VCE BIOLOGY 2019

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	10	10	80
			Total 120

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 2019 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

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SECTION A – Multiple Choice Questions

Question 1
Which of the following pathogens could be classified as living?
A. Bacteria responsible for Tetanus.
B. Prion responsible for Scrapie.
C. Virus responsible for Influenza.
D. Viroid responsible for tobacco stain disease.

Question 2
The 'fluid mosaic model' of a plasma membrane refers to the fact that
A. the plasma membrane is mostly composed of water.
B. the peripheral proteins on the surface of the plasma membrane make a definable pattern.
C. the phospholipids form a bilayer with the fatty acid tails facing each other.
D. proteins embedded in the plasma membrane are able to move across the surface of the membrane.

*Information in **Figure 1** to be used to answer Questions 3 and 4.*

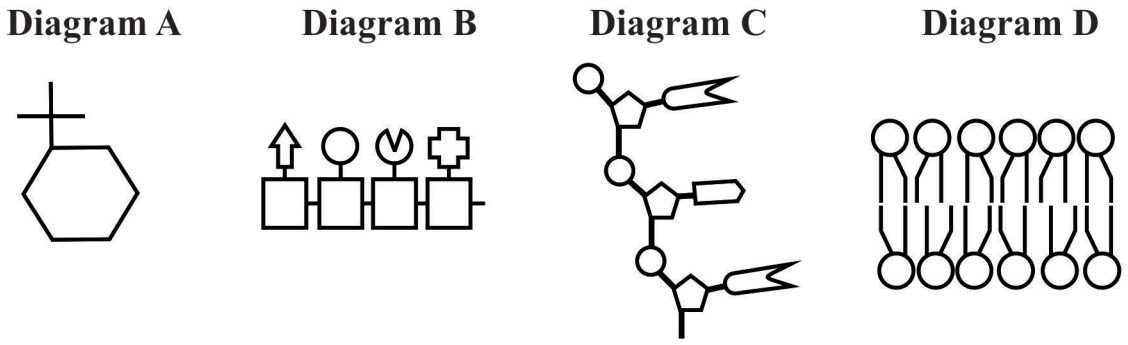

Figure 1

Question 3
Which of the diagrams shown in **Figure 1** would be considered a cell organelle?
A. Diagram A.
B. Diagram B.
C. Diagram C.
D. Diagram D.

Question 4
The element nitrogen is found in molecules present in which of the diagrams shown in **Figure 1**?
A. Diagrams A and B.
B. Diagrams C and D.
C. Diagrams B and C.
D. Diagrams A and D.

Question 5
Which of the following modes of transport across a plasma membrane require ATP?
A. Facilitated diffusion and endocytosis.
B. Active transport and exocytosis.
C. Simple diffusion and facilitated diffusion.
D. Active transport and osmosis.

Question 6
Which level of protein structure involves bonding between ions?
A. Primary structure.
B. Secondary structure.
C. Tertiary structure.
D. Quaternary structure.

Question 7
The nucleotide uracil would be most similar in size and chemical behaviour to which deoxyribonucleotide?
A. Adenine.
B. Cytosine.
C. Guanine.
D. Thymine.

Question 8
Which of the following statements is correct?
A. Introns are removed from the DNA template after transcription.
B. Introns are removed from the pre-mRNA after transcription.
C. Exons are removed from the DNA template after transcription.
D. Exons are removed from the pre-mRNA after transcription.

Question 9

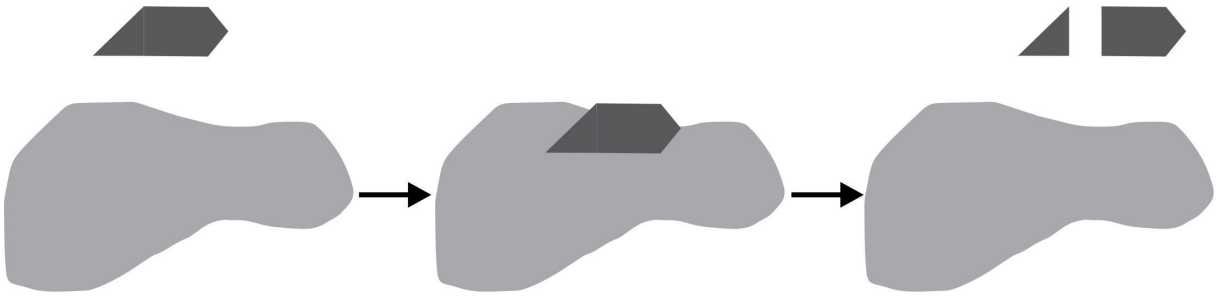

Figure 2

In the metabolic pathway shown in **Figure 2** the triangle represents a/an
A. enzyme.
B. substrate.
C. product.
D. enzyme substrate complex.

Question 10
Globular proteins are unlikely to have a function in
A. structural support for various cells and tissues in an organism.
B. enzyme activity.
C. the transport of molecules around the body.
D. defence against disease.

Question 11
The inputs in the light dependent stage of photosynthesis are
A. ADP, P_i and $NADP^+$.
B. ATP and $NADP^+$.
C. ATP and NADPH.
D. ADP, P_i and NAD^+.

Question 12
One molecule produced by the process of anaerobic respiration in humans is
A. carbon dioxide.
B. pyruvate.
C. lactic acid.
D. oxygen.

