D B C ✓ ✓ ✓	If the order is incorrect, award one mark each for: • F first and C last • A before E	3	AO1 6.2.1(b)(i)
6(a)(i)	Any three from: <i>idea that</i> increase in temperature raises enzyme activity ✓ <i>idea that</i> temperatures above optimum break hydrogen bonds ✓ <i>idea that</i> pH changes can break ionic / hydrogen bonds ✓ (pH and temperature are controlled to) stop enzymes denaturing ✓		3 max	AO1 2.1.4(d)(i) 6.2.1(i)

A Level OCR Biology

24 Cloning and biotechnology – answers

Question	Answers	Extra information	Mark	AO Spec reference								
6(a)(ii)	<table border="1"> <thead> <tr> <th>Method of immobilisation</th> <th>What is done?</th> </tr> </thead> <tbody> <tr> <td>adsorption</td> <td>enzymes form weak attachments to alginate beads, silica or another inert material</td> </tr> <tr> <td>covalent bonding</td> <td>enzymes (covalently) bonded to insoluble support / polymer / clay particles / silica gel OR enzymes are cross-linked / bonded to each other</td> </tr> <tr> <td>entrapment</td> <td>enzymes trapped in gelatin / cellulose / membrane / matrix</td> </tr> </tbody> </table>	Method of immobilisation	What is done?	adsorption	enzymes form weak attachments to alginate beads, silica or another inert material	covalent bonding	enzymes (covalently) bonded to insoluble support / polymer / clay particles / silica gel OR enzymes are cross-linked / bonded to each other	entrapment	enzymes trapped in gelatin / cellulose / membrane / matrix	One mark per correct box	3	AO1 6.2.1(i)
	Method of immobilisation	What is done?										
	adsorption	enzymes form weak attachments to alginate beads, silica or another inert material										
	covalent bonding	enzymes (covalently) bonded to insoluble support / polymer / clay particles / silica gel OR enzymes are cross-linked / bonded to each other										
entrapment	enzymes trapped in gelatin / cellulose / membrane / matrix											
6(a)(iii)	Any one from: glucose isomerase to make fructose ✓ lactase to make lactose-free milk ✓ glucoamylase to make glucose ✓	Accept any correct example not listed in the specification	1 max	AO1 6.2.1(i)								
6(b)	Any three from: few(er) ethical issues ✓ <i>idea that</i> large numbers can be produced quickly ✓ (relatively) easy to genetically engineer ✓ cheap nutrient requirements ✓ <i>idea of</i> grown anywhere / not climate dependent ✓ requires small energy input / low temperatures ✓	Accept description Accept use of waste products from other processes (as nutrients)	3 max	AO1 6.2.1(f)								

A Level OCR Biology

24 Cloning and biotechnology – answers

Skills box answers

Question	Answer
1	pH = 1
2	pH = 0.3
3	pH = 2.6
4	$6.31 \times 10^{-3} \text{ mol dm}^3$
5	$1.95 \times 10^{-9} \text{ mol dm}^3$
6	$1.58 \times 10^{-6} \text{ mol dm}^3$