VCE BIOLOGY 2015

YEAR 12 **TRIAL EXAM**

Units 3/4
Reading time: 15 minutes
Writing time: 2 hours 30 minutes

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	40	40	40
B	12	47	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

												Letter
Figures												
Words												

Student Name....……..... .....

VCE Biology 2015 Year 12 Trial Exam Units 3/4

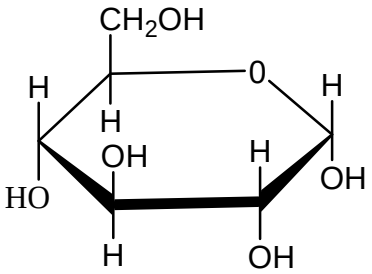
There are **40 Multiple Choice Questions** to be answered by circling the correct letter in the table below. Use only a 2B pencil. If you make a mistake, erase it and enter the correct answer. Marks will not be deducted for incorrect answers.

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 2015 Year 12 Trial Exam Units 3/4

SECTION A – Multiple Choice Questions

Question 1
The molecule shown below is



A. maltase, inorganic and a polysaccharide.
B. glucose, organic and a monomer.
C. a lipid, inorganic and hydrophobic.
D. glucose, inorganic and a polymer.

Question 2
Deoxyribonucleic acid (DNA) is a double stranded molecule. Each strand of DNA is formed by
A. a series monomers linked by hydrogen bonds.
B. alternating purines and nucleotides.
C. a series of amino acids.
D. the phosphate of one monomer joining to the pentose sugar of another monomer.

Question 3
Two types of ribonucleic acid that are involved in transcription and translation respectively include
A. rRNA and tRNA.
B. DNA and mRNA.
C. rRNA and mRNA.
D. mRNA and tRNA.

The following information refers to Questions 4 and 5.
Enzyme X is made by a particular cell type, and catalyses chemical reactions.
Figure 1 shows Enzyme X, with its active site labelled and four possible substrates.

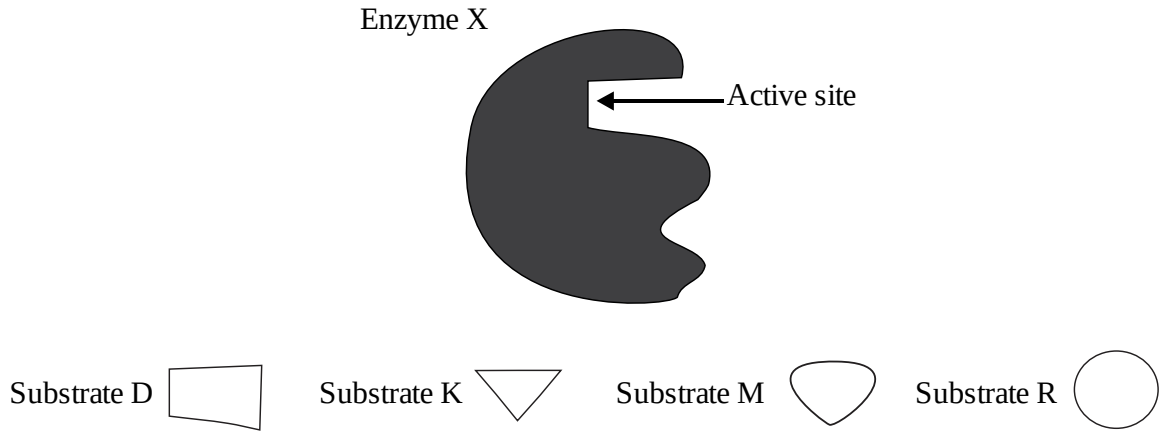


Figure 1

Question 4
The site of synthesis of Enzyme X is the
A. ribosome.
B. nucleus.
C. endoplasmic reticulum.
D. golgi complex.

Question 5
Which of the substrates shown in **Figure 1** will most likely activate Enzyme X?
A. M.
B. R.
C. D.
D. K.

The following information refers to Questions 6 and 7.

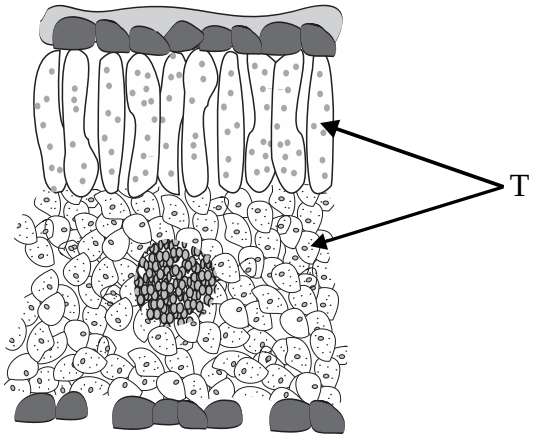


Figure 2: A cross-section of a leaf

Question 6
In **Figure 2**, the structure labelled as T is a plant organelle and acts as the site of photosynthesis. Structure T is most likely to be

A. carbon dioxide.
B. a guard cell.
C. a stoma.
D. a chloroplast.

Question 7
The chemical reactions that occur in structure T include the

A. light independent reactions in the thylakoid membranes and the light dependent reactions in the chlorophyll.
B. light dependent reactions in the thylakoid membrane and the light independent reactions in the stroma.
C. Calvin cycle in the grana and the Krebs cycle in the stroma.
D. electron transport chain reaction and a condensation reaction.

Question 8
Fungal cells produce energy through anaerobic respiration. The products of anaerobic respiration, in this example, include

A. carbon dioxide, water and ATP.
B. glucose, oxygen and water.
C. NADH, carbon dioxide and ATP.
D. ethanol, carbon dioxide and ATP.

The following information refers to Questions 9 and 10.
Figure 3 shows three types of signalling pathways.

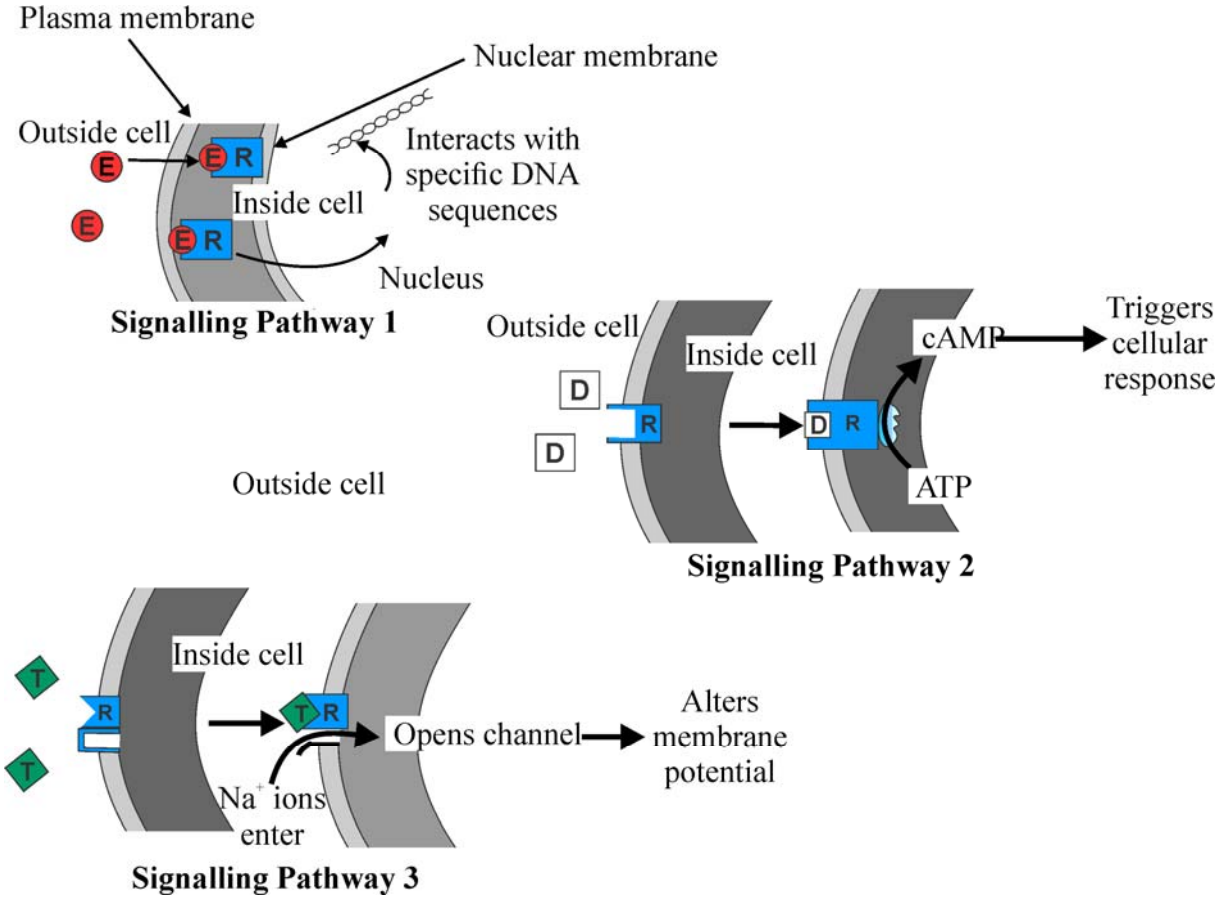


Figure 3

Question 9
In **Figure 3**, it would be reasonable to expect that molecule E is
A. protein based whereas molecule D is a neurotransmitter.
B. a neurotransmitter whereas molecule D is lipid insoluble.
C. lipid insoluble whereas molecule D is lipid soluble.
D. lipid soluble whereas molecule D is not-lipid soluble.

Question 10
The effect of molecule T would most likely be
A. either an excitatory or inhibitory one on a postsynaptic cell.
B. the activation of an enzyme.
C. the activation of a major histocompatibility complex.
D. to initiate apoptosis.

Question 11
A fruit moth, *Grapholita molesta*, responds to chemical signals in the environment. The female fruit moth of this species releases certain chemicals into the air to attract a mate. The released chemical is best described as being a

A. steroid-based hormone.
B. phytohormone.
C. pheromone.
D. neurotransmitter.

Question 12
Figure 4 is a timeline of synaptic density in a healthy human brain.

Figure 4

Between the ages of 2 and 14 years old, some of the cells were genetically programmed to terminate. These cells were then phagocytised. This is an example of

A. a neurological disease.
B. necrosis.
C. an error in a signalling transduction pathway.
D. apoptosis.

Question 13
Chemical communication can occur between a nerve cell and an effector cell. An example of an effector cell is
A. another nerve cell.
B. a muscle cell.
C. a haemoglobin cell.
D. a Schwann cell.

Question 14

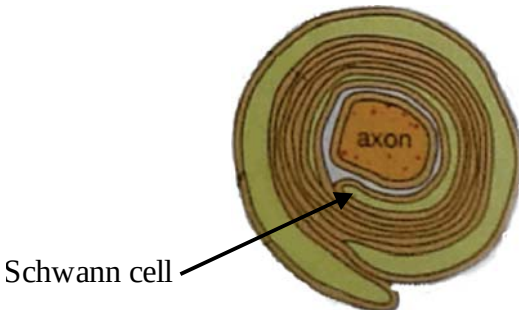


Figure 5

Figure 5 shows the cross-section of a myelinated neuron. The type of impulse that travels along an axon of a neuron cell, of this type, is best described as being
A. chemical.
B. osmotic.
C. enzymatic.
D. electrical.

