



VCE BIOLOGY 2016

YEAR 12 TRIAL EXAM

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Units 3/4

Reading time: 15 minutes

Writing time: 2 hours 30 minutes

<i>Section</i>	<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
A	40	40	40
B	7	7	70
			Total 110

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

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STUDENT NUMBER

Figures

Words

Letter

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Student Name.....**VCE Biology 2016 Year 12 Trial Exam Units 3/4**

There are **40 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	Question 26	A	B	C	D
Question 27	A	B	C	D	Question 28	A	B	C	D
Question 29	A	B	C	D	Question 30	A	B	C	D
Question 31	A	B	C	D	Question 32	A	B	C	D
Question 33	A	B	C	D	Question 34	A	B	C	D
Question 35	A	B	C	D	Question 36	A	B	C	D
Question 37	A	B	C	D	Question 38	A	B	C	D
Question 39	A	B	C	D	Question 40	A	B	C	D

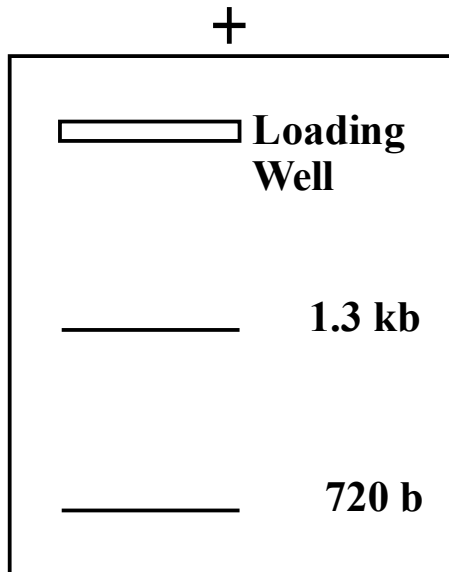
VCE Biology 2016 Year 12 Trial Exam Units 3/4

SECTION A – Multiple Choice Questions

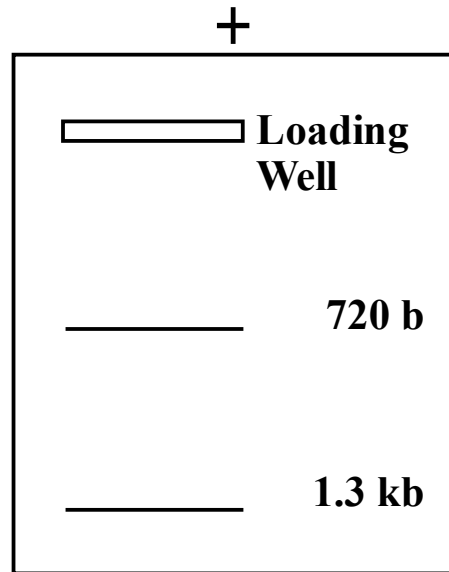
Question 1

A strand of DNA was treated with restriction enzymes resulting in two lengths of DNA. One fragment was 1.3 kb long and the other fragment was 720 bases in length. The most likely result when run through a gel electrophoresis would be

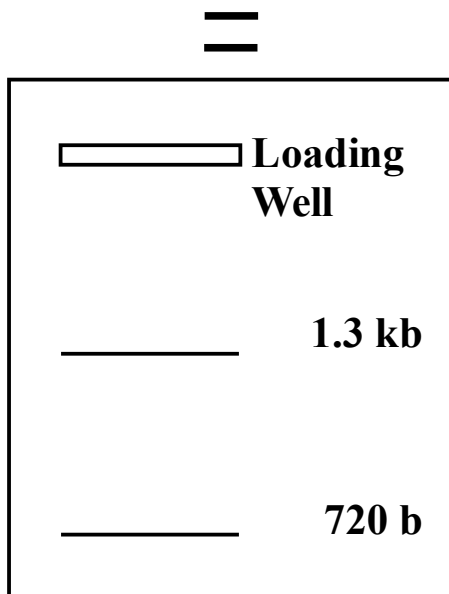
A.



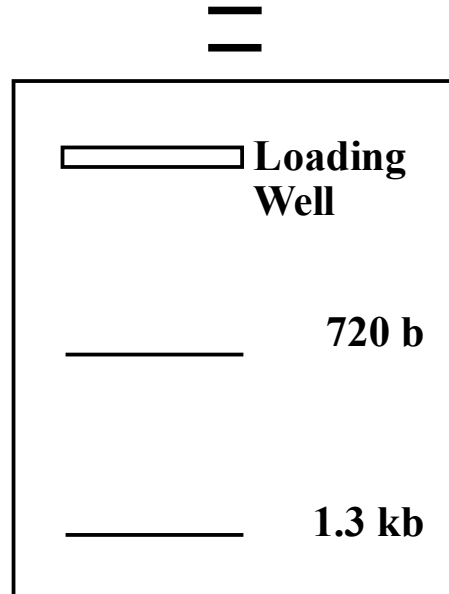
B.



C.



D.



Question 2

The DNA that codes for identical proteins in different species can still be used to determine their evolutionary relationship. This is due to

- A. non coding regions.
- B. silent mutations.
- C. three possible stop codons.
- D. telomeres.

Question 3

Which of the following hormones would be **least** likely to initiate a secondary messenger being released within the target cell?

- A. Amino acid derivative hormone.
- B. Peptide hormone.
- C. Protein hormone.
- D. Steroid hormone.

Question 4

Crossing over occurs between homologous chromosomes and involves the exchange of genetic material. This would occur during

- A. prophase 1 of meiosis.
- B. anaphase 1 of meiosis.
- C. metaphase of mitosis.
- D. telophase of mitosis.

Figure 1 relates to Questions 5 and 6.

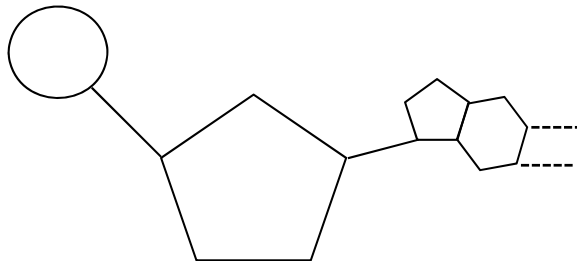
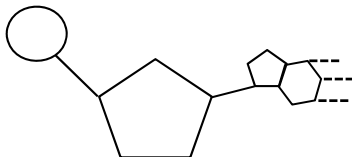


Figure 1

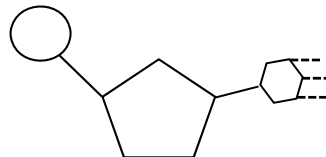
Question 5

The DNA nucleotide that would complement the shape in **Figure 1** would be

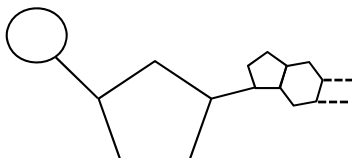
A.



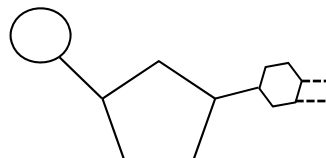
B.



C.



D.



Question 6

The DNA nucleotide shown in **Figure 1** would be

- A. adenine.
- B. guanine.
- C. cytosine.
- D. thymine.

Question 7

The enzyme ATP synthase is present

- A. on the grana of chloroplasts and in the matrix of the mitochondria.
- B. in the stroma of chloroplasts and on the cristae of the mitochondria.
- C. on the grana of chloroplasts and on the cristae of mitochondria.
- D. in the matrix of chloroplasts and in the stroma of mitochondria.

Question 8

In a typical section of double stranded DNA, what percentage of the nitrogen bases would be expected to be pyrimidines?

- A. 50%
- B. 30%
- C. 70%
- D. It varies depending on the individual species.

Question 9

A retired couple were approached by a man claiming to be their biological son. Blood tests were carried out on all three individuals. The father's blood type was found to be AB+ and the mother's blood type was O-. The man claiming to be their child was found to have O+ blood. Further tests were carried out on the mitochondria of the individuals and the mitochondria of the two males was found to be matching. It is likely that the man claiming to be the son of the couple is

- A. the child of the retired couple.
- B. the son of the mother but not the father.
- C. the son of the father but not the mother.
- D. not the son of either parent.

