aced

Victorian Certificate of Education 2020

Name: _____

Teacher's name: _____

Need more great revision?
Go to acedvce.com

STUDENT NUMBER | | | | | | | | | Letter | |

BIOLOGY

Written examination

2020

Reading time: 15 minutes
Writing time: 2 hours 30 minutes

QUESTION AND ANSWER BOOK

Structure of book

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	40	40	40
B	11	11	80
			Total 120

• Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners and rulers.
• Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.
• No calculator is allowed in this examination.

Materials supplied
• Question and answer booklet.
• Answer sheet for multiple-choice questions.

Instructions
• Write your **student number** in the space provided above on this page.
• Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.
• All written responses must be in English.

At the end of the examination
• Place the answer sheet for multiple-choice questions inside the front cover of this book.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

SECTION A – Multiple-choice questions

Instructions for Section A

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.
Choose the response that is **correct** or that **best answers** the question.
A correct answer scores 1, an incorrect answer score 0.
Marks will **not** be deducted for incorrect answers.
No marks will be given if more than one answer is completed for any question.

Question 1
Nitrogen is found in which of the following?
A. amino acids and water
B. RNA bases but not DNA bases
C. DNA bases but not RNA bases
D. both DNA and RNA bases

Question 2
There are four levels of protein structure. When two or more polypeptides are joined, this refers to
A. primary structure.
B. secondary structure.
C. tertiary structure.
D. quaternary structure.

Use the following information to answer Questions 3 and 4.

1 = viruses	*2 = prokaryotic cells*	*3 = prions*	*4 = eukaryotic cells*

Question 3
DNA and/or RNA can be found in
A. 1 only.
B. 1 and 2 only.
C. 1, 2 and 4 only.
D. 1, 2, 3 and 4.

Question 4
Polypeptides could be found in
A. 1 only.
B. 1, 2, 3 and 4.
C. 3 only.
D. 1 and 2 only.

Question 5
In relation to the production, transport and export of a protein from a cell, which of the following organelles correctly matches its function?

	Organelle	**Function**
A.	golgi body	packages proteins into vesicles
B.	ribosome	modifies proteins
C.	endoplasmic reticulum	synthesises proteins
D.	cell membrane	transports proteins around the cell

Use the following information to answer Questions 6 and 7.

Thelma and Louise were discussing movement through the plasma membrane of an animal cell. Louise suggested that there are many molecules that can move through the phospholipid bilayer without requiring energy and also do not require the use of protein channels.

Question 6

The correct processes that the molecules Louise was referring to may utilise include

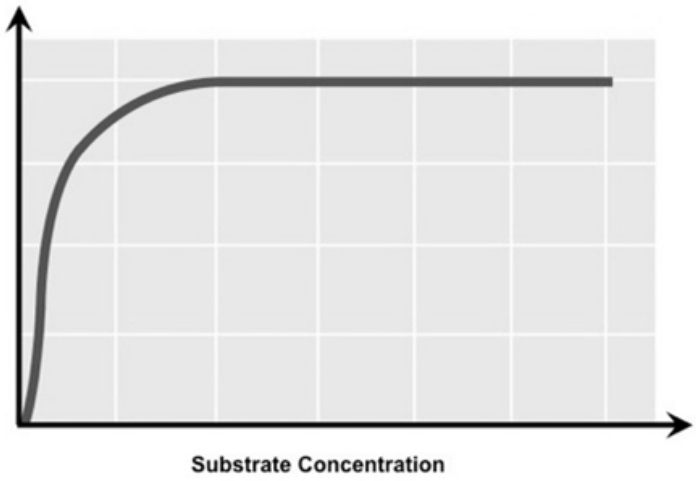
A. osmosis, simple diffusion and active transport.
B. osmosis and simple diffusion.
C. osmosis and exocytosis.
D. simple diffusion, exocytosis and endocytosis.

Question 7

Examples of molecules that can move through the phospholipid bilayer and do not require protein channels include

