# VCE BIOLOGY 2011

# YEAR 12 TRIAL EXAM UNIT 4



## Time allowed: 90 minutes
## Total marks: 75

25 Multiple Choice Questions
7 Short Answer Questions

**An Answer Sheet is provided for Section A.**
**Answer all questions in Section B in the space provided.**

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**Student Name....…….....**

# VCE Biology 2011 Year 12 Trial Exam Unit 4

There are 25 **Multiple Choice Questions** to be answered by circling the correct letter in the table below. Use only a 2B pencil. If you make a mistake, erase it and enter the correct answer. Marks will not be deducted for incorrect answers.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Question 1* | A | B | C | D | *Question 2* | A | B | C | D |
| *Question 3* | A | B | C | D | *Question 4* | A | B | C | D |
| *Question 5* | A | B | C | D | *Question 6* | A | B | C | D |
| *Question 7* | A | B | C | D | *Question 8* | A | B | C | D |
| *Question 9* | A | B | C | D | *Question 10* | A | B | C | D |
| *Question 11* | A | B | C | D | *Question 12* | A | B | C | D |
| *Question 13* | A | B | C | D | *Question 14* | A | B | C | D |
| *Question 15* | A | B | C | D | *Question 16* | A | B | C | D |
| *Question 17* | A | B | C | D | *Question 18* | A | B | C | D |
| *Question 19* | A | B | C | D | *Question 20* | A | B | C | D |
| *Question 21* | A | B | C | D | *Question 22* | A | B | C | D |
| *Question 23* | A | B | C | D | *Question 24* | A | B | C | D |
| *Question 25* | A | B | C | D | | | | | |

# VCE Biology 2011 Year 12 Trial Exam Unit 4

## SECTION A – Multiple Choice Questions

*Questions 1 and 2 refer to* **Figure 1**, *a diagram of DNA.*

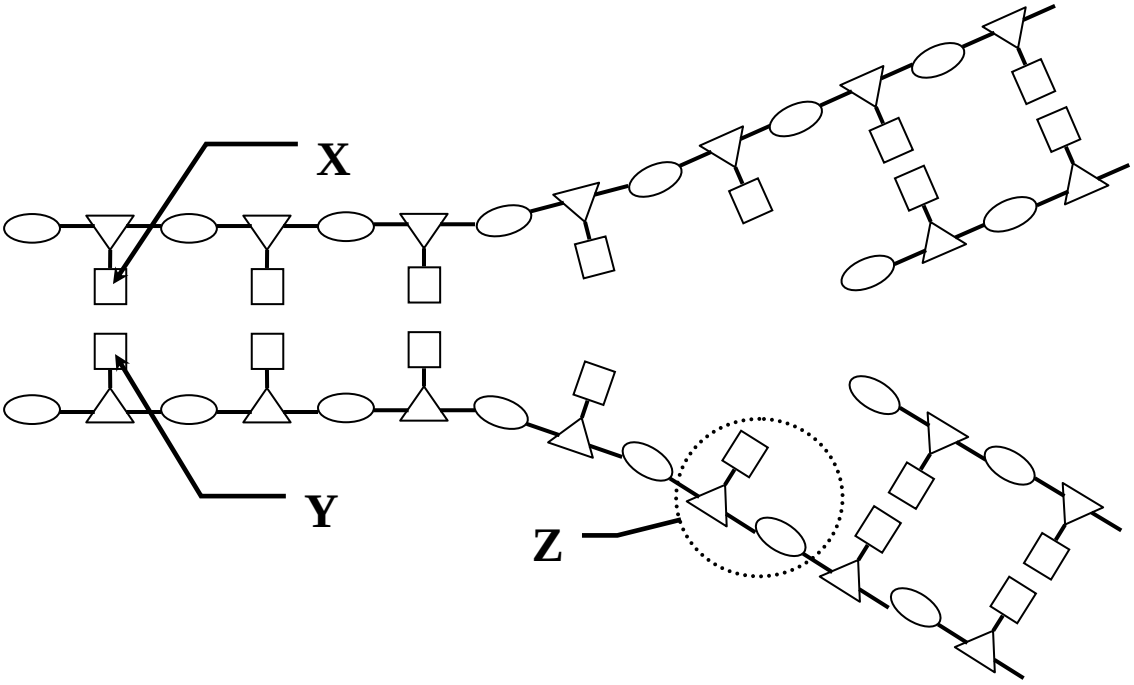



**Figure 1**

**Question 1**
Which statement is correct?
A. The diagram shows a stage in protein synthesis.
B. The triangle shapes represent deoxyribose.
C. X and Y could be adenine and guanine.
D. The basic unit of DNA, indicated by Z, is an amino acid.

**Question 2**
The process shown in the diagram
A. will result in two identical molecules of RNA.
B. will result in equal amounts of thymine and cytosine.
C. can only occur in the presence of DNA polymerase.
D. will result in the formation of a polypeptide.

**Question 3**
Protein synthesis requires a system that can store, copy and move information, as well as the ability to assemble the building blocks of a protein in the correct sequence. In the process of protein synthesis

A. double-stranded mRNA moves from the nucleus to the ribosome.
B. mRNA binds with tRNA during transcription.
C. amino acids are created at the ribosome.
D. complementary base pairing ensures that the correct anticodon attaches to a codon.