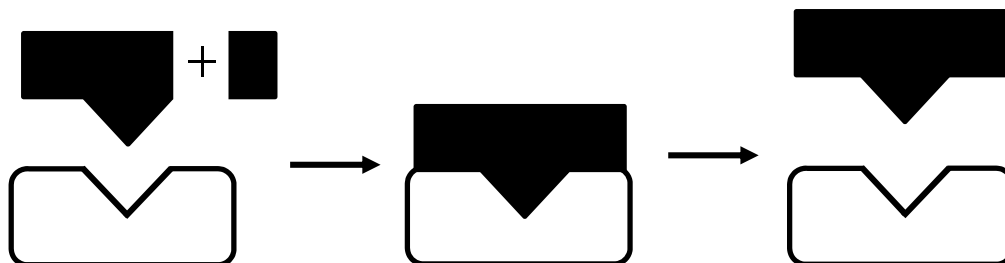
Question 10

Figure 2

The diagram in **Figure 2** shows a/an

- A. catabolic reaction that produces water.
- B. catabolic reaction that requires water.
- C. anabolic reaction that produces water.
- D. anabolic reaction that requires water.

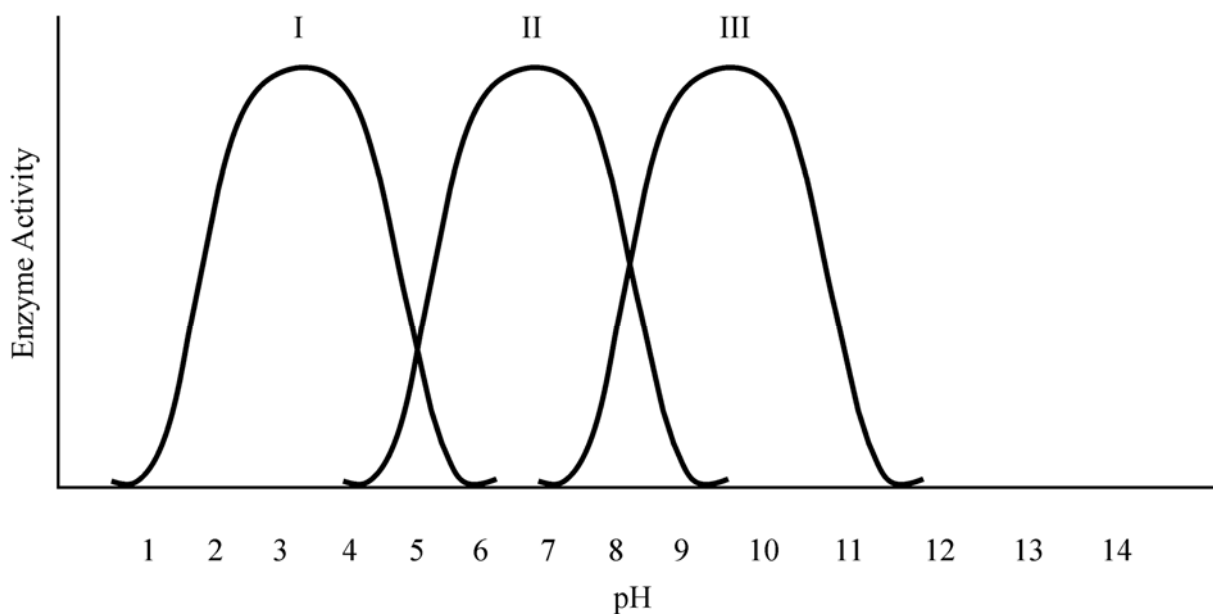
Question 11

An organic molecule was broken down and found to consist of five carbon atoms, 10 hydrogen atoms and 5 oxygen atoms. This molecule is most likely to be a

- A. monosaccharide.
- B. disaccharide.
- C. polypeptide.
- D. lipid.

Question 12

Enzymes have an optimum pH, where they function most efficiently. In humans, the enzyme amylase is active in the mouth in a neutral environment, the enzyme pepsin works most effectively in the acidic environment of the stomach, whilst lipase functions optimally in the small intestine in an alkaline environment.



Graph 1

From **Graph 1**, the correct order of enzymes would be

- | | I | II | III |
|----|----------|-----------|------------|
| A. | amylase | pepsin | lipase |
| B. | pepsin | lipase | amylase |
| C. | lipase | pepsin | amylase |
| D. | pepsin | amylase | lipase |

Question 13

The functioning of ATP synthase is powered by

- A. sunlight energy.
- B. the flow of protons across a membrane.
- C. the flow of electrons across a membrane.
- D. the rotation of the earth.

Question 14

The nervous and endocrine systems in humans are similar in that in all cases,

- A. messages are passed between cells via chemicals.
- B. receptors for chemical messengers are on the surface of the cell membrane.
- C. there is a fast response to a chemical signal.
- D. chemical messengers last in the body for a long time.

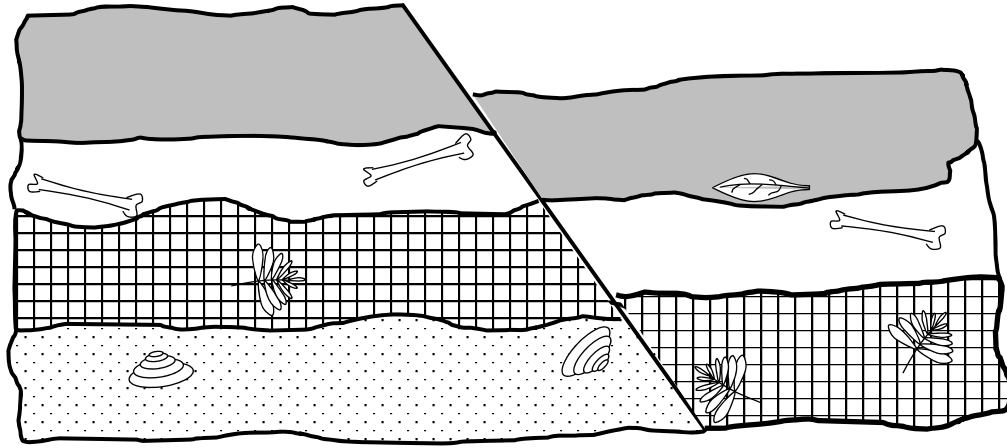


Figure 3

Question 15

According to **Figure 3**, which fossil would be the youngest?

- A. 
- B. 
- C. 
- D. 

Question 16

The fossilised shell in **Figure 3** is believed to have come from an ocean that was abundant with jellyfish. The reason shell fossils are common and jellyfish fossils are rare is because

- A. shells are more likely to fall into underground volcanos.
- B. jellyfish float.
- C. shells possess a hard outer covering.
- D. jellyfish were more widespread in the oceans.

Question 17

A wooden bowl was determined to be approximately 20,000 years old. The most accurate method of determining the age of this object would be

- A. argon / potassium dating.
- B. carbon dating.
- C. electron spin resonance.
- D. counting the growth rings.

Question 18

If an animal cell and a plant cell were placed in pure water, the animal cell would

- A. lyse and the plant cell would plasmolyse.
- B. crenate and the plant cell would become turgid.
- C. lyse and the plant cell would become turgid.
- D. crenate and the plant cell would plasmolyse.

Question 19

When an ant discovers food it will lay a scent trail as it returns back to the nest. Other worker ants can then find the food source by following the scent trail. The chemical released by the ant to make the scent trail is considered to be a

- A. pheromone.
- B. neurotransmitter.
- C. neurotoxin.
- D. paracrine hormone.

Question 20

Map butterflies have two distinct phenotypes. The butterflies that emerge in spring are black and orange while those that emerge in late summer are black and white coloured. When scientists looked at the genes responsible for colour in the map butterflies, they found that the genes were identical despite the variation in colour. This variation in colour of the map butterflies is due to

- A. genetic drift.
- B. recessive traits.
- C. environmental factors.
- D. new mutations.

Question 21

If a new predator was introduced into the environment and it ate large numbers of the black and orange coloured map butterflies, one would expect in the following year

- A. a lower ratio of black and orange butterflies to black and white butterflies to emerge in spring.
- B. a lower ratio of black and white butterflies to black and orange butterflies to emerge in late summer.
- C. a higher ratio of black and white butterflies to black and orange butterflies to emerge in spring.
- D. no change in the ratios of black and orange butterflies to black and white butterflies.

