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VCE BIOLOGY 2007 TRIAL EXAM Year 12 Unit 4

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Time allowed 90 minutes
Total Marks 75
Multiple Choice Section 25 marks
Short Answer Section 50 marks

QUESTION AND ANSWER BOOKLET
Structure of Booklet

Section	Number of Questions	Number of Questions to be Answered
A	25	25
B	8	8

Answer Multiple Choice questions by circling the appropriate letter on the answer sheet attached. Use space provided below question in Short Answer section.

Lisachem Materials
PO Box 2018, Hampton East, Victoria, 3188
Ph: (03) 9598 4564 Fax: (03) 8677 1725
Email: orders@lisachem.com.au

Student Name.....

VCE Biology 2007 Year 12 Trial Exam Unit 4

Student Answer Sheet

Answer each Multiple Choice question by circling the appropriate letter. Use a pencil. If you make a mistake erase and enter the correct answer. Marks will not be deducted for incorrect answers.
Write your answers to Short Answer Section in the space provided directly below the question.

Multiple Choice

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 2007 Year 12 Trial Examination Unit 4

Multiple Choice Section

Question 1.
Which one of the following statements is correct with regard to messenger RNA?
When it leaves the nucleus:

A. introns and exons have been transcribed onto messenger RNA.
B. only introns have been transcribed onto messenger RNA.
C. only exons have been transcribed onto messenger RNA.
D. neither introns nor exons have been transcribed onto messenger RNA.

Use the following information to answer questions 2 and 3:
One section on the template strand of a DNA molecule has the following nucleotide sequence: TCGATCCCGTACACTGGT.

Question 2.
From this information, one could conclude that the number of anti-codons that would correspond to the codons formed from this DNA nucleotide sequence would be:

A. nine.
B. four.
C. six.
D. eighteen.

Question 3.
Which one of the following nucleotide sequences would contain the anti-codons that correspond to the section of DNA molecule above?

A. AGCTAGGGCATGTGACCA.
B. AGCTAGGGCAUGTGACCA.
C. AGCUGAGGCATGUGACCA.
D. AGCUAGGGCAUGUGACCA.

Use the following information to answer questions 4 and 5:
Figure 1 below is a pedigree showing the pattern of inheritance of a genetic disorder in which human red blood cells can be destroyed under certain conditions.

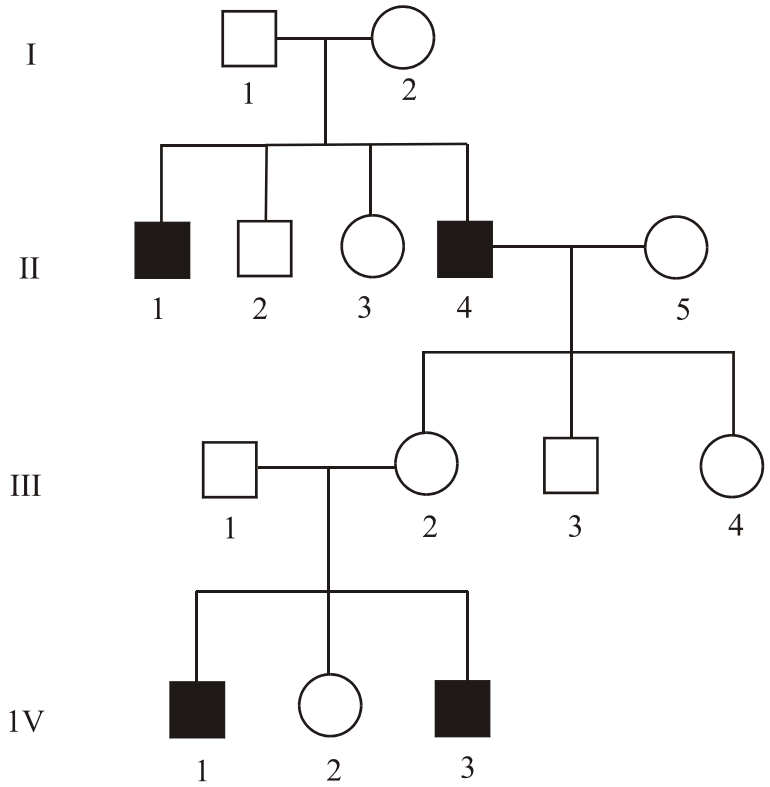

Figure 1

Question 4.
Which one of the following statements best describes the mechanism of inheritance of this genetic disorder?

