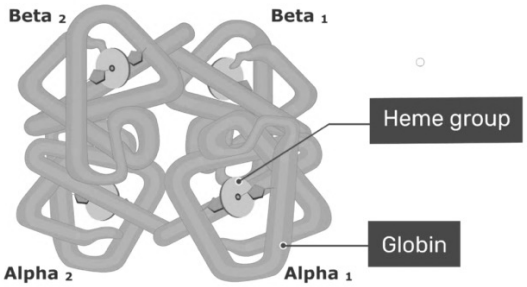
Units 3&4 Biology Practice Exam 2022 – Trial 1 – Assessment Guide

Section A

VCAA Key Knowledge	Question	Answer guide
Amino acids as the monomers of a polypeptide chain and the resultant hierarchical levels of structure that give rise to a functional protein	**Question 1** Haemoglobin is a protein that is found in blood cells that contains iron, which enables the molecule to transport oxygen. Which of the following protein structures is illustrated in the image below?  Source: https://www.getbodysmart.com/respiratory-gases-and-their-transport/hemoglobin-structure **A.** primary **B.** secondary **C.** tertiary **D.** quaternary	*D* *Quaternary; haemoglobin contains more than two polypeptide chains joined together (four in total).*
Nucleic acids as information molecules that encode instructions for the synthesis of proteins: the structure of DNA, the three main forms of RNA (mRNA, rRNA and tRNA) and a comparison of their respective nucleotides	**Question 2** Which of the following nucleic acids does not contain a ribose sugar? **A.** DNA **B.** mRNA **C.** tRNA **D.** rRNA	*A* *DNA contains a deoxyribose sugar.*

The genetic code as a universal triplet code that is degenerate and the steps in gene expression, including transcription, RNA processing in eukaryotic cells and translation by ribosomes

Question 3

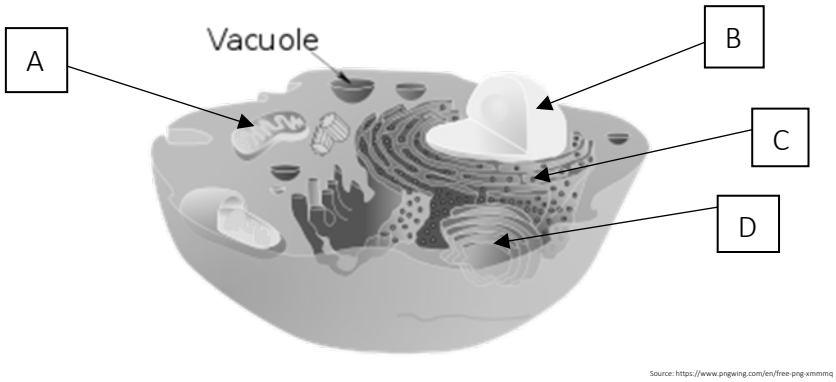
The DNA of all organisms contain the same nitrogenous bases. This indicates that the genetic code is

A. redundant.
B. universal.
C. degenerate.
D. degenerative.

B *The DNA of all organisms contain adenine, thymine, guanine and cytosine; therefore, the genetic code is universal.*

Use the following information to answer Questions 4 and 5.

Consider the following animal cell.



Source: https://www.pngwing.com/en/free-png-xmmmq

The general role of enzymes and coenzymes in facilitating steps in photosynthesis and cellular respiration the general structure of the biochemical pathways in photosynthesis and cellular respiration from initial reactant to final product

Question 4

The primary process occurring at structure A would be

A. anaerobic respiration.
B. photosynthesis.
C. ATP synthesis.
D. DNA synthesis.

C *Mitochondria are the location of cellular respiration (the process that is responsible for creating ATP).*

The role of rough endoplasmic reticulum, Golgi apparatus and associated vesicles in the export of proteins from a cell via the protein secretory pathway

Question 5

Which organelle is responsible for the final packaging of proteins for export from the cell?

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

D *The Golgi body is responsible for storing, modifying and the final packaging of proteins in preparation for their export from the cell.*

Analyse and evaluate bioethical issues using relevant approaches to bioethics and ethical concepts, including the influence of social, economic, legal and political factors relevant to the selected issue

Question 6

Which of the following describes a duty- and/or rule-based approach to resolving ethical issues?

A. is concerned with how people act (the means) and places central importance on the idea that people must act in a particular way, regardless of the consequences that may be produced.

B. an approach that places central importance on the consideration of the consequences of an action (the ends), with the aim to achieve maximisation of positive outcomes.

C. is concerned with the moral character of the person carrying out the action, providing guidance about the characteristics and behaviours a good person would seek to achieve to then be able to act in the right way.

D. none of the above.

A *Option A describes the duty- and/or rule-based approach to resolving ethical issues. B is consequence-based and C is virtues-based.*

Causes of changing allele frequencies in a population's gene pool, including environmental selection pressures, genetic drift and gene flow; and mutations as the source of new alleles

Question 7

mRNA level	AAG	AAA	UAG	AGG
Protein level	Lys	Lys	STOP	Arg

Referring to the table, the DNA triplet corresponding to the STOP codon would be

A. UAG.

B. UTC.

C. ATC.

D. GTC.

C *The STOP codon's mRNA is UAG. Working backwards, the DNA triplet must be ATC.*

The basic elements of gene regulation: prokaryotic trp operon as a simplified example of a regulatory process

Question 8

The trp operon contains an operator region where

A. RNA polymerase binds.

B. the repressor binds.

C. structural genes form.

D. coding for enzyme production occurs.

B *The repressor binds to the operator region.*

The genetic code as a universal triplet code that is degenerate and the steps in gene expression, including transcription, RNA processing in eukaryotic cells and translation by ribosomes

Question 9

RNA processing occurs in the

A. nucleus.

B. ribosome.

C. rough endoplasmic reticulum.

D. cytosol.

A *RNA processing occurs in the nucleus during transcription.*

The general role of enzymes and coenzymes in facilitating steps in photosynthesis and cellular respiration

Question 10

Acetylcholinesterase (AChE) is an enzyme that is found at the synapse of nerves and muscles that has the function of breaking down acetylcholine to ensure proper muscle contraction and relaxation. An individual was admitted to hospital with organophosphate poisoning that causes excess acetylcholine to accumulate. This demonstrates

A. acetylcholinesterase is an organic catalyst.
B. acetylcholine is an organic catalyst.
C. organophosphates are biological catalysts.
D. acetylcholine breaks down the organophosphates.

A *Acetylcholinesterase is an enzyme and enzymes are organic catalysts.*

The general structure of the biochemical pathways in photosynthesis and cellular respiration from initial reactant to final product
the general role of enzymes and coenzymes in facilitating steps in photosynthesis and cellular respiration

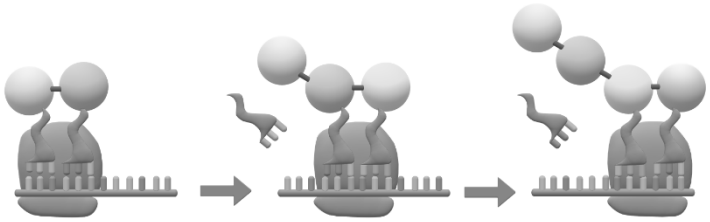
Question 11

The acceptor molecule NAD^+ is involved in cellular biochemical processes. It is correct to state that

A. NAD^+ is found in the grana.
B. NAD^+ becomes NADH in the stroma.
C. NAD^+ becomes NADPH in the Krebs cycle.
D. NAD^+ becomes loaded NADH in cellular respiration.