Question 22

Which of the following lists of hominins shows the correct order for increasing brain size?

- A. *Australopithecus africanus*, *Homo sapiens*, *Homo habilis*, *Homo neanderthalensis*.
- B. *Australopithecus africanus*, *Homo habilis*, *Homo neanderthalensis*, *Homo sapiens*.
- C. *Australopithecus africanus*, *Homo habilis*, *Homo sapiens*, *Homo neanderthalensis*.
- D. *Homo habilis*, *Australopithecus africanus*, *Homo neanderthalensis*, *Homo sapiens*.

Question 23

Which of the following events would most likely result in the formation of a fossil?

- A. A bird flying into molten lava.
- B. A worm becoming stuck in the mud.
- C. A bee becoming entombed in tree sap.
- D. A camel dying in the desert.

Question 24

Which of the following statements about aerobic respiration is correct?

- A. Oxygen is a product of the Krebs cycle.
- B. In glycolysis, two NADPHs are produced for every molecule of glucose broken down.
- C. In aerobic respiration, 36 – 38 ADPs are produced for every glucose molecule broken down.
- D. The Krebs cycle produces 2 FADH₂s per glucose molecule broken down.

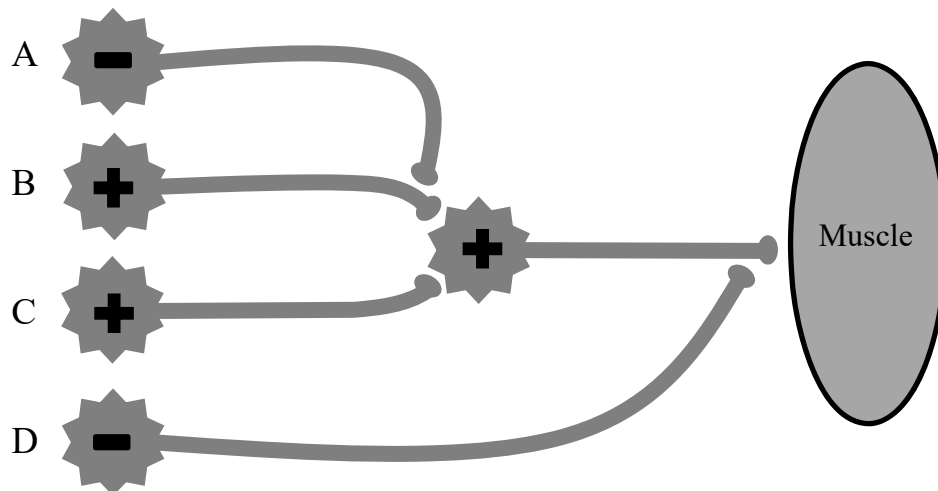


Figure 4

Question 25

Which of the following combination of nerve impulses shown in **Figure 4** would result in the muscle contracting if they were fired simultaneously? (+ represents an excitatory neuron and - represents an inhibitory neuron)

- A. B, C, D.
- B. A, C, D.
- C. A, B, D.
- D. A, B, C.

Question 26

Which of the following is not a monomer of a biological macromolecule?

- A. Glucose.
- B. Fatty acid.
- C. Amino acid.
- D. Nucleotide.

Question 27

The Australian wombat and the marsupial mole both have pouches that face backwards. This avoids the problem of the pouch filling with dirt and suffocating the young developing in the pouch. Researchers have determined, however, that the common ancestor of the Australian wombat and the marsupial mole did **not** have a pouch that faced backwards. A backwards facing pouch is therefore an example of

- A. divergent evolution.
- B. convergent evolution.
- C. sexual dimorphism.
- D. differing selection pressures.

Question 28

A peptide bond forms between

- A. amino acids in a protein.
- B. the nitrogen bases in DNA.
- C. glucoses in cellulose.
- D. nucleotides in RNA.

Questions 29 and 30 refer to **Figure 5**.

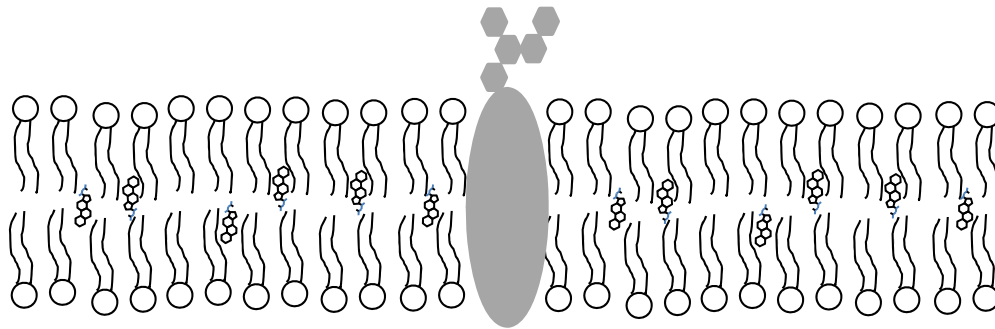


Figure 5

Question 29

The protein in **Figure 5** produces the secondary messenger molecule cyclic AMP within the cell. This protein is most likely to be a

- A. class II MHC marker.
- B. protein gate.
- C. receptor for a particular steroid hormone.
- D. receptor for a particular protein hormone.

Question 30

The diagram in **Figure 5** is of a cell membrane of a/an

- A. animal cell.
- B. plant cell.
- C. bacterial cell.
- D. fungal cell.

Question 31

Members of the genus *Homo* are distinct from other hominids in that they

- A. display bipedalism.
- B. possess a larger brain to body ratio.
- C. use tools.
- D. do not have a tail.

Question 32

An allergic reaction is caused when antibodies bound to a specific antigen interact with

- A. cytotoxic T cells.
- B. mast cells.
- C. plasma cells.
- D. memory T cells.

Question 33

Immunity in an individual, resulting from a vaccination by a physician, is best described as being

- A. naturally acquired and active.
- B. naturally acquired and passive.
- C. induced and active.
- D. induced and passive.

Question 34

The following pedigree chart shows the incidence of Tay-Sachs disease, a lethal genetic disorder, in a family. Shaded individuals suffer from the disease.

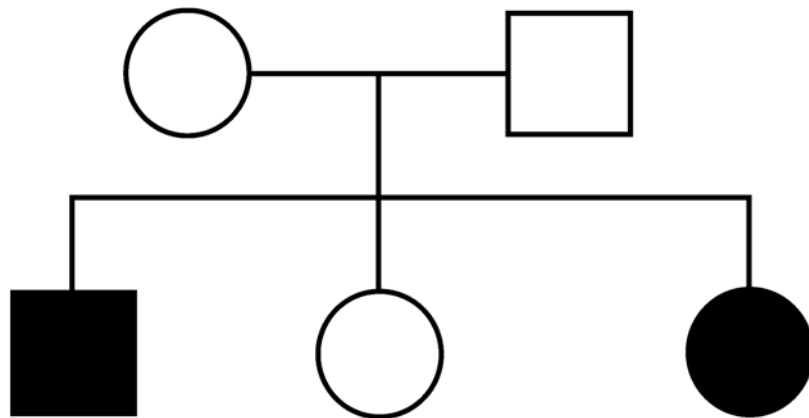


Figure 6

According to the pedigree chart in **Figure 6**, the mode of inheritance for Tay-Sachs disease is

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

Question 35

The incidence of Tay-Sachs disease is nearly a hundred times greater amongst Ashkenazic Jews (Jewish people whose ancestors hailed from central Europe) when compared to the general population or Sephardic (Mediterranean) Jewish people.

This high incidence of Tay-Sachs disease amongst the Ashkenazic Jews is most likely due to

- A. high levels of gene flow.
- B. a large population.
- C. higher rate of mutation.
- D. selective mating.

Question 36

The cause of death in Tay-Sachs disease is due to the failure of an enzyme that would normally break down gangliosides, a type of lipid formed in brain cells. The gangliosides accumulate in the brain cells, resulting in the cell no longer functioning optimally and leading to its eventual death.

In normal cells, the enzyme responsible for breaking down gangliosides would be found in the

- A. lysosome.
- B. nucleus.
- C. mitochondria.
- D. golgi body.

Question 37

Which of the following molecules is most likely to contain the amino acid serine?

- A. Cholesterol.
- B. Glycolipid.
- C. Lipase.
- D. Myelin.

