Principles of genetic technology

Mark Scheme 1

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Genetic Technology
Sub Topic	Principles of genetic technology
Booklet	Theory
Paper Type	Mark Scheme 1

Time Allowed : **56 minutes**

Score : **/ 46**

Percentage : **/100**

Grade Boundaries:

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

1 **(a** 1 ref. to VNTR (sequences) **;**

2 quantity of DNA increased by PCR **;**

3 DNA fragmented by, restriction enzyme(s) / endonuclease(s) **;**

4 loaded (into wells) in agarose gel **;**

5 (at) negative end / cathode end **;**

6 ref. to buffer / electrolyte **;**

7 direct current applied **;**

8 phosphate groups of DNA give negative charge **;**

9 (negatively charged) DNA attracted to, anode / positive electrode **;**

10 short pieces / smaller mass, move further / move faster **; ora**

11 (pieces) transferred to, membrane / nylon / nitrocellulose / absorbent paper
or
Southern blotting **;**

12 heated to separate strands **;**

13 probes / fluorescent dye, added **;**

14 X-ray film / UV light / lasers **;**

15 pattern of stripes / ref. banding pattern **;** [max 9]

(b) 1 it is identical to human insulin **; ora**

2 (more) rapid response **; ora**

3 no / fewer, immune response / side effects / allergic reactions **; ora**

4 ref. to ethical / moral / religious, issues **; ora**

5 cheaper to produce in large volume / unlimited availability **; ora** **R** cheap to produce

6 less risk of, transmitting disease / infection **; ora**

7 good for people who have developed tolerance to animal insulin **; ora** [max 6]

[Total:15]

2 (a (i) 1. easier to, identify / screen**;**

2. more economical / time saving / labour saving / harmless**;**

3. resistance gene(s) can be passed to other bacteria**;**

4. idea of antibiotics no longer effective
or
requiring development of new antibiotics**;** [2 max]

(ii) 1. promoter, initiates transcription / switches on gene /causes gene expression / AW**;**

2. ref. binding of, RNA polymerase / transcription factors**;**

3. otherwise gene has to be inserted near an existing promoter**;**

4. this is difficult to do / this may disrupt expression of existing gene**;**

5. in eukaryotes precise position of promoter important**;**

6. idea that you need a coral promoter to switch on a coral gene**;** [3 max]

(b) (1. DNA fragmented by, restriction enzyme(s) / endonuclease(s)**;**

2. loaded (into wells) at, negative end / cathode end, (of gel)**;**

3. ref. buffer / electrolyte**;**

4. phosphate groups of DNA give negative charge**;**

5. (negatively charged) DNA attracted to, anode / positive electrode**;**

6. separation due to, electric field / PD / potential difference**;**

7. short pieces / smaller mass, move further (in unit time) / move faster**; ora**

8. ref. impedance of gel / AW**;** [4 max]

(ii) 1. idea of comparison of position with reference DNA**;**

2. ref. staining / fluorescence in UV**;**

3. by use of DNA probe**;**

4. ref. single-stranded / complementary base pairing**;** [2 max]

(c) 1. allows estimate of numbers of each type;

2. to check success (of release of sterile males);

3. if sterile males wrongly identified as wild;

4. there will be a waste of resources, e.g. pesticides;

5. if wild males wrongly identified as sterile males;

6. a potential infestation may be missed;

7. AVP**;** e.g. to determine which moths to (re)release [2 max]

(d) 1. that DsRed is not toxic to predators of the moth;

2. that DsRed does not persist in the environment;

3. that the gene cannot pass to other organisms;

4. does not alter, food web / ecosystem, (in harmful way); [2 max]

[Total: 15]

3 **(a** 1. VNTRs with more repeats are, longer / greater mass ; **ora**

2. phosphate groups (of DNA) give negative charge ;

3. fragments / DNA, attracted to, anode / positive electrode ;

4. Shorter / lower mass / fewer repeat, pieces move, faster / further in unit time; **ora**

5. ref. impedance of gel / AW ; [3 max]

(b) *N.B. answer on Fig 3.2*
one band in exactly same place as given band ; *may be drawn thinner*

second band above the first ; [2]

(c) *to identify*
1. a carrier / heterozygote, before marriage ;

2. a carrier / heterozygote, before conceiving child ;

3. HbS HbS child *in utero* re: termination ;

4. HbS HbS child at birth re: treatment ;

5. ref. genetic counselling ; [3 max]

[Total: 8]

4 **(a** 1. sequence of, bases / nucleotides, in the original DNA strand(s) ;

2. complementary base-pairing ;

3. A with T and C with G ;

4. purine with pyrimidine ;

5. 2 H-bonds and 3 H-bonds ; *allow marks from annotated diagram* [2 max]

(b) chance / random ;
only present in low concentration ; [2]

(c) **(i)** ATCGAT / in order of size starting with shortest ; [1]

(ii) 1. fragments are separated according to, length / mass ;

2. phosphate groups (of DNA) give negative charge ;

3. fragments move to, anode / positive electrode ;

4. short / light, fragments move, faster / further in unit time / **ora** ;
must be comparative

5. ref. impedance of gel / AW ; [3 max]

[Total: 8]