**Question 4**
Early in embryonic development, every cell in the embryo is a stem cell and has the potential to become any tissue type in the body. Later, the range of tissue types that the cell can differentiate into becomes much smaller. Totipotent stem cells can differentiate into any cell type, whereas pluripotent stem cells can differentiate into a limited number of cell types. Differentiated cells lose the ability to become other cell types.

Muscle cells and nerve cells are able to differentiate from stem cells because

A. muscle cells contain different genes to nerve cells.
B. genes can be switched on and off in cells.
C. the same gene can result in different proteins in different cells.
D. muscle cells and nerve cells are stem cells.

**Question 5**
Forensic science is the study of evidence related to crime. The scientist collects the DNA from the crime scene and compares it with the DNA of suspects. Among the available techniques to the scientist is PCR.
PCR

A. stands for polymer chain replication.
B. is used to make protein molecules bigger.
C. cannot use any type of DNA polymerase because the heat would denature the enzyme.
D. doubles the number of DNA molecules each cycle.

**Question 6**
A restriction enzyme was added to a bacterial plasmid which produced fragments of differing size. Gel electrophoresis was used to separate the fragments. DNA fragments of known size (see **Figure 2**) were put in the left track. A power pack was attached.

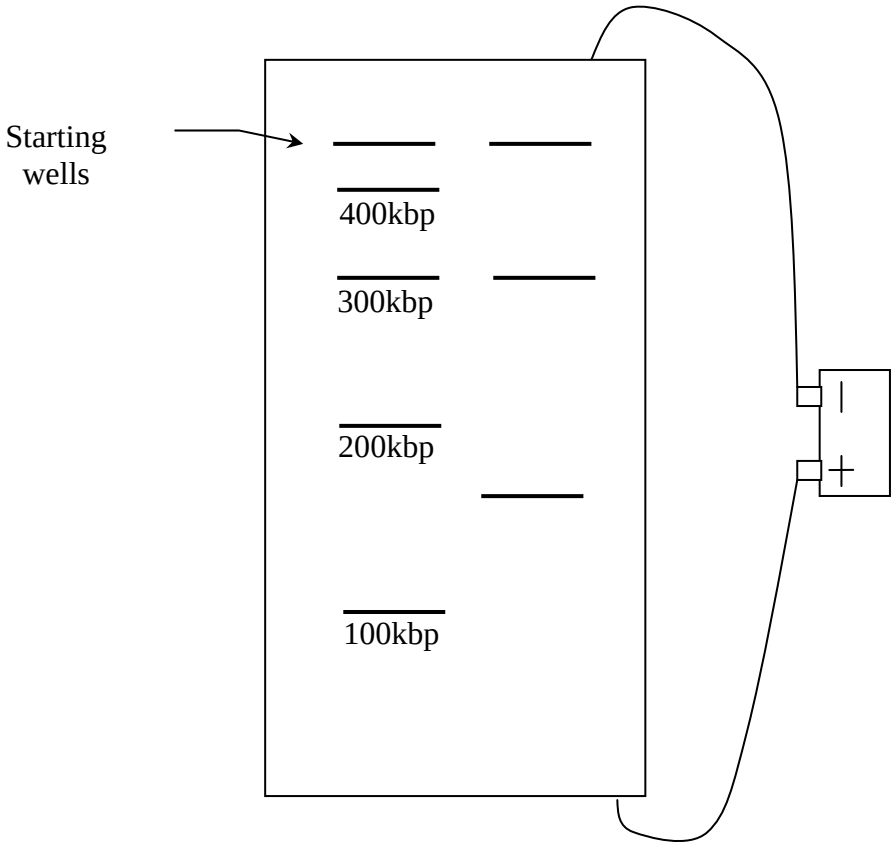



**Figure 2**

Which statement is correct?
A. The restriction enzyme cut the DNA at two sites.
B. The total size of the plasmid is approximately 450 kb.
C. The fragments travel from the negative end towards the positive end of the gel.
D. All of the above.

**Question 7**
Sweet corn is a plant that is susceptible to attack by insects. This can make the corn ear unsightly and consumers are less likely to purchase the corn. Farmers in the past have had to spray insecticide onto the corn a number of times to kill the insects. *Bacillus thuringiensis*, simply known as Bt, is a bacterium that produces a naturally occurring insecticide. Scientists have cut the insecticide gene from the bacterial DNA and spliced it into the sweet corn DNA.

Which statement is correct?
A. DNA from a prokaryote cannot function in a eukaryote.
B. The insects can never evolve resistance to the Bt insecticide gene.
C. The Bt insecticide does not kill desirable insects that eat other pests.
D. The transgenic sweet corn will be able to produce a new generation that contains the Bt insecticide gene.

**Question 8**
**Figure 3** represents a cell with a diploid number of four during cell division.

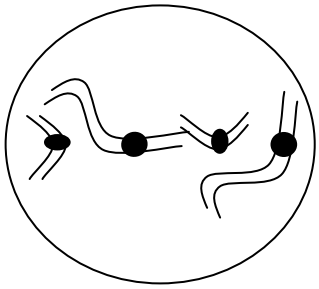


**Figure 3**

The cell is
A. in metaphase of mitosis.
B. in metaphase I of meiosis.
C. in metaphase II of meiosis.
D. haploid.

**Question 9**
Processes occur during some stages of meiosis which act as a source of genetic variation. Selection pressures then act on any different phenotypes that may result.
Which stage of meiosis is **least** likely to result in genetic variation?
A. Interphase I.
B. Metaphase I.
C. Prophase I.
D. Telophase I.