D *NAD^+ is the acceptor molecule (co-enzyme) involved in cellular respiration. It accepts hydrogen ions and its electrons to become NADH.*

The diagram below shows a biological process.



Source: https://upload.wikimedia.org/wikipedia/commons/thumb/3/37/Protein_.png/1200px-.png?20201230224554

The genetic code as a universal triplet code that is degenerate and the steps in gene expression, including transcription, RNA processing in eukaryotic cells and translation by ribosomes

Amino acids as the monomers of a polypeptide chain and the resultant hierarchical levels of structure that give rise to a functional protein

Question 12

The circles in the diagram represent

A. tRNA.
B. peptide bonds.
C. amino acids.
D. nucleic acids.

C *The circles represent the monomers of a protein – amino acids.*

Evaluate investigation methods and possible sources of personal errors/mistakes or bias, and suggest improvements to increase accuracy and precision, and to reduce the likelihood of errors

Question 13

An example of a systematic error in an experiment could be

A. writing down a measured volume using incorrect units.
B. repeating an experiment.
C. mis-reading a measuring tool when taking a single reading.
D. incorrectly calibrating equipment prior to use.

D *Incorrectly calibrating equipment can contribute to all group's measurements being incorrect – a systematic error.*

The use of enzymes to manipulate DNA, including polymerase to synthesise DNA, ligase to join DNA and endonucleases to cut DNA

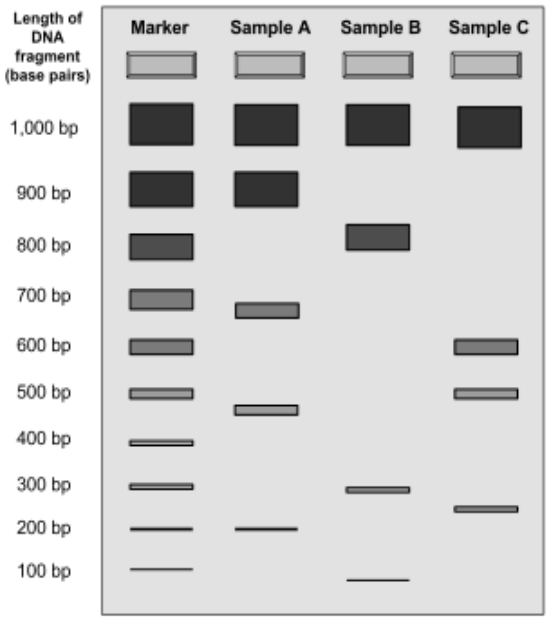
Question 14

Endonucleases can be described as

A. circular DNA that are isolated from bacteria.
B. enzymes that cut DNA.
C. bacterial plasmids.
D. nucleic acids that are derived from bacteria.

B *Endonucleases (also known as restriction enzymes) are enzymes that cut DNA at specific recognition sequences.*

Use the following gel electrophoresis to answer Questions 15 and 16.



Source: https://commons.wikimedia.org/wiki/File:Gel_Electrophoresis.svg

Amplification of DNA using polymerase chain reaction and the use of gel electrophoresis in sorting DNA fragments, including the interpretation of gel runs for DNA profiling

Question 15

Using the gel electrophoresis, which of the following statements is correct?

A. sample A was approximately 1900 bp long
B. sample B was cut with a restriction enzyme that produced three strands of DNA
C. sample C was approximately 2350 bp long
D. sample A was cut with a restriction enzyme that produced three strands

C *The original DNA strand was 2350 bp long. This can be calculated by adding the size of the 4 bands in sample C together.*

Amplification of DNA using polymerase chain reaction and the use of gel electrophoresis in sorting DNA fragments, including the interpretation of gel runs for DNA profiling

Question 16

The best explanation for the DNA samples in wells A, B and C separating is that

A. DNA has a positive charge.
B. the positive electrode is attached to the same end as the well.
C. DNA has a negative charge.
D. the negative electrode is attached to opposite end of the well.

C *DNA has a slight negative charge that enables it to be attracted to the positive electrode and travel towards that electrode through the gel.*

The function of CRISPR-Cas9 in bacteria and the application of this function in editing an organism's genome

Question 17

CRISPR is a gene editing technology that can be used to manipulate an individual's DNA. It involves the use of the Cas9 enzyme that is found in and isolated from bacteria. The purpose of the Cas9 enzyme in bacteria is to

A. catalyse the joining of the bacteria's DNA.
B. increase bacterial cellular respiration.
C. cut viral DNA that has infected the bacteria.
D. promote the lysis of the bacteria.

C *Cas9 plays a part in the immune defence of bacteria against viruses. Its function is to cut the viral DNA into pieces.*

Use the following information to answer Questions 18 and 19.

Polymerase Chain Reaction (PCR) is a frequently used technique to amplify DNA that requires high temperatures at its various stages.

Amplification of DNA using polymerase chain reaction and the use of gel electrophoresis in sorting DNA fragments, including the interpretation of gel runs for DNA profiling

Question 18

In one of the steps of PCR, the purpose of heating DNA to 95°C is to

A. enable the functioning of Taq polymerase.
B. catalyse the joining of the primer.
C. catalyse the joining of the free nucleotides.
D. denature the DNA.

D *Heating the DNA strand to 95°C breaks the hydrogen bonds and separates the strands, denaturing DNA.*

Amplification of DNA using polymerase chain reaction and the use of gel electrophoresis in sorting DNA fragments, including the interpretation of gel runs for DNA profiling

Question 19

In PCR, which of the following is used in order to catalyse the joining of nucleotides to the growing DNA strand?

A. DNA ligase
B. DNA polymerase
C. Taq polymerase
D. free nucleotides

C *Taq polymerase is isolated from thermophilic bacteria and used in place of DNA polymerase due to its ability to withstand high temperatures.*

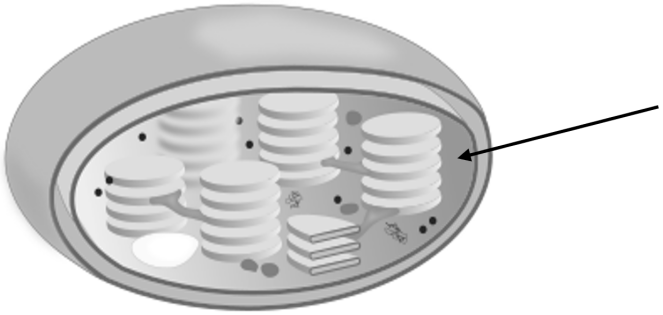
Uses and applications of anaerobic fermentation of biomass for biofuel production

Question 20

Biofuel can be described as the conversion of biomass into a liquid using

A. anaerobic fermentation.
B. aerobic fermentation.
C. yeast fermentation.
D. viral respiration.

A *Biofuel is created using microbes that undergo anaerobic fermentation.*



Source: https://commons.wikimedia.org/wiki/File:Chloroplast-drawing.svg

Inputs, outputs and locations of the light dependent and light independent stages of photosynthesis in C3 plants (details of biochemical pathway mechanisms are not required)

Question 21

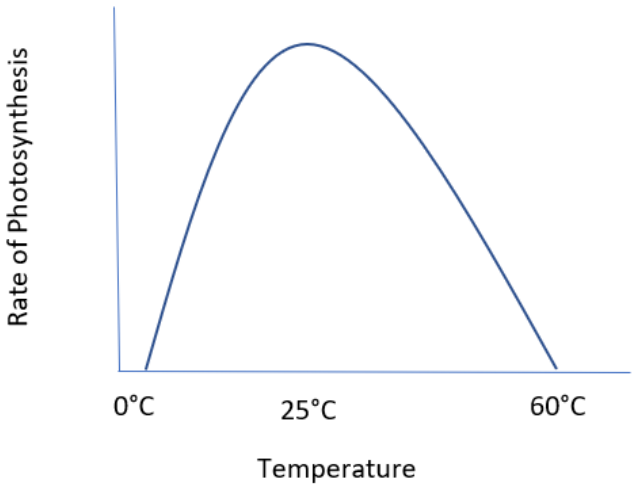
The above diagram of a chloroplast has an arrow that points to the location where

A. protein synthesis occurs.
B. the light-dependent stage of photosynthesis occurs.
C. the light-independent stage of photosynthesis occurs.
D. the splitting of water occurs.