Question 13
One advantage of fermentation over aerobic cellular respiration is it
A. produces more ATP per molecule of glucose.
B. breaks down molecules other than glucose.
C. doesn't require the molecule NAD^+.
D. can occur whether oxygen is present or not.

Question 14
Steroid hormones differ from peptide hormones in that
A. steroid hormones bind to receptors on the plasma membrane.
B. peptide hormones affect a variety of cells throughout the body.
C. peptide hormones act directly on genes.
D. steroid hormones travel through the bloodstream with the aid of carrier proteins.

Question 15
Ants that have found a good source of food will often mark their trail back to the ant nest with a chemical that other ants can follow back to the food source. This chemical marker is most likely to be a
A. cytokinin.
B. pheromone.
C. perfume.
D. neurotransmitter.

Question 16
The extrinsic pathway of apoptosis is initiated within a cell when
A. the cell is infected with a virus.
B. mitochondria release cytochrome C.
C. a signalling molecule binds to the plasma membrane of the cell.
D. caspases initiate blebbing of cell contents.

Question 17
Which of the following conditions is caused by the actions of a pathogen?
A. Measles, caused by a viral infection.
B. Mesothelioma, caused by exposure to asbestos fibres.
C. Scurvy, caused by vitamin C deficiency.
D. Down's syndrome, caused by a chromosomal abnormality.

Question 18
Which of the following lists is ordered correctly in terms of increasing size?
A. Bacteria – Prions – Viruses.
B. Prions – Viruses – Bacteria.
C. Viruses – Prions – Bacteria.
D. Prions – Bacteria – Viruses.

Question 19
When organ transplants occur there is often a risk of the body rejecting the new organ. However this is not the case with corneal transplants in the eye. This is most likely because
A. the cells of the cornea have the same HLA markers as other cells.
B. autoantibodies are produced.
C. the cells of the cornea do not possess any HLA markers.
D. there is no blood flow to the cornea, so cells of the immune system never encounter corneal cells.

Question 20
A vaccination is an example of
A. natural, passive immunity.
B. natural, active immunity.
C. induced, active immunity.
D. induced, passive immunity.

Question 21
Phenotypic variation within a population is largely due to
A. variation of alleles.
B. environmental factors.
C. polyploidy.
D. aneuploidy.

Question 22
Which of the following factors is **unlikely** to maintain a stable allele frequency within a given population?
A. Large population.
B. Random mating.
C. Selection pressures
D. Lack of gene flow.

Question 23
The sequence of DNA reading strand for a section of a gene is

CGGATTACATGACA

Which of the following mutations is considered a block inversion?
A. **CGGAATACATGACA**.
B. **CGGCATTAATGACA**.
C. **CGGAATTACATGACA**.
D. **CGGATACATGACA**.

Question 24
Allopatric speciation occurs when different populations of a species
A. are exposed to different selection pressures.
B. are isolated from each other by geographical barriers.
C. undergo mutations at different rates.
D. compete for resources.

Question 25
As the carbon-14 isotope within a sample of wood decays it would be expected that the sample of wood
A. decreases slightly in mass.
B. increases slightly in mass.
C. stays at the same mass.
D. decreases to half its original mass.

Question 26
Which of the following materials would not be a suitable medium in which a fossil could form?
A. Mud.
B. Sand.
C. Tree sap.
D. Marble.

Question 27 refers to the following pedigree chart.

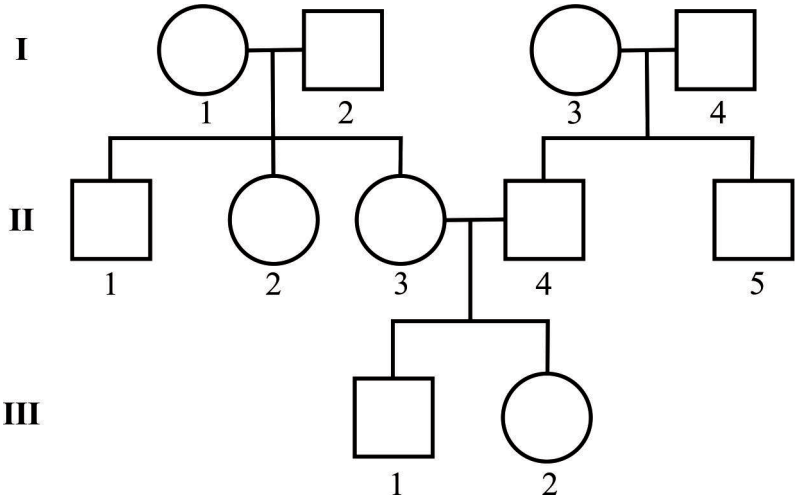

Figure 3

Question 27
With regard to **Figure 3**, mitochondrial DNA could be used to demonstrate a genetic link between which of the following individuals?
A. I-1 and II-5.
B. I-3 and III-1.
C. II-2 and III-2.
D. II-5 and III-1.

Question 28
A man suffering from achondroplasia, a form of dwarfism that is an X linked dominant trait, has recently had a son. His wife does not have any genetic history of achondroplasia. Which form of genetic testing would you recommend for the newborn child?
A. Adult screening to see whether he has inherited a greater risk of the disease.
B. Carrier detection to see if he is carrying the achondroplasia allele.
C. Predictive screening to see whether the disorder develops.
D. No genetic screening, as it would be of no benefit.