**Question 10**
The feature that distinguishes sexual reproduction from asexual reproduction is the former requires the fusing of gametes to form a zygote. This would cause a problem with regard to the chromosomes were it not for the process of meiosis.
Meiosis results in
A. haploid (N) cells with half the number of chromosomes.
B. diploid (2N) gametes.
C. four cells with the same number of chromosomes as the parent cell.
D. cells that are identical to the parent cells.

*Questions 11 and 12 refer to **Table 1**.*
Chromosomes of a cell can be photographed and rearranged in a table. **Table 1** is a simplified representation.

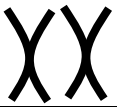
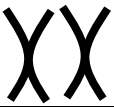
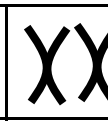
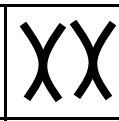
| | | | | | | | |
|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  |  |  |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|  |  |  |  |  |  |  |  |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|  |  |  |  |  |  |  | |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | |

**Table 1**

**Question 11**
Arrangement of the chromosomes in this way is called a
A. karyotype.
B. phase indicator.
C. chromatophore.
D. prokaryote.

**Question 12**
The chromosomes in the table indicate that the person
A. is female.
B. has Turner's syndrome.
C. has Klinefelter's syndrome.
D. has Down syndrome.

**Question 13**
A colony of honey bees contains one queen bee. Her unfertilised eggs become males, called drones. If she mates with a drone, her fertilised eggs become female bees, called workers. Workers are infertile unless fed an exclusive diet of royal jelly in which case the worker develops into a queen bee.
Which statement is incorrect?
A. A drone has no father and cannot produce sons, but has a grandfather and may have grandsons.
B. A drone produces sperm by mitosis.
C. The somatic cells of worker bees are diploid.
D. Queen bees are able to produce both sperm and eggs.

**Question 14**
A person has two green eyes except that one of their eyes is partly brown. The brown coloration is caused by a mutation. The mutation
A. must have occurred in the previous generation.
B. must have occurred during meiosis.
C. occurred in a single eye cell.
D. will follow the germ line.

**Question 15**
Himalayan rabbits grow white fur all over when they are in an environment of $35^0$C or above. At lower temperatures the rabbit grows black hair on its extremities, as shown in **Figure 4.**

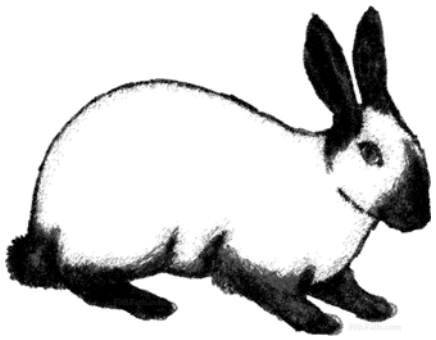


**Figure 4**

Which statement is correct?
A. If a cool bag is attached to the rabbit's back, it will not grow a black patch on its back.
B. Fur colour is not determined by the action of genes.
C. Some genes can be switched on and off by the environment.
D. The rabbit's ears have a small surface area for their volume.

**Question 16**
Mutations have been occurring in DNA forever, although some aspects of modern life may increase the frequency of DNA mutations. Which of the following cannot produce mutations in DNA?
A. Transcription during protein synthesis.
B. Radioactivity during dental X-rays.
C. Ultraviolet (UV) radiation during sunbathing.
D. DNA replication during interphase of mitosis.

**Question 17**
In humans, acondroplasia, or dwarfism, is dominant over normal height. A homozygous dominant person dies before the age of one. A heterozygous person is dwarfed. A dwarf man marries a dwarf woman. Their first child is of normal height.
Which statement is true?
The chance of the couple's second child being born of normal height is
A. one half.
B. one quarter.
C. one sixteenth.
D. zero.

**Question 18**
In summer squash, white fruit colour (W) is dominant over yellow fruit colour (w) and disk-shaped fruit (D) is dominant over sphere-shaped fruit (d).
A plant with genotype **Wwdd** is crossed with a plant that is heterozygous for both traits. The chance of producing an offspring that has white, sphere-shaped fruit would be

A. $^1/_8$
B. $^3/_8$
C. $^1/_4$
D. $^3/_4$

**Question 19**
Snapdragon is a flowering plant with flower colour under control of two alleles at one locus. Let us assign the symbol $\mathbf{S_r}$ to the allele that codes for the production of red pigment. Also, let us assign the symbol $\mathbf{S_w}$ to the allele that codes for no pigment production (white). Phenotypes resulting from particular genotypes are listed in **Table 2**.

| Genotype | Phenotype |
|---|---|
| $S_rS_r$ | red flowers |
| $S_rS_w$ | pink flowers |
| $S_wS_w$ | white flowers |

**Table 2**

Heredity of colour in snapdragons is an example of

A. incomplete dominance.
B. co-dominance.
C. continuous variation.
D. multiple alleles.

**Question 20**
Colour blindness is a X-linked, recessive genetic condition.

Which statement is **incorrect**?

A. Colour-blind fathers cannot pass the colour-blindness gene to their sons.
B. More males than females suffer from colour-blindness.
C. The son of a colour-blind mother may have normal vision.
D. The colour-blindness gene is located on the X chromosome.

**Question 21**
The wing of a wedge-tailed eagle (a bird) and the wing of a ghost bat (a mammal) perform the same function. That is, for flight.

