Genetically modified organisms in agriculture

Mark Scheme 2

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Genetic Technology
Sub Topic	Genetically modified organisms in agriculture
Booklet	Theory
Paper Type	Mark Scheme 2

Time Allowed : **41 minutes**

Score : **/ 34**

Percentage : **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 **(a (i)** 1. greater in teosinte (than in maize) ;

2. greater at 9 loci / less at 1 locus / except at locus 7

3. greatest difference at locus ;

4. use of comparative figures [max 2]

(ii) 1. artificial selection / selective breeding ;

2. humans carry out selection

3. of plants with desirable traits

4. not all <u>alleles</u> selected (in cultivated varieties)

5. increased homozygosity

6. *idea that* greater variety of alleles are needed to survive in the wild environment ;
[max 3]

(iii) 1. wild plants have greater variety of, alleles / base sequences ;

2. could be useful for future breeding

3. example of use e.g. to cope with climate change / drought [max 2]

(b) 1. to avoid inbreeding depression ;

2. hybrids have, higher yields / hybrid vigour

3. avoids expression of harmful recessive alleles

4. ref. to genetic uniformity

5. (which) results in easier, cultivation / harvest / etc [max 3]

[Total: 10]

2 **(a** transfer of pollen from anther to stigma ;
on the same, flower / plant ; [2]

(b) 1. *idea of* genetic variation ;
2. increased heterozygosity ; **ora**
3. hybrid vigour / decreased inbreeding depression ;
4. able to adapt to changing conditions ;
5. *idea of* some individuals surviving ;
6. AVP ; e.g. reduced risk of expression of harmful recessive alleles [3 max]

(c) (i) 1. initially / first 24 mins, exposure time increases, number of seeds produced / (chance of) fertilisation ;
2. then / after 24 or 44 mins, steep decrease in, number of seeds produced / (chance of) fertilisation ;
3. from 120 mins, no seeds produced / no fertilisation ; [2 max]

(ii) 1. plant GM maize some distance away from places that teosinte grows ;
2. estimate how far pollen can travel in 120 minutes ;
3. need more results between 60–120 minutes ; [2 max]

[Total:9]

3 **(a** 1 obtain mRNA from β cells (of islets of Langerhans of pancreas) **;**

2 reverse transcriptase **;**

3 make (single-stranded) cDNA **;**

4 DNA polymerase used to make cDNA double stranded **;**

5 sticky ends created **; A** description

6 (obtain) plasmids **;**

7 cut with restriction, endonuclease / enzyme **; A** named e.g. EcoR1

8 ref. complementary sticky ends **;**

9 cDN / insulin gene, mixed with plasmid **;**

10 DN ligase **;**

11 seals nicks in sugar-phosphate backbone **; R** anneals 8]

(b) 1 (recombinant) plasmids mixed with bacteria **;**

2 (some) bacteria, take up plasmids / transformed **;**

3 heat shock / calcium chloride solution / Ca^{2+} ions / electroporation **;**

to identify bacteria containing plasmids

4 grow on, agar / medium, containing antibiotic (A) **; A** ampicillin

5 plasmid contains, antibiotic (A) / ampicillin, resistance gene(s) **;**

6 bacteria with plasmid survive **; ora**

to identify recombinant bacteria

7 replica plate **; A** description e.g. sponge / velvet pad / absorbent paper

8 (onto) agar / medium, containing second antibiotic (B) **; A** tetracycline

9 *(*tet^R / B / 2nd) resistance gene inactivated (by insertion of new, DNA / gene) / AW **;**

10 (ID) colonies from, 1st / ampicillin, plate that do not grow on, 2nd / tetracycline, plate **;**

[max 7]

[Total:15]