Question 15
Sponges, when put through a sieve, dissociate into cells. In **Figure 6**, two different species of sponge - **Sponge A** and **Sponge B** - were dissociated into separate cells.

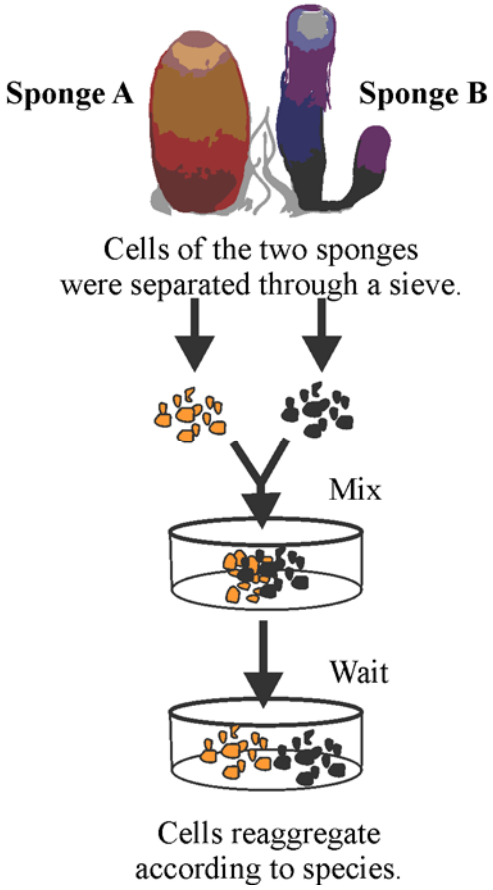


Figure 6

The cells separate back into clusters of the two original species because
A. cells from **Sponge A** are lipid soluble whilst those from **Sponge B** are lipid insoluble.
B. the different sponge cells became either positively or negatively charged when they were dissociated and now repel each other.
C. of chemical interactions between surface molecules of the different cells, enabling each type to distinguish between 'self' and 'non-self'.
D. this is a temporary state returning back to being mixed after a short period of time.

Question 16
In humans, skin provides a physical barrier to pathogens. The equivalent in plants is the
A. transport system in plants.
B. enzyme found in certain plant tissues.
C. antibodies that some plants are able to produce as a response to infection.
D. epidermis throughout the root and shoot system.

The following information refers to Questions 17 and 18.
Figure 7 shows some of the structures involved in the immune system.

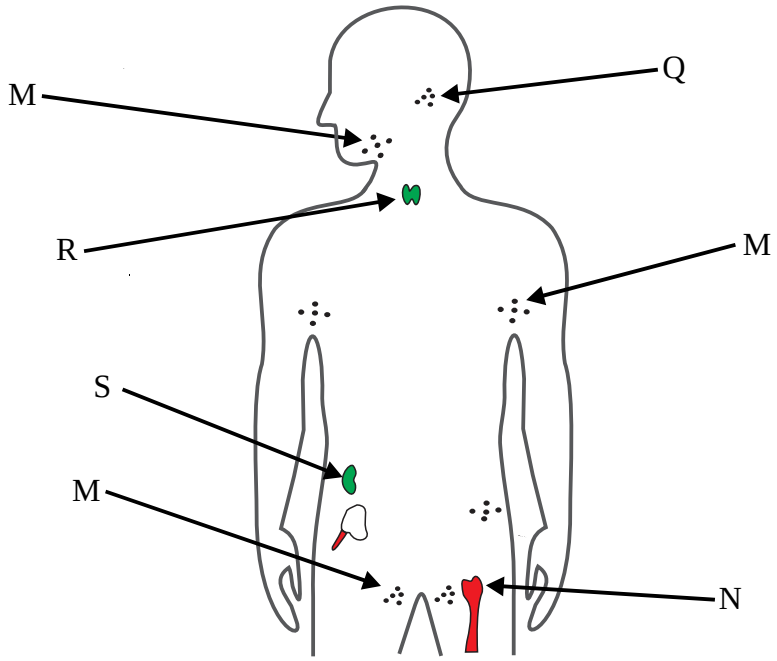


Figure 7

Question 17
The organ labelled R is the site where
A. T-lymphocytes mature.
B. blood cells are produced.
C. leukocytes are produced.
D. neutrophils are assembled.

Question 18
B cells are found in structure M and are part of
A. non-specific immunity, where they phagocytise pathogens.
B. cell-mediated immunity, where they alert helper T cells of specific antigens.
C. active immunity, where they are passed from the mother to the developing baby through the placenta during pregnancy.
D. humoral immunity, where they recognise and bind to antigens.

Question 19

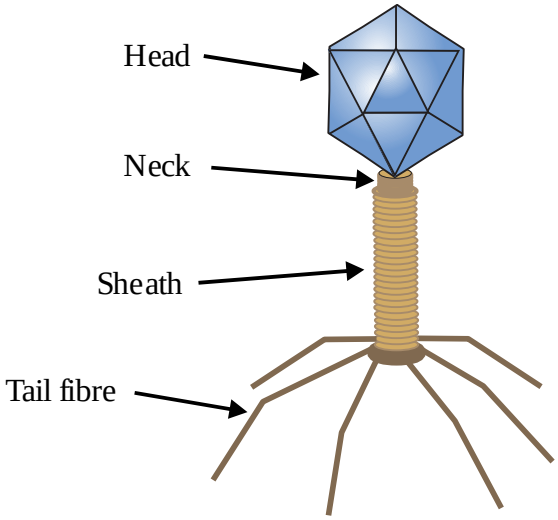


Figure 8

The genetic material of a bacteriophage is contained in the

A. neck.
B. sheath.
C. head.
D. tail fibres.

Question 20

Scrapie disease affects the neurons of sheep and is caused by a non-cellular agent that does not contain DNA or RNA, known as a

A. virus.
B. prion.
C. bacteriophage.
D. viroid.

Question 21
Figure 9 illustrates a roaming phagocytic cell engulfing foreign material.

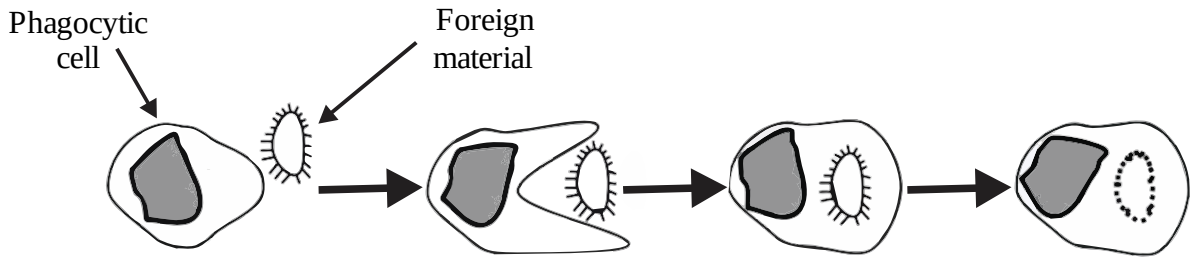


Figure 9

This cell-mediated defence is an example of
A. a secondary response to a pathogen.
B. acquired immunity.
C. specific immunity.
D. an innate, non-specific defence.

Question 22
Phillip has rheumatoid arthritis of the hands, which results in significantly swelled joints and pain. The pain occurs because his antibodies and T lymphocytes attack the connective tissue in his hands. Rheumatoid arthritis is an
A. immunodeficiency disease.
B. allergen.
C. autoimmune disease.
D. allergic response.

Question 23
Shaun has stood on a rusty nail whilst gardening and goes to see his local doctor, who administers an injection of tetanus antitoxins. The type of immunity provided would be
A. naturally-acquired passive immunity.
B. artificially-acquired passive immunity.
C. naturally-acquired active immunity.
D. artificially-acquired active immunity.

The following information refers to Questions 24 and 25.
Figure 10 illustrates a cellular event that can occur during sexual reproduction.

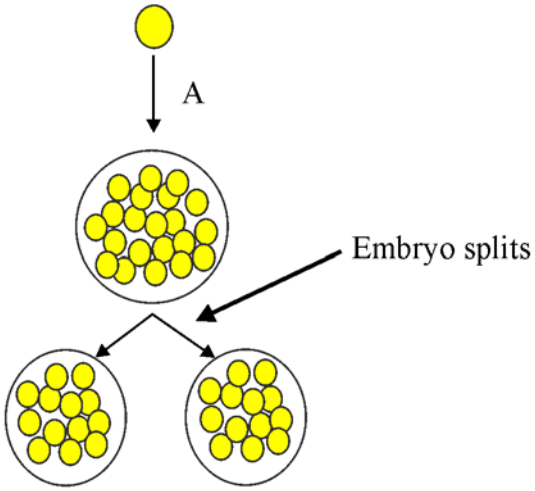


Figure 10

Question 24
The process that occurs at point A is
A. meiosis.
B. apoptosis.
C. mitosis.
D. cloning.

Question 25
It would be reasonable to expect, following this event, that
A. genetically identical twins would result.
B. no embryos would survive the split.
C. fraternal twins would result, sharing approximately the same amount of genetic material that a brother and sister born two years apart would share.
D. twins would result, one being a female baby and the other being a male baby.

Question 26
DNA is said to be 'semi-conservative' because
A. it is not always copied correctly and can have mutations.
B. each daughter DNA molecule has two strands of parental DNA.
C. DNA consists of only four repeating nucleic acids.
D. each daughter DNA molecule has one strand of parental DNA and one newly synthesised strand.

Question 27

A ferret has a diploid number of 40 and a racoon has a diploid number of 38.This means that a

A. ferret has a haploid number of 80 and a racoon has a haploid number of 76. A ferret has one more pair of chromosomes than a racoon.

B. racoon has a haploid number of 22 and a ferret has a haploid number of 20. A ferret has two more pairs of chromosomes than a racoon.

C. ferret has a haploid number of 20 and a racoon has a haploid number of 19. A racoon also has one less pair of chromosomes than a ferret.

D. racoon has a haploid number of 18 and a ferret has a haploid number of 17. A ferret has one less pair of chromosomes than a racoon.

Question 28

Figure 11 is a diagram of the process of transcription occurring within the nucleus of a cell.

