VCE BIOLOGY 2012

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 2012 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 2012 Year 12 Trial Exam Unit 4

SECTION A – Multiple Choice Questions

*Use the information provided in **Figure 1** to answer Questions 1 and 2.*
Figure 1 shows a karyotype from a human cell nucleus.

Figure 1

Question 1
The number of autosomes shown in **Figure 1** is
A. 22
B. 23
C. 44
D. 46

Question 2
From **Figure 1** it can be concluded that
A. the nucleus was from an egg cell.
B. the person has Down syndrome.
C. the person is male.
D. the person has a defective allele.

Question 3
Parrots have sex chromosomes that determine the gender of their offspring. Like all birds, male parrots possess the sex chromosomes ZZ while female parrots possess the sex chromosomes ZW.
The gender of a female parrot is determined
A. after it hatches out of the egg.
B. by the genotype of the ovum.
C. by the gamete of the male parent.
D. by the temperature of the egg.

Question 4
Genes control various structures and functions in a cell. A gene might code for a structural protein, an enzyme that controls a chemical reaction or might control other genes. Which statement concerning genes is correct?

A. A gene has a position on a chromosome called a chromatid.
B. There are approximately 20,000 different genes in a human cell.
C. Genes are synthesized at ribosomes.
D. The maximum number of alleles for a gene is two.

Question 5
With respect to the ABO blood group locus, which cross can only ever produce offspring with one blood type?

A. Type A x Type A.
B. Type O x Type B.
C. Type AB x Type AB.
D. Type O x Type O.

Question 6
In humans, the allele for free ear lobes (F) is dominant over the allele for attached ear lobes (f). Two people, heterozygous for the trait, have a child with free ear lobes. What is the probability that the child is heterozygous for the trait?

A. $^1/_4$
B. $^1/_3$
C. $^1/_2$
D. $^2/_3$

Question 7
Tyrosinase is an enzyme responsible for producing the dark pigment melanin in the fur of rabbits. A mutant allele of the gene which codes for tyrosinase produces a version of this enzyme that is only active below a critical temperature. Himalayan rabbits produce this mutant form of the enzyme and have extremities coloured with a dark pigment while the rest of the animal is light in colour.
A scientist shaved off a patch of white fur from the back of a Himalayan rabbit. He then attached a chilled pad to the shaved area. The temperature of the pad was below the critical temperature. After a period of time, new fur grew back under the chilled pad. The new fur will be

A. black because the cells under the chilled pad will produce active tyrosinase.
B. black because the chilled pad will cause a mutation in the tyrosinase gene.
C. white because the shaved fur was white.
D. white because the genotype cannot be altered by the environment.

Question 8
Some cats have distinctive patches of colour which gives an overall effect called tortoiseshell. One of the colours of the patches is orange (called ginger) and the other is usually black. The gene that controls the orange colour is located on the X chromosome. The gene has two alleles:
X^O codes for orange colouring
X^- codes for no orange colouring (resulting in the default colouring).
The default colour (usually black) is controlled by a gene on an autosome.
In each female cat cell, one of the X chromosomes is inactivated and it is random which X chromosome is inactivated. This occurs in embryonic development. Thus, a patch of one colour is the result of the allele on one X chromosome and a patch of the other colour is the result of the allele on the other X chromosome. With regard to cats,
A. half the X chromosomes are inactive in tortoiseshell females.
B. half the X chromosomes are inactive in ginger males.
C. the gene for orange colouring in males is located on the Y chromosome.
D. all the X chromosomes are active in tortoiseshell females.

Question 9
Figure 2 is a diagram of a homologous pair of chromosomes in a cell during meiosis. Three gene loci are shown and crossing over is about to occur.

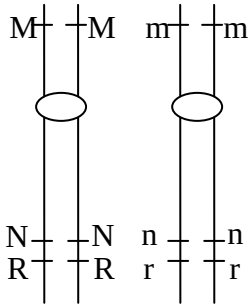


Figure 2

Which are the alleles least likely to be present together in a gamete produced from the cell?
A. mnr.
B. MNr.
C. Mnr.
D. mNR.

Question 10
Figure 3 shows a human pedigree for a genetic condition in a particular family over three generations. Family members with the condition are indicated by shading.

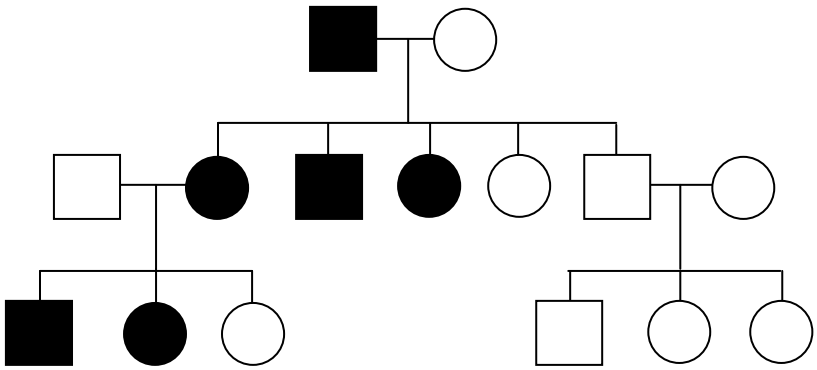


Figure 3

The term that would best describe the mode of inheritance shown in **Figure 3** would be
A. Y-linked.
B. X-linked dominant.
C. X-linked recessive.
D. autosomal dominant.

Use the following information to answer Questions 11 and 12.
In pea plants the genes for seed colour and stem length are on separate chromosomes. The allele for yellow seeds (Y) is dominant over the allele for green seeds (y); while the allele for long stem (T) is dominant over the allele for short stem (t).

Question 11
A student has a plant with yellow seeds and a long stem. She wants to perform a cross with another plant to determine if the plant with yellow seeds and long stem is heterozygous or homozygous for the two traits. She has plants with different genotypes to choose from. Which one should she choose?
A. YYTT.
B. yytt.
C. yt.
D. YT.