A. sex-linked dominant.
B. autosomal dominant.
C. autosomal recessive.
D. sex-linked recessive.

Question 5.
If individual IV-1 has children with a female partner, whose family history has none of this genetic disorder, what is the probability that their daughter could have this genetic disorder?

A. 0
B. ¼
C. ½
D. 1

Question 6.
In a particular species of plants, the allele for yellow flowers (Y) is dominant over the allele for white flowers (y). What is the genotypes of the plants that resulted in 50% of their offspring having white flowers?

A. YY and YY.
B. YY and yy.
C. Yy and Yy.
D. Yy and yy.

The diagram in **Figure 2** below represents one pair of homologous chromosomes during meiosis where crossing-over can occur between alleles B/b and E/e.

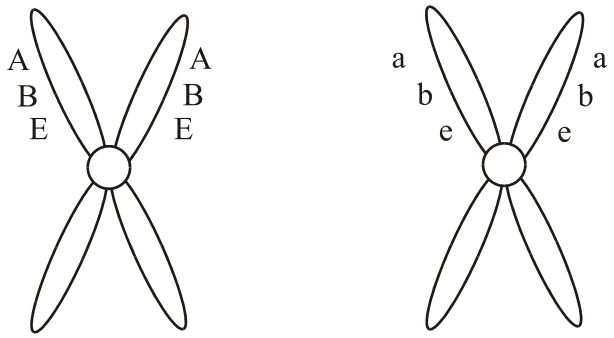

Figure 2

Question 7.
The gametes that could be produced if crossing-over occurred between alleles B/b and E/e are:

A. ABE, aBE, Abe, abe.
B. ABE, ABe, aBe, abe.
C. ABE, aBE, AbE, abe.
D. ABE, abE, aBe, abe.

Use the following information to answer questions 8, 9 and 10.
In cats an autosomal gene that controls fur length has two alleles with short fur dominant (F) to long fur (f). Another autosomal gene that controls colour also has two alleles with black dominant (B) over grey (b). The two genes are not linked.

Question 8.
In order for a student to find out the genotype of a cat that had short black fur, the student would need to mate the short black fur cat with a cat that had the genotype:

A. FFBB.
B. ffbb.
C. FfBb.
D. FFBb.

Question 9.
What is the genotype of the offspring that would result from a mating between two cats that had the following genotypes? FFbb and ffBB.

A. FFBB.
B. ffbb.
C. FfBb.
D. ffBB.

Question 10.
What is the chance of producing a grey cat with long fur if both parents are heterozygous for both the fur length gene and the colour gene?

A. 1/2
B. 1/4
C. 1/8
D. 1/16

Question 11.
A particular polypeptide consists of 21 amino acids. What is the minimum number of nucleotides that are needed in the code that enables the amino acids to form this polypeptide?

A. 21.
B. 42.
C. 63.
D. Cannot be determined from the information given.

Question 12.
Messenger RNA can sometimes act as a template in the formation of a single stranded DNA molecule known as copy DNA. The enzyme that catalyses the joining of nucleotides to form the copy DNA is:

A. DNA polymerase.
B. restriction endonuclease.
C. DNA recombinase.
D. reverse transcriptase.

Question 13.
A tortoise shell cat has a combination of orange and black fur. The allele for orange fur is X^o while the allele for black fur is X^b. If an orange cat (X^oY) is mated with a tortoiseshell female (X^o X^b), what could the phenotypes of the female offspring be?

A. orange and black.
B. tortoiseshell and black.
C. orange and tortoiseshell.
D. tortoiseshell only.

Question 14.
Which one of the following statements applies to all intact double stranded DNA molecules? The number of:

A. cytosine and thymine bases are equal.
B. thymine and adenine bases are equal.
C. adenine, thymine, guanine and cytosine bases are equal.
D. guanine and adenine bases are equal.

Figure 3 below represents the movement of five DNA fragments during electrophoresis.