Question 38

Two distinct species are said to share analogous structures. This means that they have structures that are structurally

- A. similar but used for different purposes.
- B. similar and used for the same purpose.
- C. different yet used for the same purpose.
- D. different but used for different purposes.

Question 39

The greater prairie chicken of North America was believed to have a population of over a million when Europeans first settled. Due to hunting and habitat destruction, the number of birds dropped to fewer than fifty individuals in the 1990s. A recent study has discovered very limited genetic diversity amongst the greater prairie chickens, with the birds being homozygous for over 99% of their gene loci.

This lack of genetic diversity is due to

- A. the founder effect.
- B. a genetic bottleneck.
- C. cloning.
- D. low mutation rates.

Question 40

With regard to immunity, an example of one part of the body's second line of defence would be

- A. interferon released by a virus-infected cell.
- B. lysozymes excreted in tears.
- C. acid produced in the stomach.
- D. antibodies produced by a plasma cell.

End of Section A

VCE Biology 2016 Year 12 Trial Exam Units 3/4

SECTION B – Short Answer Questions

Question 1 (12 marks)

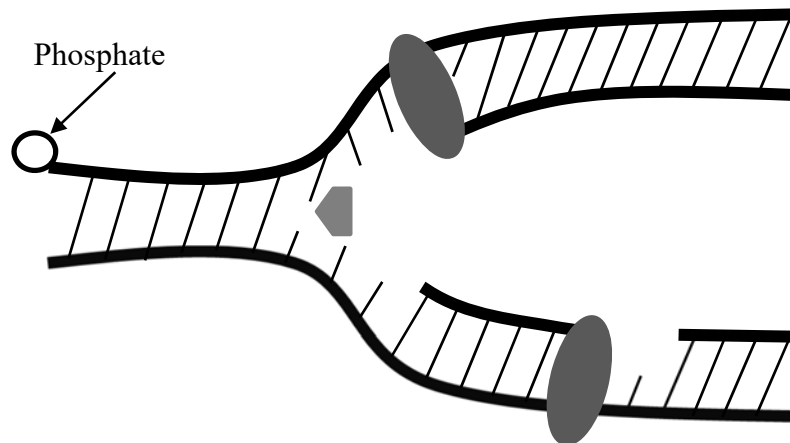


Figure 7

Figure 7 shows a section of DNA undergoing the process of replication.

- a. In **Figure 7**, label each of the 4 strands shown with a 5', a 3' and an arrow showing the direction of DNA synthesis. **4 marks**

- b. What term is given to the unlinked sections of DNA that are synthesised on the lagging strand in **Figure 7**? **1 mark**

- c. Name and describe the function of each of the enzymes, shown below, involved in this process.

i. 

2 marks

ii. 

2 marks

- d. Another enzyme involved in DNA replication but not shown in **Figure 8**, is the enzyme DNA ligase. Scientists have used this enzyme in a variety of gene manipulation techniques. Describe the role DNA ligase plays in one genetic engineering process you have studied.

2 marks

Figure 8 is a diagram of a cell cycle.

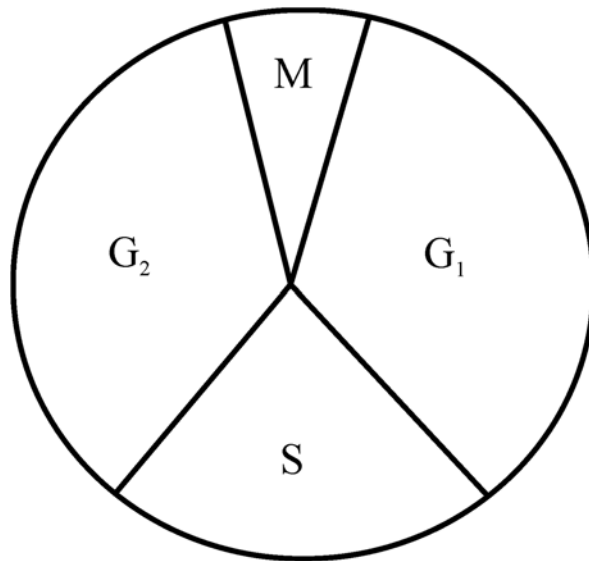


Figure 8

- e. During which phase would DNA replication occur?

1 mark

Question 2 (13 marks)

The London Underground is a complex system of subway lines and stations, stretching over 200 kilometres underneath London and its surrounding suburbs. For a number of years, passengers in London's subway system have complained about a particularly vicious form of mosquito, *Culex molestus*, that has been dubbed the 'London Underground mosquito'.

Scientists researching this mosquito have discovered that its DNA differs to that of the common *Aedes* genus of mosquito that is well known for feeding on humans and transmitting a variety of viruses including the Zika virus. *Culex molestus* appears to be more closely related to the *Culex pipiens*, a mosquito that normally feeds on birds, than to species of the *Aedes* genus.

- a. What name is given to the situation where a small number of individuals from a species are separated from the larger gene pool? **1 mark**
-
- b. Describe how *Culex molestus* may have evolved from *Culex pipiens*. **3 marks**
-
-
-
-
- c. *Culex molestus* mosquitoes appear to be structurally identical to *Culex pipiens* mosquitoes when viewed under a microscope. How would scientists determine if the London underground mosquito should be classified as a different species from the *Culex pipiens* mosquito? **2 marks**
-
-
-

- d. Draw a phylogenetic tree to show the relative closeness of the *Culex molestus* and *Culex pipiens* mosquitoes to the *Aedes* genus of mosquitoes.

2 marks



- e. What name is given to an organism, like a mosquito, that is capable of transmitting viruses between different host organisms?

1 mark

- f. Intact skin is part of the body's first line of defence against infection by pathogens and is responsible for preventing a number of viral infections. Explain why the first line of defence failed in the case of mosquitoes transferring viruses like the Zika virus.

1 mark

- g. Scientists are now trying to use mosquitoes to defend against some of the very diseases that they spread. Researchers are currently attempting to insert the DNA that codes for viral antigens into the DNA of a mosquito. It is hoped that the mosquito will produce the antigen protein in its saliva and inject it into people when they feed. Explain how this will help protect people from viruses like the Zika virus.

3 marks

Question 3 (13 marks)

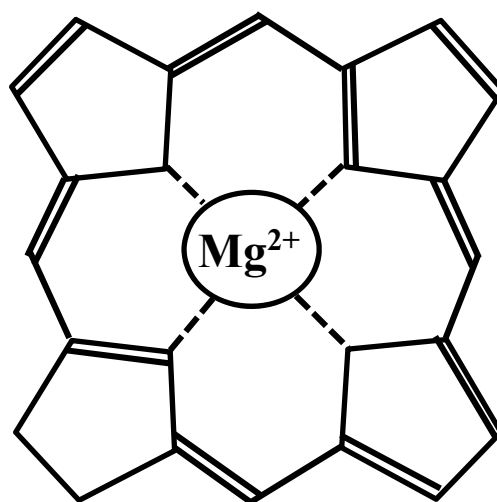


Figure 9

Figure 9 shows part of the structure of a chlorophyll molecule.

- a. What term is given to ions like Mg^{2+} that are required for molecules such as chlorophyll and haemoglobin to function correctly? **1 mark**

- b. Where specifically would chlorophyll be located within a plant cell? **1 mark**

- c. Magnesium ions are usually found in solution present in the surrounding soil, often at lower concentration levels than that found in the roots of plants. By what process would plants absorb these magnesium ions into their roots? **1 mark**

Plants that are magnesium deficient typically have a lower rate of photosynthesis and display yellowing of the leaves.

