



# **The Australian Education Academy Pty Ltd 2006**

## **BIOLOGY**

### **TRIAL EXAMINATION UNIT 4 - Solutions**

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## SECTION ONE

| QUESTION<br>NUMBER | ANSWER |
|--------------------|--------|
| 1                  | D      |
| 2                  | C      |
| 3                  | A      |
| 4                  | D      |
| 5                  | D      |
| 6                  | A      |
| 7                  | B      |
| 8                  | B      |
| 9                  | A      |
| 10                 | C      |
| 11                 | B      |
| 12                 | C      |
| 13                 | B      |
| 14                 | B      |
| 15                 | C      |
| 16                 | C      |
| 17                 | A      |
| 18                 | B      |
| 19                 | A      |
| 20                 | C      |
| 21                 | B      |
| 22                 | B      |
| 23                 | A      |
| 24                 | C      |
| 25                 | A      |

**Total (25 marks)**

## SECTION TWO

### Question 1

- (a) DNA or deoxyribonucleic acid (1 mark)
- (b) Genetic code (1 mark)
- (c) Recombinant DNA (1 mark)
- (d) Genetic engineering (1mark)
- (e) The human insulin gene is isolated and inserted into a bacterial plasmid.  
The genetically engineered plasmid is taken up by the bacterial cell and is now capable of producing insulin.  
When they reproduce new generations will contain the human insulin gene. (2 marks)
- (f) Restriction enzymes: DNA and plasmid are cut with the same restriction enzyme to reveal complimentary sticky ends  
DNA ligase: Joins the DNA and plasmid together

(2 marks)  
**(Total 8 marks)**

### Question 2

(a)

| Stage of protein Synthesis |
|----------------------------|
| 2                          |
| 6                          |
| 1                          |
| 3                          |
| 5                          |
| 7                          |
| 4                          |

(1/2 a mark each, total 3.5 marks)

- (b) A frame shift mutation will result when a nitrogenous base is added or deleted to the sequence of nitrogenous bases. This will result in the entire "reading frame" being shortened or lengthened, which will result in a polypeptide being synthesised with an almost completely different amino acid sequence. The effects of this kind of mutation are much more significant than those of a point mutation, which changes just one nitrogenous base in a position, and may or may not change an amino acid.
- (2 marks)

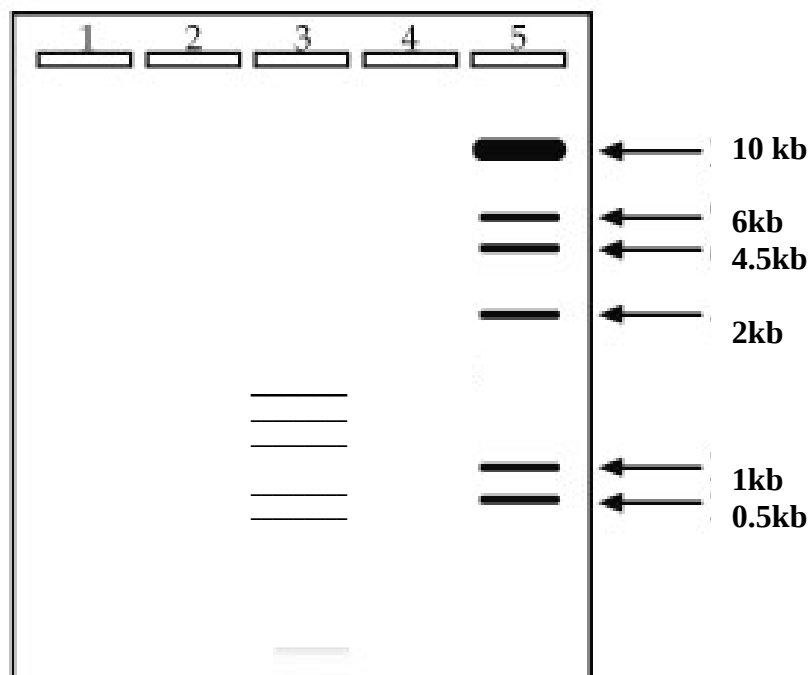
- (c) There are 20 amino acids and 64 possible codon combinations. There more than on codon can code for a particular amino acid which means is a mutation occurs to one base they same amino acid and therefore protein may be produced.