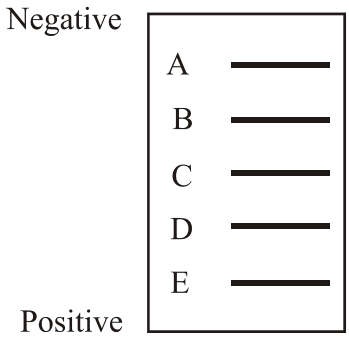

Figure 3

Question 15.
From the information provided in **Figure 3** above, it is reasonable to conclude that:

A. fragment C is smaller than A and B, but larger than D and E.
B. fragment D is smaller than B, but larger than A and C.
C. fragment D has moved further than B because it has more nucleotides.
D. fragments D and E are larger than A and B.

Question 16.
The different species of finches found on the Galapagos Islands are believed to have evolved from a common ancestor that reached there from South America. This is an example of:

A. adaptive radiation.
B. convergent evolution.
C. allopatric speciation.
D. selection pressures.

Question 17.
Natural selection can be described as the process in which organisms:

A. change their acquired characteristics slowly over time to adapt to a changing environment.
B. that are physically the strongest have the greatest chance of survival.
C. best suited to the environment survive to sexual maturity and pass on their genetic characteristics to their offspring.
D. compete with each other for food, shelter, mates and resources so that their offspring have an equal chance of survival.

Figure 4 below shows a table containing data on the radioactive decay of carbon-14 over time.

Time (years)	Percentage of original radioactivity
0	100
5,500	50
11,000	25
16,500	12.5
22,000	6.25

Figure 4

Question 18.
From the information provided in **Figure 4** above, one could conclude that a fossil with 37.5% of original radioactivity would be approximately:

A. 8000 years old.
B. 8250 years old.
C. 8500 years old.
D. 8750 years old

Question 19.
Organs and structures found in organisms that appear to have no real function or purpose are referred to as:

A. non-adaptive.
B. analogous.
C. hybrids.
D. vestigial.

Question 20.
Which one of the following could be regarded as examples of genetic drift?

A. gene flow and gene pool.
B. selection pressure and natural selection.
C. hybridization and variation.
D. founder effect and bottleneck.

Question 21.
Which one of the following statements is correct for a mutation that produces a dominant allele in an organism? The mutation would be:

A. expected to spread through the organism's population more quickly than a recessive mutation.
B. expected to cause a decline in the organism's population.
C. seen in the phenotype of an organism whose genotype is heterozygous.
D. only seen in the phenotype of an organism whose genotype is homozygous.

Question 22.
Homologous structures provide evidence which supports the theory of evolution because they show:

A. transitional forms of different species.
B. different species could have a common ancestor.
C. the structures performing exactly the same function in different species.
D. different species living in a different habitat cannot be closely related in their ancestry.

Figure 5 below is a cladogram which shows the evolutionary relationship between six species of organism.

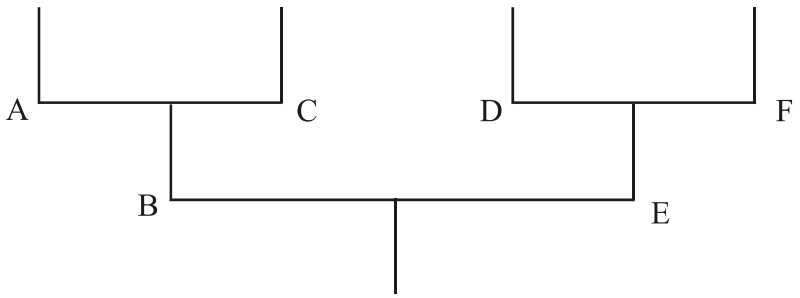

Figure 5

Question 23.
From the above cladogram in **Figure 5** one can conclude that: Species

A. A and D are more closely related than species B and C.
B. B and C are more closely related than species C and D.
C. C and D are more closely related than species D and E.
D. A and E are more closely related than species E and F.

Question 24.
When comparing the whole skull of a human being with a whole skull of a chimpanzee one would expect: The

A. brain case of a chimpanzee to be larger than the brain case of a human.
B. lower jaw of humans to be larger than the lower jaw of chimpanzees.
C. foramen magnum to be central at the base of the skull in humans and not central at the base of the skull in chimpanzees.
D. teeth size and shape of chimpanzee and human teeth to be similar.