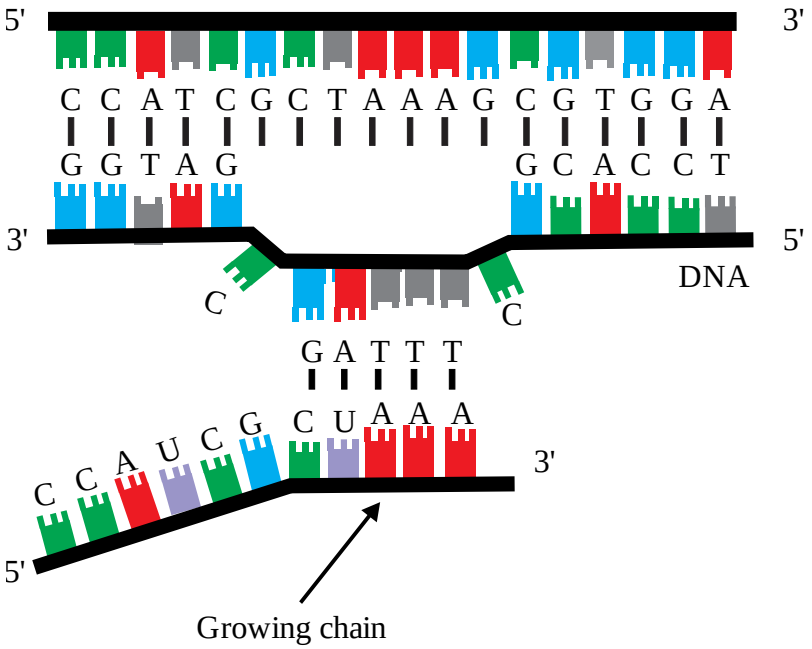


Figure 11

The 'growing chain' shown in **Figure 11** is

A. rRNA.

B. mRNA.

C. DNA.

D. tRNA.

The following information refers to Questions 29 and 30.

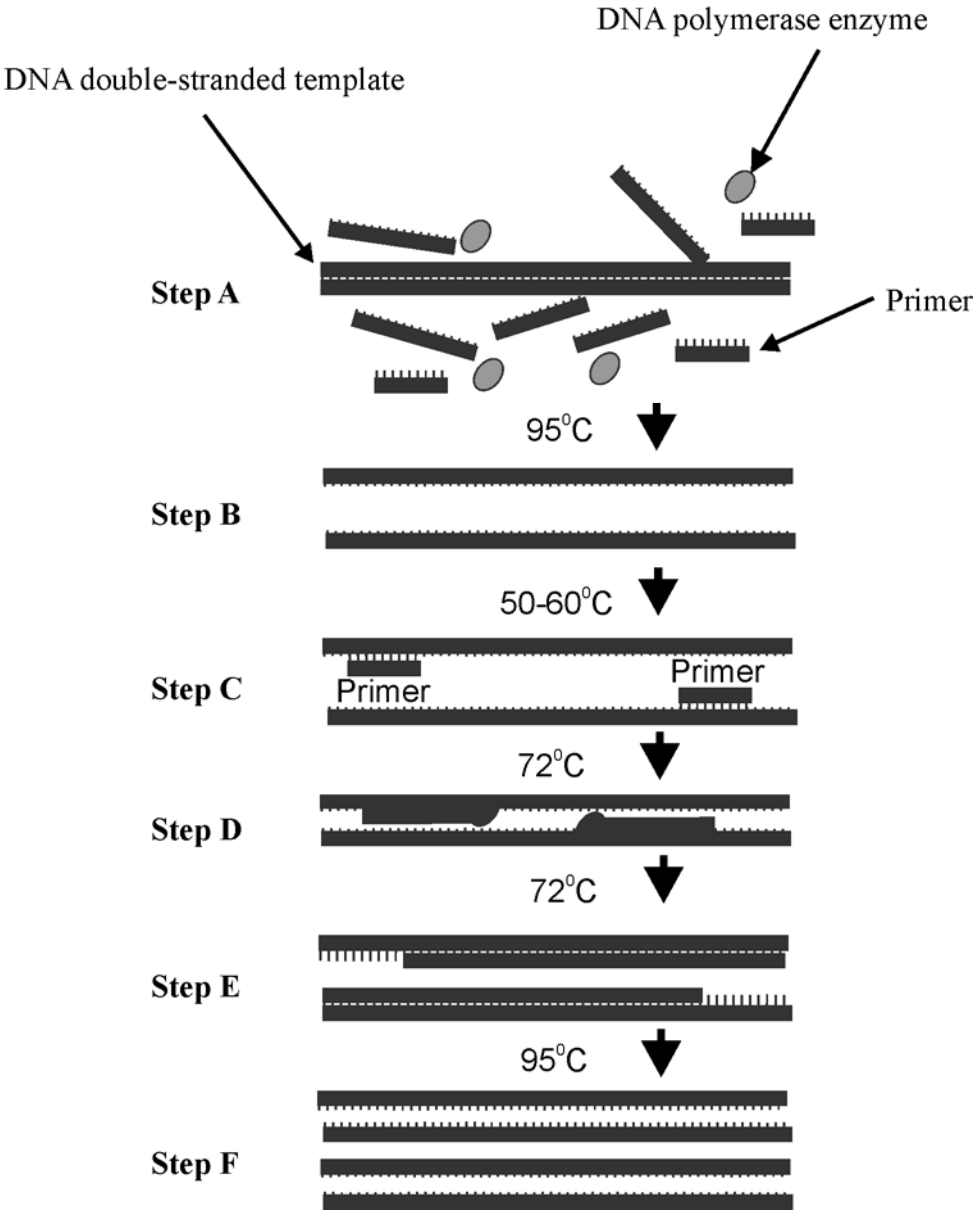


Figure 12

Question 29

Figure 12 illustrates a technology in molecular biology referred to as

A. a bacterial transformation.
B. gel electrophoresis.
C. plasmid recombination.
D. the polymerase chain reaction.

Question 30

The purpose of heating the components between Step E and Step F to 95°C is to

A. allow two primers to bind to complementary DNA sequences.
B. allow DNA polymerase to synthesise a new strand of DNA.
C. irreversibly denature the DNA.
D. halt DNA synthesis and cause the strands to separate.

Question 31

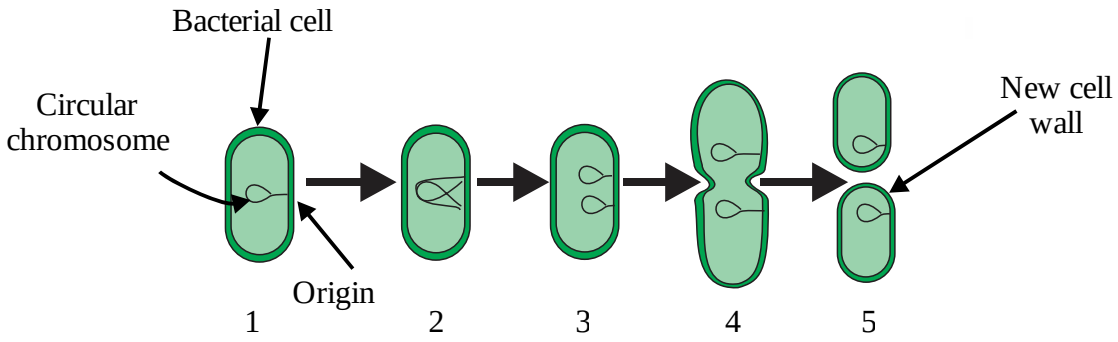


Figure 13: Cell replication involving a bacterial cell.

According to **Figure 13**, binary fission would start at point

A. 3
B. 4
C. 1
D. 5

Question 32

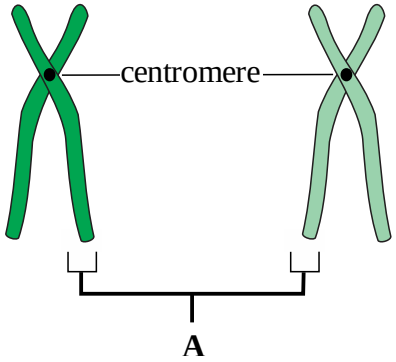


Figure 14

The pair of chromosomes in **Figure 14** could be described as being

A. homologous with label A indicating two non-sister chromatids.
B. nonhomologous with label A indicating two non-sister chromatids.
C. homologous with label A indicating two sister chromatids.
D. nonhomologous with label A indicating two sister chromatids.

The following information refers to Questions 33 and 34.

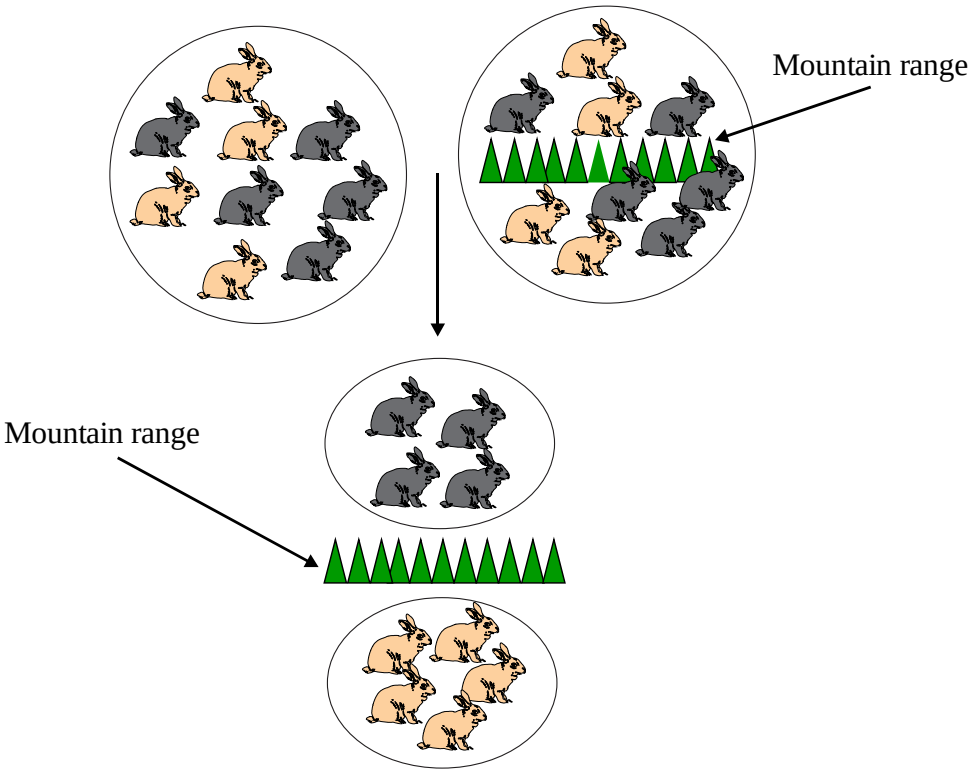


Figure 15

Question 33
The type of speciation occurring in **Figure 15** is best described as being
A. allopatric.
B. sympatric.
C. artificial.
D. hybrid.

Question 34
The evolutionary process that is shown in **Figure 15** is referred to as
A. co-evolution.
B. convergent evolution.
C. selective breeding.
D. divergent evolution.

Question 35
Heliothis moths were sprayed with an insecticide to stop them eating soybean crops. Only the moths that were genetically resistant to the insecticide survived. These moths then reproduced. Over time, the moths that were genetically resistant increased in number. This is an example of
A. convergent evolution.
B. the bottleneck effect.
C. the founder effect.
D. evolution due to natural selection.