Question 12
Another student decided to cross two plants that were both heterozygous for the genes that determine seed colour and stem length. What would be the phenotypic ratio in a large number of offspring that result from this cross?
A. 1 yellow seed/tall : 1 yellow seed/short : 1 green seed/tall : 1 green seed/short.
B. 9 yellow seed/tall : 3 yellow seed/short : 3 green seed/tall : 1 green seed/short.
C. 4 yellow seed/tall : 3 yellow seed/short : 2 green seed/tall : 1 green seed/short.
D. There is not enough information provided to determine the phenotypic ratio.

Question 13
Hox genes result in proteins that either activate or repress other genes by binding to specific regions of DNA. The protein product of a particular Hox gene can act as a repressor for one gene and an activator for another gene. In the fly *Drosophila melanogaster*, the protein product of the Hox gene represses genes involved with eye and antenna formation but activates genes involved with the growth of the leg and wing. Mutations in Hox genes can result in dramatic malfunctions, such as legs growing on the head instead of antennae. Hox genes

A. are examples of homeotic genes.
B. result in structural proteins.
C. are active throughout the life of the fly.
D. are not transcribed.

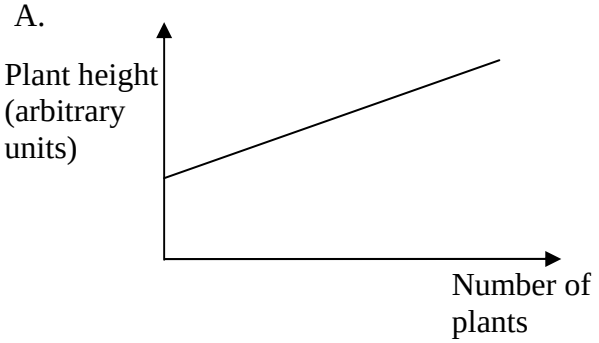
Question 14
A scientist performs the following procedure:
Step 1: Heat DNA strands to 94°C
Step 2: Bind primers to the single stranded DNA at 55°C
Step 3: Add *Taq* polymerase at 72°C
Step 4: Repeat Steps 1 to 3 about 20 times.

The above procedure

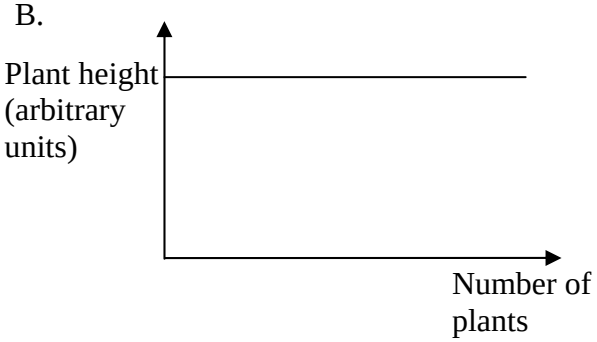
A. results in a transgenic organism.
B. confirms the presence of a particular allele.
C. can be used to cut DNA at specific locations.
D. results in multiple copies of the DNA.

Question 15
Maize plants show variation in height. Height is under the control of a large number of genes. Each gene has two alleles with one allele adding to the height and the other having no effect. The genes are independently inherited. Which of the following graphs best shows the frequency distribution of height in maize plants?

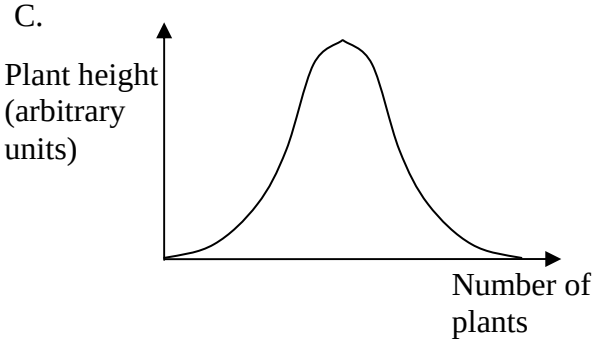
A.



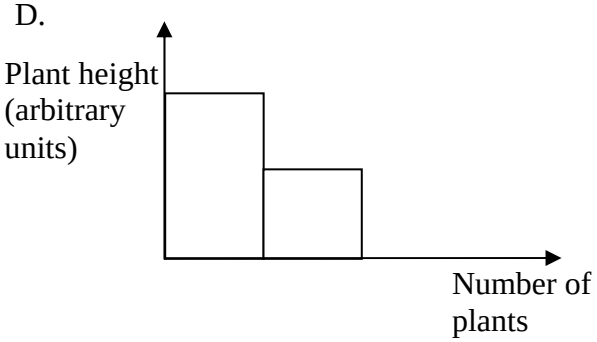
B.



C.



D.



Question 16
Biologists are excited about finding life on other planets. They are particularly interested in the structure of extra-terrestrial organisms and how the code for their structure might be stored. A biologist referring to life on Earth was heard to say, "DNA is the universal genetic code". If life is found on other planets it will be interesting to see how universal the genetic code is. The expression "DNA is the universal genetic code" is consistent with the

A. successful production of transgenic organisms.
B. observation that the code for every protein in a human is found in DNA.
C. inevitable replacement of RNA with DNA.
D. nature of the genetic code of retroviruses.

Question 17
In the last 150 years, the science of Biology has been profoundly affected by some very significant new ideas and discoveries. They have included the following:

I. The process whereby new species come into existence
II. The simple patterns of inheritance
III. The sequence of bases in the human genome
IV. The structure of DNA

The correct chronological sequence of these events is

A. I, II, III, IV.
B. II, IV, III, I.
C. II, I, IV, III.
D. I, III, II, IV.

Question 18
Genetic drift can be best described as

A. random changes in allele frequencies within small populations.
B. the process that leads to evolutionary change and speciation.
C. selection pressures causing a change in the frequencies of alleles.
D. the slow movement of continents that contain plants, animals and other organisms.