A. water only.
B. water and oxygen only.
C. water, oxygen and carbon dioxide.
D. oxygen and carbon dioxide only.

Question 8



Source: https://www.nagwa.com/en/worksheets/702178634958/

The y-axis variable in the enzyme graph above is most likely to be

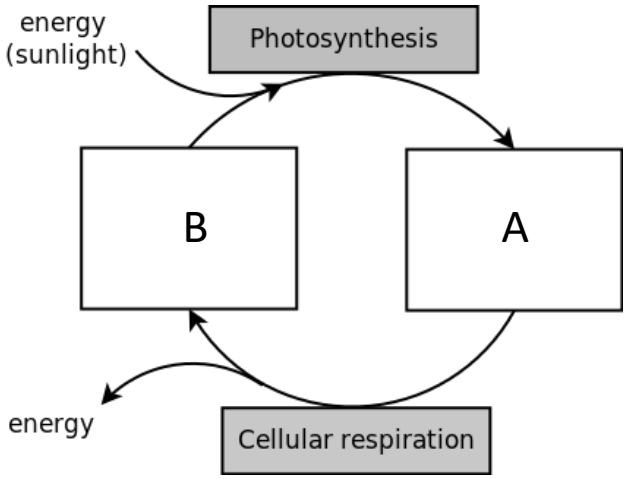
A. rate of reaction.
B. temperature.
C. pH.
D. substrate concentration.

Question 9

Enzymes _____ activation energy.

A. increase
B. neutralise
C. lower
D. remove

Use the following information to answer Questions 10 and 11.



Source: https://www.siyavula.com/read/science/grade-8/photosynthesis-and-respiration/01-photosynthesis-and-respiration

Question 10

The molecules that best align with A and B are:

	A	B
A.	Oxygen Glucose	Carbon dioxide Water
B.	Carbon dioxide Water	Oxygen Glucose
C.	Oxygen Carbon dioxide	Glucose Water
D.	ATP Oxygen	Carbon dioxide ATP

Question 11

Photosynthesis is a/n _____ reaction and cellular respiration is a/n _____ reaction.

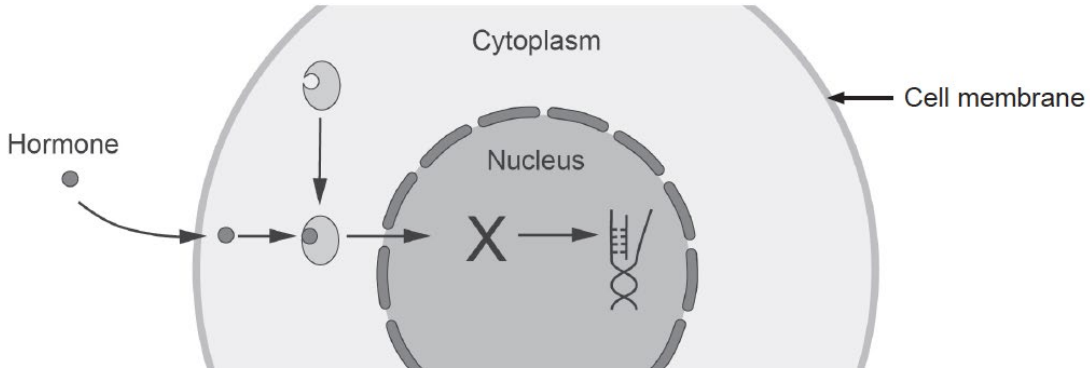
A. catabolic; anabolic
B. anabolic; anabolic
C. catabolic; catabolic
D. anabolic; catabolic

Question 12

Coenzymes

A. perform the same function as enzymes in cellular respiration.
B. are not made of protein.
C. perform no role in photosynthesis.
D. that are involved in photosynthesis are only ATP and NADH.

Question 13



Source: https://www.sciencedirect.com/topics

At point X in the diagram, the

A. hormone binds with the receptor.
B. secondary messenger binds to DNA.
C. hormone-receptor complex binds to DNA.
D. cell response is complete.

Question 14

Receptor proteins

A. always bind with molecules on the surface of a cell to cause changes within that cell.
B. cannot initiate the process that leads to cell death.
C. enable communication between cells to stimulate change in target cells.
D. always bind with molecules inside a cell to cause changes within that cell.

Question 15

The presence of mitochondria in the axon terminal of a neuron assists with cellular signalling, because the mitochondria can provide energy for

A. the movement of neurotransmitters across the synapse through diffusion.
B. the release of neurotransmitters from the axon terminal via exocytosis.
C. the movement of neurotransmitters across the synapse through active transport.
D. the release of neurotransmitters from the axon terminal via endocytosis.

Question 16

In relation to active and passive immunity, which of the following options correctly matches the type of immunity with its function?

	Passive immunity	Active immunity
A.	can result in a long-lasting memory of pathogens	involves complement proteins and neutrophils
B.	involves the production of antibodies	involves the production of B memory cells
C.	can result in the inflammatory response being activated	involves the same general response for each pathogen encountered
D.	involves complement proteins and neutrophils	can result in a long-lasting memory of pathogens

Question 17

Herd immunity

A. can be obtained through both natural infection and vaccination.
B. can be obtained only through natural infection.
C. cannot be obtained through either vaccination or natural infection.
D. can be obtained only through vaccination.

