

Principles of genetic technology

Mark Scheme 2

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Genetic Technology
Sub Topic	Principles of genetic technology
Booklet	Theory
Paper Type	Mark Scheme 2

Time Allowed : 45 minutes

Score : / 37

Percentage : /100

Grade Boundaries:

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

- 1 (a) 1 increases, cellular uptake of glucose (from blood) / membrane permeability to glucose ;
 2 (by), liver / muscle / adipose, cells ;
 3 increased, respiration / metabolism, of glucose ; **A** increased glycolysis
 4 causes conversion of glucose to, glycogen / fat ; **A** inhibits glycogenolysis
 5 (blood glucose concentration maintained between) 80–120 mg per 100 cm³ ;
A single value between 80–120 [3 max]

- (b) 1 it is identical to human insulin / ora ;
 2 (more) rapid response ;
 3 no / fewer, rejection problems / side effects / allergic reactions ;
 4 ref. to ethical / moral / religious, issues ;
 5 cheaper to produce in large volume / unlimited availability ; **R** cheap to produce
 6 less risk of, transmitting disease / infection ;
 7 good for people who have developed tolerance to animal insulin ; [2 max]

- (c) (i) 1 single target site will be in correct resistance gene ;
 2 (gene to be inserted has) complementary sticky ends to target site sticky ends ;
 3 more cuts would fragment plasmid ; [2 max]

(ii)

circle of DNA taken up by bacteria	bacteria resistant to ampicillin	bacteria resistant to tetracycline
unaltered plasmids	✓	✓ ;
recombinant plasmids that have taken up the wanted gene	✓	✗ ;
circles of the wanted gene	✗	✗ ;

[3]

- (d) (i) 1 risk spread of resistance to other bacteria ;
2 spread of resistance makes the use of antibiotics less effective / AW ;
3 via, conjugation / transformation / uptake of plasmids ; **A** description
4 via, 'phage / transduction ; **A** description
5 ref. R plasmid multiple resistance (MDR) / extreme resistance (XDR) ; [3 max]
- (ii) 1 gene for fluorescent substance ;
2 source of gene ; e.g. from jellyfish
3 substance fluoresces when exposed to appropriate light ;
or
4 lacZ gene / gene for β -galactosidase ;
5 splits non-blue substrate ;
6 product is blue ; [2 max]

[Total: 15]

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— TUITION —

2	(a)	(i)	same band of DNA as, first / affected, child ;	[1]
		(ii)	1. father and mother, have normal and mutant alleles / a heterozygous ; 2. mutant / CF, DNA is, shorter / lighter 3. therefore travels further	[2 max]
	(b)	1 2 3 4 5 6	outcome of test needs explanation / counsellor gives advice on options ; already have one affected child to care for or problems / cost, of care ; ref. termination ; life expectancy increasing with improved drugs ; gene therapy, not as yet successful / likely to be temporary ; possibility of, pre-implantation genetic diagnosis (PGD) / artificial insemination by donor sperm (AID), on another occasion ;	[4 max]
				[Total: 7]

- 3 (a) (i) 1 anthers, versatile / loosely attached / attached at one point (to filaments) ;
2 anthers / stamens / tassels / androecium, on long filaments / hang out (of flower) ;
3 anthers / stamens / tassels / androecium, above leaves ;
4 stigmas / silks, hang out (of flower) ;
5 stigmas, large surface area / hairy / feathery / branched, (to catch pollen) ; [3 max]
- (ii) *advantages*
1 genetic variation / more diverse gene pool / increased gene pool ;
2 increased heterozygosity ;
3 less likely that harmful recessive alleles will be expressed ;
4 hybrid vigour / decreased inbreeding depression ;
5 ability to respond to changing conditions / named example ;
e.g. different environments / pests / disease / increased survival of offspring [3 max]
- (b) (i) 1 cut DNA (into fragments) ;
2 by, restriction enzymes / named enzyme ;
3 place on (agarose) gel ;
4 apply, current / p.d. / electricity ;
5 fragments travel towards anode ;
6 short fragments travel, further / faster, than long ones ; A mass of fragments
7 visualise DNA with UV light / other means of visualisation ;
8 AVP ; e.g. Southern blotting / described [4 max]
- (ii) 1 change to, primary structure / secondary structure / tertiary structure / folding / 3D shape ;
2 protein / enzyme, cannot carry out its normal function ;
3 (could be an enzyme) that is essential for a metabolic pathway ;
4 (could) control the expression of another gene / series of genes ; [2 max]
- (iii) 1 (only) one base / base pair / triplet, needs to change (for teosinte to become maize) ;
2 idea that this could occur in a natural population of teosinte / mutation ;
3 variant, looks different / easy to spot ;
4 early farmers could have selected it to breed from ;
5 no need for complex breeding programme ; [3 max]

[Total: 15]