Question 19
A tree produces nectar to attract a certain species of bird which will pollinate its flowers. Only the birds that pollinate the tree have bills that fit the shape of the flower in order to obtain the nectar. While the bird is drinking the nectar, the stamens deliver the pollen onto the head of the bird and this pollen is delivered to the stigma of the flower next visited by the bird resulting in pollination. The mutually beneficial development of this flowering plant and the birds which pollinate it is an example of

A. speciation.
B. parallel evolution.
C. co-evolution.
D. convergent evolution.

Question 20
Nothofagus beech trees evolved about 100 million years ago. Representatives of the genus *Nothofagus* are only found in South America, New Zealand, Australia and Papua New Guinea. Fossils of *Nothofagus* beech trees have been found in Antarctica. The distribution of *Nothofagus* beech trees and its fossils is evidence of

A. speciation.
B. divergent evolution.
C. natural selection.
D. continental drift.

Question 21
Figure 4 is a graph showing the radioactive decay of Carbon-14 (C-14). The decay of C-14 can be used to determine the age of fossils.

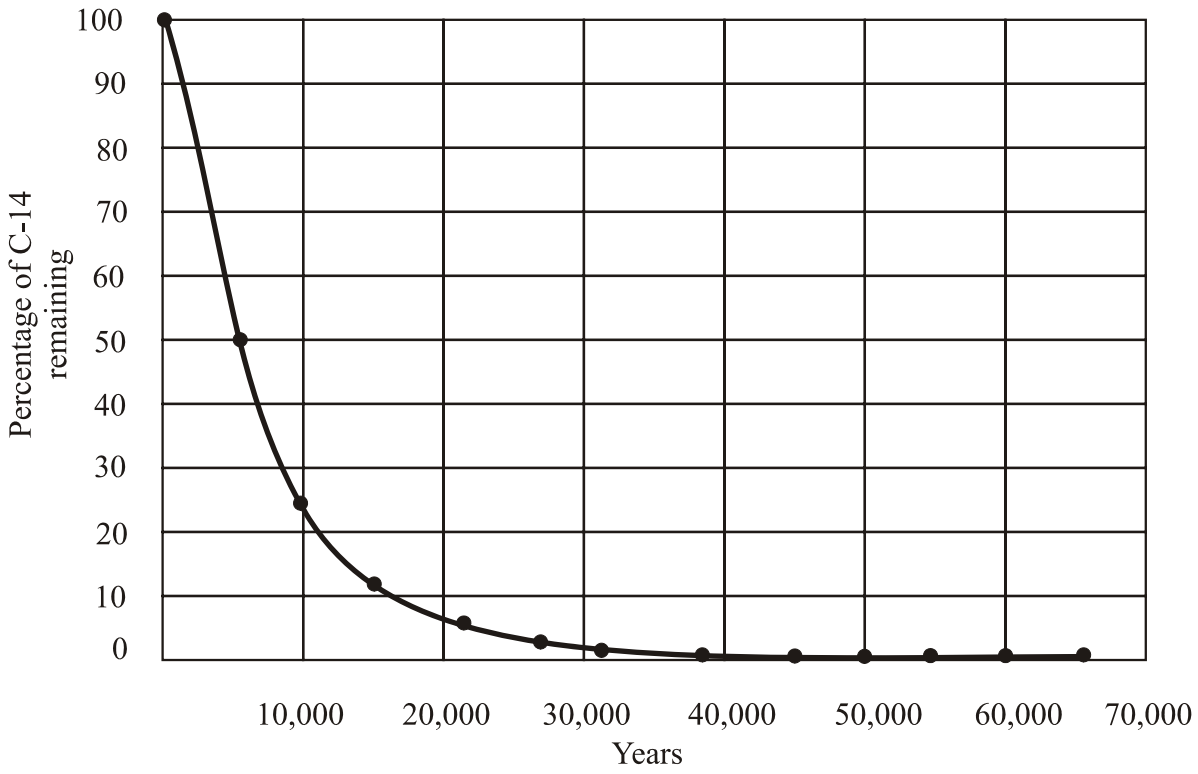


Figure 4

With reference to **Figure 4** it can be inferred that

A. the half life of C-14 is about 20,000 years.
B. after 30,000 years the percentage of C-14 left would be about 25%.
C. the percentage of Carbon-12 would decrease at the same rate.
D. some fossils would not be able to be dated using C-14 because they are too old.

Question 22

Figure 5 is a diagram showing the relationship between mammals, primates and hominins. X, Y and Z are representative groups of animals in each part of the diagram.

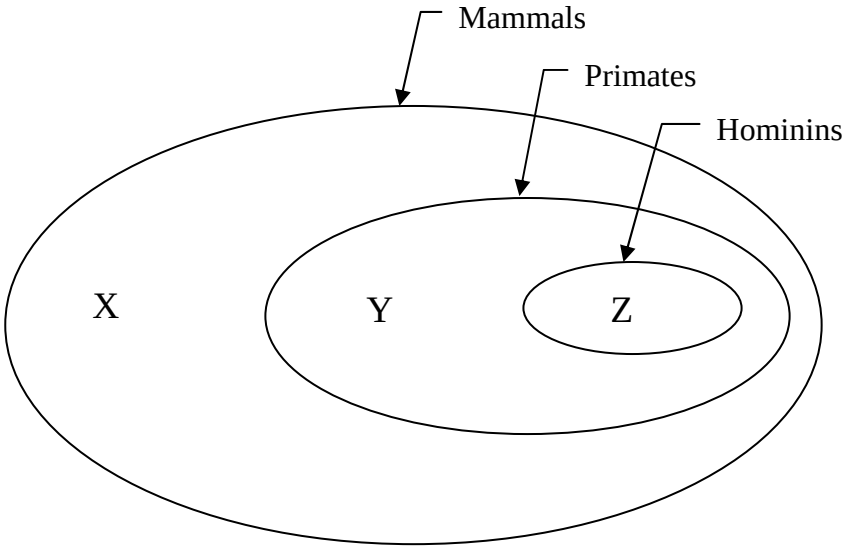


Figure 5

The animals X, Y and Z could be (in order)

A. dog, gorilla, *Australopithecus africanus*.
B. orang-utan, Lucy (*Australopithecus afarensis*), *Homo sapiens*.
C. kangaroo, gorilla, chimpanzee.
D. lizard, spider monkey, *Homo erectus*.