Question 18
The following is a list of the main steps in the life cycle of a virus in no particular order.

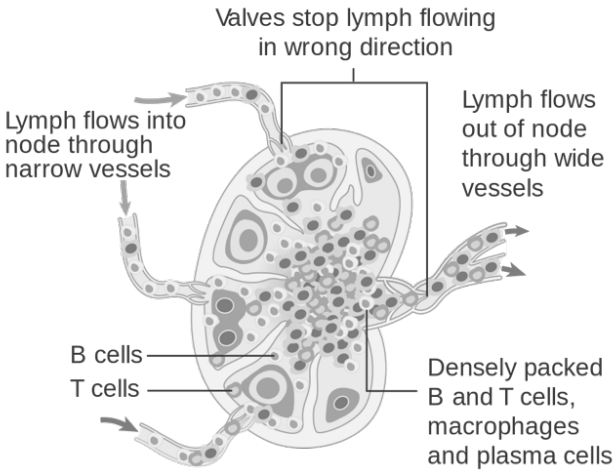
Step A: Viral proteins and nucleic acids are assembled in the host cell.
Step B: The virus binds to the host cell.
Step C: The virus injects its nucleic acid into the host cell.
Step D: The host cell releases viral particles.
Step E: The host cell produces viral nucleic acids and proteins.

Which of the following lists these steps in the order in which they occur in the life cycle of a virus?
A. D – A – E – C – B
B. C – A – B – D – E
C. B – C – E – D – A
D. B – C – E – A – D

Question 19
T helper cells
A. directly attack cells infected with viruses.
B. release cytokines which stimulate B cells.
C. produce antibodies.
D. interact with antigens presented on cytotoxic T cells.

Question 20
Monoclonal antibodies
A. directly attack cancer cells.
B. can deliver radiation to cancer cells.
C. can deliver chemotherapy to cancer cells.
D. all of the above.

Use the following information to answer Questions 21 and 22.



Source: https://en.wikipedia.org/wiki/Lymph_node#/media/File:Diagram_of_a_lymph_node_CRUK_022.svg

Question 21

The diagram above is where

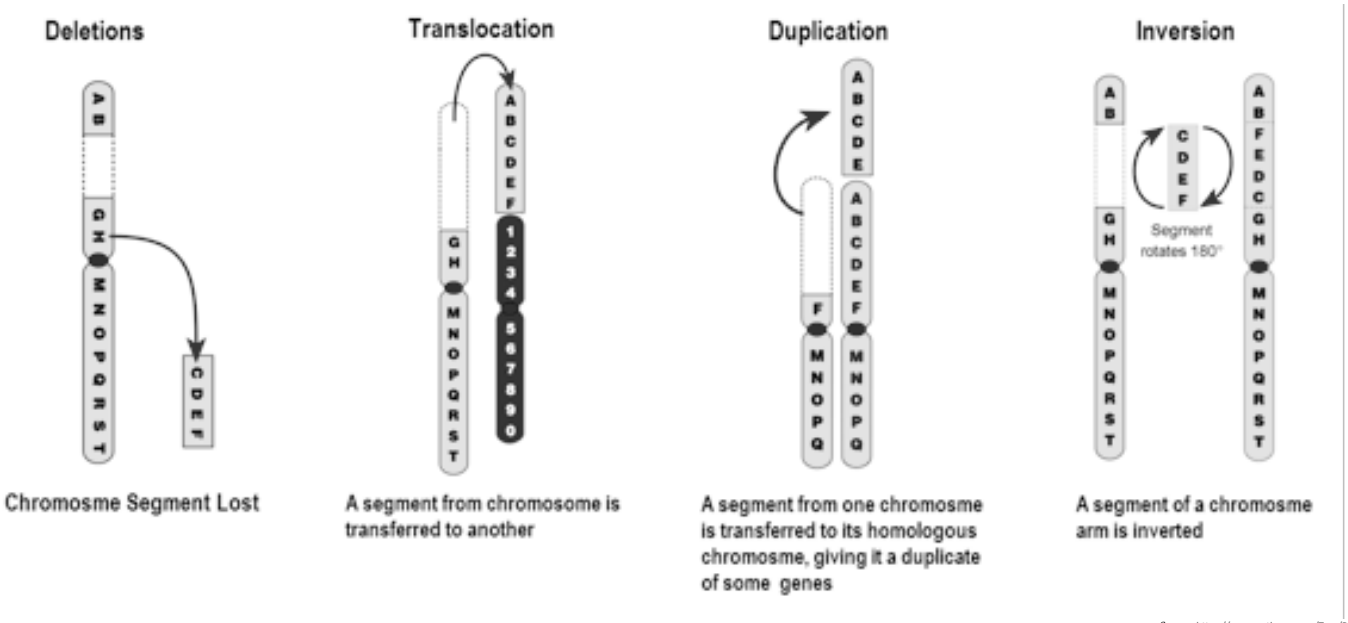
A. antigen recognition occurs by lymphocytes.
B. pumping occurs to move fluid through vessels.
C. fluid drains back into the circulatory system.
D. the allergic response is initiated.

