Question Number	Answer	Acceptable answers	Mark
1(a)(i)	A description including **three** the following points: • (cloned animals) tend to be larger at birth / body organs /named organ enlarged (1) • embryo rejected/fails to develop normally/many cloned mammals failed to develop (1) • (cloned animals) early death /speeds up aging (1) • narrowing of the gene pool / less (genetic) variation (1) • genetic disorders / defects (1) • susceptible to same diseases / pathogen (1)	Ignore answers related to the meat/food product /ethics	**(3)**

Question Number		Indicative Content	Mark
QWC	***1 (a (ii)**	A description including • use of body cell • nucleus removed from body / parent cell • use of egg cell • nucleus removed from egg cell/enucleated egg • nucleus (from body cell) transferred to enucleated egg • electric shock; • to stimulate cell division • mitosis • formation of embryo; • embryo implanted • into surrogate	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• Limited description of 2 of the stages involved in cloning and the sequence of events is confused • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description of 3 or more of the stages involved in cloning but some of the steps may be missing or out of sequence • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description of 5 or more of the stages involved in cloning but the sequence is largely in order and complete • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	**C** haploid gametes combine to produce a diploid zygote		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	A description including **two** of the following • transcription (1) • DNA unzips (1) • (formation of) mRNA (1) • complementary to / copy of DNA / DNA acts as a template (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)	**A description to include three of the following** selection of individuals with {favourable characteristics/largest cobs}/collect seeds from plants with large cobs (1) cross breeding (of selected individuals)/plant seeds together (from maize with large cobs) (1) selection of offspring (1) repeat process over time (1)	accept selective breeding	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(b)	**An explanation including two of the following** reduce number of pests (1) reduced damage to crop/maize (1) increased yield (1) OR kills weeds (1) reduces competition for {light/space/named resource}(1) increased yield (1)	accept kill pests/insects/named pest/deters animals **reject** predators	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)	**A discussion to include a maximum of two from Advantages:** removes CO_2 when growing (1) less use of {fossil fuels/named fuel} (1) reduced SO_2 emissions (1) renewable / can be regrown quickly /sustainable (1) **A discussion to include a maximum of two from Disadvantages:** reduced food production (1) takes up land (1) reduced biodiversity (1) crop growth is weather dependent (1)	accept carbon neutral **reject** CO^2 **reject** SO^2 accept deforestation ignore references to cost and energy content	**(4)**

Question Number	Answer	Acceptable answers	Mark
2(d)	**A** ☒ *Agrobacterium tumefaciens*		**(1)**

Total for Question 2 = 10 marks

Question number	Answer	Mark
3(a)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (2 marks): • penicillin prevents the bacteria from dividing as they cannot make a new cell wall (1) • because humans cells do not have a cell wall (1) • they are unaffected by penicillin (1)	**(3)**

Question number	Answer	Mark
3(b)	An answer that combines knowledge (2 marks) and understanding (2 marks) to provide a logical description: • use restriction enzymes to remove the gene and cut the plasmid (1) • use of ligase to join DNA molecules together (1) • cut the gene from the genome of the fungus and extract a plasmid from the bacteria (1) • insert the recombinant plasmid back into the bacteria (1)	**(4)**

Question number	Indicative content	Mark
*3(c)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 (6 marks)** • bacteria reproduce rapidly generating a large population • there is variation among a bacterial population • some bacteria develop a resistance to antibiotics through mutation • antibiotic treatment exerts a selection pressure • bacteria resistant to antibiotics survive • antibiotic resistance inherited • non-resistant bacteria do not survive • levels of antibiotic resistance in a population of bacteria increase	**(6)**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
Level 2	3–4	• Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5–6	• Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents an explanation that has a well-developed structure that is clear, coherent and logical. (AO1)