Question 29

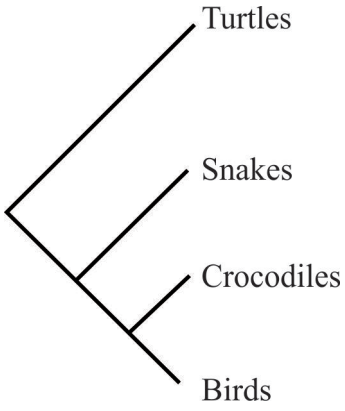

Figure 4

Figure 4 is an example of a
A. cladogram and shows the rate of evolution.
B. cladogram and is based on physical features.
C. phylogenetic tree and shows the rate of evolution.
D. phylogenetic tree and is based on physical features.

Question 30
Closely related species would be expected to display
A. a high melting point in DNA hybridization.
B. early differences between the embryos of the two species.
C. a large amount of variation between their DNA sequences.
D. a number of analogous structures.

Question 31
An opposable thumb is necessary for
A. upright walking.
B. brachiation.
C. swimming.
D. capturing prey.

Question 32
The primary feature that distinguishes members of the genus *Homo* from other primates is
A. increased brain capacity.
B. stereoscopic vision.
C. the presence of a sagittal crest.
D. the lack of a tail.

Question 33
Restriction enzymes are naturally found in
A. bacteria and viruses.
B. viruses and archaea.
C. archaea and prions.
D. bacteria and archaea.

Question 34
If a gel electrophoresis was left to run for 24 hours longer than normal, what would be expected to happen to the DNA fragments?
A. They would get darker.
B. They would all collect at the positive terminal.
C. They would all collect at the negative terminal.
D. There would be no apparent difference.

Question 35
When do plasmids replicate?
A. During binary fusion.
B. During binary fission.
C. Independently of the circular prokaryotic chromosome.
D. At the same time as the circular prokaryotic chromosome.

Question 36
A particular DNA marker used in DNA profiling has four possible variations of length, namely 8, 10, 16 and 21. If this marker was used as part of a DNA profile, which of the following results is least likely?
A. 8, 14
B. 10, 10
C. 8, 16, 21
D. 21, 10

Question 37
Mice have been genetically modified in the laboratory to incorporate the genes for a number of human genetic disorders like thalassaemia and cystic fibrosis. The purpose for creating these mice is to
A. see how the mice cope with human genetic mutations.
B. see if human genetic defects could be used to combat mice plagues.
C. develop a mouse resistant to these conditions.
D. study the effects of these diseases and to test the effectiveness of different drugs.

Question 38
Cotton has been genetically modified to contain the Bt gene. This gene produces a toxin that specifically acts on the larvae of the bollworm that ingest it, killing them. Should this form of genetically modified cotton be introduced into the environment one would expect that it would
A. become more common in the gene pool due to its selection advantage.
B. destabilise the ecosystem as it is toxic to most insects.
C. have no effect on the ecosystem.
D. outcompete other species of plants in the ecosystem.

Question 39
The Zika virus was first identified in monkeys in Uganda in 1947. By May 2016 cases of Zika virus infections had been reported in over 50 countries. Which event would have contributed most to the spread of this global pandemic?

A. The Zika virus' ability to affect both humans and primates.
B. The FIFA World Cup in Brazil in 2014.
C. The mutation of the Zika virus into a more virulent form.
D. The spread of the Zika virus to over 70% of the population of a small island in Micronesia.

Question 40
If a person is infected with a strain of Influenza A the best course of treatment would be to give the person

A. an Influenza A vaccine.
B. strong antibiotics like amoxicillin.
C. antiviral medication like Relenza.
D. a placebo.

End of Section A

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SECTION B – Short Answer Questions

Question 1 (7 marks)
The human genome is believed to possess fewer than 21,000 genes yet is able to produce a staggering array of different proteins. Rather than one gene producing just one specific protein, scientists now believe up to 60% of genes can produce a variety of different proteins by a process known as alternative splicing.

a. Name in the correct order the two stages needed to produce a protein from a gene. **1 mark**

_____

b. Which specific molecule undergoes alternative splicing? **1 mark**

_____

c. Explain the process of alternative splicing and its benefits. **3 marks**

_____

_____

_____

_____

_____

d. Of the different cell types studied this year, which ones can produce a variety of different proteins on their surface membrane by the process of alternative splicing? **1 mark**

_____

e. Explain whether bacterial cells are able to produce different proteins by alternative splicing. **1 mark**

_____

Question 2 (9 marks)
Cyanide is a simple molecule consisting of just carbon, nitrogen and hydrogen, yet it has a profound effect on most organisms.