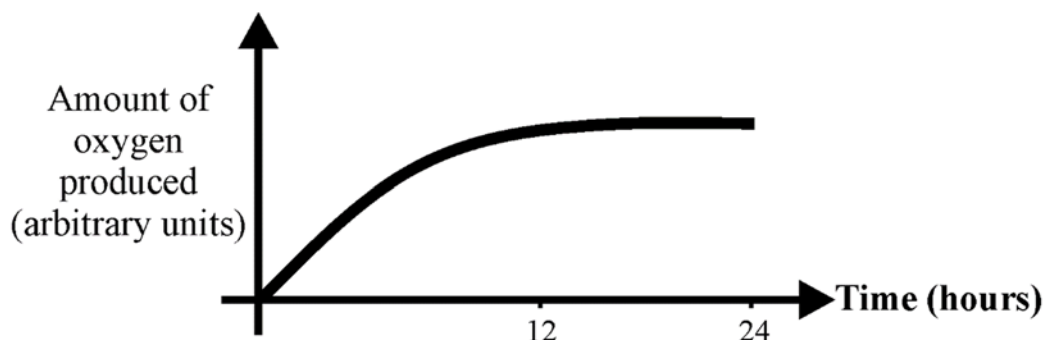
- d. Which stage of photosynthesis is most likely to be affected by a lack of magnesium? **1 mark**

- e. Explain why magnesium deficiency would lead to yellow leaves and a decreased rate of photosynthesis. **2 marks**

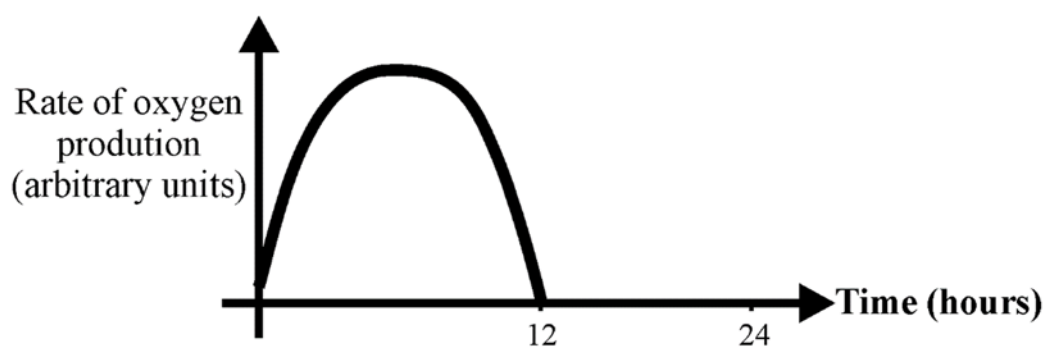
- f. Write a **balanced** chemical equation for photosynthesis. **2 marks**

Graphs 2 and 3, displayed below, show the amount and the rate of oxygen production for a plant placed in a sealed container and exposed to light over a 24-hour period.

- g.** Add to the graphs the results you would expect to see for a magnesium deficient plant placed under the same conditions. **2 marks**



Graph 2: Amount of oxygen produced by a plant due to photosynthesis over a 24-hour period.



Graph 3: Rate of oxygen production by a plant due to photosynthesis over a 24-hour period.

- h.** Megan had taken twenty cuttings of her favourite camellia bush but all the young plants seemed to have yellow leaves and were growing very slowly. Design an experiment that would determine whether magnesium deficiency is the cause of the stunted plant growth, and state the results that would support the proposed hypothesis. **3 marks**

Question 4 (10 marks)

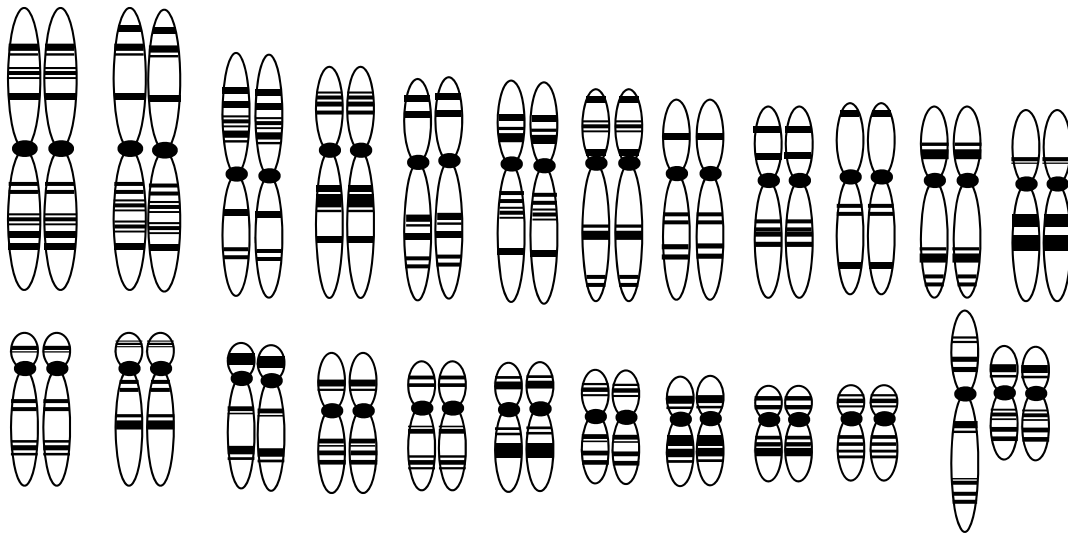


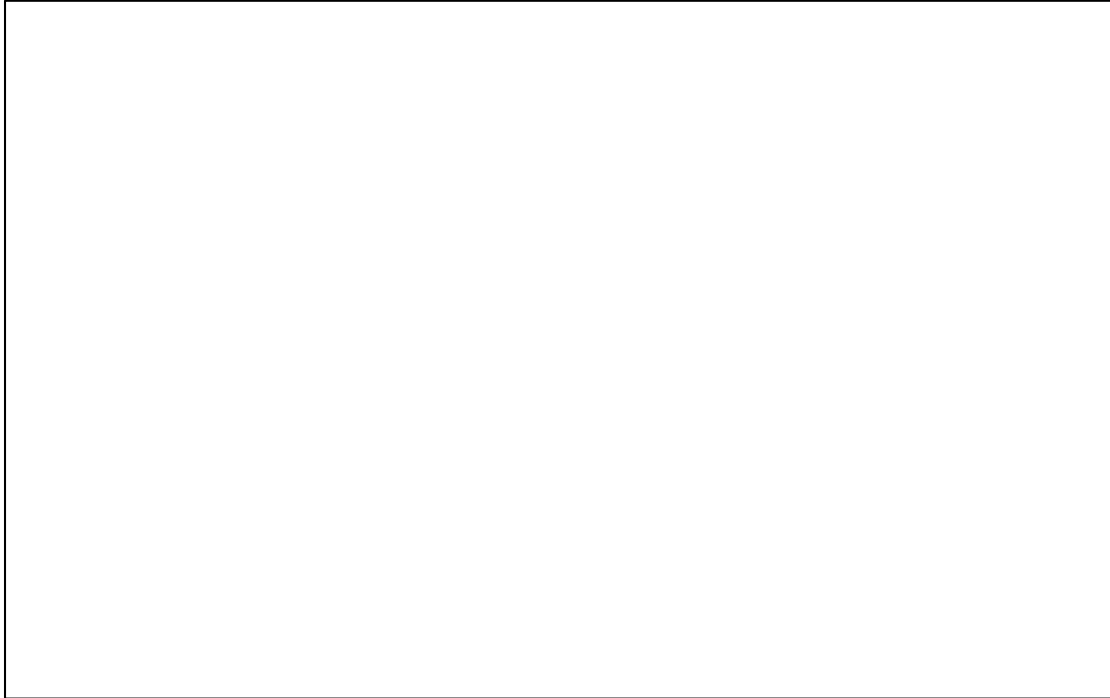
Figure 10

Figure 10, is a karyotype produced from cells isolated from the amniotic fluid of a six-month old foetus.

- a. What is the number of chromosomes in a normal diploid human cell? **1 mark**
-
- b. What term is given to describe an abnormal number of chromosomes in a cell? **1 mark**
-
- c. Is the foetus, whose karyotype is shown in **Figure 10**, a male or female? Explain. **2 marks**
-
-

- d.** Explain, with the aid of a diagram, how the unusual number of chromosomes has been produced. Include the relevant stages of meiosis in the diagram.

3 marks



Even though X and Y chromosomes have a large number of differing genes, there is a section of approximately 30 genes that is found on both the X and the Y chromosomes. This is known as the 'pseudo-autosomal' region.

- e.** Explain what benefit this pseudo-autosomal region may have for the cell during meiosis.

1 mark

- f.** Is it possible for a man to pass on a Y chromosome that carries some of his mother's genes? Explain.

2 marks

Question 5 (9 marks)

Tomato plants have a number of monogenic traits that show a clear dominant / recessive mode of inheritance.