Which statement is correct? The wings are
A. analogous structures because they have been inherited from a recent common ancestor.
B. analogous structures because they have not been inherited from a recent common ancestor.
C. homologous structures because they have been inherited from a recent common ancestor.
D. homologous structures because they have not been inherited from a recent common ancestor.

**Question 22**
Consider the following taxonomic technique.

- DNA is collected from two organisms, P and Q.
- The DNA is heated until the double-stranded DNA becomes single-stranded.
- The single-stranded DNA from P and Q are allowed to mix, thus forming some double-stranded DNA from both P and Q.
- The temperature at which the strands separate is a measure of how many base pairs are complementary.

In this way, it has been found that approximately 98% of the DNA is the same in chimpanzees and humans.

The technique described above is
A. the study of homology.
B. the study of patterns of embryonic development.
C. DNA hybridization.
D. divergent evolution.

**Question 23**
While Charles Darwin was formulating his theory of natural selection, he became interested in bird breeding. Darwin bred pigeons to show that change in a species could occur by artificially selecting a desirable trait.
Which of the following statements about artificial selection is **incorrect**? Artificial selection
A. requires some variation in the population.
B. is a continuation of the natural evolutionary process.
C. is a form of directional selection.
D. can oppose natural selective pressures that would remove a phenotype.

**Question 24**
Primates have features in common that enable them to be classified together. As the hominin group evolved separately, it developed new characteristics. Which of the following hominin characteristics developed first?
A. More erect stance.
B. Tool making.
C. Communication with language.
D. Larger brain.

**Question 25**
Human evolution occurred over a long period of time. Nomadic scavengers became hunters and gatherers. Subsequently the development of agriculture meant that these people could settle in one place. There were changes in rituals, tools and art.

The changes in rituals, tools and art are examples of
A. convergent evolution.
B. co evolution.
C. genetic drift.
D. cultural evolution.

## End of Section A

# VCE Biology 2011 Year 12 Trial Exam Unit 4

## SECTION B – Short Answer Questions

**Question 1**

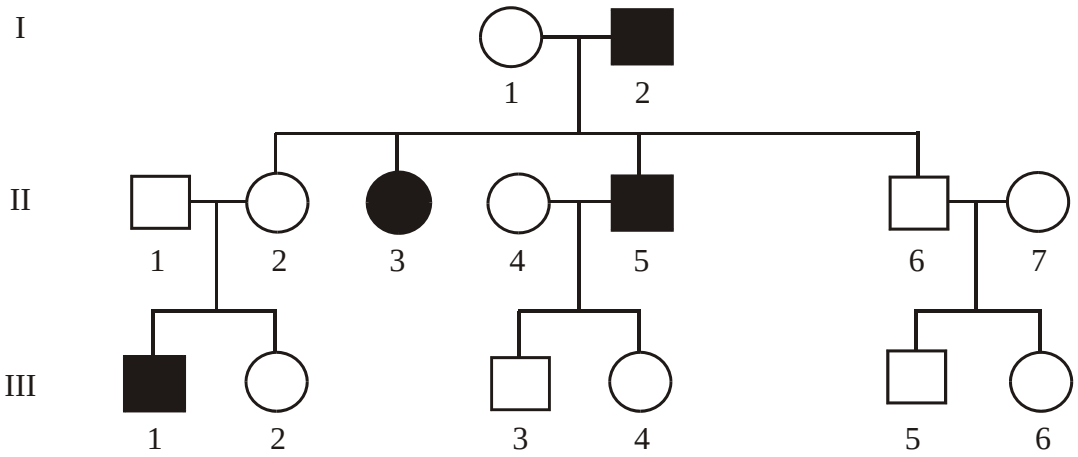



**Figure 5**

The pedigree shown in **Figure 5** illustrates the trait of haemophilia in a family for three generations. The gene for haemophilia is located on the X chromosome.

a. Is haemophilia a dominant or recessive condition? Use evidence from the pedigree to justify your answer.

_____

_____

_____

_____

**(2 marks)**

b. From whom did individual II-5 get the haemophilia allele? Justify your choice.

_____

_____

_____

**(2 marks)**

c. Using the example in the pedigree, explain why fewer females than males suffer from haemophilia.

_____

_____

_____

**(1 mark)**

***Total = 5 marks***

**Question 2**

Cystic fibrosis is an autosomal recessive genetic allele that results from a mutation. About 1 in 25 people have one copy of the mutated allele and are carriers with no symptoms. Cystic fibrosis causes symptoms throughout the body, mainly as a result of thickened mucus. The most common form of cystic fibrosis is caused by the deletion of three bases.

Use **Table 3** to help answer the questions.

| mRNA CODE FOR AMINO ACIDS | | | | | | | |
|---|---|---|---|---|---|---|---|
| UUU | Phe | UCU | Ser | UAU | Tyr | UGU | Cys |
| UUC | Phe | UCC | Ser | UAC | Tyr | UGC | Cys |
| | | UCA | Ser | | | | |
| | | UCG | Ser | | | | |
| UUA | Leu | | | UAA | STOP | UGA | STOP |
| UUG | Leu | | | UAG | STOP | UGG | Trp |
| CUU | Leu | CCU | Pro | CAU | His | CGU | Arg |
| CUC | Leu | CCC | Pro | CAC | His | CGC | Arg |
| CUA | Leu | CCA | Pro | CAA | Gln | CGA | Arg |
| CUG | Leu | CCG | Pro | CAG | Gln | CGG | Arg |
| AUU | Ile | ACU | Thr | AAU | Asn | AGU | Ser |
| AUC | Ile | ACC | Thr | AAC | Asn | AGC | Ser |
| AUA | Ile | ACA | Thr | AAA | Lys | AGA | Arg |
| AUG | START/ Met | ACG | Thr | AAG | Lys | AGG | Arg |
| GUU | Val | GCU | Ala | GAU | Asp | GGU | Gly |
| GUC | Val | GCC | Ala | GAC | Asp | GGC | Gly |
| GUA | Val | GCA | Ala | GAA | Glu | GGA | Gly |
| GUG | Val | GCG | Ala | GAG | Glu | GGG | Gly |