Question 22

The diagram above represents

A. quaternary lymphoid tissue.
B. primary lymphoid tissue.
C. secondary lymphoid tissue.
D. tertiary lymphoid tissue.

Question 23



Source: https://www.pathwayz.org/Tree/Plain/S

The diagram above represents

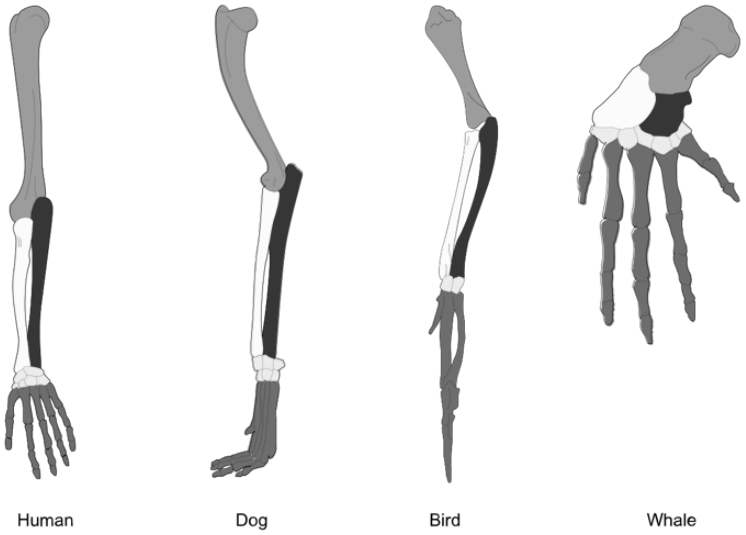
A. the polymerase chain reaction.
B. point mutations.
C. frameshift mutations.
D. block mutations.

Question 24

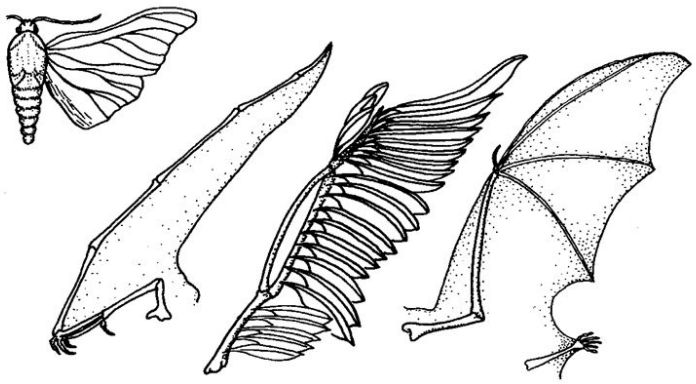
Selective breeding

A. will always reduce genetic diversity in a population.
B. will always increase genetic diversity in a population.
C. can be used as a method to increase the survival chances of an endangered species.
D. is only used to increase the survival chances of an endangered species.

Question 25



1



2

Source: https://en.wikipedia.org/wiki/_(biology)

Which of the following is true of the images above?

A. both 1 and 2 represent analogous structures
B. both 1 and 2 represent structural morphological evidence of biological change over time
C. both 1 and 2 represent homologous structures
D. 1 represents analogous structures and 2 represents homologous structures

Question 26

Two species of lizards live on separate islands. These two species evolved from a common ancestor by allopatric speciation. The likely order of events in the speciation, from first to last, would have been