C *The arrow is pointing to the stroma, the site of the light-independent stage of photosynthesis.*

Use the following information to answer Questions 22 and 23.

A group of students performed an experiment using *Elodea* (a water-based plant) leaves and monitored oxygen production levels as a reflection of the photosynthetic rate. The light exposure was kept constant throughout the experiment. They graphed their results as shown below:



The factors that affect the rate of photosynthesis: light availability, water availability, temperature and carbon dioxide concentration

Question 22

The graph shows that the hypothesis that students were most likely testing is

A. that the limiting factor is the rate of photosynthesis.
B. that increasing the temperature above 25°C increases photosynthesis.
C. that a temperature above 60°C will cause photosynthetic enzymes to slow down.
D. that increasing the temperature above 25°C will lead to a reduction of the photosynthetic rate due to an increase in the denaturation of photosynthetic enzymes.

D *As the temperature increases, photosynthesis increases up to a point; beyond this, photosynthesis decreases due to the denaturation of enzymes.*

The general factors that impact on enzyme function in relation to photosynthesis and cellular respiration: changes in temperature, pH, concentration, competitive and non-competitive enzyme inhibitors

Question 23

The most likely explanation for the lower photosynthetic rate at lower temperatures is

A. that the kinetic energy of the enzymes that are involved in photosynthesis has decreased.
B. the presence of a competitive inhibitor.
C. that the enzymes that are involved in photosynthesis have denatured.
D. that the active site of the enzyme can no longer bind to its substrate.

A *At lower temperatures, enzyme activity slows down.*

The role of Rubisco in photosynthesis, including adaptations of C3, C4 and CAM plants to maximise the efficiency of photosynthesis

Question 24

C_3 plants use the enzyme Rubisco to convert carbon dioxide into glucose in the Calvin cycle; however, Rubisco can also bind to oxygen, resulting in photorespiration. Photorespiration is likely to occur when

A. the stomata are open.
B. in the presence of high quantities of water.
C. the temperature is high.
D. the CO_2 concentration is high.

C *When the temperature is high, oxygen becomes more likely to bind to Rubisco than carbon dioxide; this results in photorespiration.*

The main inputs, outputs and locations of glycolysis, Krebs Cycle and electron transport chain including ATP yield (details of biochemical pathway mechanisms are not required)

Question 25

The outputs of glycolysis include

A. NADPH, ATP and pyruvate.
B. NAD, ATP and pyruvate.
C. NADH, ADP+Pi and glucose.
D. NADH, ATP and pyruvate.

D *Glycolysis breaks down glucose to form two molecules each of pyruvate, ATP and NADH; the latter of which were formed when hydrogen ions were picked up by NAD.*

The characteristics and roles of the components of the adaptive immune response against both extracellular and intracellular threats, including the actions of B lymphocytes and their antibodies, helper T and cytotoxic T cells

Question 26

The function of natural killer cells and cytotoxic T cells can be described as

A. inducing apoptosis in virally infected cells.
B. coating extracellular pathogens with proteins to attract other immune cells.
C. creating immunological memory.
D. antibody-secreting cells.

A *Natural killer cells and cytotoxic T cells destroy virally infected cells by inducing apoptosis.*

The innate immune response including the steps in an inflammatory response and the characteristics and roles of macrophages, neutrophils, dendritic cells, eosinophils, natural killer cells, mast cells, complement proteins and interferons

Physical, chemical and microbiota barriers as preventative mechanisms of pathogenic infection in animals and plants

Question 27

The second line of defence of the immune system in humans includes

A. complement proteins.
B. non-pathogenic bacteria.
C. mucus membranes.
D. sweat, tears and saliva.

A *Mucus membranes, non-pathogenic bacteria as well as sweat, tears and saliva form parts of the first line of defence. Complement proteins are part of the second line of defence.*

The innate immune response including the steps in an inflammatory response and the characteristics and roles of macrophages, neutrophils, dendritic cells, eosinophils, natural killer cells, mast cells, complement proteins and interferons
the characteristics and roles of the components of the adaptive immune response against both extracellular and intracellular threats, including the actions of B lymphocytes and their antibodies, helper T and cytotoxic T cells

Question 28

The adaptive immune system in humans does not include

A. natural killer cells.
B. cytotoxic T cells.
C. immunological memory.
D. specificity.

A *Natural killer cells are part of the innate immune system, belong to the second line of defence, and are non-specific white blood cells.*

The role of the lymphatic system in the immune response as a transport network and the role of lymph nodes as sites for antigen recognition by T and B lymphocytes

Question 29

The best description of the function of lymph nodes is that they are where

A. B cells mature.
B. T cells mature.
C. antigen presentation occurs.
D. red blood cells are filtered.

C *Antigen presentation occurs in lymph nodes. B cells mature in the bone marrow. T cells mature in the thymus. Red blood cells are not present in lymph nodes.*

Initiation of an immune response, including antigen presentation, the distinction between self-antigens and non-self antigens, cellular and non-cellular pathogens and allergens

Question 30

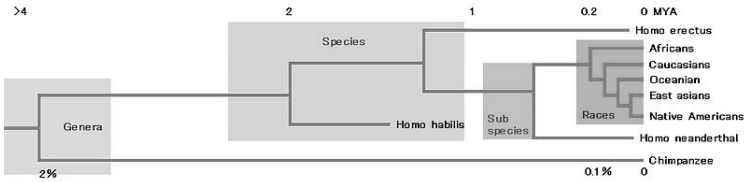
Transplanted organs can be identified by a recipient's body as foreign. Cyclosporin is an immune-suppression drug given to transplant patients. Cyclosporin would most likely help to

A. increase antigen presentation to white blood cells.
B. increase a recipient's ability to accept the transplanted organ.
C. increase the ability of the immune system to recognise self-cells.
D. increase antibody production toward the transplanted organ.

B *Transplanted organs can be identified by the recipient's body as foreign and, thus, are destroyed by the immune system. Cyclosporin is an immune-suppressing agent that enables the recipient to accept the transplanted organ.*

The use and interpretation of phylogenetic trees as evidence for the relatedness between species

Question 31



Source: https://commons.wikimedia.org/wiki/File:Human_evolutionary_tree.jpg

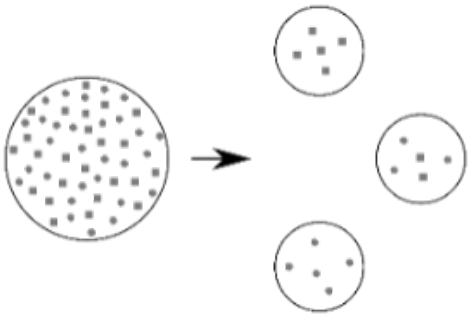
Using the above phylogenetic tree, which of the following is correct?