Question 23

Fossils of *Homo floresiensis* were found in Indonesia in 2004. An adult female was one metre tall and had a brain capacity of 380 mL. Which of the following would be evidence of cultural evolution in *Homo floresiensis*?

A. Male and female skeletons were found together.
B. Skeletons of other animals were found with *Homo floresiensis* skeletons.
C. Many chipped rocks with sharp edges were found with the fossils.
D. The fossils were dated at 18,000 years old.

Question 24

Fossil skulls of *Australopithecus aethiopicus* (a robust australopithecine) differ from fossil skulls of *Homo habilis*. Compared to *Homo habilis*, *Australopithecus aethiopicus* has

A. a prominent skull crest and small zygomatic arches (cheek bones).
B. large canine teeth and a small braincase.
C. a sloping face and large jaw.
D. a foramen magnum located at the posterior end of the skull and large brow ridges.

Question 25

A scientist performed the following procedure:

a) isolate the nucleus of an animal somatic cell
b) remove the nucleus of an unfertilised egg cell
c) transfer the nucleus of the somatic cell to the enucleated egg cell
d) allow the egg cell to repeatedly divide and become an embryo
e) transfer the embryo to a surrogate mother

This procedure is an example of

A. stem cell therapy.
B. cloning.
C. artificial insemination.
D. *in vitro* fertilisation.

End of Section A

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SECTION B – Short Answer Questions

Question 1
Figure 6 shows two homologous chromosomes during cell division, in early prophase. The cell in which this is occurring is located in the anther of a flower and will result in the production of pollen grains.

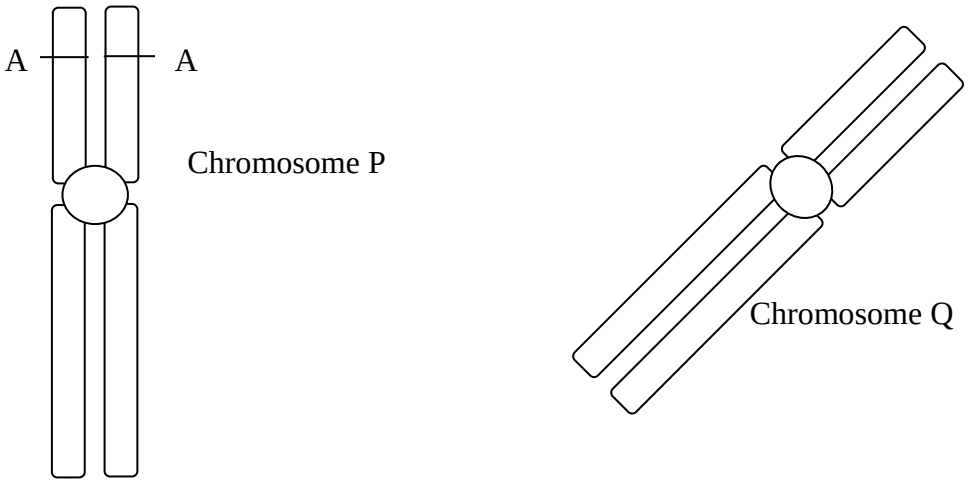


Figure 6

a. Explain the term homologous chromosomes.

_____

_____

_____

_____

(2 marks)

b. Name the type of cell division occurring in **Figure 6**.

_____

(1 mark)

Two alleles in **Figure 6** are labelled A.

c. Why is it almost certain that these two alleles will be identical?

_____

_____

_____

(1 mark)

d. During this cell division, crossing over will occur. Describe two outcomes of crossing over.

_____

_____

_____

_____

(2 marks)

e. During this cell division, the homologous pairs of chromosomes will randomly sort. What is the effect of random assortment on the next generation?

_____

_____

_____

(1 mark)

Total Marks = 7 marks

Question 2

Figure 7 shows a family pedigree. Family members that show a genetically controlled characteristic are indicated by shading.

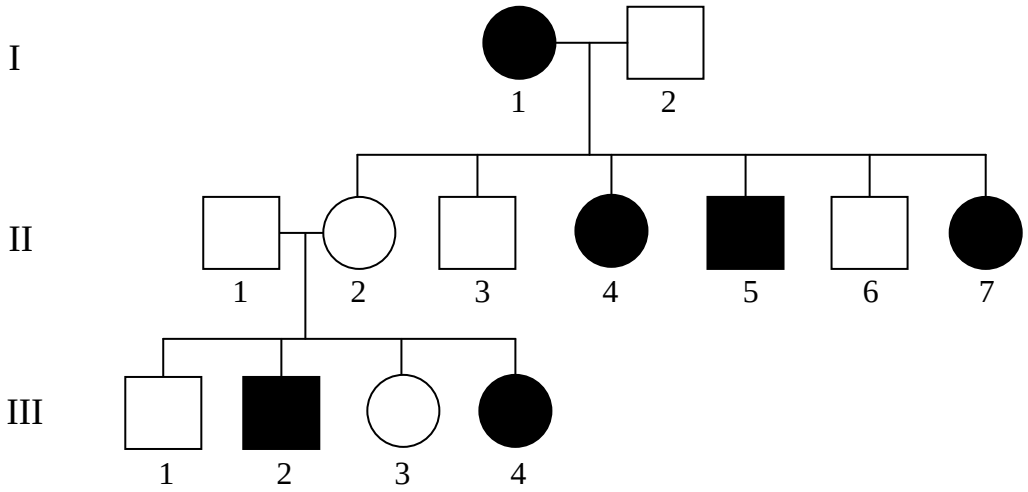


Figure 7

a. What kind of inheritance is shown in **Figure 7**? Justify your answer.