| AMINO ACIDS | |
|---|---|
| Ala | Alanine |
| Arg | Arginine |
| Asn | Asparagine |
| Asp | Aspartate |
| Cys | Cysteine |
| Gln | Glutamine |
| Glu | Glutamate |
| Gly | Glycine |
| His | Histidine |
| Ile | Isoleucine |
| Leu | Leucine |
| Lys | Lysine |
| Met | Methionine |
| Phe | Phenylalanine |
| Pro | Proline |
| Ser | Serine |
| Thr | Threonine |
| Trp | Tryptophan |
| Tyr | Tyrosine |
| Val | Valine |

**Table 3**

The following sequence of mRNA bases is from a normal allele. The rectangle indicates the three bases that are deleted in the mutation that causes cystic fibrosis.

A U C  A U C  U U U  C C U  C A A

a. Going from left to right, fully name the amino acids that make up this part of the polypeptide in a cystic fibrosis sufferer.

_____

_____

**(1 mark)**

There are over one thousand amino acids coded for in the complete gene. This product is called cystic fibrosis transmembrane regulator (CFTR) which forms a membrane channel for chloride ions.

b. State two structural differences between the normal CFTR and the abnormal CFTR that would cause the abnormal CFTR to not work properly.

_____

_____

**(2 marks)**

**Figure 6** shows the production of the CFTR polypeptide.

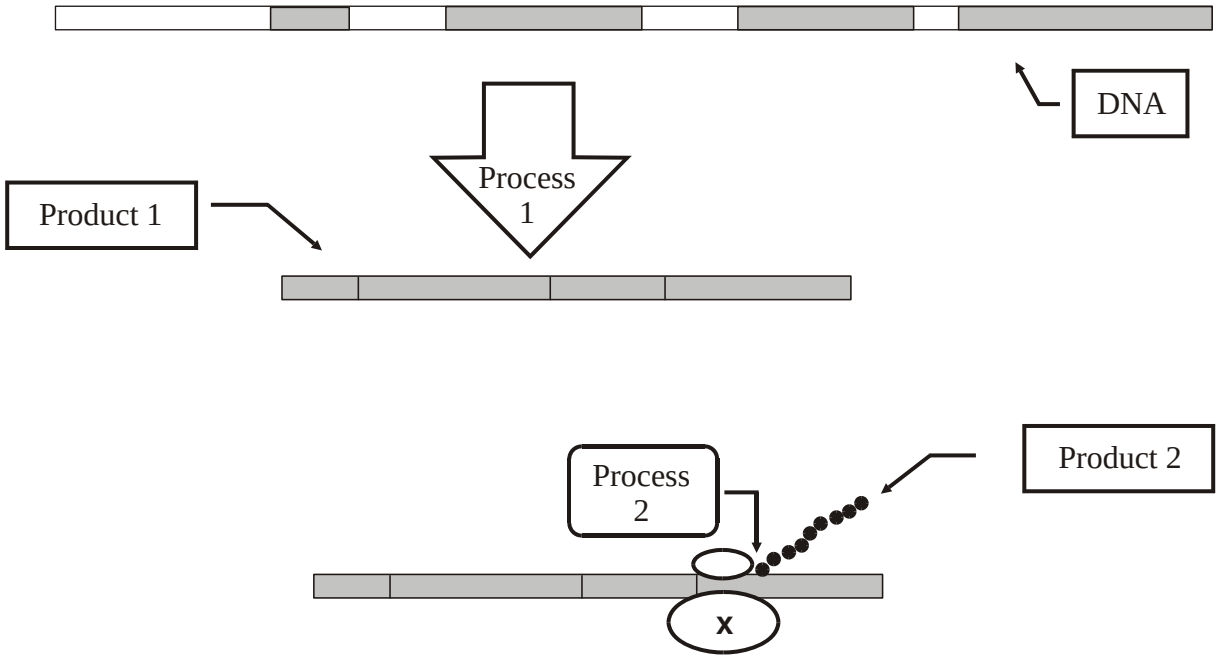



**Figure 6**

c. Name the processes, products and structure by completing the table.

| | |
|---|---|
| Process 1 | i. |
| Process 2 | ii. |
| Product 1 | iii. |
| Product 2 | iv. |
| Structure X | v. |

**(3 marks)**

d. What do the white areas on the DNA represent?

_____

**(1 mark)**

***Total = 7 marks***

**Question 3**

A scientist was investigating a gene involved in neuron functioning. It was found that there were two alleles for this gene. The allele for normal functioning consisted of 700 base pairs, and the mutant allele that caused impaired functioning consisted of 1300 base pairs. The mutant phenotype is recessive. People suffering from the condition have trouble with fine motor skills because of tremors. Symptoms of the disorder may not appear until after childhood.