(2 marks)

**(Total 7.5 marks)**

### Question 3

(a)



(1/2 marks each, total 2.5 marks)

- (b) DNA fragments have a negative charge and therefore move along the current towards the positive pore. The smaller the DNA fragment the further it will move along the gel.
- (2 marks)

- (c) i. Will have 4 strands: 400, 1300, 1500 and 1700bp's
- ii. Will have 2 strands 900 and 4000 bp's

iii. One strand 4900 bp's

(3 marks)

**(Total 7.5 marks)**

#### Question 4

(a)

|                     | Pedigree A | Pedigree B | Pedigree C |
|---------------------|------------|------------|------------|
| Autosomal Recessive | yes        | yes        | yes        |
| Autosomal Dominant  | yes        | yes        | no         |
| X-linked Recessive  | yes        | yes        | no         |
| X-linked Dominant   | no         | no         | no         |

(3 marks)

(b) Each child is independent of the other children therefore the chance of the third child having the disease is  $1/4$  or 0.25

(2 marks)

(c)  $1/2$  or 0.5 chance. The females are not included in the percentages as they know it will be a boy.

(2 marks)

(d) i. If this were an autosomal dominant gene it would have had to show up in III1

(1 mark)

ii. Autosomal recessive

(1 mark)

**(Total 9 marks)**

#### Question 5

(a) Normal body colour: C or N or any reasonable suggestion  
Black body colour: c or n or any reasonable suggestion  
Normal wings: W or any reasonable suggestion  
Vestigial wings: w or any reasonable suggestion

(1/2 marks each, total 2 marks)

- (b) If unlinked:  
P: NNWW x nnww
- All F1: NnWw
- Data cross NnWw x nnww
- F2: 1 NnWw (wild type): 1 Nnww (Normal, vestigial): 1 nnWw (Black, normal): 1: nnww Black, vestigial) ( 3 marks)
- This shows that the genes are not linked as the data is approximately displaying the ratios of unlinked genes.
- (c) 2/3 as black body colour (homozygous recessive) has no chance of being heterozygous and therefore is not included.

(2 mark)  
**(Total 7 marks)**

### Question 6

(a)

| Skull sample | Hominid species |
|--------------|-----------------|
| 1            | H. sapiens      |
| 2.           | A. africanus    |
| 3.           | A. afarensis    |
| 4.           | H. erectus      |

(1/2 marks each, total 2 marks)

- (b) Any of:  
- Brow ridge absent  
- Large brain case  
- Any other reasonable suggestion (1 mark)
- (c) Potassium/ argon dating as the fossil is around 2 million years old (1 marks)
- (d) To determine a relative age of the fossil, an index fossil may be used. Stratigraphy which states that the oldest stratum is at the bottom and the younger layers lie above can also be used. (1 mark)
- (e) Any of the following:  
- Before fossilisation the individual was partially eaten or decomposed

- Its bones were scattered by water/ predators.
- After fossilisation the fossil could have been broken or destroyed by Earth's movements

(1 mark)

(f) Humans have the advantage of:

Any of the following:

- Free hands for carrying, using weapons, making tools
- More efficient locomotion for low speed, long distance movement by walking
- Seeing above grass to detect predators or locate food

(1 mark)

- (g) - Two populations become isolated from one another.  
- There is selection for different characteristics in the two populations. The different selection pressures in each environment results in the two populations becoming distinct from one another  
- Over time the differences become so large that they are unable to interbreed and produce fertile offspring

(3 marks)

(h) The loss of alleles from a population

(1 mark)

**(Total 11 marks)**