	Dominant	Allele symbol	Recessive	Allele symbol
Plant height	Tall	T	Short	t
Fruit texture	Even	E	Stripy	e
Fruit colour	Red	R	Yellow	r
Flower colour	Yellow	Y	White	y

A researcher found a wild tomato that was tall and produced even-textured fruit. Realising that both traits were dominant, he crossed it with a short tomato plant that produced stripy fruit to determine the exact genotype of the wild tomato.

- a.** What term is given to this type of cross? **1 mark**

Despite producing thirty offspring, the researcher discovered that all the offspring produced were either tall plants with stripy fruit or short plants with even-textured fruit. The researcher concluded that the two traits must be carried on the same chromosome.

- b.** Write the genotypes of the two parent tomato plants involved in this cross. **2 marks**

- c.** With the aid of punnett squares, show how the results obtained by the researcher would differ to that of a similar cross for two characteristics that were unlinked. Include the correct phenotypic and genotypic percentages for both linked and unlinked scenarios. **4 marks**

- d.** On repeating this experiment, the researcher produced a tomato plant that was tall and produced even-textured fruit. Explain how offspring of this type could be produced. **2 marks**

Question 6 (5 marks)

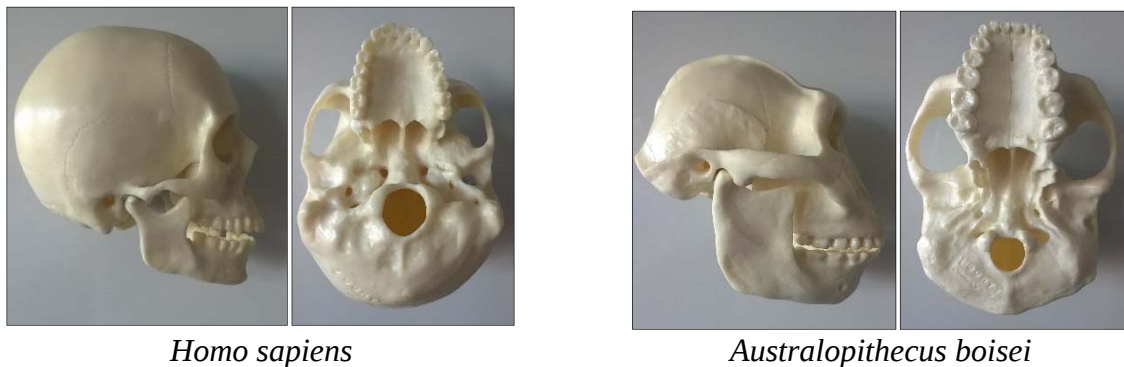


Figure 11

Figure 11 shows the skulls of *Homo sapiens* and *Australopithecus boisei*.

- a.** What conclusion can you draw about the difference in diet between modern humans and *Australopithecus boisei*? State two structural features that support your answer. **3 marks**

- b.** What piece of cultural evolution would have had a profound impact on the diet of *Homo sapiens*? State what the impact of this cultural change would have been. **2 marks**

Question 7 (8 marks)

Auxin is a plant hormone that is responsible for a wide array of processes within the plant. It promotes positive geotropism in the roots of the plant as well as negative geotropism and positive phototropism in the shoots. Auxin also influences apical dominance and fruit development as well as inhibiting leaf abscission.

- a.** Name another plant growth regulator which is involved in leaf abscission. **1 mark**

- b.** Explain how a single chemical like auxin can have such varied effects on different cells of a plant. **2 marks**

Part of the reason auxin is so effective is because it can influence the DNA of cells, as shown in **Figure 12**.

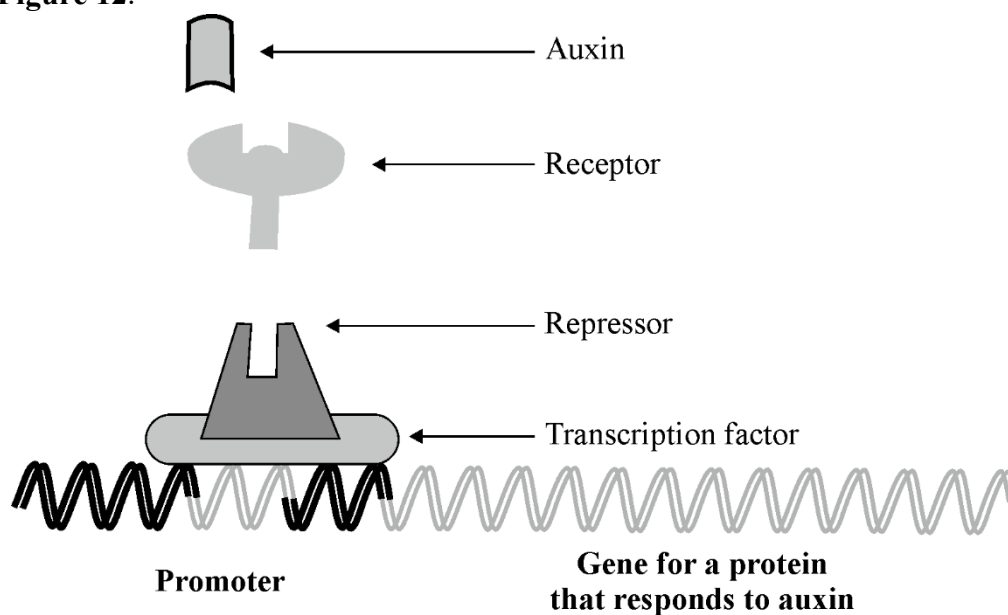


Figure 12

- c. Explain the process shown in **Figure 12** and state why it is beneficial for the cell to have repressor molecules like those shown acting on the genes.

3 marks

- d. Promoter sites are also known as TATTA boxes. Explain why a large amount of thymine and adenine bearing nucleotides in sequence are used as promoter sites.

2 marks

End of Section B

End of Trial Exam

Suggested Answers

VCE Biology 2016 Year 12 Trial Exam Units 3/4

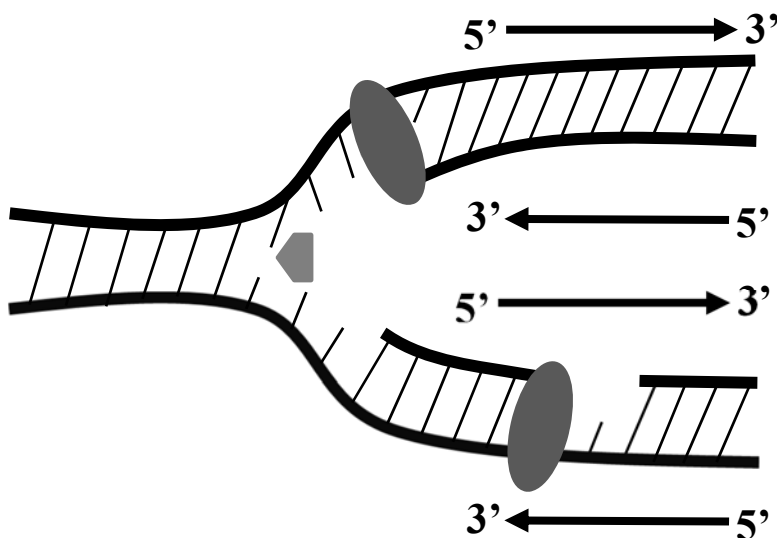
SECTION A – Multiple Choice Questions

- | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1. C | 2. B | 3. D | 4. A | 5. D | 6. A | 7. C | 8. A | 9. D | 10. C |
| 11. A | 12. D | 13. B | 14. A | 15. D | 16. C | 17. B | 18. C | 19. A | 20. C |
| 21. D | 22. C | 23. C | 24. D | 25. D | 26. B | 27. B | 28. A | 29. D | 30. A |
| 31. B | 32. B | 33. C | 34. B | 35. D | 36. A | 37. C | 38. C | 39. B | 40. A |

SECTION B – Short Answer (Answers)

Question 1 (12 marks)

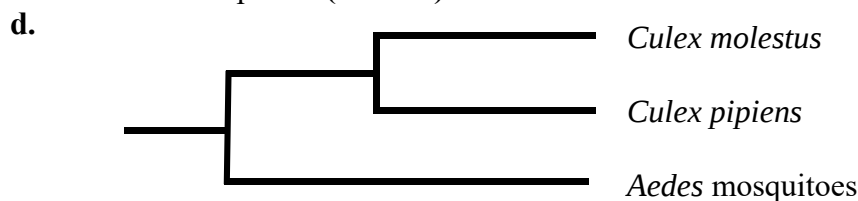
- a. 1 mark for each strand for a total of (4 marks).