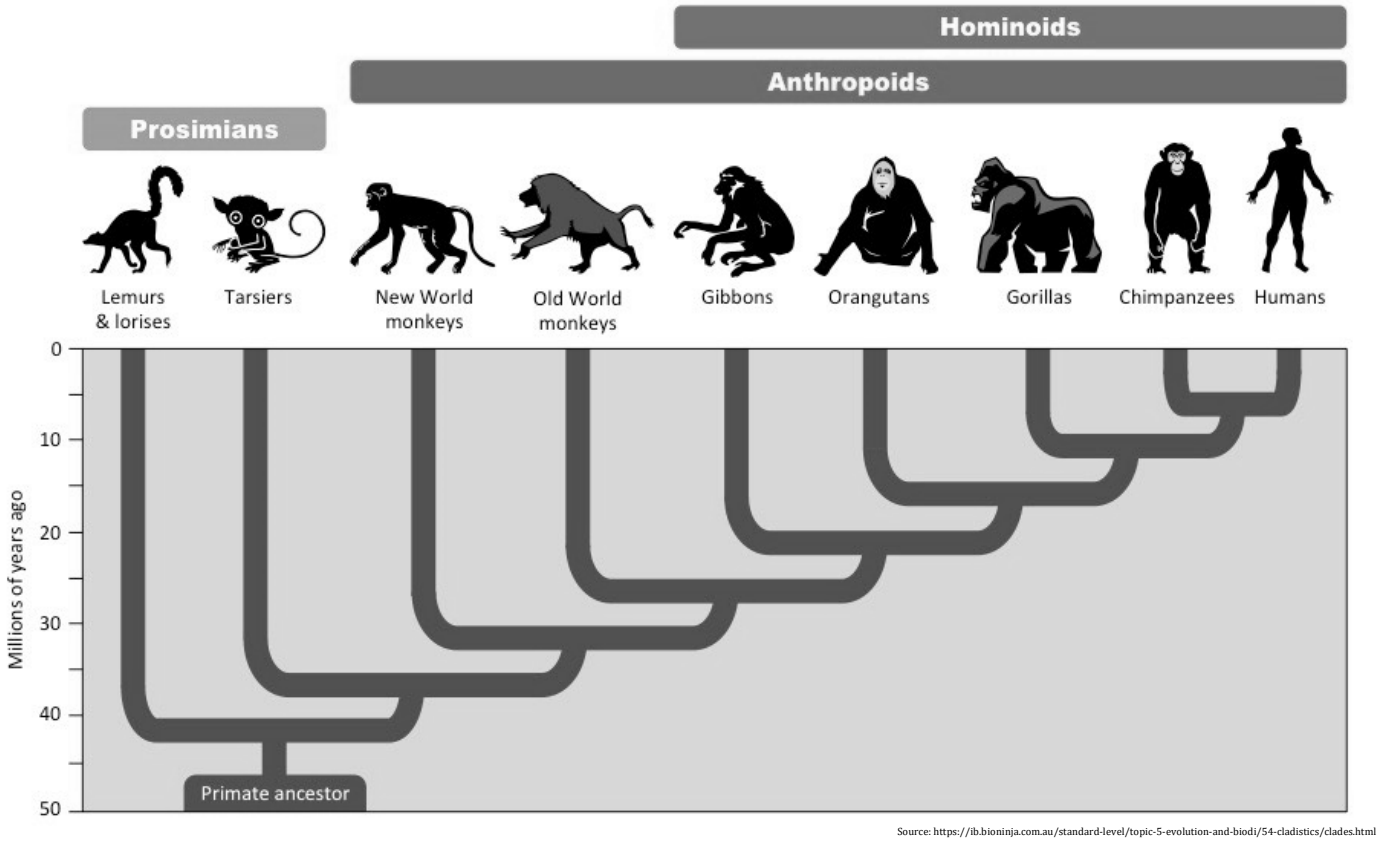
A. geographical isolation, reproductive isolation, natural selection.
B. geographical isolation, natural selection, reproductive isolation.
C. natural selection, geographical isolation, reproductive isolation.
D. natural selection, reproductive isolation, geographical isolation.

Question 27

If the rate of gene flow between two populations is high, then it is likely that

A. speciation will not occur.
B. speciation will occur.
C. the selection pressures in the two populations are the same.
D. there are long distances between the two populations.

Question 28



Source: https://ib.bioninja.com.au/standard-level/topic-5-evolution-and-biodi/54-cladistics/clades.html

According to this cladogram

A. Old World monkeys evolved after New World monkeys.
B. Orangutans evolved before Gibbons.
C. Tarsiers are more closely related to humans than New World monkeys.
D. Lemurs and lorises are the least closely related.