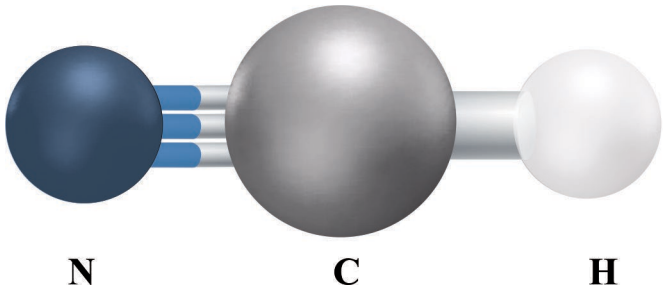


Figure 5

Cyanide is produced by a variety of bacteria as well as by fungi and some species of plants. It is poisonous to most species of animals. Cyanide works by acting as an inhibitor of cytochrome c, one of the molecules required for the electron transport chain of aerobic respiration.

a. Explain what is meant by the term inhibitor in this example and describe how it works. **2 marks**

_____

_____

b. Write a balanced chemical equation for the process of aerobic respiration. **1 mark**

_____

c. Name both the molecule that is no longer produced in the electron transport chain as a result of the disruption caused by the presence of cyanide, and the enzyme responsible for the molecule's production. **2 marks**

_____

d. What effect would the inhibition of the electron transport chain have on a human affected by cyanide poisoning? **2 marks**

_____

_____

e. Though cyanide poisoning can often be fatal, explain how a person could survive despite not being able to respire aerobically. **1 mark**

_____

f. Explain why cyanide has no effect on the bacteria and fungi that produce it. **1 mark**

_____

Question 3 (9 marks)
Up to 5% of cats worldwide are infected with Feline Immunodeficiency Virus (FIV). Similar to HIV in humans, FIV can attack T cells and drastically affect the immune system of its host. It spreads throughout the body and can lie dormant in the cells for years before becoming active. FIV particles can also be found in the cat's saliva.
Though rarely fatal, a vaccine against FIV is now readily available.

a. FIV is not spread through the air. Suggest a possible means of transmission from cat to cat. **1 mark**

_____

b. FIV is a retrovirus. What **two** substances would be released into a host cell by FIV? **1 mark**

_____

Newborn kittens may already possess antibodies against FIV. Vaccination usually occurs at 8 weeks, after the kitten is weaned off its mother's milk. This is followed by a booster shot at 10 weeks and a third booster shot at 12 weeks.

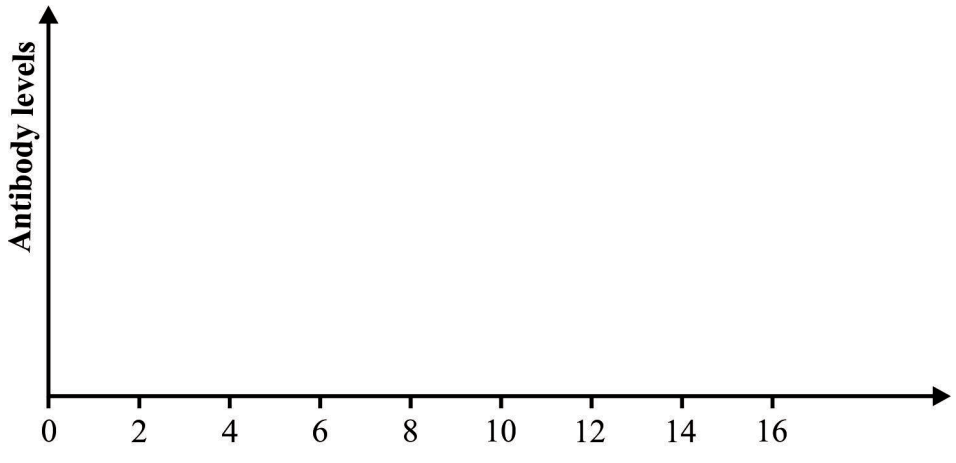
Figure 6: Kitten aged 8 weeks

c. Explain why FIV requires two booster shots, even though the disease is rarely fatal. **2 marks**

_____

_____

d. On **Graph 1** draw the relative levels of antibodies one would expect to see in a kitten that was vaccinated according to the above schedule. **2 marks**



Graph 1

e. What is the FIV vaccine likely to consist of? **1 mark**

_____

f. Since FIV is considered very serious, explain why a kitten is not vaccinated until it is weaned. **2 marks**

_____

_____

Question 4 (9 marks)

Cellulitis is a serious infection of the inner layers of the skin. Symptoms include painful swelling, redness and heat in the affected area. It is usually caused by the bacterium *Staphylococcus aureus* having gained entry via a cut or scratch.

a. Explain each of these symptoms in terms of the body's defence against disease. **2 marks**

_____

_____

_____

_____

One common treatment of cellulitis is to administer a course of antibiotics, usually methicillin. Methicillin works by damaging the bacterial cell wall, causing it to lyse.

b. *Staphylococcus aureus* is a Gram-positive bacterium. What does the term Gram-positive mean? **1 mark**

_____

Recently a new strain of *Staphylococcus aureus* has become prevalent that is resistant to the action of methicillin. Known as methicillin resistant *Staphylococcus aureus* or MRSA, it is of particular concern in hospitals and areas where people have weakened immune systems.

c. Explain how antibiotic resistant bacteria like MRSA are likely to have developed. **2 marks**

_____

_____

_____

Should a person suffering from cellulitis actually be infected with a methicillin resistant strain of *Staphylococcus aureus*, doctors will instead prescribe the antibiotic co-trimoxazole. Co-trimoxazole works by binding to and inhibiting the action of folate (Vitamin B_9). Folate is an important molecule in cellular metabolism. It usually acts as a coenzyme and is used in the synthesis of DNA and RNA and proteins.

d. What is meant by the term coenzyme and explain what benefit a coenzyme might have over a normal enzyme in terms of the reaction it catalyses. **2 marks**

_____

_____

_____

e. Why is co-trimoxazole only prescribed in the case of MRSA based cellulitis rather than to all cases of cellulitis? **2 marks**

_____

_____

_____

Question 5 (8 marks)