A. East Asians are most closely related to Oceanians
B. *Homo erectus* diverged from a common ancestor approximately 1.2 MYA
C. *Homo neanderthalensis* and Chimpanzees would have more similar DNA sequences than Africans and Native Americans
D. *Homo habilis* diverged from a common ancestor approximately 4 MYA

B Home erectus *is shown to have diverged from a common ancestor approximately 1.2 MYA.*

Causes of changing allele frequencies in a population's gene pool, including environmental selection pressures, genetic drift and gene flow; and mutations as the source of new alleles

Question 32



Source: https://upload.wikimedia.org/wikipedia/commons/thumb/7/77.svg/996px-.svg.png?20201009135937

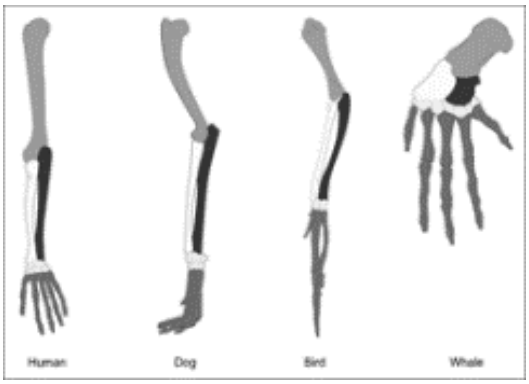
The above image shows different allele frequencies in different population groups. The squares and circles represent individuals with different alleles for a trait. The three smaller populations migrated from the parent population to various locations that were unpopulated. The diagram is an example of

A. gene flow.
B. the bottleneck effect.
C. mutation.
D. the founder effect.

D *As the three smaller populations migrated from the parent population into unpopulated areas and as these new populations have differing allele frequencies owing to non-genetically representative migration, the diagram is an example of the founder effect.*

Evidence of relatedness between species: structural morphology – homologous and vestigial structures; and molecular homology – DNA and amino acid sequences

Question 33



Source: https://commons.wikimedia.org/wiki/File:_vertebrates-en.svg

The image above shows four limbs of different species that share a recent common ancestor. This is an example of

A. analogous structures.
B. homologous structures.
C. comparative embryology.
D. similarity in amino acid sequencing.

B *Homology shows bone structures that are similar but adapted for different functions.*

Biological consequences of changing allele frequencies in terms of increased and decreased genetic diversity

Question 34

Asiatic cheetahs (*Acinonyx jubatus venaticus*) and African cheetahs (*Acinonyx jubatus*) are both threatened species due to climate change, habitat destruction and predation by humans. This has led to cheetahs inbreeding. They also have a low reproduction success rate. The genetic drift of these small Cheetah populations could result in extinction.

Adapted from: https://education.nationalgeographic.org/resource/cheetahs-brink-extinction-again

Which of the following factors would naturally increase their chances of surviving a possible species-specific virus?

A. increasing the genetic diversity of the population
B. decreasing gene flow between populations
C. further inbreeding with greater reproductive success
D. human intervention through selective breeding

A *Increasing the genetic diversity of a population increases the species' abilities to survive chance events, such as a species-specific virus.*

Manipulation of gene pools through selective breeding programs

Question 35

One problem with farmers selectively breeding cows for high quality meat is that

A. organisms with favourable phenotypes can be bred.
B. it causes an increase in the range of alleles in a population.
C. it reduces the genetic diversity of the cow population.
D. it increases an organism's ability to adapt to environmental change.

C *Selective breeding enables the reproduction of organisms with favourable phenotypes but decreases the range of alleles in a population and, therefore, its genetic diversity.*

Changes in species over geological time as evidenced from the fossil record: faunal (fossil) succession, index and transitional fossils, relative and absolute dating of fossils

Question 36

Which of the following is not a characteristic of an index fossil?

A. short-lived
B. abundant
C. wide geographic distribution
D. found in many different rock strata

D *Index fossils are useful as they are found in limited rock strata.*

Consequences of bacterial resistance and viral antigenic drift and shift in terms of ongoing challenges for treatment strategies and vaccination against pathogens

Question 37

Small changes in the genetic composition of a virus' genome due to mutations can result in

A. antigenic drift.
B. antigenic movement.
C. antigenic shift.
D. antigenic recombination.

A *Antigenic drift refers to the genetic mutations that occur in a virus; in contrast, antigenic shift is where genes from different viruses mix.*

Scientific and social strategies employed to identify and control the spread of pathogens, including identification of the pathogen and host, modes of transmission and measures to control transmission

Question 38

A virus' reproductive number has been a well-used term throughout the COVID-19 pandemic; it indicates how many people will be infected by an infected person, on average. Measles has an R_0 value of 18 in contrast to COVID-19's 3.5.

Source: https://www.medscape.com/answers/2500117-197541/what-is-the-r-naught-of-coronavirus-disease-2019-covid-19

This means that

A. measles is 18 times more pathogenic than COVID-19.
B. for every COVID-19 case, there are 3.5 times more measles cases.
C. for every COVID-19 case, there are 18 people who are expected to become infected.
D. for every measles case, 18 people are expected to become infected.

D

The R_0 value is the expected number of individuals who will be infected from one infected individual; as such, 18 people would be expected to become infected from one measles case.

Scientific and social strategies employed to identify and control the spread of pathogens, including identification of the pathogen and host, modes of transmission and measures to control transmission

Question 39

Human Immunodeficiency Virus (HIV) is a blood-borne viral disease that emerged from chimpanzees. The most effective means of controlling the spread of HIV would be to

A. create antimicrobial drugs against the virus.
B. encourage frequent hand washing.
C. encourage mask wearing.
D. create a vaccine against HIV.

D *Creating a vaccine would be the most effective method of control as it is a blood-borne viral disease; therefore, mask wearing, handwashing and antimicrobials would not be effective.*

The shared characteristics that define mammals, primates, hominoids and hominins

Question 40

Hominins

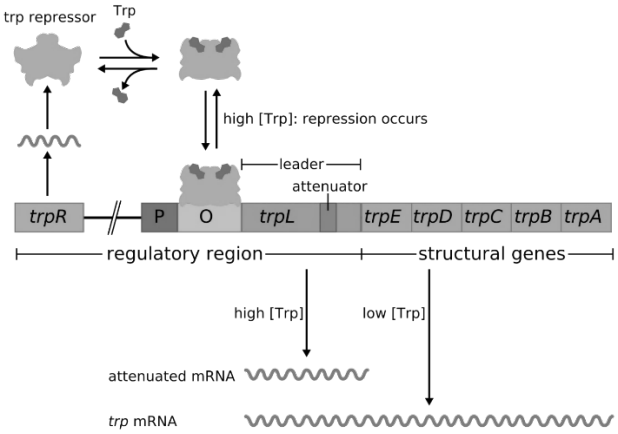
A. include humans and the great apes.
B. are bipedal.
C. branch to include hominoids.
D. have smaller brains than hominoids.

B *Hominins only include bipedal ancestors of humans.*

Section B

VCAA Key Knowledge	Question	Answer guide

E. coli bacteria have mechanisms to change their metabolism based on the environment. One metabolic pathway regulated by *E. coli* is tryptophan production. Tryptophan is an amino acid that is needed to build the proteins that are required to sustain the life of the organism. The image below shows the components of the trp operon.



Source: https://upload.wikimedia.org/wikipedia/commons/thumb/9/95/Trpoperon.svg/2560px-Trpoperon.svg.png

The structure of genes: exons, introns and promoter and operator regions *the basic elements of gene regulation: prokaryotic trp operon as a simplified example of a regulatory process*	**Question 1a** (1 mark) Describe the function of the promoter region (P) in the diagram above.	**Answer:** • *The promoter region is the site where RNA polymerase binds to DNA to enable the transcription of the structural genes.* **Marking protocol:** One mark for the above point.