Question 25.
Which one of the following is an example of cultural evolution in humans? The

A. development of bipedalism.
B. increasing length of hind limbs relative to forelimbs.
C. development of a fully opposable thumb leading to a precision grip.
D. development of stone tools and implements.

Short Answer Section

Question 1.

In the ABO blood group there are three alleles. The alleles A and B are co-dominant, while both alleles A and B are dominant over allele O. **Figure 6** below shows the blood groups of two couples. Each one of the couples has a baby. Baby X has blood group O, while baby Y has blood group A.

	Blood Group	
	Father	Mother
Couple 1	B	B
Couple 2	O	AB

Figure 6

a. Write down the genotype of the father in couple two.

_____

(1 mark)

b. How many different phenotypes are possible in the human population with respect to the ABO gene?

_____

(1 mark)

c. Explain which couple are the parents of Baby X.

_____

_____

_____

_____

_____

(2 mark)

d. Explain whether it is possible for either couple to have a child with blood group AB.

_____

_____

_____

_____

(1 marks)

A particular type of red-green colour blindness is a sex-linked recessive condition. The symbols for alleles that are used to indicate the genotypes of individuals that could have red-green colour blindness are X^H, X^h and Y.

e. If the father in couple 1 has red-green colour blindness and the mother has no family history of red-green colourblindness, what is the chance that there child will be red-green colour blind? Show all workings.

_____

_____

_____

_____

_____

_____

(2 marks)

f. Explain why this inherited type of red-green colour blindness is more common in men than women.

_____

_____

_____

_____

_____

(1 mark)

Total = 8 marks.

Question 2.

Within the nucleus of a cell, there are structures called chromosomes, which contain DNA. The DNA molecule is regarded as a template for polypeptide synthesis and also determines the type of characteristics for a particular cell. A section of DNA has the following sequence of bases: -GAG-CAC-CCT-TAC-CCG-ATC-CGA-

a. What is the corresponding base sequence on the complimentary DNA strip?

_____

(1 mark)

b. Explain the difference between translation and transcription.

_____

_____

_____

_____

(2 marks)

c. During the formation of the polypeptide from –GAG-CAC-CCT-TAC-CCG-ATC-CGA what would be the corresponding base sequence of the transfer RNA?

_____

_____

_____

_____

(2 marks)

d. Name the segments of DNA within a gene that are transcribed but not translated.

_____

(1 mark)

Total = 6 marks.

Question 3.

The following pedigree in **Figure 7** below shows how a particular genetic disorder was inherited in a family over three generations with shaded individuals having the genetic disorder.

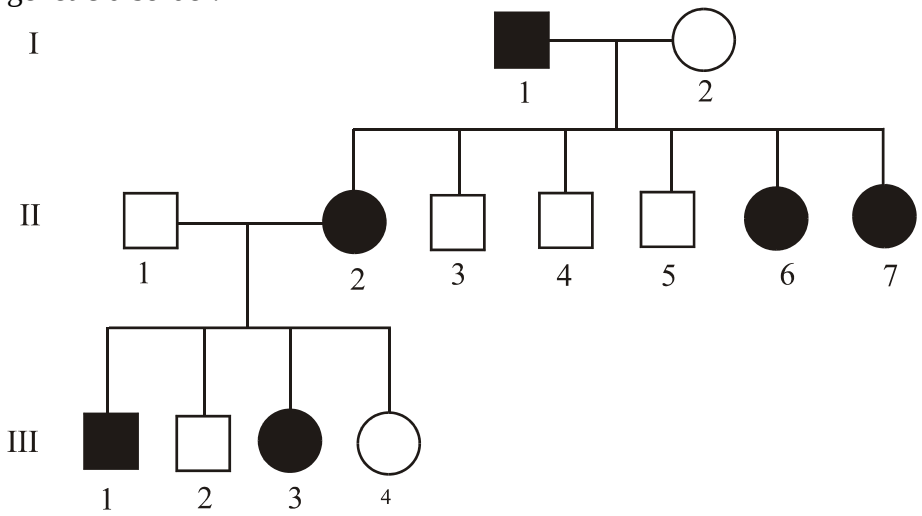

Figure 7

a. How is the genetic disorder shown in the pedigree above inherited?

_____

(1 mark)

b. Explain your answer for **3a** above.