_____

_____

_____

_____

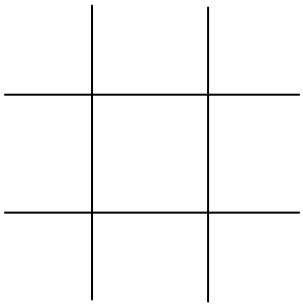
(2 marks)

b. If individuals II-1 and II-2 had two more children, what is the probability that the second child would have the characteristic?

_____

(1 mark)

c. Show the cross described in **Question 2b** on a Punnett square.



(1 mark)

The characteristic shown in the pedigree in **Figure 7** is the inability to synthesize a particular enzyme.

d. A student suggested that even if individual II-6 has a partner who is unable to synthesize the enzyme, all of their children must be able to synthesize the enzyme. Explain whether you agree or disagree with the student.

_____

_____

_____

_____

_____

(2 marks)

e. A scientist found that homozygous individuals without the characteristic produced twice as much enzyme as heterozygous individuals. Explain the scientist's observation.

_____

_____

_____

(1 mark)

Total marks = 7 marks

Question 3

Figure 8 is a representation of an important process occurring in living cells.

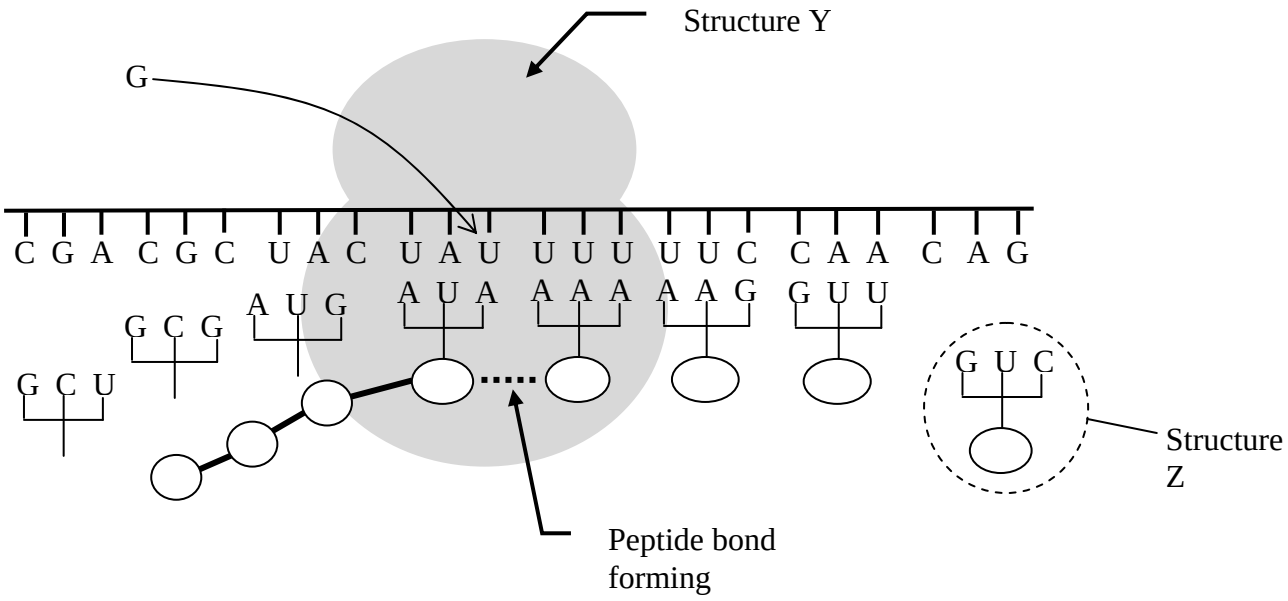


Figure 8

a. Name the product of the process occurring in **Figure 8**.

_____

(1 mark)

b. What name is given to the DNA strand (not shown in **Figure 8**) that provides the information to make the correct product?

_____

(1 mark)

c. What is the name given to the group of three letters at the end of Structure Z?

_____

(1 mark)

d. What does Structure Y consist of chemically?

_____

_____

(1 mark)

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

KEY TO SYMBOLS USED IN TABLE 1	
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 1

e. From left to right, fully name all eight amino acids in the growing polypeptide chain shown in **Figure 8**, using **Table 1**.

_____

_____

(1 mark)

f. The twelfth letter from the left on the long strand is U. What effect would it have on the product if this letter U was replaced with the letter G (as shown on **Figure 8**)?

_____

_____

_____

(1 mark)

g. What are the names of the chemicals for which A, G, U and C are abbreviations?

_____

_____

(1 mark)

Total Marks = 7 Marks

Question 4

Huntington's disease (HD) is a genetic condition that results in the gradual degeneration of neurons, eventually resulting in significant loss of muscle control, reduced mental ability and early death. Symptoms start appearing at any age but usually at about 40 years. Genetic studies have shown that males and females are equally likely to suffer from the condition. If one parent suffers from the disease then there is a 50% chance that a particular child will also suffer from the disease.

a. State the pattern of inheritance of Huntington's disease.

_____

_____

(1 mark)

The gene, which has an allele resulting in HD, contains repeating units of the DNA bases CAG (i.e. CAGCAGCAGCAGCAG...). Generally, people with fewer than 36 repeats do not suffer from the disease. People with 36 or more repeats develop the disease, with the number of repeats affecting the age that symptoms appear. Thus, a person with 40 repeats will develop the disease much later in life, while a person with 100 repeats may develop the disease in early childhood. Specific primers bind to either side of the region containing the CAG repeats and PCR is used to amplify this region.

Six unrelated people were tested for HD at a young age. DNA was taken from each individual and the number of CAG repeats in the relevant gene was determined using electrophoresis. **Figure 9** shows the results.