Causes of changing allele frequencies in a population's gene pool, including environmental selection pressures, genetic drift and gene flow; and mutations as the source of new alleles	**Question 1b** (4 marks) Explain the likely impact of a nonsense mutation in the regulatory region of the trp operon.	**Answer:** • *A nonsense mutation occurs as a result of a point mutation that results in the coding of a STOP codon.* • *This can result in a shortened, non-functional protein.* • *This would mean that the repressor can no longer bind to the operator (O).* • *The impact of this would be the continuous production of the amino acid tryptophan.* **Marking protocol:** One mark for each of the above points.

The structure of genes: exons, introns and promoter and operator regions *the basic elements of gene regulation: prokaryotic trp operon as a simplified example of a regulatory process*	**Question 1c** (4 marks) Outline the process that occurs in *E. coli* when tryptophan is absent from its external environment.	**Answer:** • *When tryptophan is absent from its external environment, the repressor can no longer bind to the operator region.* • *This enables RNA polymerase to bind to the promoter region.* • *Hence, the transcription of the structural genes will occur.* • *Therefore, the enzymes involved in the production of tryptophan are produced.* **Marking protocol:** One mark for each of the above points.

Insulin, a hormone that is required for efficient glucose uptake by cells, is one protein that scientists have been able to reproduce through cloning the gene for insulin production. It involves the use of EcoR1, which was isolated from bacteria; it contains 277 amino acids, three of which are involved in severing bonds in the sequence GAATTC to isolate the insulin gene. It is a commonly used DNA manipulation tool.

Source: https://cbm.msoe.edu/images/contentImages/smartTeams/alumni/2012-13/Milwaukee%20Academy%20of%20Science.pdf

The use of enzymes to manipulate DNA, including polymerase to synthesise DNA, ligase to join DNA and endonucleases to cut DNA	**Question 2a** (2 marks) Name the EcoR1 DNA manipulation tool and explain its function in obtaining the insulin gene.	**Answer:** • *Restriction enzyme/Endonuclease.* • *The function of endonuclease is to recognise and cut DNA at specific recognition sequences to isolate the insulin gene.* **Marking protocol:** One mark for each of the above points.

Proteins as a diverse group of molecules that collectively make an organism's proteome, including enzymes as catalysts in biochemical pathways	**Question 2b** (1 mark) EcoR1 is an essential component of some bacteria's proteomes. Define 'proteome.'	**Answer:** • *The complete set of proteins that is found in a cell or organism.* **Marking protocol:** One mark for the above point.

The use of recombinant plasmids as vectors to transform bacterial cells as demonstrated by the production of human insulin	**Question 2c** (5 marks) Outline how the gene for human insulin is cloned using gene cloning.	**Answer:** • *Target DNA is extracted from a cell or made using reverse transcriptase. This is cut with a specific restriction enzyme to isolate the insulin gene.* • *Plasmids (circular DNA found in bacteria) are cut with the same restriction enzyme (to create complementary sticky ends) and the gene for ampicillin/antibiotic resistance is added.* • *The plasmids, target DNA and DNA ligase – an enzyme that joins DNA – are mixed to enable the plasmid to incorporate the target DNA.* • *Bacterial cells are then treated to make them permeable to the plasmids. (This is done through a heat shock/electric pulse).* • *The bacterial cells that have taken up the plasmid are identified. This is done by placing them on an agar plate that contains ampicillin, an antibiotic. The bacterial cells that survive have taken up the plasmid that contained the gene for ampicillin resistance and are now transformed. They are then isolated and allowed to multiply to clone the gene.* **Marking protocol:** One mark for each of the above points.

A group of students conducted an investigation to observe what happens when yeast is supplied with sucrose in a sealed environment. In their experiment, they used lime water which is typically colourless. When carbon dioxide gas is passed through lime water, the lime water becomes milky due to the formation of white insoluble calcium carbonate. The following method was used:

Method

1. Place 10g of sucrose solution into a flask.
2. Add 100ml of lukewarm water and stir until dissolved.
3. Add 2g of yeast to the sucrose solution and add a layer of paraffin oil to create an anaerobic environment, sealing the conical flask with a rubber stopper containing one hole.
4. Connect tubing to the rubber stopper and to a separate flask containing lime water. The tubing end that enters the separate flask should be submerged in the limewater.
5. Record observations of the sucrose and limewater solutions.

The students recorded their results in Table 1.

Table 1. Observations

Solution	Observation
Sucrose solution	• Colour change from clear to brown liquid
Limewater solution	• Colour change from clear to white liquid. • Formation of precipitate. • Bubbles produced from tubing end submerged in limewater.

The location, inputs and the difference in outputs of anaerobic fermentation in animals and yeasts	**Question 3a** (1 mark) Name the biochemical reaction that was occurring in the yeast.	**Answer:** • *Anaerobic fermentation.* **Marking protocol:** One mark for the above point.

The location, inputs and the difference in outputs of anaerobic fermentation in animals and yeasts *the main inputs, outputs and locations of glycolysis, Krebs Cycle and electron transport chain including ATP yield (details of biochemical pathway mechanisms are not required)*	**Question 3b** (1 mark) In the limewater solution, the students recorded the presence of bubbles of what gas?	**Answer:** • *Carbon dioxide.* **Marking protocol:** One mark for the above point.

The location, inputs and the difference in outputs of anaerobic fermentation in animals and yeasts *the main inputs, outputs and locations of glycolysis, Krebs Cycle and electron transport chain including ATP yield (details of biochemical pathway mechanisms are not required)*	**Question 3c** (1 mark) Apart from the gas that was produced, state one other output of this process that was not measured in this experiment.	**Answer:** • *Ethanol.* • *(Two molecules of) ATP.* **Marking protocol:** One mark for either of the above points.

The location, inputs and the difference in outputs of anaerobic fermentation in animals and yeasts *the main inputs, outputs and locations of glycolysis, Krebs Cycle and electron transport chain including ATP yield (details of biochemical pathway mechanisms are not required)*	**Question 3d** (2 marks) Explain the purpose of this biochemical reaction in yeast with reference to ATP production.	**Answer:** • *Fermentation occurs when oxygen is absent from the yeast's environment.* • *Even though this means that aerobic respiration cannot occur, it enables the yeast to continue to generate energy in the form of two ATP molecules.* **Marking protocol:** One mark for each of the above points.

The students decided to alter the experiment to see what would happen if they repeated the experiment at different temperatures. They decided to monitor the production of the gas by observing the height of bubbles that are produced from the flask containing the limewater over 60 seconds. Their results are provided in Table 2.

Table 2. Results

Temperature (°C)	Height of bubbles
35	High
50	Moderate
60	Low

The factors that affect the rate of cellular respiration: temperature, glucose availability and oxygen concentration	**Question 3e** (3 marks) Analyse the students' results and explain the difference in the results between 35°C and 60°C.	**Answer:** • *CO_2 gas production can be used as a measure of the rate of anaerobic cellular respiration (fermentation) as it is an output for this reaction.* • *At 35°C, a high height of bubbles indicates a high level of fermentation.* OR • *35°C appears to be the optimal temperature for enzymes involved in fermentation.* • *At 60°C, the active site of the enzyme may have started to change shape and, therefore, can no longer bind to its specific substrate, leading to a low height of the bubbles and hence a low gas production.* **Marking protocol:** One mark for either the second or third points. One mark each for the remaining points.