- b. Okazaki fragments (1 mark).
c. i. DNA helicase (1 mark) unwinds/ unzips the double stranded DNA molecule (1 mark).
ii. DNA polymerase (1 mark) attaches complementary DNA nucleotides to the growing polynucleotide chain (1 mark).
d. DNA ligase is used in creating transgenic organisms or recombinant plasmids (1 mark). It is used to re-join DNA fragments that have been cut with restriction enzymes (1 mark).
e. S Phase or Synthesis phase (1 mark).

Question 2 (13 marks)

- a. Founder effect (1 mark).
- b. There is natural variation for traits which exist within the species of *Culex molestus* (1 mark).
A group of *Culex* mosquitoes became isolated underground from the rest of the population of *Culex molestus* (1 mark).
Those mosquitoes who were able to bite humans survived and bred, passing this trait onto their offspring (1 mark).
- c. Scientists should try breeding *Culex molestus* with *Culex pipiens* (1 mark).
If they cannot produce fertile viable offspring, then they can be considered to be different species (1 mark).

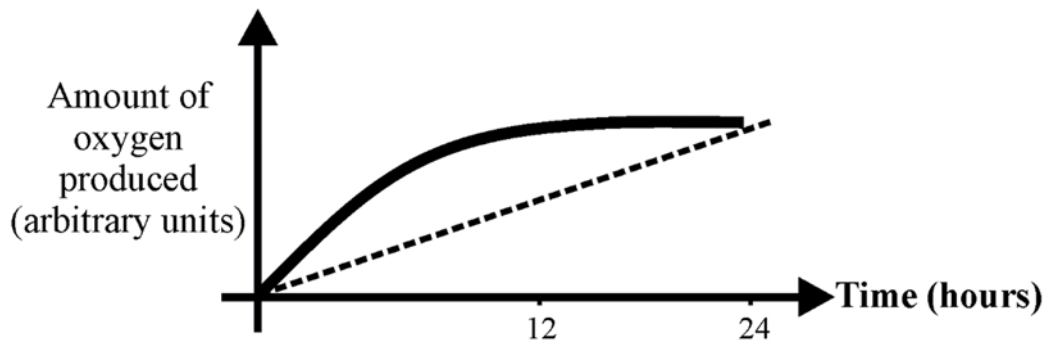


- (1 mark) for showing *Culex molestus* and *Culex pipiens* closer than *Aedes*.
(1 mark) for showing common ancestor for all the mosquitoes.
- e. Vector (1 mark).
- f. Mosquitoes bite through the skin, bypassing the first stage of defence (1 mark).
- g. Viral antigens injected through the mosquito bite would be detected by the immune system of the host as non-self (1 mark). This would lead to the production of memory B and T cells and antibodies specific to the introduced viral antigens. (1 mark). Should the person later be infected with the actual virus, the body's immune system would be better equipped to destroy the virus (1 mark).

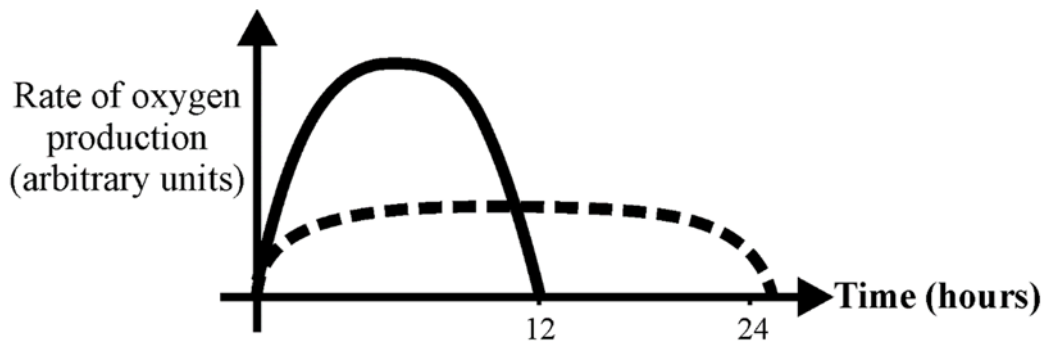
Question 3 (13 marks)

- a. Cofactors (1 mark).
- b. In the grana of chloroplasts (1 mark).
- c. Active transport or pinocytosis (1 mark).
- d. The light-dependent stage of photosynthesis (1 mark).
- e. Chlorophyll absorbs light, reflecting the green wavelengths. Less chlorophyll will mean the plant appears less green (1 mark).
Chlorophyll is needed to produce the NADPH and ATP required for the light-independent stage of photosynthesis. Less chlorophyll will result in a lower rate of photosynthesis (1 mark).
- f. $6 \text{ CO}_2 + 12 \text{ H}_2\text{O} \xrightarrow[\text{chlorophyll}]{\text{light}} \text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{ O}_2 + 6 \text{ H}_2\text{O}$
(1 mark) for balanced reactants and products.
(1 mark) for light and chlorophyll.

- g.** 1 mark for each graph (shown as a dotted line) for a total of **(2 marks)**.



Amount of oxygen produced by a plant due to photosynthesis over a 24-hour period.

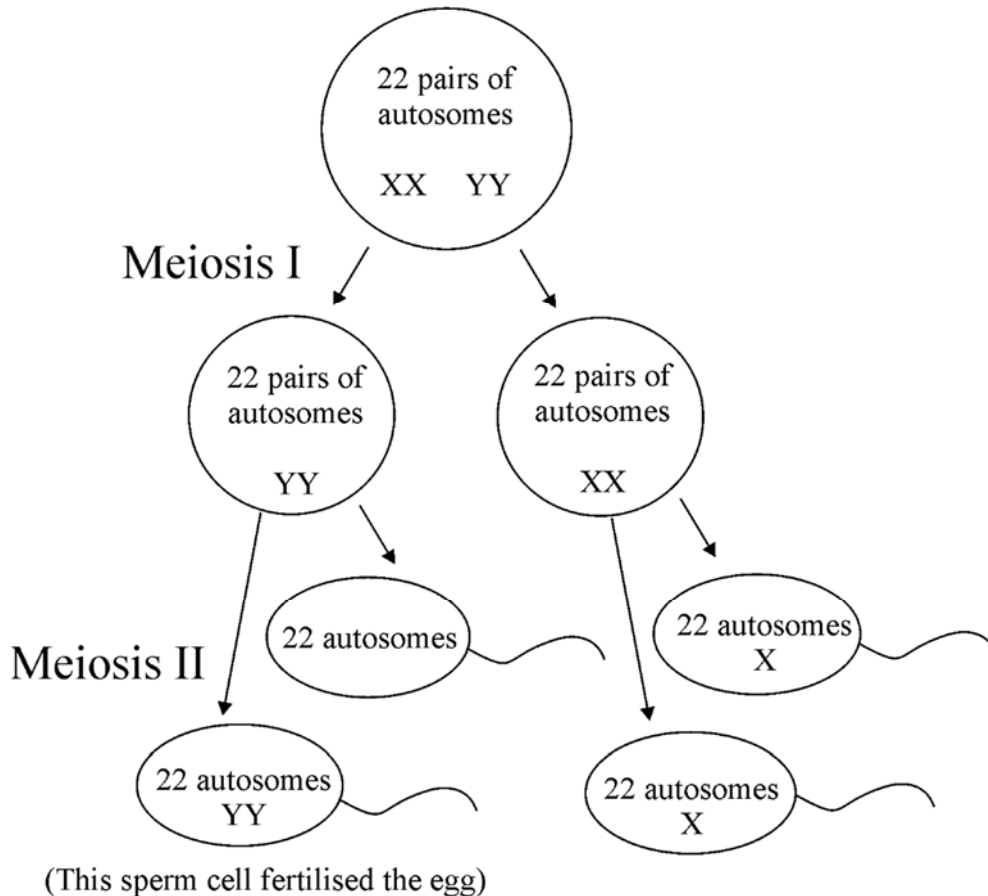


Rate of oxygen production by a plant due to photosynthesis over a 24-hour period.