_____

_____

_____

_____

_____

(1 mark)

c. Using the letters **G** and/or **g** for the alleles of the gene, write down the correct genotypes for individuals III-1 and III-4.

_____

_____

(1 mark)

d. Explain your answer for **3c** above.

_____

_____

_____

_____

_____

(1 mark)

e. Write down the correct genotype of individual III-3 using the letters **G** and/or **g**.

_____

_____

(1 mark)

f. Individual III-3 decides to have children with a male partner who also has the genetic disorder. What is the chance that their children will have the genetic disorder? Explain.

_____

_____

_____

_____

_____

(2 mark)

Total = 7 marks.

Question 4.

A forensic scientist decided to investigate a piece of DNA that was 12.8kbp in length. To begin, she decided to make multiple copies of this particular piece of DNA. After making multiple copies, she cut the DNA in 3 positions to obtain 4 pieces of DNA which were 2.6kbp, 3.8kbp, 1.7kbp and 4.7kbp respectively in size.

a. Name the technique that is used to make multiple copies of a piece of DNA.

_____

(1 mark)

Figure 8 below shows the results obtained when she separated the 4 pieces (A, B, C and D) of DNA.

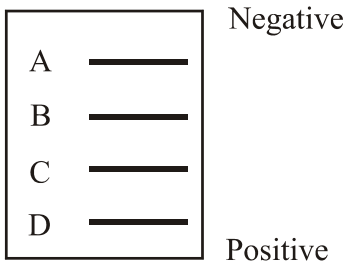

Figure 8

b. What technique is used to separate different size pieces of DNA?

_____

(1 mark)

c. Beside each letter A, B, C and D, which correspond to the results obtained in **Figure 8** above, write down the correct size of each piece of DNA.

A_____B_____

C_____D_____

(2 marks)

d. Briefly explain how the scientist could join these four pieces of DNA into the original one piece of 12.8kbp.

_____

_____

_____

(1 mark)

Scientists sometimes wish to attach pieces of DNA material to vectors so that the piece of DNA can be inserted into a cell.

e. What is the name of the vectors found in bacterial cells?

_____

(1 mark)

f. Name the process by which vectors with foreign pieces of DNA are taken up by bacterial cells.

_____

(1 mark)

Total = 7 marks.

Question 5.
During the 20th Century there has been an enormous increase in the human population. The use of pesticides in agriculture to improve food production in order to feed more people, and the use of antibiotics to treat people with bacterial infections has also increased. While this has certainly helped the human population, the use of pesticides and antibiotics had also resulted in increased survival rates by insects to certain pesticides and by bacteria to certain antibiotics.

a. Explain why when pesticides were first applied to protect agricultural crops, while the number of insect pests of a particular species was greatly reduced, not all of the insect pests were eliminated by the pesticide.

_____
_____
_____
_____
_____

(2 marks)

b. Briefly explain what could happen to an insect pest population if the same pesticide is used over and over for many years.

_____
_____
_____
_____

(1 mark)

c. Explain why antibiotics, which were effective in treating bacterial infections 30 years ago, are now being replaced by new and different antibiotics.

_____
_____
_____
_____
_____

(2 marks)
Total = 5 marks.

Question 6.
Figure 9 below shows the evolutionary relationship between seven different species of reptiles (A, B, C, D, E, F and G).

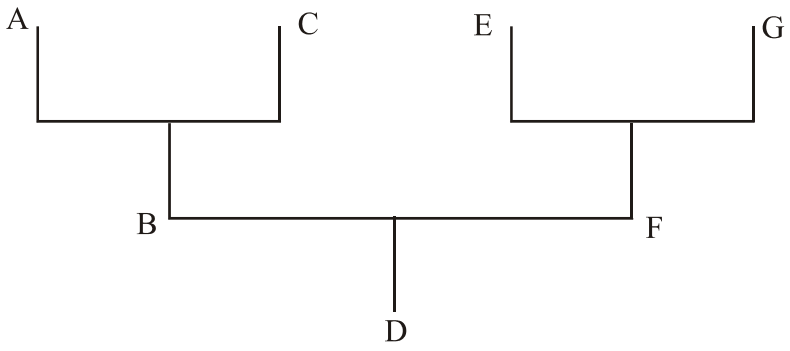

Figure 9

a. What species could be regarded as the common ancestor to all the other species?