Question 36

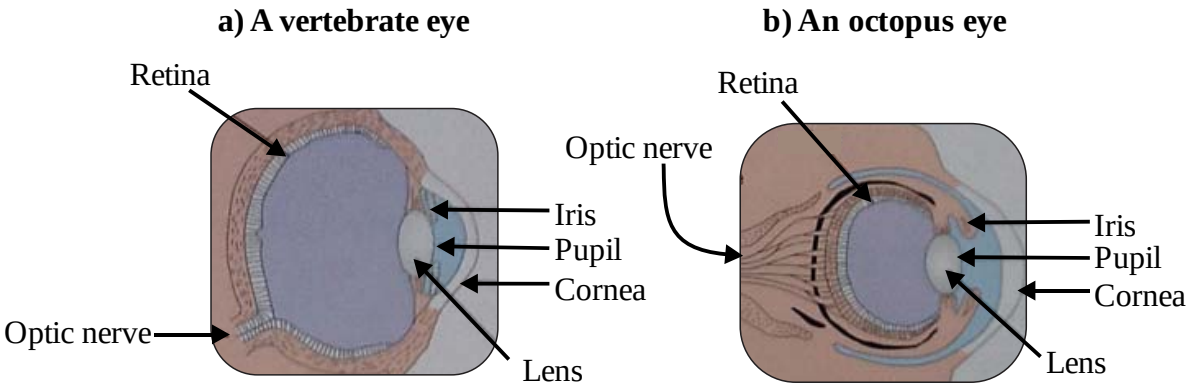


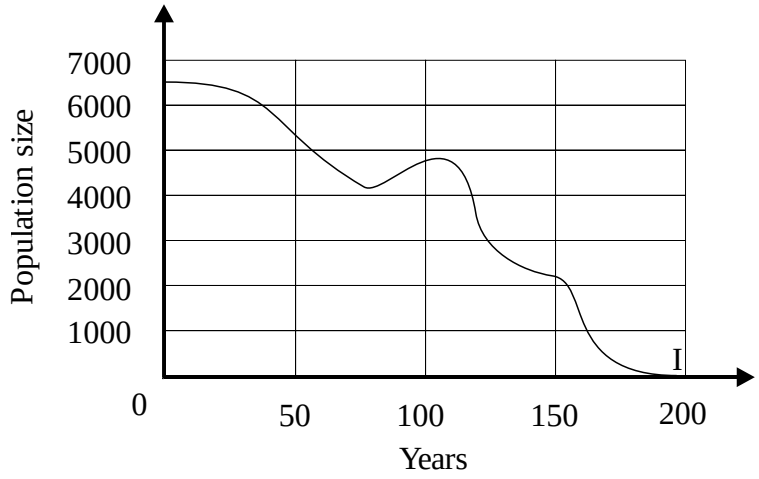
Figure 16

The eye of a vertebrate and the eye of an octopus have a very similar structure; however they did not evolve from a common ancestral species. The evolutionary process whereby organisms not closely related independently evolve similar traits, is best described as being an example of

A. a series of mutations in DNA that has resulted in structural differences.
B. convergent evolution.
C. evolution due to artificial selection.
D. divergent evolution.

Question 37

Graph 1 shows the population size of Species K over time.



Graph 1

Occurring at point I, is

A. extinction.
B. hibernation.
C. population growth.
D. a resting period.

Question 38
The radioisotope carbon-14 can be used to date fossils. **Figure 17** shows the amount of carbon-14 left in an organism after it has died.

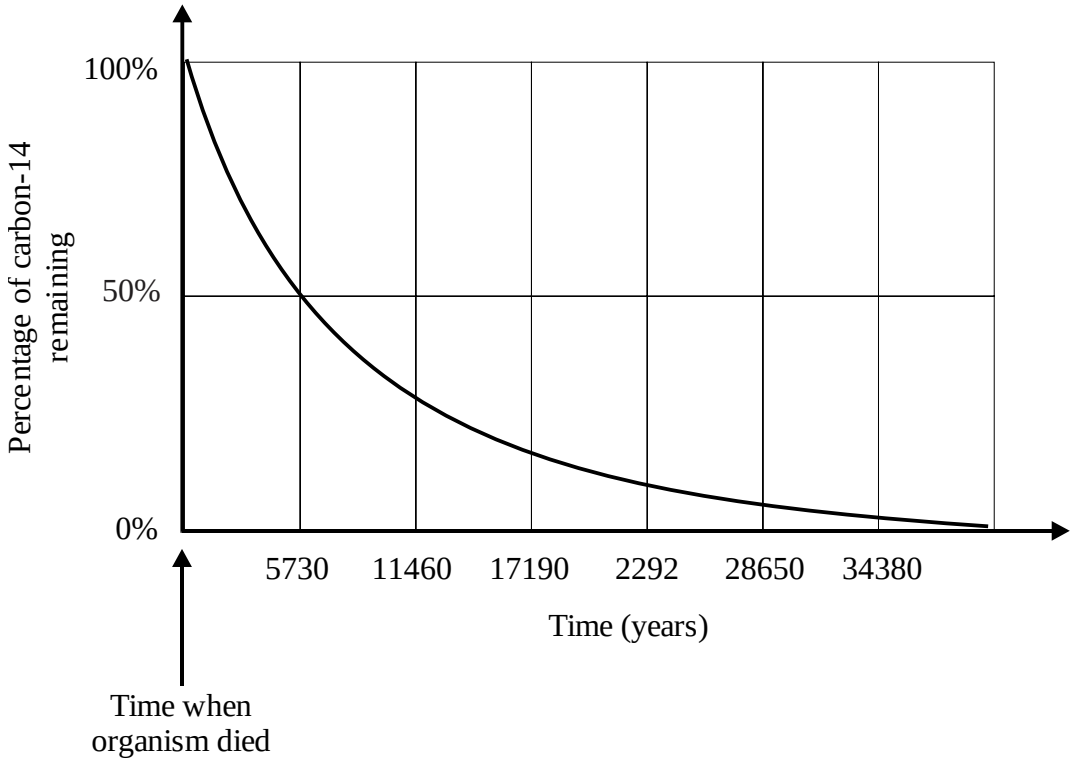


Figure 17

The half-life of carbon-14 is
A. 17,190 years.
B. 34,380 years.
C. 5,730 years.
D. 11,460 years.

Question 39
Tree T is a species of tree which is found in all of the areas of the world shaded in **Figure 18**. There are three, closely related species to Tree T which are native to Africa, Madagascar and Australia.

Figure 18: Distribution of Tree T

The most likely explanation for the distribution of Tree T is that

A. it is just chance that there is a closely related species of Tree T on Madagascar, Africa and Australia.

B. it is a random occurrence and there is no relationship between the shaded areas on the map.

C. seeds of Tree T were blown across the water from Australia to Africa or Madagascar and then began to colonise these areas.

D. at some point in history, Australia, Africa and Madagascar where once connected to each other.

Question 40
DNA hybridisation is a tool that can be used to compare

A. the bonding of complementary bases between single-stranded DNA of two different organisms.

B. the rock strata at different sites that two organisms are found in.

C. the amount of uracil in fossilised organisms.

D. the differences in the processes of translation that have been acquired over time by different organisms.

End of Section A

VCE Biology 2015 Year 12 Trial Exam Units 3/4

SECTION B – Short Answer Questions

Question 1 (5 marks)

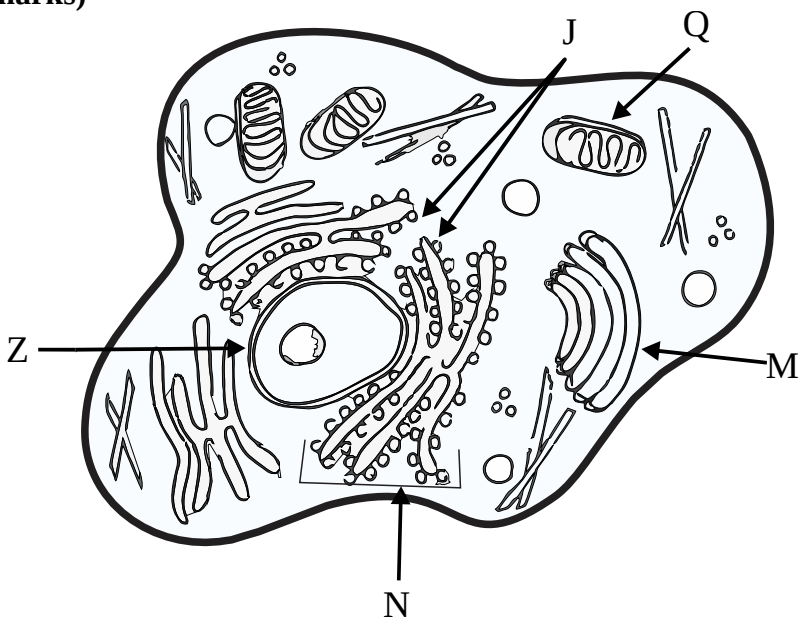


Figure 19

a. In **Figure 19,** Structure J synthesises Product A. What type of biomolecule is Product A? **1 mark**

_____

b. What is the name of the process that results in the assembly of Product A? **1 mark**

_____

c. Product A can be described as having four levels of structural organisation. One of the components of its secondary structure is shown in **Figure 20**.

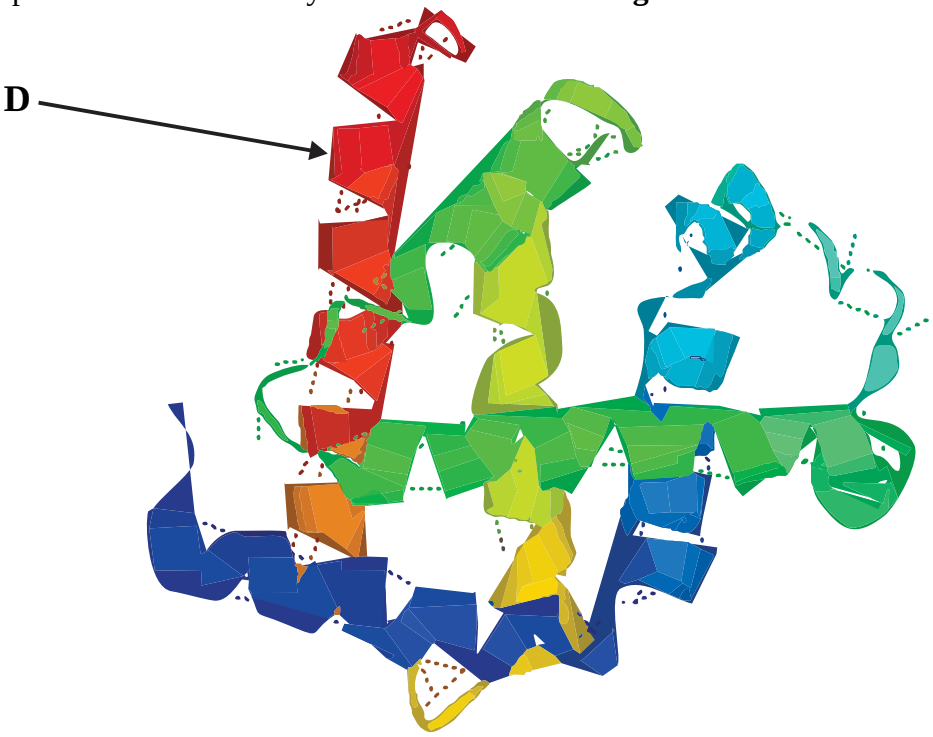


Figure 20

i. What is the name of the structure labelled D in **Figure 20**? **1 mark**

_____

ii. Name another type of secondary structure not shown in Product A. **1 mark**

_____

iii. Describe a key feature of the primary structure of Product A. **1 mark**

_____

_____

_____

_____

Question 2 (7 marks)