Question 29

Hominoids and hominins

A. lack opposable thumbs.
B. are all bipedal.
C. lack tails.
D. could all use tools to make fire.

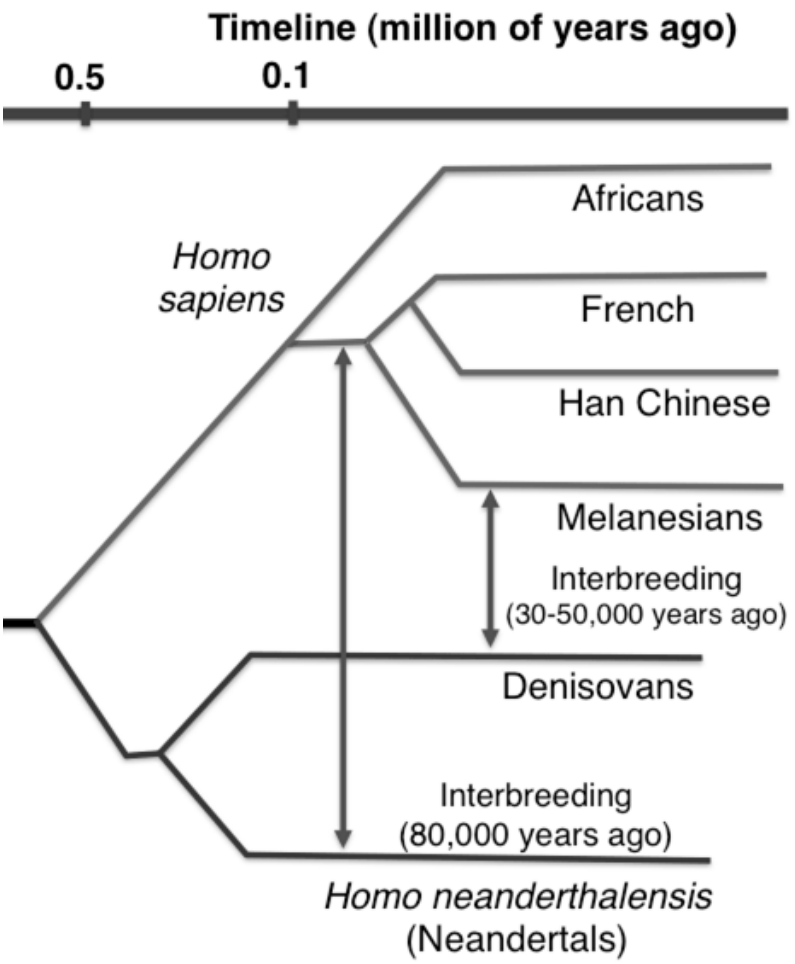
Question 30

What evidence would support the notion that interbreeding occurred between *Homo neanderthalensis* and *Homo sapiens*?

A. they were both alive during the same period of time
B. they both shared cultural traditions
C. they both possess similar structural traits such as a large brain case
D. modern day *homo sapiens* possess Neanderthal DNA

Question 31

The diagram below is one depiction of an aspect of the human family tree.



Source: https://i0.wp.com/sitn.hms.harvard.edu/wp-content/uploads/2012/12/fig1.png

The family tree indicates that Neanderthals and Denisovans diverged approximately

