Genetic technology applied to medicine
Mark Scheme 2

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Genetic Technology
Sub Topic	Genetic technology applied to medicine
Booklet	Theory
Paper Type	Mark Scheme 2

Time Allowed :   47   minutes

Score   :   / 39

Percentage   :   /100

Grade Boundaries:

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

Question 1

(a) peptide bonds between amino acids ;
primary structure / amino acid sequence determines folding sites ;
hydrogen bonds maintain (secondary structure) ;
ref. beta pleated sheet / alpha helix ;
ref. folding to form tertiary structure / globular shape ;
sulphur bridges / ionic bonds / Van de Waals forces / hydrophobic
interactions ;

3 max

(b) reverse transcriptase / synthesise DNA from mRNA ;
restriction endonuclease / enzyme ;
produces sticky ends ;
plasmid cut by restriction enzyme ;
recombinant DNA formed ;
DNA ligase (correct ref) ;
DNA inserted into host e.g. Hamster kidney / ovary cells ;
Detail of insertion e.g. electric shock / calcium ions.

4 max

(c) no contamination / ref. named infection HIV / reduced rate of infection /
greater production rate ;   **1**

(d) ref. to introns and exons / only mammalian cells have Golgi / enzymes (for
post translational modification) ;

1

Total: 9

2 **(a (i)** *reverse transcriptase*: produces (c)DNA from mRNA **;**

DNA polymerase: produces double stranded DNA from, single stranded (DNA) / cDNA **;**

restriction enzyme: cuts, DNA / plasmid **;**

DNA ligase: joins (gaps in) the sugar-phosphate backbone (of DNA) **;**   [4]

(ii) 1   causes blood glucose <u>concentration</u>, to decrease / return to normal (from high) **;**

2   (target cells are) liver / muscle **;**

3   increased, absorption of glucose (from blood) / permeability of cell surface membrane to glucose **;**

4   increased (rate of) respiration of <u>glucose</u> **;**

5   *idea of* increased conversion of glucose to glycogen **;**

6   inhibits secretion of glucagon / decreased gluconeogenesis **;**   [max 3]

(ii) 1   identical to that produced by body **;**
2   activity the same / fast response / no immune response **;**

3   no need for animal insulin / AW **;**
4   for religious reasons / for ethical reasons / for e.g. vegetarian **;**

5   uncontaminated / pure **;**
6   so no risk of disease **;**

7   production very efficient / always available **;**
8   extraction from animals, costly / complex / limited by supply of animals **;**   [max 2]

(b) (i) *insulin **X** ora throughout for human insulin*

1   greater initial increase in activity / AW **;**

2   time of maximum activity / peak, earlier **;** [1.9h v. 3h]

3   maximum activity / peak, greater **;** [9.4 v 5.4 (a.u.)]

4   rate of decrease greater **;**

5   activity always higher **;**

6   comparative figures **;** [see above]   [max 4]

(ii) 1   changes, tertiary / 3D structure **;**

2   affects binding to receptor (on cell surface membrane) **;**

3   (this) affects production of second messenger **;**

4   hydrophilic / hydrophobic, bonds different **;**

5   AVP **;** e.g. may affect, solubility in blood / transport in blood / rate at which broken down   [max 2]

[Total: 15]

3 **(a)** 1. (CF caused by) <u>mutation</u> ;

2. of CFTR gene

3. (CFTR) protein defective

4. (so) insert, normal / dominant, (CFTR) <u>allele</u>

5. into DNA **A** chromosome

6. in cells of respiratory system   **A** named part of airway   **Ignore** alveoli

7. ref. to <u>vector</u>

8. taken as spray / inhaled

9. use liposomes

10. use harmless viru

11. not all cells take up viru

12. may have unpleasant side-effect

13. effects are short-lived / treatment needs repeatin   [max 8]

(b) *counsellor:*

1. ref. to pedigree analysis

2. ref. to genetic screening / DNA analysis

3. detail of genetic screening   e.g. tissue samples from adults / IVF and test embryos/ amniocentesis

4. explains results of test *I* estimates chances of having affected child ;

5. (may discuss) termination

6. (may discuss) alternative, therapi   *I* treatments ;

7. (may discuss) financial implications (of having affected child)

8. (may discuss) the effect of having affected child on existing siblings

9. (may discuss) ethical issues   *max 6*

couple referred if:

10. either has genetic disease (in family) or are carrier

11. history of recurrent miscarriage

12. older woma   [max 7]

                                                                                                [Total: 15]