Photosynthesis uses inorganic compounds to produce the organic compound glucose. There are three main groups of photosynthetic plants that differ in the ways in which they undertake the Calvin cycle – CAM, C_3 and C_4 plants. C_3 photosynthesising plants are the most abundant on Earth.

The role of Rubisco in photosynthesis, including adaptations of C_3, C_4 and CAM plants to maximise the efficiency of photosynthesis

Question 4a (4 marks)

Complete the table below comparing C_3 and C_4 plants.

	C_3 Plants	C_4 Plants
Carbon Dioxide-Fixing Enzyme		
Location of Calvin Cycle		

Answer:

	C_3 Plants	C_4 Plants
Carbon Dioxide-Fixing Enzyme	Rubisco	PEP carboxylase
Location of Calvin Cycle	Mesophyll cells	Bundle sheath cells

Marking protocol:

One mark for each of the above points.

CRISPR-Cas9 is a gene-editing technology that can be used to increase photosynthetic efficiency.

Potential uses and applications of CRISPR-Cas9 technologies to improve photosynthetic efficiencies and crop yields

Question 4b (2 marks)

Suggest what CRSIPR-Cas9 might target to reduce photorespiration in C_3 plants and, therefore, how this may improve photosynthetic efficiency.

Answer:

- *CRISPR-Cas9 might target the genes that code for Rubisco.*

AND

- *This would increase its ability to bind to carbon dioxide, reducing photorespiration.*

OR

- *This would decrease its ability to bind to oxygen, reducing photorespiration.*

Marking protocol:

One mark for the first point.

One mark for either of the following two points.

In Australia, canola can be genetically modified to be resistant to the common herbicide glyphosate. Its modification involves the insertion of a gene called the 'GOX' gene, isolated from a bacterium. The gene codes for an enzyme that enables the modified canola to break down the herbicide. *Agrobacterium tumefaciens* bacteria contain a plasmid, called the Ti plasmid (tumour-inducing), that is used to transport the 'GOX' gene into the canola.

Source: https://en.wikipedia.org/wiki/Genetically_modified_canola

The use of genetically modified and transgenic organisms in agriculture to increase crop productivity and to provide resistance to disease	**Question 5a** (2 marks) Name the vector that is used to produce GM canola and justify your reasoning.	**Answer:** • *The Ti plasmid.* • *A vector transports a foreign gene into cells (in this case, the Ti plasmid transports the 'GOX' gene).* **Marking protocol:** One mark for each of the above points.

The use of genetically modified and transgenic organisms in agriculture to increase crop productivity and to provide resistance to disease	**Question 5b** (3 marks) Explain the difference between a genetically modified organism and a transgenic organism and justify why GM canola is considered transgenic.	**Answer:** • *Genetically modified organisms are those that have had their genomes altered.* • *Transgenic organisms also have their genomes altered; however, this is through the inclusion of DNA from a separate species.* • *GM canola is transgenic as it has had its genome altered by the 'GOX' gene that was isolated from bacteria.* **Marking protocol:** One mark for each of the above points.

COVID-19 was once an emerging disease caused by an enveloped single-stranded RNA virus. Infection occurs when the virus uses its S spike proteins to enter into cells via the ACE2 receptor. The viral RNA is then translated and suppresses the host cell's RNA so that it can translate its own.

Adapted from: https://www.nature.com/articles/d41586-021-02039-y

The genetic code as a universal triplet code that is degenerate and the steps in gene expression, including transcription, RNA processing in eukaryotic cells and translation by ribosomes	**Question 6a** (4 marks) Outline how viral RNA is translated.	**Answer:** • *The viral mRNA travels through the cytosol to a ribosome.* • *The mRNA is read 3 bases at a time and its reading attracts the complementary tRNA molecules.* • *(Translation begins with the start codon AUG). The complementary tRNA molecule brings the (methionine) amino acid to the mRNA and hydrogen bonds are formed between the base pairs of the codon and the anti-codon.* • *The amino acid detaches from the tRNA molecule and peptide bonds form between adjacent amino acids through condensation reactions. (Translation ends once a STOP codon is reached).* **Marking protocol:** One mark for each of the above points.

The role of rough endoplasmic reticulum, Golgi apparatus and associated vesicles in the export of proteins from a cell via the protein secretory pathway

Question 6b (3 marks)
Complete the following table by explaining the roles of the different organelles in the production of proteins that are associated with the structure of COVID-19.

Answer:

Organelle	Role
Endoplasmic Reticulum	*Transports new viral protein particles throughout the cell.*
Golgi Body	*Stores, packages and modifies viral protein particles.*
Vesicles	*Transports viral protein particles to the cell membrane for exocytosis (and also between the endoplasmic reticulum and Golgi body).*

Marking protocol:
One mark for each of the above points.

The emergence of new pathogens and re-emergence of known pathogens in a globally connected world, including the impact of European arrival on Aboriginal and Torres Strait Islander peoples

Question 6c (1 mark)
Explain what is meant by an emerging disease.

Answer:
- *An emerging disease is one that is caused by a previously unknown and unidentified pathogen.*

Marking protocol:
One mark for the above point.

The Australian COVID-19 vaccination programme involved the phased roll-out of the vaccine. Aboriginal and Torres Strait Islander peoples were one of the first to be offered the vaccine; however, uptake in this population was quite low as of November 2021.

Source: https://www1.racgp.org.au/newsgp/clinical/aboriginal-and-torres-strait-islander-covid-vaccin

The difference between natural and artificial immunity and active and passive strategies for acquiring immunity

Question 6d (2 marks)
Explain what type of immunity is conferred through COVID-19 vaccination.

Answer:
- *The vaccine provides artificial/induced active immunity.*
- *It enables the recipient's immune system to create antibodies and memory B cells against COVID-19.*

Marking protocol:
One mark for each of the above points.

Ways of using fossil and DNA evidence (mtDNA and whole genomes) to explain the migration of modern human populations around the world, including the migration of Aboriginal and Torres Strait Islander populations and their connection to Country and Place.
scientific and social strategies employed to identify and control the spread of pathogens, including identification of the pathogen and host, modes of transmission and measures to control transmission

Question 6e (1 mark)
Outline one strategy that could have been used to increase vaccine uptake by Indigenous Australians.

Answer:
- *Community elders could have been educated to provide a trusted source of information to the Indigenous community.*
- *Vaccine doses could have been brought directly to central places in Indigenous communities.*
- *Media campaigns that included Indigenous Australians could have been created.*

Marking protocol:
One mark for any one of the above points or any other reasonable answer.

Systemic Lupus Erythematosus (SLE) is an autoimmune disease that produces widespread inflammation in many organs of the human body. It is thought to be triggered by both genetic (in susceptible individuals) and/or environmental factors (such as UV radiation, viruses, medications and oestrogen). The disease causes antigen-antibody complexes to form and deposit in tissues and organs, which produces inflammation. Scientists have found that B cells play a significant role in contributing to this disease with almost all affected individuals showing the presence of specific antibodies, called antinuclear antibodies, in their blood and tissues.

Source: https://www.healthline.com/health/systemic-lupus-erythematosus#causes

The development of immunotherapy strategies, including the use of monoclonal antibodies for the treatment of autoimmune diseases and cancer	**Question 7a** (3 marks) Explain the role of B cells in producing antinuclear antibodies in SLE.	**Answer:** • *Specific B cells identify foreign antigens and undergo clonal selection and expansion.* • *Plasma cells are then synthesised, producing antinuclear antibodies and forming antigen-antibody complexes that deposit in tissue.* • *Memory B cells are also produced, causing continuous disease through the production of antinuclear antibodies.* **Marking protocol:** One mark for each of the above points.