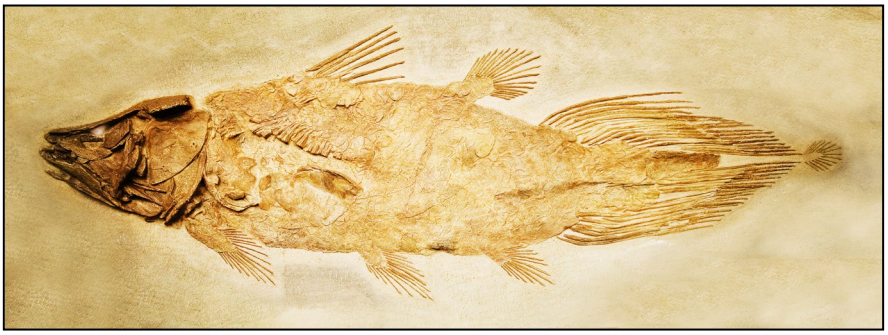


Figure 7: Fossil remains of a coelacanth

Tetrapods are creatures that possess four limbs. One of the earliest examples of a tetrapod was the coelacanths, an order of ocean dwelling fish that lived in the Cretaceous Period and was believed to have died out approximately 66 million years ago.

a. How might scientists have determined the age of the fossil remains of coelacanths? **2 marks**

_____

_____

_____

b. Explain how coelacanth fossils might have formed. **2 marks**

_____

_____

_____

c. What name is given to a fossil that displays the gradual development of a particular feature? **1 mark**

_____

In 1938 a live coelacanth was discovered in the deep ocean off the coast of South Africa, leading to its reclassification as a 'living fossil'. Though not suitable for food, live coelacanths are highly sought after by museums and universities.

d. Modern examples of tetrapod limbs include everything from flippers to paws to hands. What form of evolution is responsible for this type of variation? **1 mark**

_____

DNA comparison of coelacanths has shown that the species is not quite a 'living fossil' but is still evolving, albeit very slowly.

e. Give **two** possible reasons why the evolution of the coelacanth is so slow. **2 marks**

_____

_____

_____

Question 6 (9 marks)

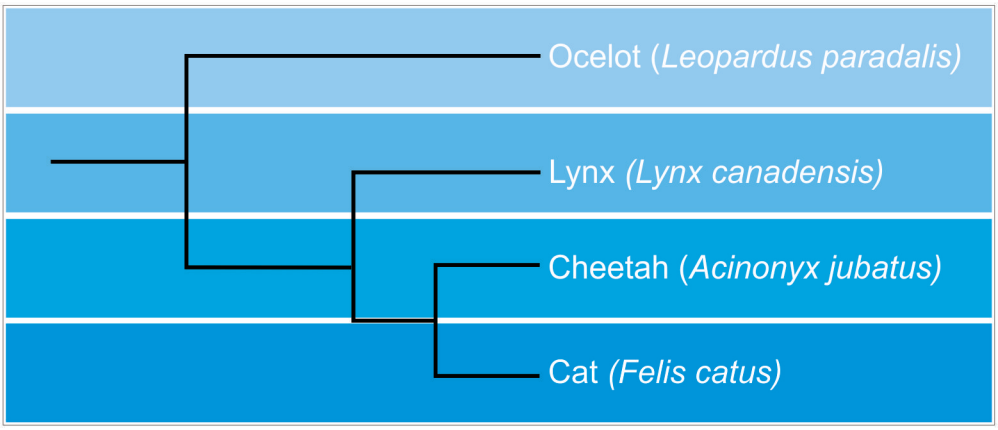


Figure 8: Evolution of the *Felidae* family.

Endogenous retroviruses (ERVs) are a form of virus whose viral genes can be incorporated into a host cell's genome, which is then passed on to its offspring. Because of this unusual event, researchers can use the presence of ERV genes in different species' genomes to determine their genetic relationship.

One specific sequence of DNA that originated in an ERV is shared by all domestic cats and the cheetah species.

a. Mark on **Figure 8** with an **X** to show the likely time this viral infection could have occurred. **1 mark**

b. In order to be incorporated into the genome and passed on to their offspring, which cells of the animal must have been infected with the ERV? **1 mark**

_____

c. Should **Figure 8** be considered a cladogram or a phylogenetic tree? Justify your answer. **2 marks**

_____

_____

Though cheetahs have many differences in their genome from common domestic cats, there is a remarkable lack of genetic variety within the cheetah population, far less than what is usually seen within a species.

d. Clearly explain the most likely reason for this lack of genetic variation within the cheetah population. **3 marks**

_____

_____

_____

_____

e. Other than DNA analysis, name and describe another technique researchers could have used to determine the genetic relationship between different species. **2 marks**

_____

_____

_____

_____

Question 7 (10 marks)
As hominins evolved there was a gradual shift from tree climbing to bipedal movement. Though difficult to determine exactly how well our early human ancestors walked, this shift in behaviour is supported by a number of pieces of evidence found in the fossils of their skeletons.

a. Name three parts of the skeleton that relate directly to upright walking and state what specific feature of this body part supports the concept of bipedalism. **6 marks**

Body Part	**Specific feature**

b. Why might upright walking, have been an advantage to early hominins? **1 mark**

_____

_____

_____

c. Other than upright walking name two other changes to structural features that occurred as hominins evolved into modern humans. **2 marks**

_____

_____

_____

d. Explain what form of evolution speech and language would be considered a part of? **1 mark**

_____

_____

_____

Question 8 (8 marks)
In order to make recombinant plasmids capable of producing human hormones like insulin, the human gene of interest must firstly be isolated and then joined to a suitable plasmid. One way of isolating the human gene is to make a complementary DNA (cDNA) strand from the relevant mRNA strand.