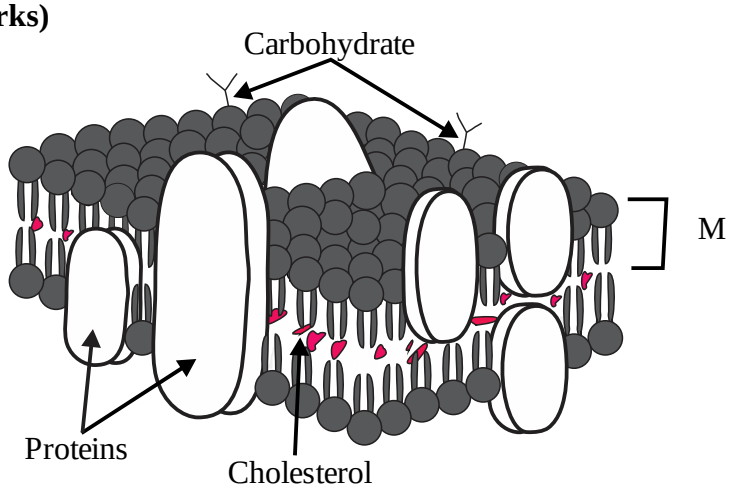


Figure 21

a. A fluid-mosaic model is often used to describe the structure of the cell membrane. Explain why this is possible in terms of the cell membrane. **2 marks**

_____

_____

_____

_____

_____

b. **i** What role does cholesterol play in the cell membrane? **1 mark**

_____

_____

_____

ii Describe the function of carbohydrate molecules on the surface of a cell membrane. **1 mark**

_____

_____

_____

_____

_____

c. A sample of molecule M was placed into a container that contained both oil and water, as shown in **Figure 22**.

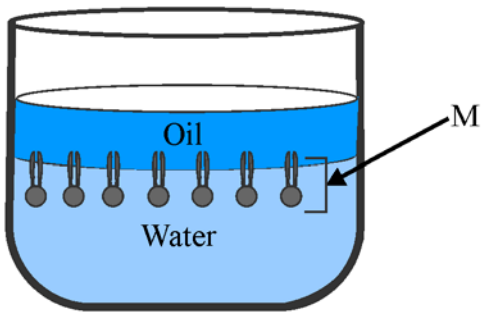


Figure 22

i. Explain the arrangement of molecule M in **Figure 22**. **2 marks**

_____

_____

_____

_____

_____

_____

ii. What is molecule M? **1 mark**

_____

_____

Question 3 (4 marks)
Mammalian cells release energy through cellular respiration.

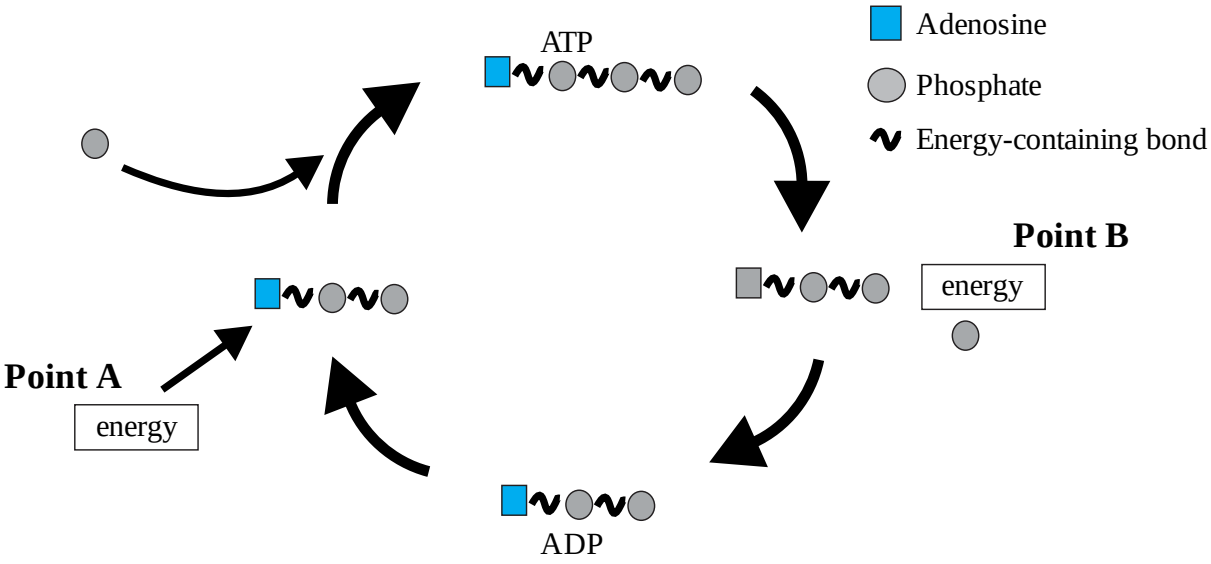


Figure 23

a. **i.** At Point A, there is an input of energy in the process outlined in **Figure 23**.
Where did this energy originate from? **1 mark**

_____

_____

ii. At Point B, there is a release of energy in the process outlined in **Figure 23**.
Where did this energy originate from? **1 mark**

_____

_____

_____

_____

_____

b. The process shown in **Figure 23** appears to involve a form of recycling. Clearly describe the main events occurring in **Figure 23** and explain how these might be linked together. **2 marks**

_____

_____

_____

_____

_____

_____

_____

_____

Question 4 (7 marks)

People donate blood so that it can be used to replenish a person's supply if they have experienced a trauma resulting in excessive blood loss. There are four blood types in humans: O, A, B, AB. Consequently, when a blood transfusion occurs, it is important that the blood type of the donor and the intended recipient are compatible. **Figure 24** outlines the different combinations of donor red blood cells and recipient serum which are possible.

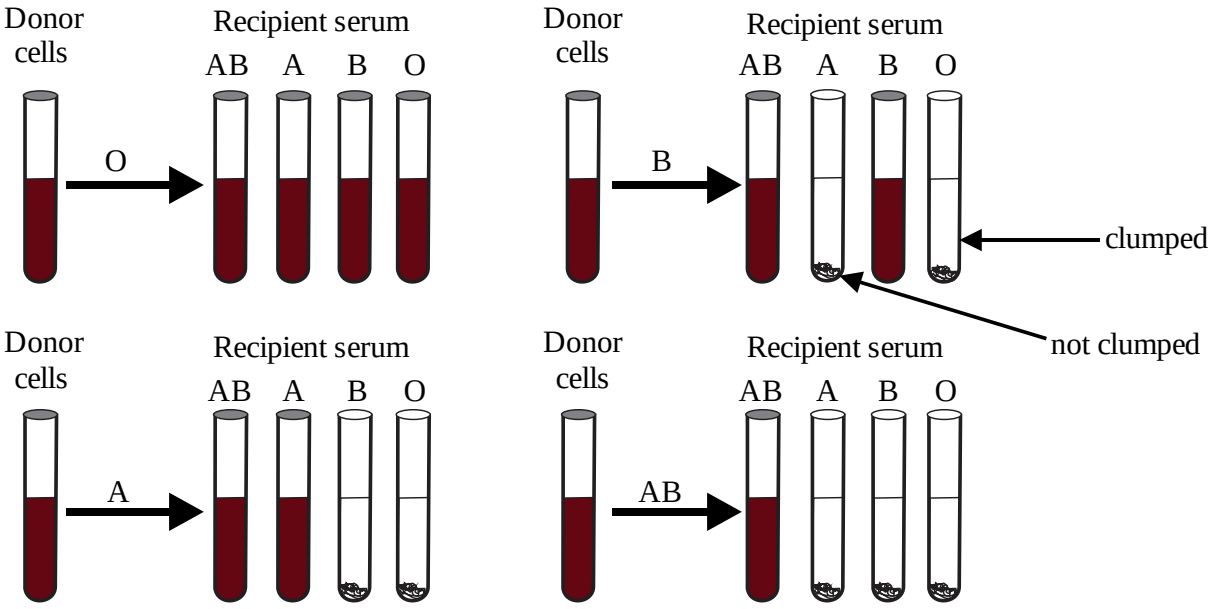


Figure 24

a. **i.** What is an antigen? **1 mark**

_____

_____

_____

ii. What type of cells produce antibodies? **1 mark**

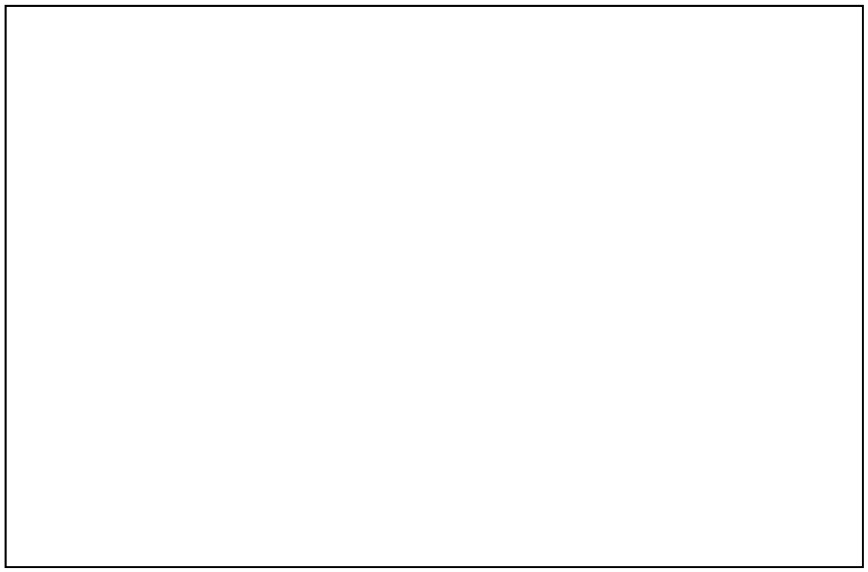
_____

_____

_____

_____

b. Draw the general structure of an antibody, labelling all important parts clearly. **2 marks**



c. Using the information shown in **Figure 24**, deduce the type of antigen(s) each donor red blood cell has. **2 marks**

_____

_____

_____

_____

_____

_____

d. Why is it possible for people with blood type O to donate blood to recipients of any blood type? **1 mark**

_____

_____

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_____

_____

Question 5 (9 marks)

The introduction of vaccines has changed the incidence of several diseases in human populations worldwide. **Figure 25** shows graphically, the impact of vaccination programs on the number of cases of measles, mumps and rubella over a 30 year period.