A family with a history of the disorder decided to be tested to find out which members, if any, had the mutant allele. The test involved DNA fragments from each family member and gel electrophoresis. The results are shown in **Figure 7.**

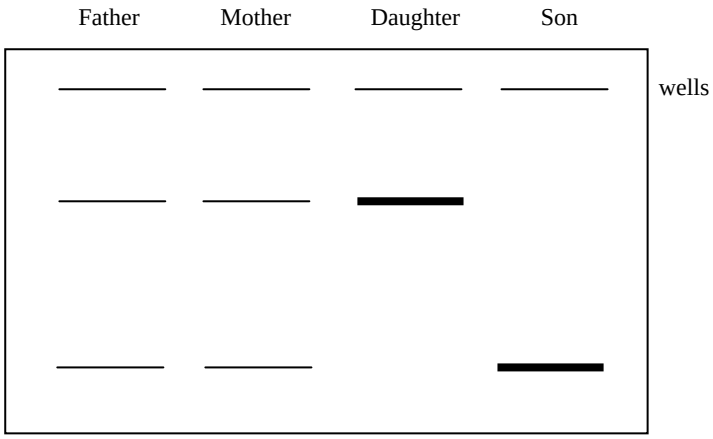



**Figure 7**

a. What property of DNA causes it to move during electrophoresis?

_____

**(1 mark)**

b. Which family members are heterozygous for the trait?

_____

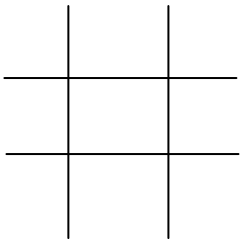
**(1 mark)**

c. Which family members, if any, have the disorder?

_____

**(1 mark)**

d. The son meets a woman who has the disorder and they have a child. What are the chances that the child will have the disorder? Justify your answer, using a Punnett square.



_____

**(2 marks)**

***Total = 5 marks***

**Question 4**

The information below shows a length of DNA from a cocoa plant. The section in bold is a gene that codes for chocolate flavour.

GGTTCATGGCCTATTAGCCTTACGGTACTTAATTAAGTTC**GGGATGCCGCGGTA GTACGTATAGCTAAGCTAGCTTCTAGGGATCTAGTAGCTATATCGATCGATA TAGCTATCCCGGGCTAAAGTCGATCGTTATCGGTAT**CGCTTAATTAACTAGAT CGTATCCGCGGCTAGGCTATATCGGCTCTCTAGAGCTTCTCTCTCGGATC

Cutting sites of certain restriction enzymes are listed in **Table 4.**

| Name | Cutting site |
|---|---|
| Ksp1 | C C G C G G<br>G G C G C C |
| Pac1 | T T A A T T A A<br>A A T T A A T T |
| PaeB1 | C C C G G G<br>G G G C C C |

**Table 4**

a. If a student wished to cut out the gene for chocolate flavouring, which one of the three enzymes above would be best to use? Justify your answer.

_____

_____

_____

_____

**(2 marks)**

b. After cutting, the gene may be inserted into a bacterial plasmid. The circular plasmid will need to be cut to make way for the chocolate gene to be inserted. Does the same cutting enzyme need to be used as was used to cut out the chocolate gene? Explain your answer.

_____

_____

_____

_____

**(2 marks)**

c. The process of inserting genes into bacterial plasmids is successful only part of the time. Only the bacteria containing the new chocolate gene are needed. What is a common way of killing only the bacteria that have not taken up the new gene?

_____

_____

_____

_____

**(2 marks)**

d. The student plans on inserting the chocolate gene into the DNA of a cow so that the cow will produce chocolate milk. In order to maximise the number of cow cells that contain the chocolate gene, what age should the cow be when the gene is inserted? Explain your answer.

_____

_____

_____

_____

**(2 marks)**

***Total = 8 marks***

**Question 5**

A group of mammals lived in a flat region as shown in **Figure 8**. They share common features. Then, over a long period of time, a mountain range was pushed up by the movement of tectonic plates. Two groups now live independently on each side of the mountain. The movement of wind over the mountains produce more rainfall on Population A and desert conditions on Population B.

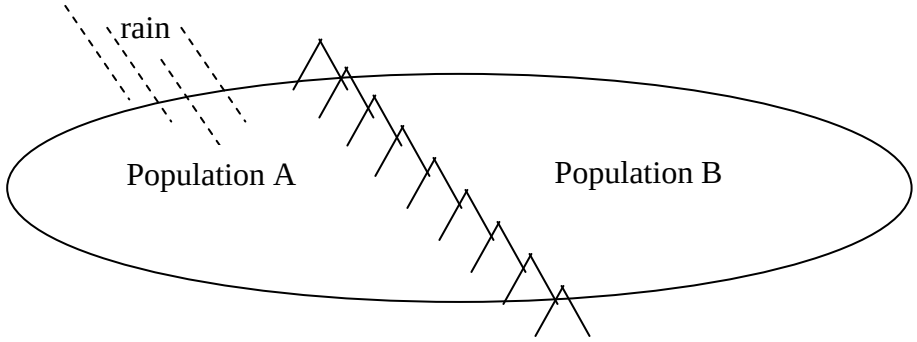



**Figure 8**

a. What test would indicate whether the two populations are one species or two?

_____

_____

**(1 mark)**

b. Define the term subspecies.

_____

_____

_____

**(1 mark)**

c. List three sources of genetic variation in the mammals.

_____

_____

_____

**(3 marks)**

d. Suggest one likely selection agent for change to occur in the mammals. Describe the effect of the selection agent on the mammals.

