

Question number	Answer	Marks	Guidance
1 (a)	<i>Reproductive cloning</i> fertilised egg placed into surrogate; cloned animal allowed to develop; <i>therapeutic cloning</i> fertilised eggs / embryos, remain in lab; e.g. stem cells collected;	3	
1 (b)	<i>Positive</i> treatment of genetic disease; treatment of infertility; medical research; <i>negative</i> idea of unforeseen problems, e.g. shortened life span, genetic disorders; religious objections; emotional problems for, clone / parents; reduction of genetic diversity;	4 max	
1 (c) (i)	Nucleus removed from adult (somatic cell); nucleus removed from egg cell of different animal; nucleus from somatic cell placed into (enucleated) egg cell; electric shock to stimulate division; embryo placed into surrogate;	3 max	
1 (c) (ii)	Mitochondria in enucleated egg cell; contains DNA;	2	
1 (d)	Production of multiple embryos from one embryo; increase success rate; reduce costs / increase inefficiency;	3	
2 (a)	<i>Explant</i> tissue removed, from, plant / animal; transferred to nutrient medium as starting culture; <i>callus</i> undifferentiated, mass of cells; <i>idea of</i> large number of cells that can be split into many cultures;	4	
2 (b)	e.g. auxins / gibberellins; used in different proportions; cell division; growth of roots; growth of shoots;	5	
3 (a)	Continuous; nutrients / examples, supplied; products removed;	3	
3 (b)	Feed valve for nutrient supply; harvest valve for product removal; sensors to monitor, conditions / named; so, conditions / named, can be maintained at optimum;	4	
3 (c)	Advantages conditions maintained at optimum; do not need to be cleaned as regularly; smaller space; lower staff costs disadvantages expensive; skilled workers required; not suitable for all products;	4	
4	<i>Against</i> cloned cows (may) suffer; example; may affect products; many people think, cloning should only be used in certain circumstances / never used; for some people, think cloning is ok or have no opinion; cloning may help solve food shortages;	6	
5	1 low(er) / less, energy (than beef); 2 useful for, slimming / weight control / AW; 3 low(er) / less, (total) fat; 4 (very) low / (much) less, saturated fat; 5 lower, cholesterol OR lower risk of, (coronary) heart disease / CHD / cardio-vascular diseases / heart attack /	7 max	CREDIT ora for beef throughout. IGNORE use of figures alone when awarding mps 1, 3, 6, 7, 9 – look for <u>descriptive statement</u> , e.g. '12 g of protein' = no mark 'only 12 g protein' = 1 mark 2 ACCEPT preventing obesity

	cardiac arrest / myocardial infarction / MI / angina / atherosclerosis / atheroma / stroke / hypertension; 6 contains carbohydrate / AW; 7 low(er) / less, iron content; 8 (increased risk of) anaemia / fewer RBCs / less haemoglobin / reduced oxygen carrying capacity of blood; 9 low(er) / less, protein; 10 (mycoprotein provides) more balanced diet; 11 need larger intake to meet requirements / AW;		ACCEPT 'less energy to burn off during exercise' DO NOT CREDIT 'burn off' unqualified 6 ACCEPT 'more carbohydrate than beef' IGNORE 'carbs' 8 IGNORE answers phrased in terms of role of iron alone e.g. 'haemoglobin contains iron' = 0 Answers must show consequence of deficiency e.g. 'less haemoglobin' = 1
6 (a) (i)	<i>Graticule</i> total count; bacteria not necessarily alive; <i>dilution plating</i> viable count; only live bacteria can form visible colonies;	4	
6 a (ii)	Colorimetry	1	
6 b	Prevent contamination; possible pathogens; inaccurate results;	3	
6 c	43; 43 / 1.26, x 1 000 000; 3.41 x 10 ⁷ ;	3	
6 d	Using 63; 63 x 100 000; 6.3 x 10 ⁶ ;	3	
7 a	Gel entrapment; covalent / cross, linkage; adsorption to inert surface; contained within membrane;	4	
7 b	Optimum temperature higher for immobilised enzymes; ORA immobilisation provides protection; rate of reaction lower for immobilized enzymes; enzyme not in direct contact with substrate; (substrate) takes time to diffuse to active site; figures quote;	5 max	