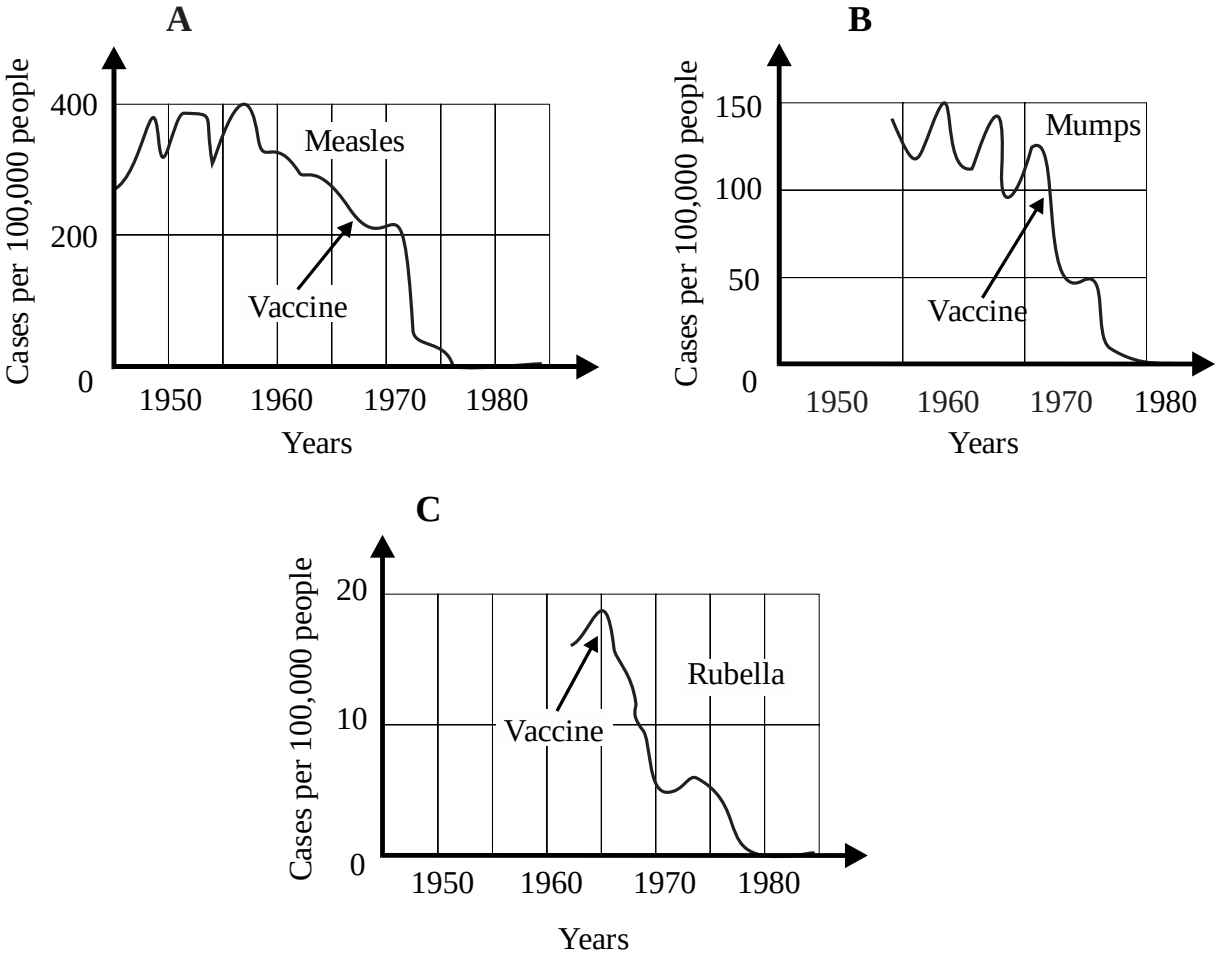

Figure 25

a. What is a vaccine? **1 mark**

_____

_____

_____

b. According to the information shown in **Figure 25**, which disease affected the most people? Include evidence from the results shown to support your answer. **1 mark**

_____

_____

_____

_____

c. Propose a hypothesis relating to vaccinating against mumps that is supported by the data in **Graph B** in **Figure 25**. **1 mark**

_____

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d. Based on the data shown in **Graph C** in **Figure 25**, after the introduction of the vaccine for rubella, it still took approximately 15 years for rubella to be eradicated from the population. Give **two** possible reasons why this occurred. **2 marks**

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e. Give **two** reasons why the incidence of a disease remains low once a vaccination program, which protects against it, is undertaken. **2 marks**

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_____

f. Suggest one possible situation which could result in an increase in the number of cases of mumps occurring. Justify your response. **2 marks**

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Question 6 (4 marks)
Plasma taken from mice that had recently recovered from a viral infection was found to be heavily populated by cytotoxic T cells. These cytotoxic T cells were isolated, radioactively labelled and used in the experiment outlined in **Figure 26**.

a. What is the role of cytotoxic T cells in the immune response? **1 mark**

_____

_____

_____

_____

b. In the immune response how does B cell recognition differ to cytotoxic T cell recognition? **2 marks**

_____

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Figure 26 *refers to Question 6.*

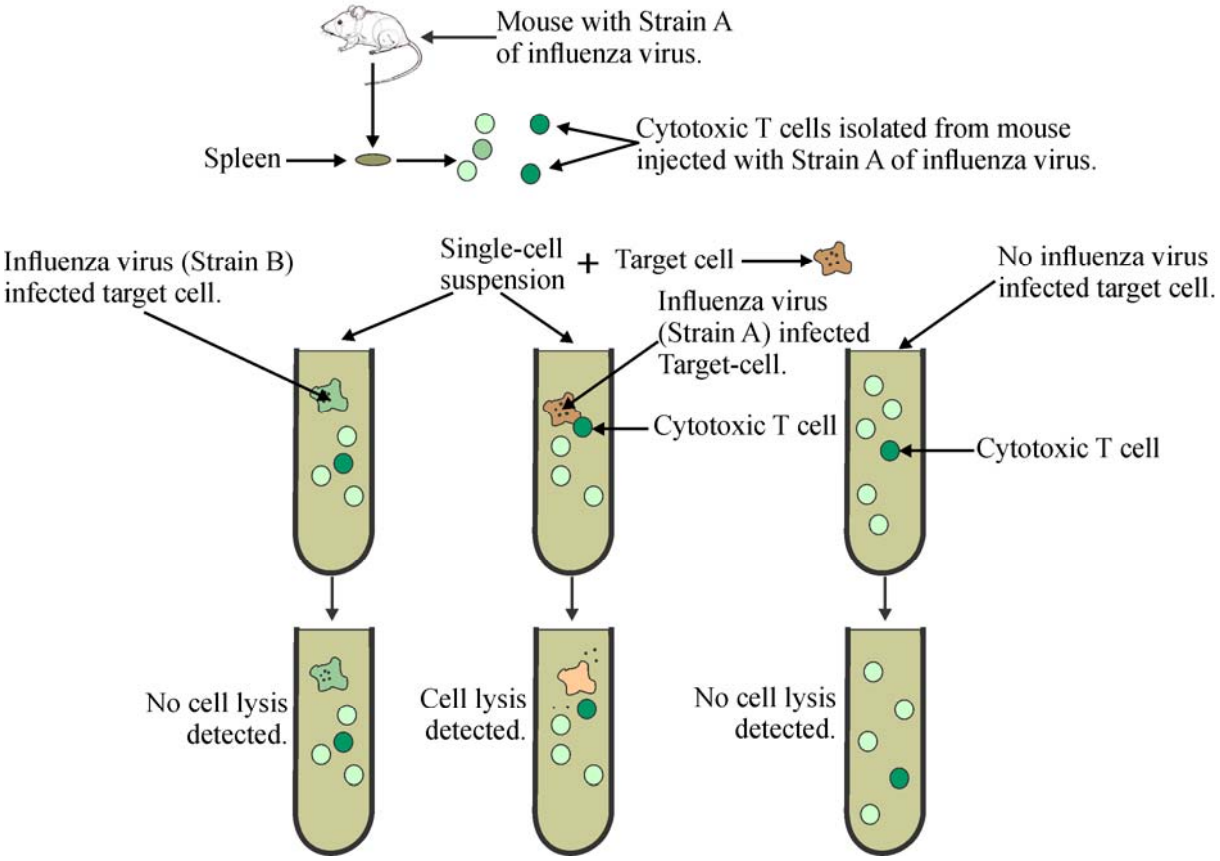

Figure 26

c. From this experiment, what can be deduced about the specificity of cytotoxic T cells? **1 mark**

_____

_____

_____

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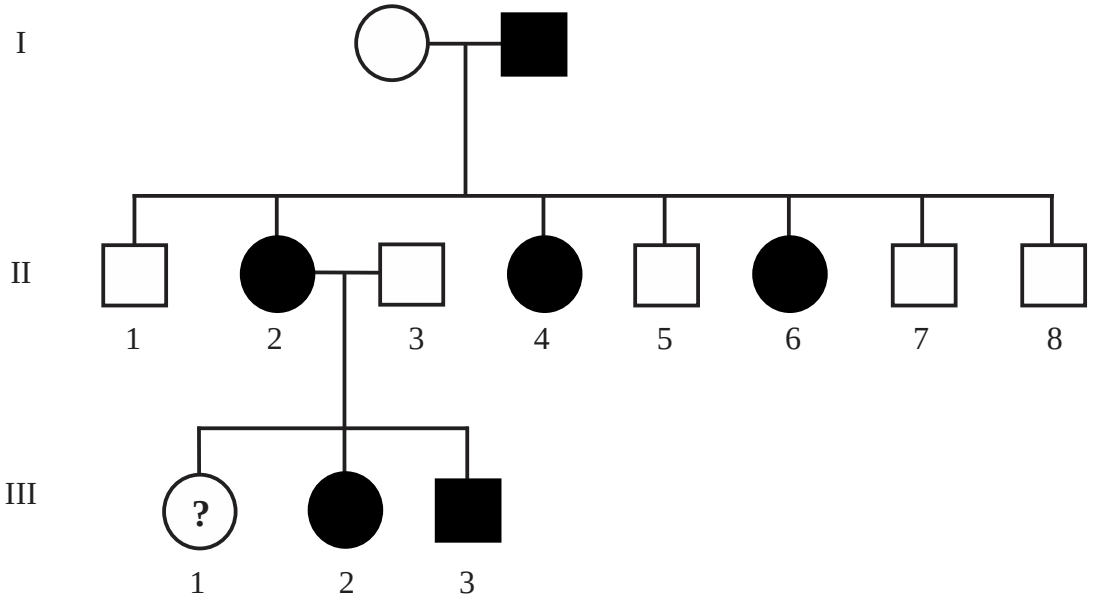
_____

Question 7 (7 marks)
Incontinentia pigmenti is a genetic disorder that affects the pigmentation of skin. Incontinentia pigmenti can also affect the hair, nails, central nervous system and result in abnormally shaped teeth in individuals affected by this condition.