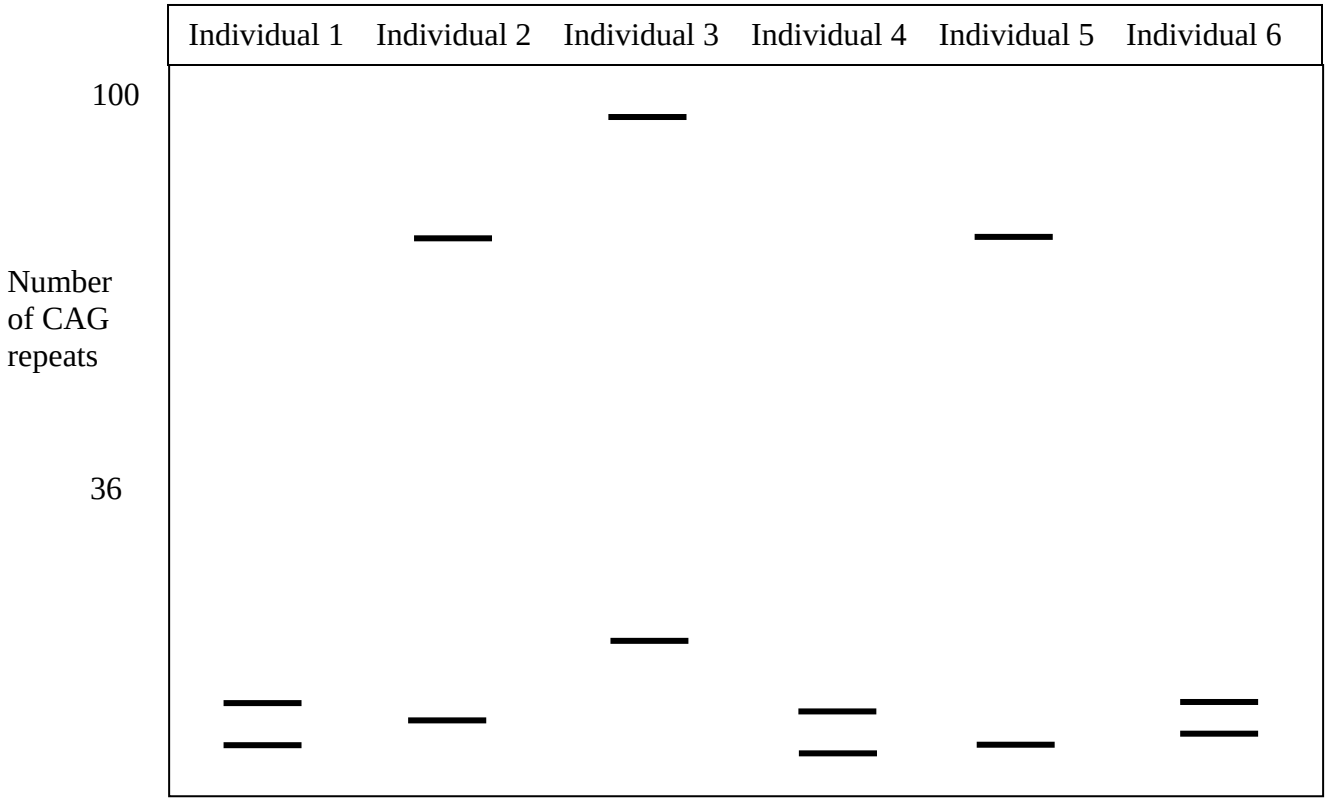


Figure 9

b. With reference to **Figure 9**, which direction would the fragments have moved during electrophoresis? How do you know?

_____

_____

_____

(1 mark)

c. Why are there two bands for each individual?

_____

_____

_____

(1 mark)

d. What general term is given to the chemical used to cut the DNA fragments prior to electrophoresis?

_____

(1 mark)

e. Which individuals are unlikely to suffer from HD? Justify your answer.

_____

_____

_____

_____

(2 marks)

f. Which individual is likely to develop symptoms of HD at the youngest age? Explain.

_____

_____

_____

_____

(2 marks)

Total marks = 8 marks

Question 5

Figure 10 shows fossilised remains of the animal *Archaeopteryx*. The fossil was found in 1861 and has been dated at approximately 150 million years old. The fossil shows features of modern birds, such as feathers and a furcula (wishbone), and at the same time has features of reptiles such as teeth, "hand" bones with claws and moveable joints and a bony tail.

Figure 10

The *Archaeopteryx* fossil was found two years after the publication of Darwin's *On the Origin of Species* and was seen as strong evidence to support Darwin's theory of Natural Selection.

a. How did the *Archaeopteryx* fossil provide evidence for evolution?

_____

_____

_____

_____

(2 marks)

The furcula, or wishbone, found in *Archaeopteryx* is a bone formed from the fusing of the two clavicles (collarbones) found in reptiles. The presence of a furcula gives structure to the chest even when the powerful flight muscles contract.

b. Describe the three stages of the process which resulted in the change from two clavicles to one furcula.

i. _____

_____

ii. _____

_____

_____

iii. _____

_____

_____

(3 marks)

Insects evolved wings for flight approximately 300 million years ago. Insect wings contain no bones or feathers. A student commented that the wings of a dragon fly and the wings of *Archaeopteryx* have the same function and are therefore homologous structures.

c. Do you agree with the student? Explain.