_____

_____

**(2 marks)**

e. What is the name given to the process that brings about this change?

_____

**(1 mark)**

***Total = 8 marks***

**Question 6**

**Table 5** shows the characteristics of a number of animals. These characteristics are significant in their evolution.

| Animal | Characteristics | | | | | | |
|---|---|---|---|---|---|---|---|
| | backbone | jaws | four limbs | amniotic egg | mammary glands | opposable thumb | upright posture |
| bear | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| human | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| lamprey | ✓ | | | | | | |
| sunfish | ✓ | ✓ | | | | | |
| newt | ✓ | ✓ | ✓ | | | | |
| chimpanzee | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| lizard | ✓ | ✓ | ✓ | ✓ | | | |
| amphioxus | | | | | | | |

**Table 5**

**Figure 9** shows a cladogram representing the evolutionary relationships between the seven vertebrates and amphioxus described in **Table 5**.

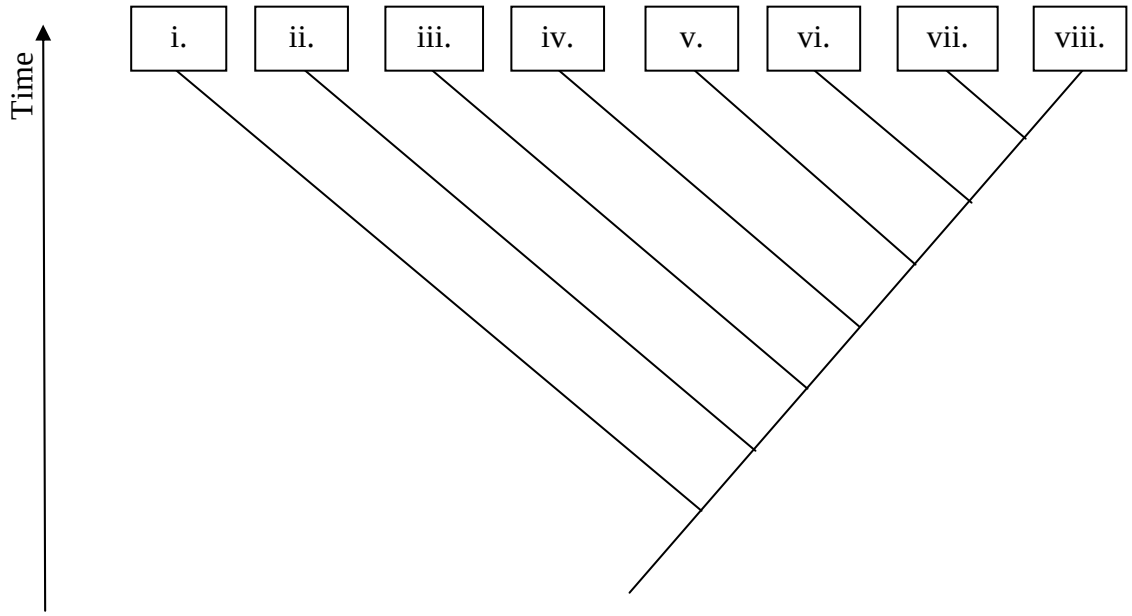



**Figure 9**

a. Indicate where each of the vertebrates goes on the cladogram by filling in the following table.

| | |
|---|---|
| i. | |
| ii. | |
| iii. | |
| iv. | |
| v. | |
| vi. | |
| vii. | |
| viii. | |

**(2 marks)**

b. Which animals are more closely related, the lamprey and sunfish or the lizard and bear? Justify your answer.

_____

_____

**(2 marks)**

c. Define divergent evolution.

_____

_____

_____

**(1 mark)**

d. Define convergent evolution.

_____

_____

_____

**(1 mark)**

e. Explain the term homologous structures. Include in your answer an example from **Table 5** that is supported by the cladogram shown in **Figure 9.**

_____

_____

_____

_____

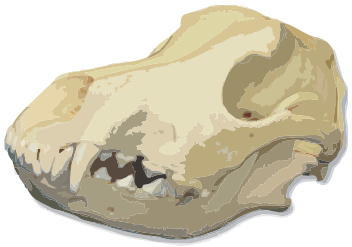
**(2 marks)**

***Total = 8 marks***

**Question 7**
The following four skulls are from a human (*Homo sapiens*), a gorilla (*Gorilla gorilla*), an australopithecine (*Australopithecus afarensis*) and a dog (*Canis familiaris*) .

Skull P

Skull Q



Skull R

Skull S

*A. afarensis* became extinct about 3 million years ago. We know about it because of fossil evidence.

a. What do scientists infer about the anatomy of animals that have large skull crests, prominent eyebrow ridges and large jaws?

_____

_____

_____

_____

**(1 mark)**

b. Why would carbon dating not be used to determine the age of the *A. afarensis* fossil?

_____

_____

_____

**(1 mark)**

c. Identify the four skulls using scientific names.

Skull P _____

Skull Q _____

Skull R _____

Skull S _____

**(2 marks)**

d. Which of the species is not considered to be a primate? Why?

_____

_____

_____

_____

**(2 marks)**

e. Describe three trends in skull anatomy that indicate the evolutionary age of a primate skull.