The following pedigree shows the inheritance of incontinentia pigmenti in the Monto family. The first individual affected by the disorder in the Monto family was male. The shaded individuals are affected by incontinentia pigmenti.



a. From analysing the Monto family pedigree, what is the most likely mode of inheritance? Justify your answer using evidence from the pedigree shown above. **2 marks**

_____

_____

_____

_____

_____

b. Explain why males can never be carriers of incontinentia pigmenti. In your answer, explain what is meant by the term carrier. **2 marks**

_____

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_____

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_____

c. It is not known whether individual III-1 has incontinentia pigmenti. What is the probability that individual III-1 has inherited this condition? Show your working out in the space below. **2 marks**

_____

_____

_____

d. It is not known how the first male of the Monto family came to have incontinentia pigmenti but it is thought that a mutation occurred. Where would this mutation have had to occur? **1 mark**

_____

_____

_____

_____

Question 8 (6 marks)
Candice is a breeder of ragdoll kittens. For her, it is important to work out the possible phenotypic ratios of kittens to give accurate information to those looking to buy a pet. The ideal ragdoll kitten has particular marks and hair colour pattern as shown in **Figure 27**.

Figure 27

In ragdoll kittens, chocolate hair colour is dominant to lilac hair colour. Another gene controls the colour of the kitten's eyes: blue eyes are dominant to brown eyes. These two genes are not linked. The symbols for the alleles of the two characteristics described above are:

C:	chocolate hair	**B:**	blue eyes
c:	lilac hair	**b:**	brown eyes

Candice decides to breed a female cat, who is heterozygous for both traits with a male cat, who is capable of producing gametes Cb, CB, cb, cB.

a. What type of cross is this? **1 mark**

_____

_____

_____

b. What is the possible phenotypic ratio resulting in the offspring from such a cross? Show all of your working out. **3 marks**

_____

_____

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c. Which one of Mendel's laws supports your findings in **8b**? In your answer, briefly explain this law. **2 marks**

_____

_____

_____

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Question 9 (5 marks)
The use of plasmids has advanced DNA technology.

The process outlined in **Figure 28** uses the bacterium *Bacillus thuringiensis* to create pest resistant cotton. This is done by inserting the gene for the toxin produced by Bacillus thuringiensis into *Agrobacterium*, another bacterial cell which naturally infects plants and causes tumours. The tumour causing portion of the genome of *Agrobacterium* has been removed and replaced with the desired genes.

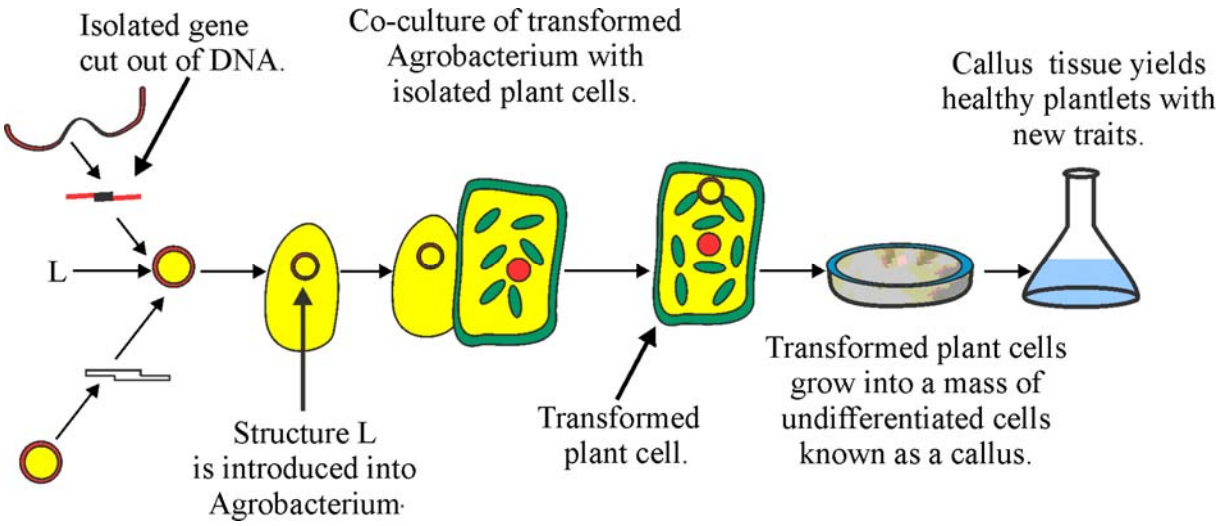

Figure 28

a. What is structure L called and how is it formed? **2 marks**

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b. How is the isolated gene inserted into the plasmid? **2 marks**

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c. Unlike animal cells, plant cells have a strong cellulose plant wall which can make introducing plasmids difficult. To create the pest resistant cotton, how have researchers overcome this difficulty? **1 mark**

_____

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Question 10 (4 marks)
Figure 29 is diagram of fossil-bearing strata discovered at two separate locations.

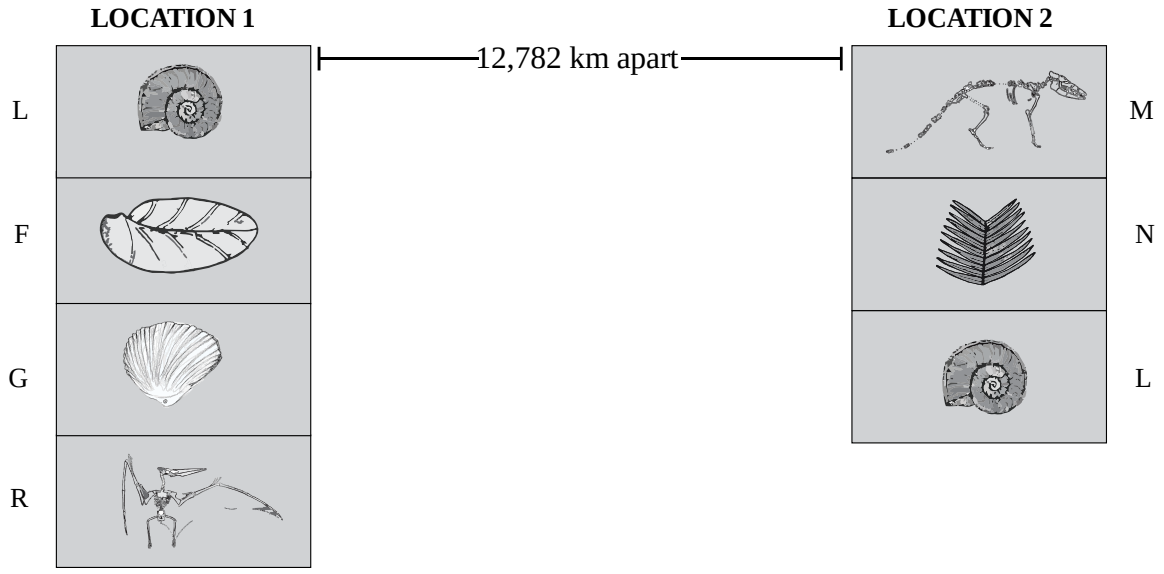

Figure 29

a. **i.** Using the letters associated with each layer, rank the fossils in order of relative age, starting with the oldest fossil. **1 mark**

_____

ii. What was the significance of Fossil L and what assumption did you make to arrive at your answer in **10a. i.**? **2 marks**

_____

_____

_____

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b. What technique was employed to date the fossils in **10a. i.**? **1 mark**

_____

_____

Question 11 (7 marks)
Figure 30 shows the vertebral column of great apes and humans.

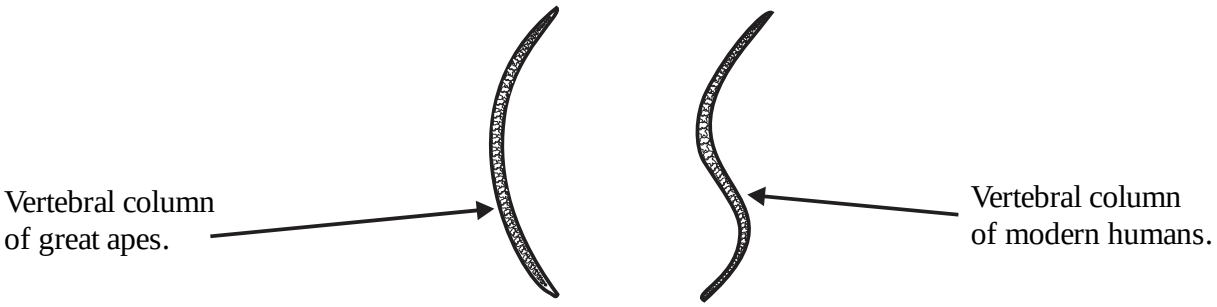

Figure 30

a. **i.** Explain the significance of the structural difference that is clearly evident between the vertebral columns of great apes and modern humans. **2 marks**

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_____

ii. Name two structural features of the skeletal system that are noticeable in great apes but are no longer apparent in modern humans. **2 marks**

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_____

b. Over time, another evolutionary difference that occurred between great apes and humans was the expansion of cultural evolution.

i. Clearly explain what is meant by the term cultural evolution. **1 mark**

_____

_____

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_____

ii. In terms of transmission, how does the way cultural evolution is passed on to new generations differ to the way other types of evolution evolve? **1 mark**

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iii. Provide an example of cultural evolution and explain the significance of the example given, in terms of human evolution. **1 mark**

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Question 12 (5 marks)
If a salamander limb is amputated, it has the ability to regenerate due to stem cell differentiation. The stages of regeneration in the salamander limb are outlined in **Figure 31**.

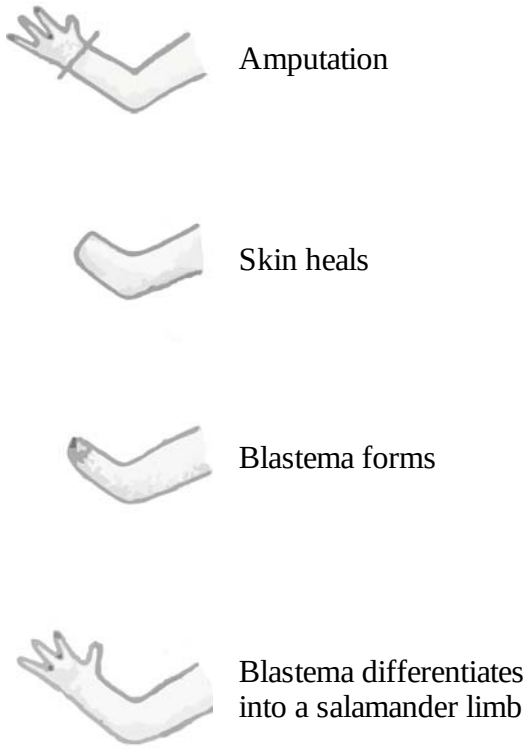


Figure 31

a. What is a stem cell? **1 mark**

_____

_____

_____

_____

b. The stem cells involved in salamander limb regeneration are adult stem cells. Compare and contrast embryonic stem cells and adult stem cells by using the table below. **4 marks**

	Embryonic Stem Cell	**Adult Stem Cell**
Advantage	_____ _____ _____ _____ _____ _____ _____	_____ _____ _____ _____ _____ _____ _____
Disadvantage	_____ _____ _____ _____ _____ _____ _____	_____ _____ _____ _____ _____ _____ _____

End of Section B

End of Trial Exam

Suggested Answers

VCE Biology 2015 Year 12 Trial Exam Units 3/4

SECTION A – Multiple Choice Answers

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

SECTION B – Short Answer (Answers)

Question 1 (5 marks)

a. A protein **(1 mark)**.

b. Translation **(1 mark)**.

c. **i.** An alpha helix **(1 mark)**.

ii. Beta pleated sheets **(1 mark)**.

iii. A linear sequence of amino acids linked together by peptide bonds **(1 mark)**.