_____

_____

_____

_____

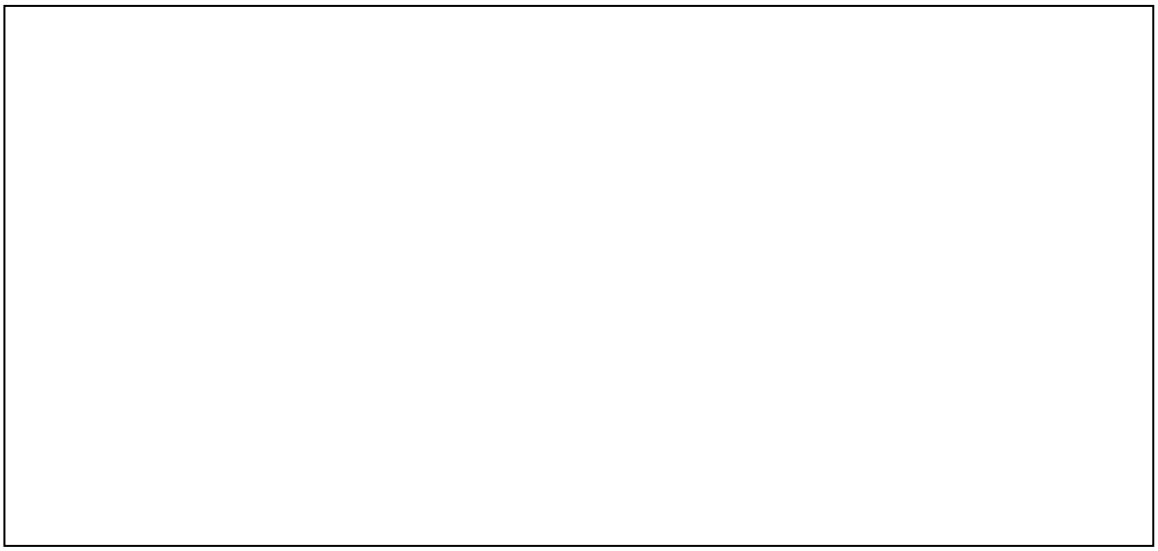
(2 marks)

Total marks = 7 marks

Question 6

Algae, mosses, pine trees and eucalypts all photosynthesize using chloroplasts, which is strong evidence that they all evolved from a common ancestor. Algae are considered primitive plants because they are not specialised into different tissues. Mosses are composed of different tissue types but have no vascular bundles for transport. Both pine trees and eucalypts evolved transport systems. Eucalypts have evolved flowers that have seeds enclosed in a fruit, but pine trees have exposed seeds on cones with no flowers.

a. Draw an evolutionary tree (also called a cladogram or phylogenetic tree) to show the relationship between algae, mosses, pine trees and eucalypts.



(1 mark)

Eucalypts have many uses by humans. It is desirable that they grow quickly, have wood of high quality, are pest and disease resistant and are easy to reproduce. Forest scientists have been using artificial selective breeding programs to improve eucalypts for human use.

b. What is the difference between artificial and natural selection?

_____

_____

_____

_____

_____

(1 mark)

Eucalypts dominate the flora of Australia and PNG and some species are found in nearby Indonesia.

c. Why are eucalypts found naturally only in Australia or nearby and not on other continents?

_____

_____

_____

_____

_____

(1 mark)

Different species within the genus *Eucalyptus* have arisen due to allopatric speciation.

d. Describe the main events that lead to allopatric speciation.

_____

_____

_____

_____

_____

_____

_____

_____

(3 marks)

e. Eucalypt plantations often use genetically identical trees. If this practice becomes widespread, how might this impact on the evolution of that species through natural selection?

_____

_____

_____

(1 mark)

Approximately 50 Australian plant species are listed as having become extinct since European settlement.

f. What is extinction?

_____

_____

_____

(1 mark)

Total marks = 8 marks

Question 7

Palaeontologists infer from fossil evidence that the evolution of distinct hominins began approximately 6 million years ago. The evidence includes fossils of bones and fossils that give clues about culture.

a. What fossil evidence would indicate bipedalism in a hominin?

_____

_____

_____

(1 mark)

The early hominins had a prominent skull crest in contrast to the later hominins (including humans) who have no skull crest.

b. What can one infer from this change in skull structure?

_____

_____

_____

(1 mark)

c. Why do palaeontologists disagree about the evolutionary relationships between hominin species?

_____

_____

_____

(1 mark)

Charles Darwin suggested that the process of evolution is natural selection.

d. Explain why the process of cultural evolution is not natural selection.

_____

_____

_____

_____

_____

(2 marks)

e. How would cultural evolution be affected by the biological evolution of speech?

_____

_____

_____

_____

(1 mark)

Total marks = 6 marks

End of Section B

End of Trial Exam

Suggested Answers

VCE Biology 2012 Year 12 Trial Exam Unit 4

SECTION A – Multiple Choice Answers

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

SECTION B – Short Answer (Answers)

Question 1

a. Homologous chromosomes carry the same gene loci. Homologous chromosomes are approximately the same length and shape. The banding pattern is the same. The centromeres are in the same corresponding places **(2 marks** for any two correct answers).

b. Meiosis **(1 mark)**.

c. The alleles are located on different chromatids of the same chromosome. As one chromatid is a copy from the other chromatid through DNA replication they will be identical (except for mutations) **(1 mark)**.

d. Genetic material will be swapped between homologous chromosomes **(1 mark)**. The variation in the offspring will increase **(1 mark)**.

e. Random assortment of chromosomes increases the genetic variation in the offspring of the next generation by randomly assigning paternal or maternal chromosomes of an individual to a gamete. Thus the sperm (or egg) of an individual will contain some chromosomes from the individual's mother and some chromosomes from the individual's father **(1 mark)**.

Question 2

a. The trait must be recessive since individuals II-1 and II-2 don't have the trait while two of their children do **(1 mark)**. The trait can't be X-linked recessive since two male offspring of female I-1 don't show the trait OR individual III-4 has the trait but her father doesn't. Therefore the trait must also be autosomal. **(1 mark)**.

b. **¼ (1 mark)**.

c. Any letter may be used. The probability is the same for any child of the couple.

	A	a
A	AA	Aa
a	Aa	aa

(1 mark)

d. Disagree with the student **(1 mark)**. Individual II-6 must be heterozygous and carry the recessive allele. He will pass on the allele to 50% of his children. His partner cannot synthesize the enzyme and therefore both alleles must be recessive and she will pass on the allele to all her children. Therefore the chance of a child, who is unable to synthesize the enzyme, resulting from this cross is ½ or 50% **(1 mark)**.

e. The allele is responsible for the production of the enzyme through protein synthesis. A person with two normal alleles will have twice the rate of transcription and translation as a person with one normal allele, resulting in twice the amount of protein produced **(1 mark)**.