The first stage of making cDNA is to attach a primer to the poly-A tail of the mRNA.

a. Where and when is the poly-A tail attached to mRNA? **2 marks**

_____

b. What is this primer likely to consist of? **1 mark**

_____

Reverse transcriptase is then used to synthesise the single stranded cDNA, after which a second strand of DNA is formed using the cDNA strand as a template.

c. Name the enzyme responsible for the production of this second strand. **1 mark**

_____

d. How might this cDNA strand differ from the original human gene? **1 mark**

_____

A restriction enzyme is then used on the cDNA as well as on a suitable plasmid and the fragments bind together.

e. What feature of the restriction enzyme digested DNA fragments ensures that they join together? Clearly explain how this joining together occurs. **2 marks**

_____

_____

_____

_____

Even though the fragments of DNA and plasmid join, they can be easily separated again by heating the mixture.

f. Name the enzyme responsible for ensuring the resultant recombinant plasmid is permanently bonded together. **1 mark**

_____

Question 9 (5 marks)
Sedums are a genus of plants that has over 600 distinct species. They are found worldwide but mostly in arid regions. Sedums have thick fleshy leaves, far thicker than leaves of most other species.

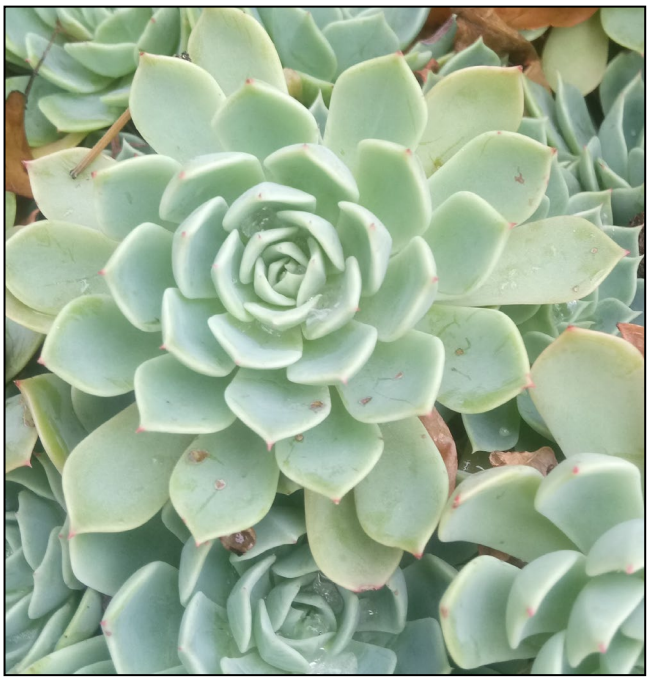


Figure 9: An example of a sedum plant.

a. Explain how the genus of sedums is likely to have evolved. **4 marks**

_____

_____

_____

_____

_____

b. Suggest the most likely reason for sedums being found worldwide. **1 mark**

_____

_____

Question 10 (6 marks)
Scientists have recently discovered that ingesting fine particles of clay with food can help with weight loss. The clay is attracted to and binds with lipid molecules, making them unable to be absorbed by the body.

a. What property must the clay particles possess in order for it to attract and bind to lipid molecules? **1 mark**

_____

The products of lipid breakdown are used to make membranes that surround many of the cell organelles, and to make the plasma membrane, where they are incorporated into phospholipid molecules.

b. Explain what part of the phospholipid molecule is made up of one of the products of lipid metabolism. **1 mark**

_____

c. What specific role do these products of lipid metabolism play within the plasma membrane? **2 marks**

_____

_____

_____

d. Since animal cells do not have cell walls they rely on another molecule found within the plasma membrane for added stability and flexibility. Name this molecule. **1 mark**

_____

e. Would you expect the molecule named in **Question 10d.** to be attracted to or repel clay? Explain your reasoning. **1 mark**

_____

_____

End of Section B

End of Trial Examination

Suggested Answers

VCE Biology 2019 Year 12 Trial Exam Units 3/4

SECTION A – Multiple Choice Answers

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

SECTION B – Short Answer (Answers)

Question 1 (7 marks)

a. Transcription then translation **(1 mark)**.

b. pre mRNA **(1 mark)**.

c. Alternative splicing occurs as part of post-transcription modification where introns are removed from pre-mRNA **(1 mark)**. During this stage the exons can be re-joined in a variety of different ways to produce different mRNA sequences **(1 mark)**. (Exons may also be omitted completely, and introns retained.) In this way, a variety of different proteins can be produced from the same DNA sequence using minimal DNA **(1 mark)**.

d. B cells **(1 mark)**.

e. No, as bacterial genes do not contain introns and exons **(1 mark)**.