The development of immunotherapy strategies, including the use of monoclonal antibodies for the treatment of autoimmune diseases and cancer	**Question 7b** (4 marks) Recently, scientists have produced a monoclonal antibody treatment for SLE that targets the CD20 protein on B cells. CD20 is involved in B cell activation and proliferation. The monoclonal antibody that is produced induces lysis, depleting B cells and, therefore, reducing the symptoms of SLE. Explain how monoclonal antibodies are produced and how it may be effective in treating SLE.	**Answer:** • *In producing monoclinal antibodies, an antigen is injected into mice so that they are induced to produce antibodies that are specific to the antigen.* • *The B cells that produce antibodies are isolated and are fused with a tumour cell to form a hybridoma.* • *Hybridomas are cultured in a medium and prompted to reproduce, creating the monoclonal antibody.* • *The monoclonal antibody targets the defective B cells, causing lysis; this can help to prevent the specific B cells from secreting antinuclear antibodies.* **Marking protocol:** One mark for each of the above points.

Bordetella pertussis is a gram-negative bacterium that causes whooping cough, a severe respiratory infection. It can be deadly in babies under the age of one year old. The pathogen causes disease by releasing toxins that damage cilia, leading to the inflammation of the airways; this causes coughing, a runny nose and, later in the disease progression, vomiting as well as coughing fits that produce high-pitched whooping sounds. In babies, they may not cough at all but, instead, completely stop breathing. Family members, such as parents, grandparents and siblings of the babies, are often the cause of the baby's infection.

Babies can be vaccinated from the age of six weeks old with five shots, occurring between the ages of six weeks and four years. This provides protection that lasts for approximately 10 years, with a booster shot given as part of the high school vaccination programme in year seven.

A free vaccination programme was introduced to help reduce the spread and the severity of the disease. It targeted pregnant women from 20-31 weeks gestation and their partners and/or primary carers, who are all eligible for free vaccination.

Source: https://www.health.vic.gov.au/immunisation/parents-whooping-cough-vaccine-program-for-health-professionals

Vaccination programs and their role in maintaining herd immunity for a specific disease in a human population *scientific and social strategies employed to identify and control the spread of pathogens, including identification of the pathogen and host, modes of transmission and measures to control transmission*	**Question 8a** (2 marks) Name the most likely primary mode of transmission of the pathogen that causes whooping cough. Justify your answer.	**Answer:** • *Direct transmission from person-to-person.* • *This type of transmission most likely occurs through droplets that contain the bacteria spreading by coughing.* **Marking protocol:** One mark for each of the above points.

Scientific and social strategies employed to identify and control the spread of pathogens, including identification of the pathogen and host, modes of transmission and measures to control transmission	**Question 8b** (2 marks) Outline how scientists identified *Bordetella pertussis* as a gram-negative bacterium.	**Answer:** • *Gram-negative bacteria contain an outer membrane that is composed of lipopolysaccharides.* • *This means that, when stained, the bacteria do not take up the violet stain but instead appear pink.* **Marking protocol:** One mark for each of the above points.

Vaccination programs and their role in maintaining herd immunity for a specific disease in a human population *the difference between natural and artificial immunity and active and passive strategies for acquiring immunity*	**Question 8c** (2 marks) Explain the importance of women being vaccinated while pregnant. Reference both the mother and her child in your response.	**Answer:** • *Vaccination induces artificial active immunity, enabling pregnant women to protect themselves from disease.* • *It also enables natural passive immunity against the disease as antibodies are passed from the mother to her child via the placenta and during breastfeeding.* **Marking protocol:** One mark for each of the above points.

Vaccination programs and their role in maintaining herd immunity for a specific disease in a human population	**Question 8d** (2 marks) Define herd immunity and suggest an improvement to this vaccination programme that could contribute to herd immunity.	**Answer:** • *Herd immunity occurs when population members without immunity receive protection against infection due to a high proportion of the population being immune.* AND • *This could be achieved for whooping cough through a programme that vaccinates the entire population and where the entire population also receives a regular booster dose, if needed, whenever this would be required.* OR • *This could be achieved for whooping cough through making the vaccine free for all family members.* OR • *This could be achieved for whooping cough through ensuring that early-childhood carers and teachers are vaccinated and boosted for free.* **Marking protocol:** One mark for each of the above points. One mark for the first point and one additional mark for one of points two, three or four.

Australia and Papua New Guinea were once joined by a land bridge with the supercontinent Sahul. Our African ancestors are thought to have migrated to Sahul and spread from east to west perhaps 50,000 years ago. This was revealed by DNA studies that were conducted on Aboriginal and Torres Strait Islander peoples. These studies also showed a large amount of genetic variation between the various populations around Australia.

Discovered in 1974, Mungo Man is the oldest human fossil skeleton that has ever been found in Australia and is dated to be 42,000 years old. Scientists studied his burial site, finding that he was very carefully and ritually laid out and sprinkled with red ochre upon his death.

Source: https://commons.wikimedia.org/wiki/File:Mungo_Man.jpg

Ways of using fossil and DNA evidence (mtDNA and whole genomes) to explain the migration of modern human populations around the world, including the migration of Aboriginal and Torres Strait Islander populations and their connection to Country and Place	**Question 9a** (2 marks) Name the absolute dating technique that was most likely used to date Mungo Man. Explain your reasoning.	**Answer:** • *Carbon dating.* • *Carbon dating is used to directly date fossils up to 60,000 years old; the Mungo Man fossil is 42,000 years old.* **Marking protocol:** One mark for each of the above points.

Ways of using fossil and DNA evidence (mtDNA and whole genomes) to explain the migration of modern human populations around the world, including the migration of Aboriginal and Torres Strait Islander populations and their connection to Country and Place	**Question 9b** (3 marks) Outline three requirements for fossil formation.	**Answer:** • *A low-oxygen environment to prevent decomposition by microorganisms.* • *A rapid burial to prevent the disturbance and decomposition of the fossil by scavengers.* • *Hard body parts that will not decompose rapidly.* • *A non-acidic environment as acid contributes to decomposition.* • *A rapid burial in freezing environments to instantly preserve the organism.* • *High pressure to enable petrification.* **Marking protocol:** One mark for any of the above points, to a maximum of three.

Ways of using fossil and DNA evidence (mtDNA and whole genomes) to explain the migration of modern human populations around the world, including the migration of Aboriginal and Torres Strait Islander populations and their connection to Country and Place	**Question 9c** (1 mark) Suggest one reason for the high amount of genetic diversity amongst Indigenous Australians.	**Answer:** • *Indigenous Australians have been here for at least 50,000 years, allowing for a greater number of mutations to accumulate in their DNA over time than non-Indigenous Australians.* • *There may have been reduced gene flow between communities that spread across Australia, allowing genetic differences to accumulate.* • *Communities adapted to their different environments, favouring different phenotypes in different ways, leading to increased genetic diversity.* **Marking protocol:** One mark for any one of the above points.