Question 3

a. Protein or polypeptide **(1 mark)**.
b. Template strand **(1 mark)**.
c. Anticodon **(1 mark)**.
d. RNA and protein (both for **1 mark**).
e. Arginine, Arginine, Tyrosine, Tyrosine, Phenylalanine, Phenylalanine, Glutamine, Glutamine (**1 mark**, must have all correct and no abbreviations).
f. If U is replaced by G in the mRNA then the codon becomes UAG which codes for STOP and the translation will stop. Therefore the protein will be incomplete and non-functional **(1 mark)**.
g. Adenine, Guanine, Uracil and Cytosine (**1 mark** for all correct).

Question 4

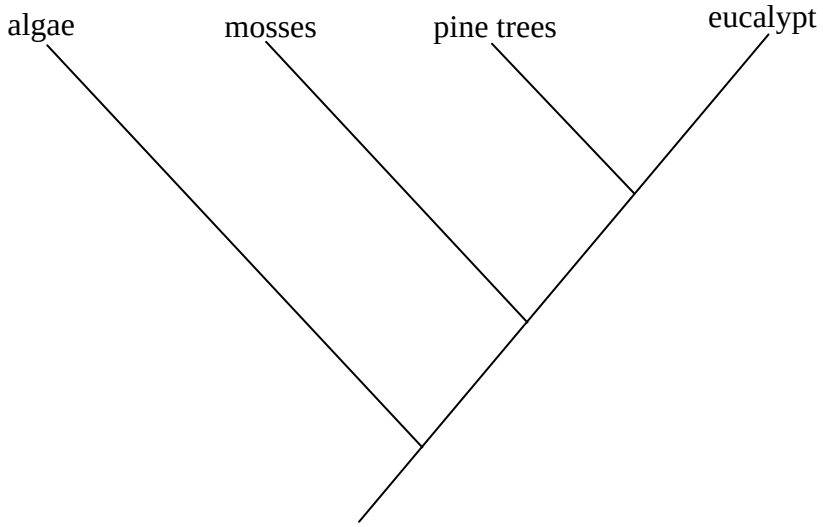
a. Autosomal dominant **(1 mark)**.
b. The fragments would have moved down the page because the largest fragments at the top of the page would have moved at the lowest speed (**1 mark** for both correct direction and reason).
c. In a diploid cell, an individual has two alleles for each gene. Each allele is likely to contain different numbers of CAG repeats which separate out into two bands according to their size **(1 mark)**.
d. Restriction enzyme **(1 mark)**.
e. Individuals 1, 4 and 6 will not suffer from HD **(1 mark)** because the number of CAG repeats on their alleles is less than 36 **(1 mark)**.
f. Individual 3 **(1 mark)** because he/she has the largest number of CAG repeats above 36 **(1 mark)**.

Question 5

a. *Archaeopteryx* provides a link between reptiles and birds because it has characteristics of both **(1 mark)**. If birds evolved from reptiles it shows the transition between the two groups **(1 mark)**.
b. i) Most reptiles that "flew" had two clavicles. Some reptiles were born with their clavicles fused together **(1 mark)**.
   ii) The reptiles that had their clavicles fused together could fly better and had a better chance of competing for food and mates **(1 mark)**.
   iii) The genetic variants for the more successful furcula was passed onto offspring and became widespread **(1 mark)**.
c. Disagree **(1 mark)**. Homologous structures have similar structure because the animals of which they are part had a recent common ancestor. The dragon fly and *Archaeopteryx* did not have a recent common ancestor because their wings are not similar in structure **(1 mark)**.

Question 6

a.



(1 mark)

b. In artificial selection, a breeder selects which phenotypes will continue the line of inheritance. In natural selection, the environment determines which phenotypes will be most successful, resulting in those organisms passing on their genes to the next generation **(1 mark)**.

c. Eucalypts evolved after Australia separated from the other land masses by continental drift. The plants had no way of travelling to other continents **(1 mark)**.

d. i) Part of a population becomes geographically isolated **(1 mark)**.
   ii) The separated population becomes genetically different from the main population because of different selection pressures **(1 mark)**.
   iii) The two populations become so different over time that, were they to come together again, the two populations would be unable to successfully breed **(1 mark)**.

e. Natural selection requires variation in the population so that the environment can select the individuals most suited to the environment. Cloning removes the variation so that the process of natural selection cannot result in change and the evolution of that species would cease **(1 mark)**.

f. Extinction occurs when a taxonomic group of organisms such as a species has no living members left in the wild, or in captivity, to breed from **(1 mark)**.

Question 7

a. The foramen magnum is positioned further forward in the skull rather than being located towards the posterior. OR If the angle between the tibia and femur allows each of the feet to fall directly under the body while walking. OR If the pelvis is rounder and more bowl-shaped **(1 mark)**.

b. The skull crest is for attachment of the muscle used for chewing. As the skull crest disappeared over time it can be inferred that the chewing muscles did not need to be so powerful because the preferred food was not so tough or was treated, possibly by cooking, prior to eating in order to soften it (**1 mark** for correct inference on muscles or food).

c. Not many fossils exist for prehistoric hominins because they did not often die in favourable conditions for fossil formation, such as where sedimentary rock will form. Where fossils do exist, scientists cannot perform breeding experiments, and without DNA they cannot perform DNA hybridisation experiments to determine genetic relationships or groupings. Evolutionary lines and common ancestors have to be hypothesised from limited evidence. Different scientists will give more weight to different aspects of the evidence **(1 mark)**.

d. Cultural evolution occurs through the process of learning from others. The learning can be by example or teaching or from stored knowledge such as in books. Only the behaviour changes, not the genotype **(1 mark)**. In natural selection, the gene frequencies will change as the environment selects for or against certain phenotypes **(1 mark)**.

e. Cultural evolution will be promoted by speech. Speech makes it more efficient for a hominin to learn a new behaviour from another **(1 mark)**.

End of Suggested Answers