Question 2 (7 marks)

a. A model or theory of the cell membrane where 'fluid' refers to the ability of the phospholipids to move within the membrane **(1 mark)**. 'Mosaic' refers to the proteins embedded within the membrane **(1 mark)**.

b. **i.** Cholesterol provides stability **OR** fluidity to the membrane **(1 mark)**.

ii. Carbohydrate molecules are important for cell recognition and cell adhesion **(1 mark)**.

c. **i.** The hydrophobic non-polar tails are immersed in the oil **(1 mark)** and the hydrophilic polar heads are immersed in the water **(1 mark)**.

ii. A phospholipid molecule **(1 mark)**.

Question 3 (4 marks)

a. **i.** When glucose is broken down during respiration, stored chemical energy is released and used in this synthesis process **(1 mark)**.

ii. The energy is released by breaking the energy containing bond of an ATP molecule **(1 mark)**.

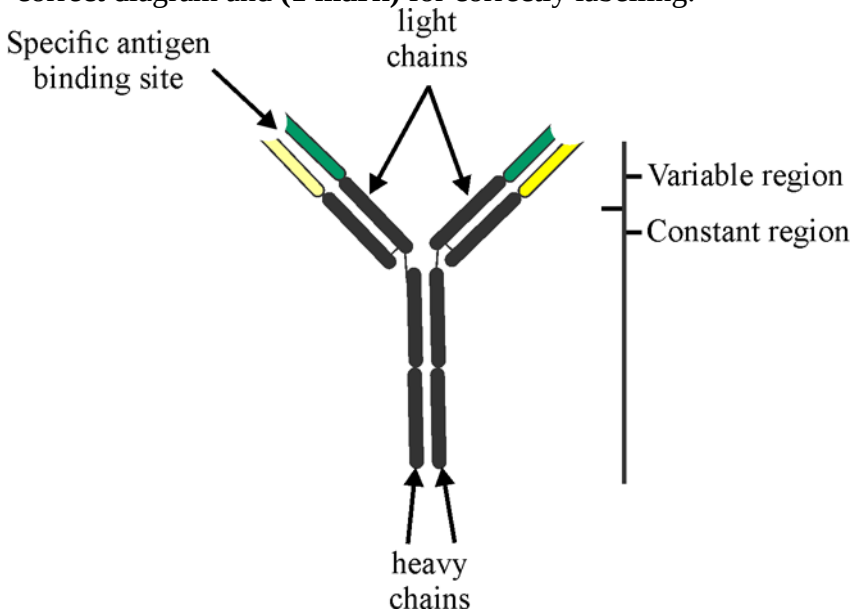
b. Energy is released from an adenosine triphosphate molecule resulting in an adenosine diphosphate molecule and inorganic phosphate molecule **(1 mark)**. Adenosine diphosphate is then recycled and converted back to adenosine triphosphate with the addition of a phosphate group using energy provided from the breakdown of glucose **(1 mark)**.

Question 4 (7 marks)

a. **i.** An antigen is a molecule which induces an immune response in the body **(1 mark)**.

ii. Antibodies are produced by plasma cells **(1 mark)**.

b. Students should draw a diagram similar to the diagram below. **(1 mark)** for the correct diagram and **(1 mark)** for correctly labelling.



c. Blood Type O has no A or B antigens. Blood Type A has A antigens **(1 mark)**. Blood Type B has B antigens. Blood Type AB has A and B antigens **(1 mark)** (Any correct combination of two blood types is worth 1 mark).

d. People with Type O blood lack A and B antigens on their red blood cells, so no antibodies in the recipient serum blood will react with these cells. Hence, Type O blood can be donated to recipients of any blood type **(1 mark)**.

Question 5 (9 marks)

a. A vaccine is typically an antigenic substance prepared from the causative agent of a disease or a synthetic substitute used to provide immunity against one or several disease(s) **(1 mark)**.

b. Measles affected the most people with approximately 400,000 people affected in the late 1950s **(1 mark)**.

c. If people are vaccinated against mumps, then the number of cases of mumps per 100,000 people will decrease over time **(1 mark)**.

d. Not everyone received the vaccine when it was available **or** it took time for the vaccine to become part of popular practice **or** it was not available for all age groups. **There are multiple suitable answers for this question. Each reasonable explanation should be awarded a mark. (Maximum 2 marks)**.

e. The vaccine results in widespread immunity in the population, which in turn, decreases the amount of people susceptible to the disease **(1 mark)**. People who are susceptible or not vaccinated are less likely to come into contact with someone who has the disease. This keeps the number of affected people low **(1 mark)**.

f. If individuals infected with mumps entered the population **(1 mark)**. Justification: This would increase the probability of contact with susceptible individuals and could then result in an increase in the number of cases of mumps **(1 mark)**. **There are multiple suitable answers for this question. Students need to provide one reason and a suitable justification to receive full marks.** Some other examples include: If people decided there was no need to vaccinate due to lack of diseased people currently living in the population **or** possibility of an increased risk of autism **or** did not believe vaccines were worthwhile. Justification: Vaccination needs to continue to occur until worldwide eradication of the disease happens. Otherwise people remain susceptible to it. If the number of people vaccinating decreases, then it is possible for the disease incidence within the population to rise again.

Question 6 (4 marks)

a. The role of cytotoxic T cells is to lyse or kill target cells **(1 mark)**.

b. B cells recognise a specific antigen and require the interaction with helper T cells to respond to the antigen being presented **(1 mark)**. Cytotoxic T cells also recognise specific antigens but bind directly to antigen presenting cells via T-cell receptors. Cytotoxic T cells bind to the complex of the MHC class 1 molecule and the antigen via this receptor and destroy the cell directly **(1 mark)**.

c. This experiment shows how specific cytotoxic T cells are, because they do not attack any virus infected cell, only those cells that have the specific antigen to which they can bind **(1 mark)**.

Question 7 (7 marks)

a. It is an X-linked dominant trait **(1 mark)**. Any daughter (II-2, II-4, II-6) of an affected male (I-2) will show the trait, but no sons (II-1, II-5, II-7, II-8) will **(1 mark)**.

b. The trait is X-linked and dominant. As males only have one X chromosome, the trait will be expressed; hence they cannot be a carrier **(1 mark)**. A carrier is a person who has the genetic allele for the trait but does not show any symptoms of the trait **(1 mark)**.

c. 50% **(1 mark)**. Students need to perform a cross correctly as shown below. The affected chromosome is marked as X^I and the unaffected chromosome is marked as X. Students only need to show the punnet square for the possible outcomes for a female, as it is known that Individual III-I is female **(1 mark)**.

	X^I	X
X	$X\ X^I$	XX

d. In the gamete (or oocyte) of his mother **(1 mark)**.

Question 8 (6 marks)

a. A dihybrid cross between two heterozygotes **(1 mark)**.

b. The ratio is 9: 3: 3: 1 **(1 mark)**. There are 9 kittens with chocolate hair and blue eyes; 3 kittens with lilac hair and blue eyes; 3 kittens with chocolate hair and blue eyes and 1 kitten with lilac hair and brown eyes **(1 mark)**. (**1 mark)** is awarded for providing the working out which should be similar to below:

	Cb	**CB**	**Cb**	**cB**
Cb	CCbb	CCBb	CCbb	CcBb
CB	CCBb	CCBB	CCBb	CcBB
Cb	Ccbb	CcBb	Ccbb	ccBb
cB	CcBb	CcBB	CcBb	ccBB

c. Mendel's Law of Independent Assortment **(1 mark)** which refers to the independent assortment of genes on separate homologous chromosomes during meiosis **(1 mark)**.

Question 9 (5 marks)

a. A recombinant plasmid **(1 mark)** which is a plasmid containing a foreign fragment of DNA **(1 mark)**.

b. The plasmid and the isolated gene are cut with the same restriction enzyme **(1 mark)** to create sticky ends which are then joined together in the presence of DNA ligase **(1 mark)**.

c. By first inserting the plasmid into *Agrobacterium*. The bacterium naturally infects the plant, going through the cell wall and when it does, it also inserts the recombinant plasmid **(1 mark)**.

Question 10 (4 marks)

a. **i.** R, G, F, L, N, M **(1 mark)**.

ii. Fossil L was an indicator fossil **(1 mark)** which assumes that both examples of fossil L are the same age, even though they are located in different geographical areas **(1 mark)**.

b. Relative dating because it is the comparison of fossils in different rock strata **(1 mark)**.

Question 11 (7 marks)

a. **i.** The vertebral column of humans is s-shaped or curved **(1 mark)** to better support the weight of bipedal humans when walking upright **(1 mark)**. The vertebral column of great apes is c-shaped.

ii. **Any two of (1 mark each)**: Prominent brow ridge, protruding chin, opposable big toe, larger teeth/protruding canines, smaller skull, position of foramen magnum toward the base of the skull, longer arm bones compared to leg bones. **There are more possible answers.**

b. **i.** Cultural evolution is accumulated knowledge, procedures and practices passed on by communication to the next generation **(1 mark)**.

ii. Cultural evolution occurs through communication whereas other types of evolution occur through the transmission of genetic material **(1 mark)**.

iii. **Example**: rock art. The significance is that it is artistic, a form of recording stories and data. **Example**: burial of the dead. The significance is that it is a ritual. **Example**: musical instruments. The significance is increased motor coordination and a new form of communication. (**There are more possible answers, but students need to provide one example and the significance of it for 1 mark)**.

Question 12 (5 marks)

a. An undifferentiated cell that has the ability to divide into new stem cells or differentiate into a particular cell type **(1 mark)**.

b. Students should accurately complete the table, as shown below:

	Embryonic Stem Cell	**Adult Stem Cell**
Advantage	Are pluripotent (can differentiate into any type of cell). **or** can divide indefinitely **or** are available from excess IVF supplies **(1 mark)**.	Less ethical objection than the use of embryonic stem cells **or** already programmed for a specific cell type **(1 mark)**.
Disadvantage	Ethical objections against harvesting stem cells from embryos **(1 mark)**.	Restricted in what they can differentiate into **(1 mark)**.

End of Suggested Answers