A. 0.5 million years ago.
B. 0.3 million years ago.
C. 0.1 million years ago.
D. 0.6 million years ago.

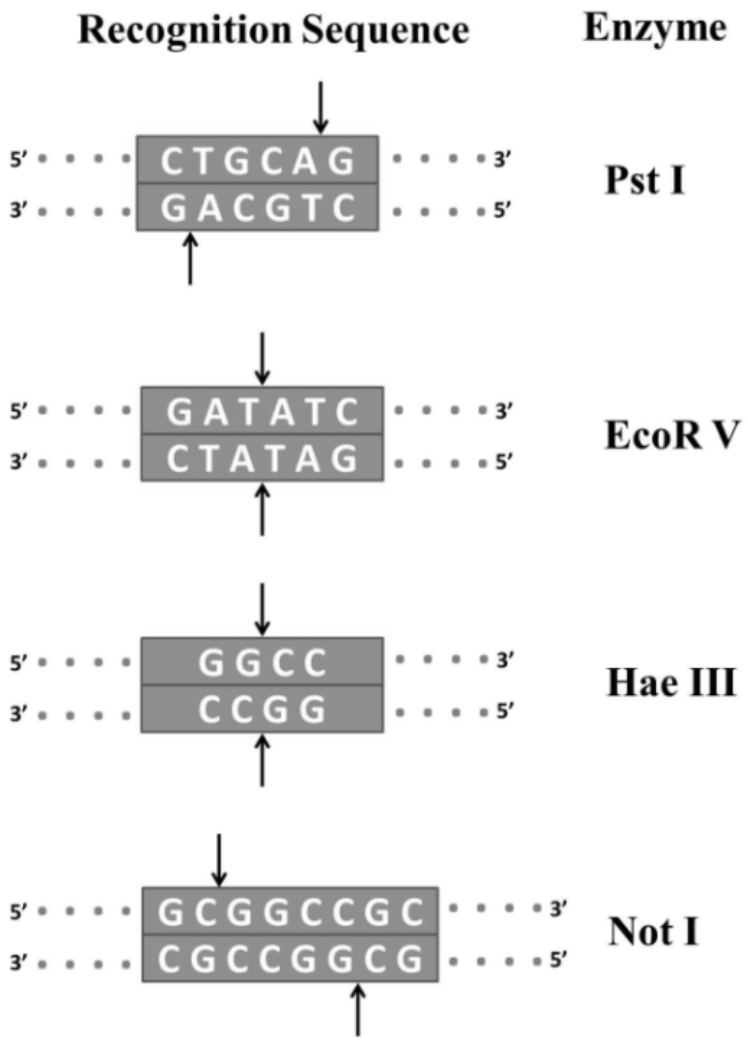
Question 32

DNA polymerase and RNA polymerase

A. are both involved in DNA replication.
B. are both involved in transcription.
C. differ as DNA polymerase is involved in DNA replication and RNA polymerase is involved in translation.
D. differ as DNA polymerase is involved in DNA replication and RNA polymerase is involved in transcription.

Question 33

The following diagram demonstrates the recognition sequence for four different restriction enzymes.



Source: https://www.chegg.com/homework-help/questions-and-answers/9

Based on the stimulus material, all cuts will lead to

A. only sticky ends being produced.
B. two sticky and two blunt ends being produced.
C. only blunt ends being produced.
D. neither sticky nor blunt ends being produced.

Question 34

Which of the following is true of gel electrophoresis and the way in which it sorts DNA fragments?

A. DNA is positively charged and therefore moves towards the positive electrode
B. DNA is negatively charged and therefore moves towards the negative electrode
C. DNA is positively charged and therefore moves towards the negative electrode
D. DNA is negatively charged and therefore moves towards the positive electrode

Question 35

A recombinant plasmid

A. can act as a vector.
B. is only found in eukaryotic cells.
C. can only contain DNA from the same species.
D. cannot be used to transform bacterial cells.

Question 36
In relation to gene cloning, heat-shock may be applied to bacteria in order to
A. prevent them from taking up recombinant DNA.
B. kill the bacteria.
C. encourage them to take up recombinant DNA.
D. encourage the bacteria to replicate.

Question 37
A pandemic
A. is easier to contain than an epidemic.
B. typically has a shorter duration than an epidemic.
C. cannot be prevented through herd immunity.
D. is the spread of a pathogen and the associated condition that covers several countries or spreads from one continent to another.

Question 38
Qualitative data
A. is always numerical in nature.
B. is often based on an experiment with a measurement tool (e.g. a thermometer).
C. always involves large sample sizes in studies.
D. is typically descriptive in nature.

Question 39
Suzie and James were conducting an experiment to determine the effects of carbon dioxide concentration on the rate of photosynthesis in hydrangeas (a type of plant).

They decided to measure the rate of photosynthesis using a newly developed oxygen concentration apparatus. The packet the apparatus came in mentioned that it required calibration before use, to ensure it was making accurate measurements, however, James forgot to calibrate the instrument before he and Suzie started their experiment.

Their experiment involved five separate groups of hydrangeas, and all of the measurements taken involved the uncalibrated apparatus.

The type of error demonstrated in the scenario is
A. a random error.
B. a personal error.
C. a systematic error.
D. a notational error.

Question 40
An increase in the sample size of an experiment will
A. not affect the reliability or validity of the experiment.
B. be more likely to increase the reliability of the experiment than its validity.
C. increase the reliability and decrease the accuracy of the experiment.
D. increase the validity of the experiment but not the reliability.