Question 2 (9 marks)

a. An inhibitor slows or limits the actions of a particular enzyme **(1 mark)**. It works by binding to an enzyme and altering or blocking the enzyme's active site **(1 mark)**.

b. $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2+6H_2O$ **(1 mark)**.

c. Adenosine triphosphate ATP **(1 mark)** is produced by ATP synthase **(1 mark)**.

d. A person is unlikely to be able to produce ATP in sufficient quantities for the body's needs **(1 mark)**. As a result they will become listless and the lack of ATP may affect brain and heart muscle resulting in death **(1 mark)**.

e. ATP is still available to the cells through anaerobic respiration, though there is far less ATP produced by this method **(1 mark)**.

f. Bacteria and fungi that produce cyanide do not undergo aerobic respiration ***or*** do not use cytochrome c as part of the process **(1 mark)**.

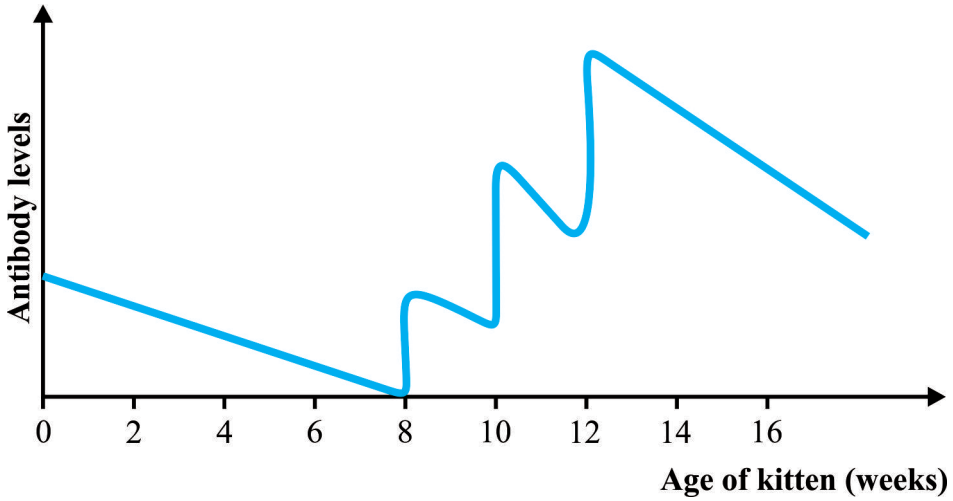
Question 3 (9 marks)

a. FIV is spread through saliva when cats fight and bite each other **(1 mark)**.

b. Viral RNA and reverse transcriptase **(1 mark)**.

c. Since FIV damages the cat's immune system it would make the cat susceptible to a variety of other infections **(1 mark)**. The two booster shots are to ensure that there are sufficient memory cells formed and spread throughout the body to be effective against the actual virus **(1 mark)**.

d.



For showing level of antibodies at birth **(1 mark)**. For showing increasing peaks at the 8, 10 and 12 weeks mark **(1 mark)**.

e. Antigens from the protein coat of the virus **(1 mark)**.

f. Kittens receive anti FIV antibodies passively from their mothers via their milk **(1 mark)**. In order for the vaccine to be effective, the kitten must produce the antibodies by itself and so needs to be immunised when there are no more maternally derived anti FIV antibodies **(1 mark)**.

Question 4 (9 marks)

a. Release of cytokines increases blood flow to the affected area and vasodilation causes redness and swelling **(1 mark)**. Heat is also produced in an attempt to kill pathogens and neutralise exotoxins **(1 mark)**.

b. Gram-positive means that the cell wall of the *Staphylococcus aureus* bacteria react to the Gram stain test **(1 mark)**.

c. Mutation (or transference of plasmids between different species of bacteria) leads to the development of a resistant strain **(1 mark)**. Exposure to antibiotics kills off the bacteria with no resistance, allowing the resistant strain to flourish with less competition **(1 mark)**.

d. A coenzyme is a molecule that binds to an enzyme to create a functional active site **(1 mark)**. The benefit of this system is the enzyme will only work when the coenzyme is present, limiting the rate and amount of product produced **(1 mark)**.

e. Methicillin has no effect on a person's cells since human cells do not have cell walls **(1 mark)**. Co-trimoxazole however has serious side effects in humans since folate is a necessary molecule in cell metabolism **(1 mark)**.

Question 5 (8 marks)

a. The rock in which the fossil is found could be subjected to radiometric dating **(1 mark)**. The amount of radioactive material that remained in the sample would be measured and the age of the fossil is determined based on the half-life of the isotope being measured **(1 mark)**.

b. The coelacanth would have died and been quickly covered by sediment, most likely sand or mud **(1 mark)**. As layers of sediment built up, the lower layers solidified and hardened to form sedimentary rock **(1 mark)**.

c. Transitional fossil **(1 mark)**.

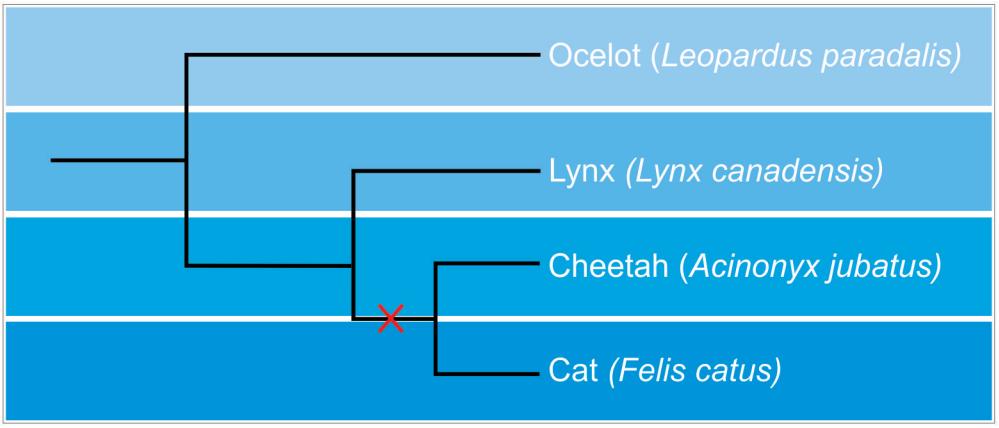
d. Divergent evolution **(1 mark)**.

