Question number	Answer	Notes	Marks
1 (a)	1. (cut with) scalpel / razor / scissors / knife / eq; 2. (transfer with) tweezers / forceps / eq; 3. sterile apparatus / sterile samples;	1. cutting is made = 0 3. ignore no microbes / no pathogens	2
(b)	1. nitrate/ammonium for amino acids / proteins / nucleic acid / DNA / genetic material / eq; 2. agnesium for chlorophyll / chloroplast; 3. phosphate for ATP / DNA / cell membranes / eq; 4. glucose/sucrose for energy / ATP / respiration;	1. gnore nitrogen / growth 3. ignore phosphorus allow other named mineral ion with correct function	2
(c)	1. sterile/aseptic conditions/apparatus/samples / fungicide / bacteriocide; 2. temperature / warmth / eq; 3. (sun)light; 4. umidity / water / moisture / eq; 5. plant growth regulators / auxins / eq;	ignore oxygen / CO_2 / pH / minerals / nutrients / pesticide / herbicide / space / overcrowding / protection from snails or predators	3

(Total for Question = 7 marks)

Question number	Answer	Notes	Marks
2 (a)	adenine / thymine / guanine / cytosine;	ignore A, T, G and C	1
(b)	1 (kill) bacteria / (kill) pathogens / fungi / microbes / viruses / eq; 2 prevent disease / prevent infection / prevent spread of disease / prevent spread of infection; 3 affect growth (of explant) / (less) competition (for minerals);	allow remove bacteria / get rid of bacteria / eq	max 2
(c)	protein / enzymes / named protein;	ignore other molecules - DNA	1
(d)	organism / bacterium / virus / fungus that causes disease / infection;	ignore harm / illness	1
(e)	1 identical / clones / all same / no variation / eq; 2 large quantities / more / high yield / eq; 3 fast / faster / eq; 4 free from disease / free from pathogens / eq; 5 all year production / prevent extinction / eq;	ignore quality and characteristics being controlled ignore cost /cheaper ignore conservation	max 2

Question number	Answer	Notes	Marks
(f)	never runs out / renewable / can be replaced / can be grown again / unlimited supply / eq;	ignore never dies out ignore reproduced ignore reused	1
(g)	1 leaching / eutrophication / run off / eq; 2 soil erosion / flooding / eq; 3 rain(fall) / water cycle effect / less transpiration / drought / desertification / eq; 4 global warming / greenhouse (effect) / (more) CO_2 in air / less CO_2 removed / eq; 5 loss of medicinal plants / eq;	ignore extinction / food chain effect ignore loss of habitat ignore loss of species / less biodiversity ignore climate change ignore loss of wood resource ignore aesthetic appearance	max 3
		Total	

Question number	Answer	Marks
3 (a)	explant / callus; small pieces of plant / eq; ignore cuttings alone agar / jelly; nutrient / named nutrient / eq; sterile / eq; growth promoter / hormone / rooting powder / eq; control moisture / fogging greenhouse / temperature / light / CO_2; clones / genetically identical / same DNA; quick process / eq; all year round / eq;	Max 6
(b)	gene / DNA / allele qualified; eg transfer of gene / transgenic / different gene / new gene / selected gene / desired gene / changed gene / recombinant / eq ignore modified vector / enzymes / plasmid / eq; resistance to pests / disease / drought / herbicide / increase food production / eq;	Max 3

Total 9 Marks

Question number	Answer	Notes	Marks
4(a) (i)	0.52 / 0.5 / 0.521;;	Allow one mark for correct use of 8863 as numerator (ie not if in list) Ignore 0.52135	2 1
(ii)	light misses plant / light misses chloroplast / light not absorbed / light reflected / eq;	Ignore reference to heat / energy / respiration / rays	
(b)	1. respiration; 2. not digested / cellulose / egested / faeces; 3. not eaten / eq;	Ignore growth / active transport / heat loss / movement / heat loss by consumer / excretion	2 max

Total 5 marks

Question number	Answer	Notes	Marks
5 (a) (i)	restriction (enzyme) / endonuclease;	ignore other words such as DNA or enzyme	1
(ii)	ligase;		1
(iii)	plasmid / virus / gene gun / eq;		1
(b)	gene/DNA/allele from different species / human genes in sheep / eq;	ignore foreign ignore organism / animal allow named examples such as spider to goat	1
(c)	1. genetical identical / same genes / same DNA / same alleles / <u>all</u> sheep have the gene / eq; 2. pro ce the protein / clotting agent / factor IX; 3. <u>re</u> (human) protein/clotting agent / mass production / eq; 4. re sheep / many sheep / faster (re)production of sheep / faster production of offspring / eq; 5. only hav to do GM once / no need to repeat GM / eq;	ignore identical alone ignore non-clotting proteins such as antibodies ignore faster alone mark point is for sheep production	Max 3

(d)	(i)	platelets;		1
	(ii)	1. less ood loss / eq; 2. less entr of microbes / less entry of pathogens / less infection / less disease / eq;		2

Total 10 marks