_____

(1 mark)

b. What is meant by the term 'common ancestor'?

_____

_____

_____

(1 mark)

c. Species' A and C evolved as a result of allopatric speciation. Explain.

_____

_____

_____

_____

_____

_____

(2 marks)

d. What name is given to structures that have the same evolutionary origin?

_____

(1 mark)

e. Does natural selection on populations living in the wild act predominantly on the phenotype or genotype?

_____

(1 mark)

Total = 6 marks.

Question 7.
In Australia, there are many breeds or varieties of cattle. Some varieties such as brahmans and herefords are bred for their ability to produce beef for human consumption, while other varieties like jerseys are bred for their milk production.

a. Do all the different breeds of cattle belong to the same species? Explain.

_____

_____

_____

(1 mark)

b. What advantage is there for the selective breeding of a particular variety of cattle?

_____

_____

_____

_____

(1mark)

c. How does artificial selection differ from natural selection? Explain.

_____

_____

_____

_____

_____

_____

_____

(2 marks)

While cloning of animals has generated a good deal of controversy, cloning of plants is particularly important in the horticultural industry.

d. Briefly explain how the cloning of organisms of a particular species might impact on their evolution.

_____

_____

_____

_____

(1 mark)

e. Briefly mention one advantage that cloning particular types of plants might have over sexually reproducing the same type of plants.

_____

_____

_____

_____

(1 mark)

Total = 6 marks.

Question 8.

Paleontologists have over many years found numerous examples of the fossilized remains of our human ancestors going back 5 million years. These fossils include skulls, jaws, teeth and many skeleton bones. As well, with some of these fossils, scientists have found stone tools, the remains of fireplaces and drawings on cave walls.

a. Why is it difficult to determine if human fossils belong to the same or different species?

_____

_____

_____

_____

(1 mark)

b. Name the method by which the definite age of a human fossil can be determined?

_____

(1 mark)

c. Briefly explain why the fossil record of humans is incomplete.

_____

_____

_____

_____

_____

(2 marks)

d. Name the evolutionary factor which has had a significant impact on humans since the emergence of *Homo sapiens*.

_____

(1 mark)

Total = 5 marks.

End of Task.

Suggested Answers VCE Biology Year 12 Trial Exam Unit 4

Multiple Choice Section.

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

Short Answer Section.

Question 1.

a. OO. (1)

b. 4. (1)

c. Couple 1. (1) Baby X is blood group O, therefore she received an O allele from each parent. It is impossible for couple 2 to be baby X's parents since the mother is AB and has no O allele. Both parents in couple 1 must have the genotype BO to have a child with blood group O. (1)

d. No, it is not possible for either couple to have a child with blood group AB. Each parent of both couples can only contribute one allele to a child. With couple 2, the father cannot contribute allele B and with couple 1, neither parent can contribute the allele A. (1)

e. Father's genotype(X^hY) Mother's genotype(X^HX^H)

Gametes: X^h and Y X^H and X^H

Possible genotypes: X^HX^h : X^HX^h : X^HY : X^HY. (1)

There is no chance that any of the children will be red-green colourblind. (1)

f. Red-green colour blindness is sex-linked and is found on the X chromosome. For red-green colour blindness to be expressed in women, it has to be present on both X chromosomes, while in men, it will be expressed if it is present on their single X chromosome. Therefore red-green colour blindness is more common in men than women. (1)

Question 2.

a. –CTC-GTG-GGA-ATG-GGC-TAG-GCT- (1)

b. Translation is the synthesis on ribosomes of a particular polypeptide that is made up of amino acids using transfer RNA to match up with the information on messenger RNA.(1) Transcription is the synthesis of messenger RNA from a particular DNA template in the nucleus. (1)

c. –CUC-GUG-GGA-AUG-GGC-UAG-GCU- messenger RNA. (1)
-GAG-CAC-CCU-UAC-CCG-AUC-GCA- transfer RNA. (1)

d. Introns. (1)

Question 3.