e. (**2 marks** for any **two** of the following):

- Stable environment would result in minimal change to selection pressures.
- Coelacanths are long lived so few generations for mutations to occur.
- Large gene pool so genetic variation remains stable.
- Random mating so allele frequencies remain stable.

Question 6 (9 marks)

a.



(1 mark) for **X** in the correct position.

b. A gamete - egg or sperm **(1 mark)**.

c. Cladogram **(1 mark)** since there is no time scale **(1 mark)**.

d. This is an example of a genetic bottleneck **(1 mark)**. Unfavourable conditions wiped out all cheetahs in the ancestral population except for a small number of individuals **(1 mark)**. All modern cheetahs have descended from these few surviving individuals, hence the lack of genetic variation **(1 mark)**.

e. Structural morphology **(1 mark)**. Closely related species will have similarities in underlying structure of features e.g. pentadactyl limb **(1 mark)**.

or

Protein comparison **(1 mark)**. Species that are closely related would have a very similar sequence of amino acids in common proteins that they both manufacture **(1 mark)**.

or

Embryo comparison **(1 mark)**. The embryos of closely related species will appear the same until a later stage of development, compared to those of more distantly related species **(1 mark)**.

Question 7 (10 marks)

a. ***(6 marks** for any **three** of the following):*

Body Part	Specific features
Foot **(1 mark)**.	A big toe in line with the other toes allows for easier rolling motion while walking whereas a big toe opposing the others is more suited to gripping branches **(1 mark)**.
Angled femur **(1 mark)**.	A more angled femur allows the leg to support the body's weight when upright from underneath rather than from one side **(1 mark)**.
Wide, flared pelvis **(1 mark)**.	A wide pelvis allows for greater muscle attachment, which in turn indicates a larger gluteus maximus required for upright walking **(1 mark)**.
Curved spine **(1 mark)**.	A curved spine acts as a shock absorber when walking upright and is not needed for an organism that is predominantly climbing **(1 mark)**.
Long leg to arm ratio **(1 mark)**.	Even leg to arm ratio is more suitable for climbing, whilst longer legs compared to arms would indicate a greater use of these limbs as in walking **(1 mark)**.
Foramen magnum **(1 mark)**.	A foramen magnum that is more centralised under the skull would indicate that the skull is balanced on top of the head while upright **(1 mark)**.

b. Upright walking allows creatures to view distant objects such as predators more easily **(1 mark)**.
or
Less surface area exposed to the sun directly above so easier to keep cool **(1 mark)**.
or
Using two legs for walking allows the creature to carry things in its arms. **(1 mark)**.
or
Bipedal walking requires less effort and energy than walking on all fours. **(1 mark)**.
(or any other reasonable answer).

c. **2 marks** for any **two** of the following:

- Smaller jaw.
- More even teeth.
- Larger brain capacity.
- More parabolic jaw.
- Less body hair.

d. Cultural evolution since language and speech can be taught by an individual to any other individual, rather than being passed on through DNA **(1 mark)**.

Question 8 (8 marks)

a. In the nucleus **(1 mark)** during post transcription modification **(1 mark)**.

b. Small section of repeated thymine or uracil nucleotides **(1 mark)**.

c. DNA polymerase **(1 mark)**.

d. cDNA would not contain any introns whereas the original genes may contain introns that are removed after transcription **(1 mark)**.

e. The restriction enzyme used must produce sticky ends on the digested DNA fragments and the plasmid **(1 mark)**. These are small sections of single stranded DNA. Since their bases are complementary to each other they will attract and join due to hydrogen bonding **(1 mark)**.

f. DNA ligase **(1 mark)**.

Question 9 (5 marks)

a. There was variation in the thickness of plant leaves in an ancestral population of sedums **(1 mark)**. In dry, arid regions those with thicker leaves lost less water to the environment and had a selection advantage over the other thinner leaved individuals **(1 mark)**. The thicker leaved sedums survived and passed on their traits to the next generation **(1 mark)**. Over time these changes accumulated to create a distinct genus of sedum plants **(1 mark)**.

b. Sedums must have evolved and spread when the continents were still all joined as one land mass **(1 mark)**.

Question 10 (6 marks)

a. Non-polar (or lipophilic or hydrophobic) **(1 mark)**.

b. The fatty acids from triglycerides make up the two fatty acid 'tails' of a phospholipid molecule **(1 mark)**.

c. Since the fatty acid tails attract each other this provides a somewhat stable barrier **(1 mark)**. The fatty acid tails also repel water which gives the plasma membrane partial permeability **(1 mark)**.

d. Cholesterol **(1 mark)**.

e. Cholesterol would be strongly attracted to clay. As it is strongly lipophilic it would bind to the clay in the same way that lipid molecules do **(1 mark)**.

End of Suggested Answers