- h.** Megan should group the plants into five groups of four. One group should be watered with distilled water. The other groups should be watered with water containing increasing levels of magnesium ions (**1 mark** for the control and experimental variable).
All the plants should receive the same amount of light, temperature and water (**1 mark**).
Should the leaves of the plants receiving magnesium appear greener than the control group then the hypothesis is supported (**1 mark**).

Question 4 (10 marks)

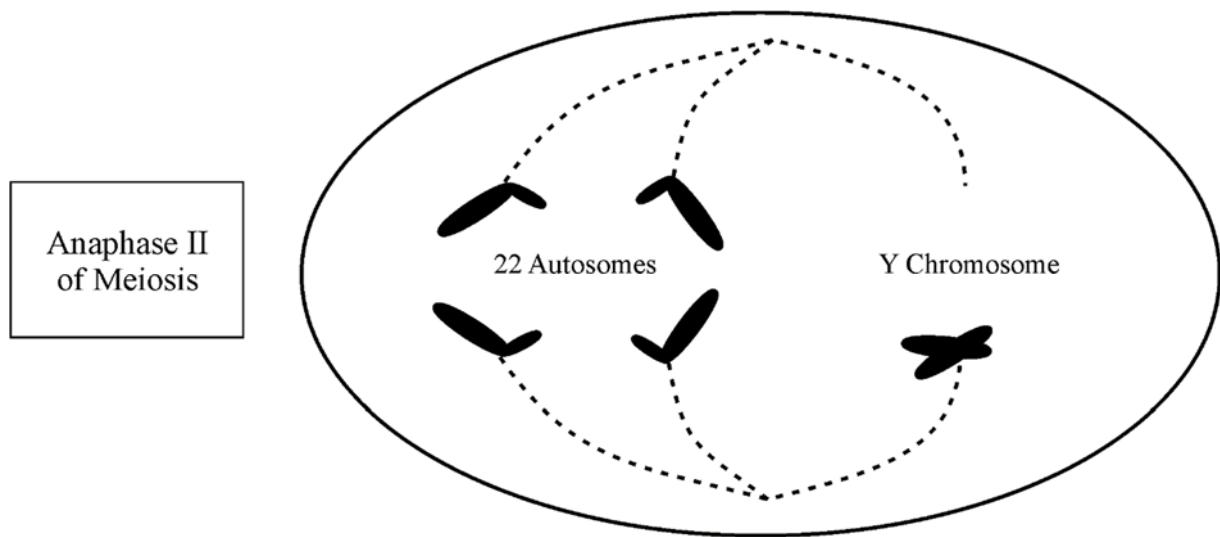
- a. 46 (1 mark).
- b. Aneuploidy (1 mark).
- c. Male (1 mark) since in humans X and Y chromosomes produce males (1 mark).
- d. Non disjunction in the sperm development has occurred (1 mark). This occurred during the second anaphase of meiosis to produce a sperm cell with 22 autosomes and 2 Y chromosomes (1 mark).
The diagram could show this nondisjunction (1 mark).



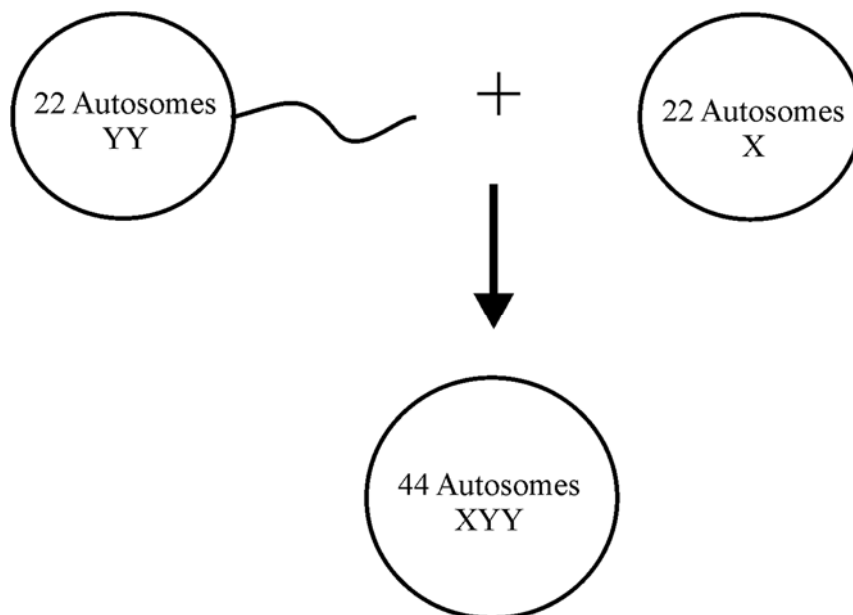
Answer continued overleaf.

Questions 4d (Continued)

Alternatively, a diagram showing the non-disjunction of the Y chromosome in Anaphase II of meiosis would also be acceptable (1 mark).



Alternatively, the diagram could also show the gametes producing the unusual zygote (1 mark).



- e. The pseudo-autosomal region on the sex chromosomes in humans allows the X and Y chromosomes to form a partial homologous pair during prophase I of meiosis (1 mark).
- f. Yes, as crossing over can occur during prophase I of meiosis between these pseudo-autosomal regions of the sex chromosomes (1 mark). Genes from the pseudo-autosomal region of the X and Y chromosomes can exchange, resulting in a hybrid Y chromosome containing maternal genes (1 mark).

Question 5 (9 marks)

- a. Test cross (1 mark).
 b. $Te/tE \times te/te$ (1 mark for each parent for a total of 2 marks).

Can also be written $\begin{array}{c} \underline{Te} \\ tE \end{array} \quad \begin{array}{c} \underline{te} \\ te \end{array}$

- c. Linked scenario

	Te	tE
te	Te/te	tE/te

50% Te/te
 Tall
 Stripy
 fruit.

50% tE/te
(1 mark)
 Short
 even-textured
 fruit **(1 mark)**

Unlinked scenario

	TE	Te	tE	te
te	TtEe	Ttee	ttEe	ttee

25% $TtEe$
 Tall
 even-textured
 fruit

25% $Ttee$
 Tall
 stripy
 fruit

25% $ttEe$
 Short
 even-textured
 fruit

25% $ttee$
(1 mark)
 Short
 stripy
 fruit
(1 mark)

- d. Crossing over may occur **(1 mark)** between the homologous pair of chromosomes during prophase I of meiosis, resulting in a chromosome that possesses the Tall allele as well as the even-textured fruit allele **(1 mark)**.

Question 6 (5 marks)

- a. *Australopithecus boisei* ate harder, more fibrous materials than modern humans **(1 mark)**.

This is shown by the **larger jaw (1 mark)** and more **pronounced molars (1 mark)** for grinding fibrous material.

(Students could also mention the **zygomatic arch** and **sagittal crest** that would support the presence of larger jaw muscles in *Australopithecus boisei*) (1 mark for each feature maximum of **(2 marks)**).

- b. Fire **(1 mark)** – allowed *Homo sapiens* to cook food to gain greater nutritional value. **(1 mark)**.

or

Weapons **(1 mark)** – allowed *Homo sapiens* to hunt food high in protein **(1 mark)**.

or

Agriculture **(1 mark)** – allowed *Homo sapiens* to maintain a stable source of food **(1 mark)**.

Question 7 (8 marks)

- a. Absciscic acid **(1 mark)**.
- b. All cells that respond to auxin must have an appropriate receptor **(1 mark)**. However, the signal transduction process which occurs is dependent on the molecules contained in specific cells. This leads to a variety of biochemical pathways and ultimately a variety of different cellular responses **(1 mark)**.
- c. The repressor molecule stops the gene from being transcribed into RNA **(1 mark)**. When auxin is present, the hormone/receptor complex binds to the repressor molecule. This deactivates the repressor molecule and allows gene transcription to occur **(1 mark)**.
This means the protein that responds to auxin is only ever produced when auxin is present in the cell **(1 mark)**.
- d. Adenine and thymine bearing nucleotides are attracted to each other by two hydrogen bonds, as opposed to cytosine and guanine bearing nucleotides which are attracted by three hydrogen bonds **(1 mark)**.
Repeating sections of adenine and thymine are therefore easier to separate to allow the template strand of DNA to be transcribed than are DNA sections of cytosine and guanine **(1 mark)**.

End of Suggested Answers