_____

_____

_____

_____

**(3 marks)**

***Total = 9 marks***

## End of Section B

## End of Trial Exam

# Suggested Answers

## VCE Biology 2011 Year 12 Trial Exam Unit 4

## SECTION A – Multiple Choice Answers

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

## SECTION B – Short Answer (Answers)

**Question 1**

a. Recessive **(1 mark)**. In order for person III-1 to inherit the disease, Person II-2 must carry the allele but does not show symptoms because she also has a normal allele which must be dominant **(1 mark)**.

b. Person II-5 must inherit the disease from his mother, Person I-1. **(1 mark)**
In order for Person II-5 to be male, he must inherit the Y chromosome (which does not include the haemophilia allele) from Person I-2, not their X chromosome (which does include the haemophilia allele). Person I-1 must be a carrier and must have passed the haemophilia allele to Person II-5 **(1 mark)**.

c. Person II-3 is the only female with haemophilia in the pedigree. In order to inherit the disease, she had to receive a haemophilia allele from both parents. Males need only to receive an allele from their mother, so it is more common **(1 mark)**.

**Question 2**

a. Isoleucine, isoleucine, proline, glutamine **(1 mark).**

b. The incorrect order of amino acids **(1 mark)** and the wrong tertiary structure or folding **(1 mark)** will result in a protein channel of the wrong shape and reduce efficiency.

c. i. transcription (and mRNA splicing).
ii. translation.
iii. mRNA.
iv. polypeptide, protein or CFTR.
v. ribosome.
**(3 marks** for all correct**, 2 marks** for 3 or 4 correct**, 1 mark** for less than 3 correct**)**

d. Introns **(1 mark)**.

**Question 3**

a. DNA is negatively charged **(1 mark)**. It is attracted to the positive end of the gel.

b. The mother and father are both heterozygous **(1 mark)**.

c. The daughter is homozygous for the mutant allele and has the disorder **(1 mark)**.

d. Let N = normal and n = mutant allele.

| | N | N |
|---|---|---|
| n | Nn | Nn |
| n | Nn | Nn |

**(1 mark for Punnett square)**

The chances of the child having the disorder is zero **(1 mark)**. All the children are heterozygous. As the normal phenotype is dominant, they are all normal.

**Question 4**

a. Pac1 **(1 mark)**. This enzyme will cut the DNA close to the chocolate flavouring gene while still leaving it complete **(1 mark)**.

b. Using the same restriction enzyme ensures that the gene to be inserted and the plasmid DNA both have the same sticky ends **(1 mark)**. This allows them to join up **(1 mark)**.

c. Insert an antibiotic resistance gene into the same plasmid at the same time **(1 mark)**. Add an antibiotic. Bacteria that don't take up the plasmid will be killed by the antibiotic, whereas bacteria that do take up the plasmid will be resistant to the antibiotic **(1 mark)**.

d. Only some cow cells will take up the chocolate gene. Inserting the gene when the cow is still embryonic will produce the largest number of cells with the chocolate gene **(1 mark)**, as any cow cells that do take up the chocolate gene will pass on that gene to daughter cells in the process of mitosis **(1 mark)**.

**Question 5**

a. If the two groups can interbreed to produce healthy, fertile offspring then they are still one species **(1 mark)**.

b. Distinct populations of a species which may over time give rise to new species if the populations remain isolated **(1 mark)**.

c. Mutation, crossing over, independent assortment **(3 marks)**.

d. Water availability **(1 mark)**. Animals that are unable to cope with little water (or too much water) will die **(1 mark)**. (Or any other sensible answer.)

e. Natural selection **(1 mark)**.

**Question 6**

a. i. amphioxus
ii. lamprey
iii. sunfish
iv. newt
v. lizard
vi. bear
vii. chimpanzee
viii. human **(2 marks** for all correct**, 1 mark** for 1 transposition.)

b. The lizard and bear are more closely related **(1 mark)** because they have a more recent common ancestor **(1 mark)**.

c. Divergent evolution occurs when one ancestral species gives rise to several new species **(1 mark)**.

d. Convergent evolution refers to evolution that results in structural similarities of organisms that are not closely related **(1 mark)**.

e. Homologous structures are structures of organisms that have arisen from a recent common ancestor **(1 mark)**. An example would be the limbs of lizards and chimpanzees, which would have arisen from the limbs of newts. Or any other sensible example **(1 mark)**.

**Question 7**

a. Any additional bony surface, such as skull crests, eyebrow ridges or large jaw, would be an attachment site for muscles. Larger muscles need a larger surface area for attachment **(1 mark)**.

b. Carbon dating relies on the ratio of C14 to C12. In a 3 million year old fossil, there would be no C14 left as it would have all decayed after about 50,000 years. **(1 mark)**.

c. Skull P is *Australopithecus afarensis.* Skull Q is *Canis familiaris*. Skull R is *Gorilla gorilla*. Skull S is *Homo sapiens*.
**(2 marks** for all correct, **1 mark** for some correct**)**.

d. The dog, Canis familiaris is not a primate **(1 mark)**. Dogs do not possess: (one of) opposable thumb, flattened nails, acute stereoscopic vision at the expense of the sense of smell, a relatively large brain **(1 mark)**. Erect stance is a characteristic of hominins, not a characteristic of primates.

e. Three of: foramen magnum moves from back to underneath, crest becomes smaller, eyebrow ridges become smaller, jaw becomes smaller, teeth become less specialised, brain case becomes larger, face becomes flatter (more vertical), snout becomes smaller, eyes closer together on front of skull. **(3 marks)**. Answer must include the trend not just the anatomical feature.

## End of Suggested Answers