a. Sex-linked dominant. (1)

b. The genetic disorder is dominant since it is present in each generation of the pedigree. The trait must be sex-linked since individuals II-2, II-6 and II-7 have the disorder as a result of inheriting the X chromosome from their father. Individual II-3, II-4 and II-5 do not have the disorder since they inherited the X chromosome from their mother who did not have the disorder. (1)

c. III-1: X^GY III-4: X^gX^g. (1)

d. III-1 has inherited the dominant allele on the X chromosome from his mother who has a dominant allele on only one X chromosome since her other son III-2 does not have the condition. III-4 does not have the condition since she inherited one X chromosome from her father, who does not have the condition and the normal X chromosome from her mother . (1)

e. III-3: X^GX^g . (1)

f. Male genotype(X^GY) Female genotype(X^GX^g)

Gametes: X^G and Y X^G and X^g

Possible genotypes: X^GX^G : X^GX^g : X^GY : X^gY. (1)

There is a 75% chance that their children will have the genetic disorder. (1)

Question 4.

a. Polymerase chain reaction. (1)

b. Electrophoresis. (1)

c. A-4.7kbp; B-3.8kbp; C-2.6kbp; D-1.7kbp. (1 for 2 correct answers; 2 marks for all correct answers)

d. It would be possible to join these four pieces of DNA together by using the enzyme ligase, which catalyses the joining together of these four pieces of DNA to form the original piece of DNA (1)

e. Plasmids. (1)

f. Transformation. (1)

Question 5.

a. In any population of insect pests, there is genetic variation between individuals of that population. (1) When the pesticide was applied, not all of the insect pests would have been killed because some of them would have had a genetic variation that made them resistant to the pesticides and therefore they would survive and not be eliminated. (1)

b. The insect pests that are resistant to the pesticide will survive and initially their numbers will be small. However, by using the same pesticide insect pests that survive will pass on their resistant characteristics to their offspring. Over time this will result in the insect pest population substantially increasing their numbers. (1)

c. Antibiotics that were effective against bacteria 30 years ago are now less likely to be effective because most of the bacterial population will be resistant to the antibiotic (1). Therefore new antibiotics have to be used to which most of the bacteria will not have any resistance with the result that these new antibiotics are going to be more effective in controlling bacterial infections. (1)

Question 6.

a. Species D. (1)

b. A common ancestor is the ancestral form of an organism which could have given rise to two or more different lines of organisms that evolved from this ancestral form. (1)

c. Because species A and C had a common ancestor B to begin with, they would have been separated into two populations. These two populations would then have been separated by a geographical barrier, such as a mountain range, to prevent the two populations from interbreeding. (1) With the two populations unable to interbreed, each population would develop their own genetic characteristics due to different selection pressures and mutations eventually resulting in species A and C. (1)

d. Homologous structures. (1)
e. Phenotype. (1)

Question 7.

a. All the different breeds of cattle belong to the same species since they can all interbreed under natural conditions and produce fertile offspring. (1)
b. With selective breeding, humans can control and choose the characteristics of a particular breed or variety of cattle and therefore breed that characteristic that they have chosen. This reduces the chance of unwanted characteristics in the variety or breed of cattle that has been chosen to be bred. (1)
c. Natural selection is the action of selection pressures on species living in the wild where individuals with the highest survival rates to sexual maturity will make the greatest contribution to the gene pool of subsequent generations. (1) Artificial selection, on the other hand, is when humans deliberately select specific individuals from a species that have a particular trait, to be the parents of subsequent generations. The selected trait might have no survival value to the individual and is only important to the humans that have selected it. (1)
d. Cloning reduces the genetic variability within a species. So if there are changes in the environment of the particular species, the decreased variability could reduce the species chances of adapting to the changing environment and therefore being able to survive into the future. (1)
e. An advantage of cloning particular plants is that cloning ensures the plants would always be genetically identical and guaranteed to have that specific characteristic. However if the plants were reproduced sexually, one could not guarantee that they would all have the specific characteristic required. (1)

Question 8.

a. Since human fossils cannot interbreed, the only way to place human fossils into particular species is by looking at the fossilized structures that are found. Whether similar structures belong to the same or different species is not as accurate as evidence from interbreeding. (1)
b. Absolute dating or radioisotope dating. (1)
c. The human fossil record is incomplete because, like other organisms, our ancestors would have decomposed and disintegrated very quickly after dying since terrestrial environments are not very suitable for fossilization. (1) Furthermore, not all human fossils that exist have been found and some will probably never be found. (1)
d. Cultural evolution. (1)