

Biotechnology and Genetic Engineering

Mark Scheme 2

Level	IGCSE
Subject	Biology
Exam Board	CIE
Topic	Biotechnology and Genetic Engineering
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 2

Time Allowed: 53 minutes

Score: /44

Percentage: /100

1 (a)	<p>phenotype ; gene ; haploid ; mitosis ;</p> <p>[4]</p>	
(b)	<p><i>if there is an error in the genetic diagram allow ecf even if final phenotypes are NOT all different as stated in the question</i></p> <p>$I^A I^O \times I^B I^O$;</p> <p>$I^A, I^O + I^B, I^O$;</p> <p>$I^A I^O, I^A I^B, I^B I^O, I^O I^O$;</p> <p>A AB B O ; <i>blood types must match genotypes</i></p> <p>[4]</p>	<p>accept IA, IB and IO for alleles A, B and O for alleles MP2 and 3 in Punnett square</p> <p>ignore spaces, commas or dots in diploid genotypes very little space between gamete genotypes</p> <p>reject I^{AB} etc as genotypes for parents or children I without A, B and o</p>
(c)	<p>1 two (or more) alleles ; R two blood groups</p> <p>2 two / both, are expressed / equally dominant / both dominant / give different phenotype ;</p> <p>3 in heterozygous / described (individual) ;</p> <p>4 AB, $I^A I^B$ (as example) ;</p> <p>[3 max]</p>	<p>A two (or more) implied, e.g. 'neither' / 'each other' / 'both' ignore ref to genes</p> <p>'neither is fully expressed' = 1 mark for MP1 'neither is dominant over the other' = 2 marks R ref. to recessive <u>and</u> dominant</p> <p>A idea 'when both alleles are present in the genotype'</p> <p>A refs. roan cattle, pink flowers as other correct examples</p>

1 (d)	<p><i>accept converse statements</i></p> <p>1 used to treat diabetes (wherever in answer) ;</p> <p>2 insulin the same as human / uses human DNA / human gene / AW ;</p> <p>3 not rejected ; A 'people not allergic'</p> <p>4 no risk of, infection / disease (from animals) ;</p> <p>5 GE insulin can be, modified / improved / AW ;</p> <p>6 animals not killed / suitable for vegans ;</p> <p>7 cheaper / more readily available / produced quickly / constantly / large amounts / large scale ; R 'easier'</p> <p>8 ref. to bacteria reproduce quickly ;</p> <p>9 increasing numbers of people with diabetes / don't produce insulin ; A don't respond to insulin [3 max]</p>	<p>MP2: e.g. animal insulin is 'foreign' / bovine insulin has three different amino acid residues from human insulin / porcine has only one different / insulin from dead animal, is not the same as human</p> <p>amino acid sequence can be modified</p> <p>A religious / ethical objections to using animals, but not to using GE insulin MP7 is related to production A animal insulin has to be obtained from animal soon after its death</p> <p>R refs. to side effects</p>
(e) (i)	<p><i>note that this is 2 marks</i></p> <p>plasmid ; DNA / <u>genes</u> ; [2]</p>	<p>R plasmic / plasma R nucleic acid unqualified by DNA</p>
(ii)	<p>(restriction) enzyme / endonuclease ; ignore restrictive, etc human / insulin, gene / DNA ; [1]</p>	<p>R incorrect enzyme, e.g. ligase R gene unqualified</p>
[Total: 17]		

- 2 (a) try to mate them together, failure = suggests different species ;
mate together, no offspring = suggests different species ;
breed together and see if any offspring are, sterile / infertile ;
test DNA / examine chromosomes ; [max 1]
- (b) (i) continuous ; **A** discrete [1]
- (ii) *Equus grevyi* ; **A** *grevyi* [1]
- (c) (i) phenotype ; **A** close phonetic spellings [1]
- (ii) *these two points are linked – ‘change’ unqualified does not get a mark, but ‘change in DNA’ gets 2 marks*
change / AW ; e.g. substitution / deletion / error in meiosis
in, DNA / gene(s) / chromosome(s) ;
change in genotype / ‘genetic, structure / genetic make-up’ = 1 mark [2]
- (d) (i) exoskeleton / external skeleton ;
segmented / jointed, limbs / legs / appendages ;
segmented body ; [max 1]
- (ii) three parts to the body / head + thorax + abdomen ;
A sections / **R** segments
wings ; *ignore numbers of wings if given*
6 / 3 pairs of, legs ; [max 2]
- (e) (i) stripes (on head and neck), become / are, horizontal (when feeding) ;
less attractive to (tsetse), flies / insects ; **A** AW
A camouflage in grass ; [2]
- (ii) 1 ref to mutation and number of stripes ;
2 ref to number of stripes and likelihood of being bitten ;
3 ref to, disease / death ;
4 survivors breed ;
5 ref to offspring ; (fewer stripes = less / more stripes = more)
6 passing on advantageous, alleles / genes (for more stripes) ;
7 natural selection / survival of fittest ;

R artificial selection

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[max 3]
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[Total: 14]

- 3 (a) (i) chloroplasts ; **R** chlorophyll
cellulose cell wall ; **A** 'not made of, murein / peptidoglycan'
(sap / large / permanent) vacuole(s) ; **A** tonoplast
nucleus / nuclear membrane / nuclear envelope ; **R** DNA / RNA
nucleolus ;
mitochondria ;
endoplasmic reticulum / Golgi ;
amyloplasts ; **A** starch, grains / granules
more than one chromosome / linear chromosome(s) ; [4]

- (ii) membrane ;
cytoplasm ;
ribosomes ;
chromosomes ; **A** 'strands of DNA' **R** DNA unqualified
glycogen granules ;
oil droplets ; [max 2]

- (b) cheese ;
yoghurt ;
sour milk ;
bread ;
alcohol / any named alcoholic drink ;
Quorn / mycoprotein ;
single cell protein ;
tofu ;
soya sauce ;
sauerkraut ;
vinegar ;
tapai ;
tempe / tempeh ;
kimchee ; [max 2]

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(c) *reject bacteria becoming immune and antibiotics causing mutation*

- 1 mutation / mutant ;
- 2 stronger wall / less permeable wall / enzyme to breakdown antibiotic / AW ;
- 3 antibiotic kills bacteria except those that are , mutant / resistant ;
- 4 antibiotic is, selective agent / AW ; **A** ref to (natural) selection
- 5 (resistant) bacteria reproduce ; *ignore mitosis*

[max 3]

(d) *this may be answered with reference to insulin*

- 1 fast reproduction rate / AW ;
- 2 identical offspring / cloning ;
- 3 small number of genes ;
- 4 single cells ;
- 5 copy / use, genes from, other organisms / viruses ;
- 6 makes, protein / named protein, from another organism ;
- 7 have plasmids ;
- 8 used to transfer gene(s) into bacteria / easy to put gene(s) in bacteria ;
A DNA for gene
R product / protein, taken from, human / other organism

[max 2]

[Total: 13]

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