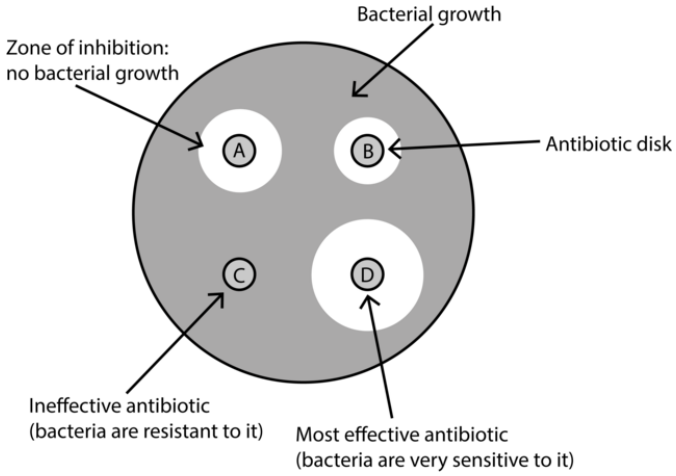
Lord Howe Island is a very small island that is located east of mainland New South Wales. It has been geographically isolated for a long time and is home to two species of palm trees – *Howea belmoreana* and *Howea forsteriana* – that grow closely to each other but are reproductively isolated. Scientists have genetically analysed the two species to try to determine how they came to be different species. They found that they both originated from one species on the island, with no evidence of geographical isolation between the two species; however, they have different flowering times. Research has shown that *H.belmoreana* and *H.forsteriana* prefer different soil types and this has influenced each species' flowering time. Scientists have suggested this difference in flowering time resulted in their eventual speciation.

Source: https://www.indefenseofplants.com/blog/2017/5/1/soil-and-speciation

Evidence of speciation as a consequence of isolation and genetic divergence, including Galapagos finches as an example of allopatric speciation and Howea palms on Lord Howe Island as an example of sympatric speciation	**Question 10a** (2 marks) Explain how sympatric and allopatric speciation differ.	**Answer:** • *Allopatric speciation involves the geographical separation of a species, preventing gene flow and resulting in the development of two different species.* • *Conversely, sympatric speciation involves the development of a new species from an existing one while both continue to inhabit the same geographic region.* **Marking protocol:** One mark for each of the above points.

Evidence of speciation as a consequence of isolation and genetic divergence, including Galapagos finches as an example of allopatric speciation and Howea palms on Lord Howe Island as an example of sympatric speciation	**Question 10b** (3 marks) Explain how these two palm trees may have become different species.	**Answer:** • *A population of Howea palms initially existed and showed variation in flowering times.* • *Different flowering times were influenced by variation in soil type, and this led to some individuals having a selective advantage in their environment. The difference in flowering times contributed to reproductive isolation and a lack of gene flow.* • *Over time, two different gene pools were created, and individuals were then no longer able to produce fertile offspring, resulting in the two different species.* **Marking protocol:** One mark for each of the above points.

Students were placed into groups of three and conducted an investigation to see which concentration of the antibiotic ampicillin would be the most effective in preventing the growth of *E. coli*, a bacterium. They used serial dilutions of ampicillin up to 2mg/mL and measured the zone of inhibition radius (ZOI - the area in which the bacteria did not grow) in millimetres after incubating the bacteria for 10 hours. The ZOI was measured with a ruler. A diagram demonstrating this information is shown below.



Source: https://commons.wikimedia.org/w/index.php?search=zone+of+inhibition&title=Special:MediaSearch&go=Go&type=image

Each student took turns to perform the method, with each student responsible for carrying out only one of the three trials. The students were provided with the method below and recorded their results in the table as shown.

Method:

1. Use a Bunsen burner to create a sterile environment.
2. Label each agar plate with the different ampicillin concentrations.
3. Use a sterile swab to transfer bacteria from the broth to the agar and rotate the plate as the bacteria are spread.
4. Use sterile forceps to dip a paper disc into the corresponding ampicillin concentration and place this onto the agar plate.
5. Seal the lid of the plate with tape.
6. Repeat steps one to five for each ampicillin concentration.
7. Incubate at 35^{o}C for 10 hours.
8. Using a ruler, measure the ZOI radius (mm) for each concentration of ampicillin.

Table 1. Student Results

	Zone of Inhibition (mm)		
Concentration of Ampicillin (mg/mL)	Trial 1	Trial 2	Trial 3
0.125	7	6	1
0.25	11	11	14
0.5	15	14	13
1	20	20	21
2	30	30	18

Characteristics of the selected scientific methodology and method, and appropriateness of the use of independent, dependent and controlled variables in the selected scientific investigation	**Question 11a** (2 marks) Identify the dependent and independent variables in this experiment.	**Answer:** • *The dependent variable is the zone of inhibition (mm).* • *The independent variable is the concentration of ampicillin (mg/mL).* **Marking protocol:** One mark for each of the above points.

The accuracy, precision, reproducibility, repeatability and validity of measurements	**Question 11b** (1 mark) Explain why the experiment was repeated.	**Answer:** • *Repeating the experiment increases the reliability of the results.* **Marking protocol:** One mark for the above point.

The accuracy, precision, reproducibility, repeatability and validity of measurements the key findings and implications of the selected scientific investigation	**Question 11c** (2 marks) Identify which concentration of ampicillin has the most precise data. Justify your answer.	**Answer:** • *1mg/mL was the most precise concentration.* • *Precision refers to how closely two or more results agree with each other. Trials one and two showed ZOI's of 20mm whilst trial three had a ZOI of 21mm.* **Marking protocol:** One mark for each of the above points.

Analyse and evaluate bioethical issues using relevant approaches to bioethics and ethical concepts, including the influence of social, economic, legal and political factors relevant to the selected issue	**Question 11d** (2 marks) After the experiment, one of the students commented that it might be a good idea to infect humans with *E.coli* and then try different concentrations of the antibiotic ampicillin to determine which is most effective. However, a second student remarked that this may breach the ethical principle of non-maleficence. Outline whether or not you think the second student is correct and justify your response.	**Answer:** • *Yes, the second student is correct. Non-maleficence refers to avoiding the causation of harm.* • *Infecting humans with E.coli may cause them to become unwell and cause them harm, thus breaching this ethical principle (and this can be avoided by carrying out an experiment such as the one in the stimulus).* **Marking protocol:** One mark for each of the above points.

VCE BIOLOGY
Written Examination
ANSWER SHEET – 2022

Student name:	

Use a **PENCIL** for **ALL** entries. For each question, shade the box which indicates your answer.

Marks will **NOT** be deducted for incorrect answers.

NO MARK will be given if more than **ONE** answer is completed for any question.

If you make a mistake, **ERASE** the incorrect answer – **DO NOT** cross it out.

1	A	B	C	**D**
2	**A**	B	C	D
3	A	**B**	C	D
4	A	B	**C**	D
5	A	B	C	**D**
6	**A**	B	C	D
7	A	B	**C**	D
8	A	**B**	C	D
9	**A**	B	C	D
10	**A**	B	C	D
11	A	B	C	**D**
12	A	B	**C**	D
13	A	B	C	**D**
14	A	**B**	C	D

15	A	B	**C**	D
16	A	B	**C**	D
17	A	B	**C**	D
18	A	B	C	**D**
19	A	B	**C**	D
20	**A**	B	C	D
21	A	B	**C**	D
22	A	B	C	**D**
23	**A**	B	C	D
24	A	B	**C**	D
25	A	B	C	**D**
26	**A**	B	C	D
27	**A**	B	C	D
28	**A**	B	C	D

29	A	B	**C**	D
30	A	**B**	C	D
31	A	**B**	C	D
32	A	B	C	**D**
33	A	**B**	C	D
34	**A**	B	C	D
35	A	B	**C**	D
36	A	B	C	**D**
37	**A**	B	C	D
38	A	B	C	**D**
39	A	B	C	**D**
40	A	**B**	C	D