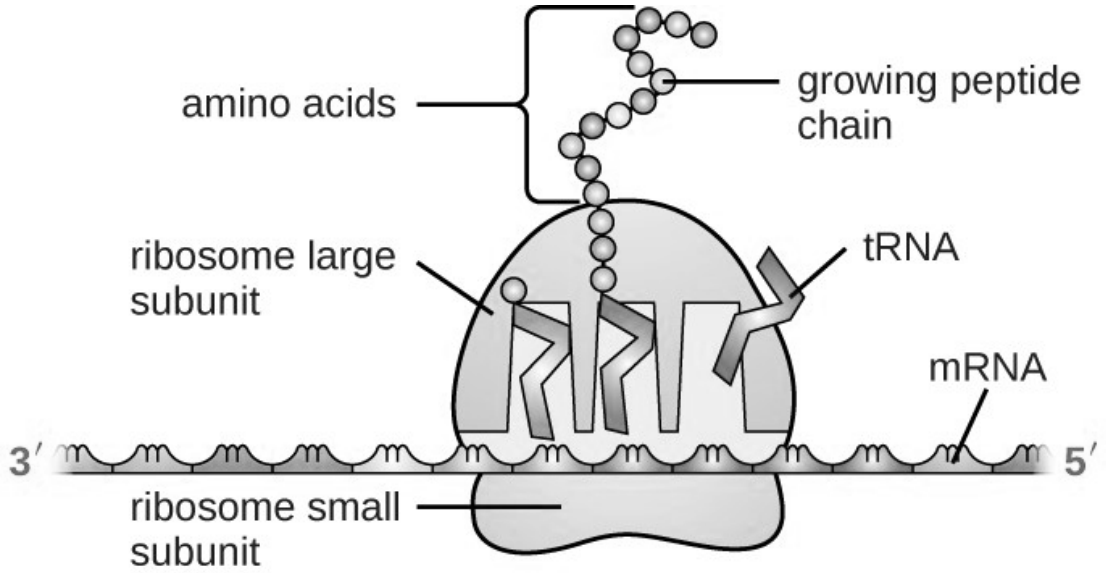
This page is intentionally blank.

SECTION B – Short-answer questions

Instructions for Section B

Answer **all** questions in the spaces provided. Write using blue or black pen.

Question 1 (8 marks)



Source: https://courses.lumenlearning.com/microbiology/chapter/structure-and-function-of-rna/

a. The image above depicts what process involved in protein synthesis? 1 mark

b. Draw a labelled diagram, in two steps, that demonstrates the process involved in joining two amino acids. Name the process you have drawn. 4 marks

c. Draw an arrow on the diagram above (in the stimulus material) that indicates the direction in which the ribosome is moving as it reads the mRNA. Explain how the ribosome knows when to stop this movement and the contribution this makes to the polypeptide chain. 3 marks

Question 2 (10 marks)

Cellular respiration is a vital process in humans that facilitates the breakdown of glucose and its conversion into a usable form of cellular energy – ATP. Energy is released from ATP when it is converted to ADP and Pi. Both aerobic and anaerobic respiration are possible in humans, however, the inputs and outputs of these two forms of cellular respiration differ.

a. Describe the structural difference between ATP and ADP and how energy is released during ATP's conversion to ADP. 2 marks

b. Name two processes by which glucose can enter a cell and describe the difference between these two processes. 4 marks

c. Once glucose has entered the cell, what stage of aerobic cellular respiration is it an input for, and where does this stage take place? 2 marks

Stage:

Location:

d. Explain why lactic acid may accumulate in the body of a person who exercises vigorously for a period of time. 2 marks

This page is intentionally blank.

Question 3 (12 marks)

A microbiologist was testing the effect of antibiotics on several strains of one pathogenic bacterium. She plated out the bacteria on a suitable agar medium and placed small disks soaked in four different antibiotic solutions of equal concentration on the agar. She then incubated the plates under matched conditions and measured the diameter of the zone of inhibition (area of no bacterial growth) surrounding the discs. The following results were obtained.

Antibiotic solution	Diameter of zone of inhibition - mm		
	Strain A	Strain B	Strain C
1	6	8	9
2	15	15	16
3	17	22	19
4	12	14	0

a. Outline a structural feature that distinguish bacteria from viruses. 2 marks

b. The microbiologist incubated the plates under 'matched conditions'. Identify what this matched condition is most likely to have been, and explain the importance of this for such an experiment. 3 marks

ci. An observer noted that one of the results in the table appeared to be an error. Identify which result is most likely to be an error and justify your response. 2 marks

cii. Describe the error that may have led to this result being obtained. 1 mark

d. List the independent and dependent variables in this experiment. 2 marks

e. Which antibiotic solution produced the most precise results? Justify your response. 2 marks

Question 4 (8 marks)

Gene structure and expression regulation mechanisms are the research hotspots and focus of modern life sciences. The lac operon is a cluster of genes through which *Escherichia coli* (a type of bacteria) catabolises lactose. It was first proposed by F. Jacob and J. Monod, who were also awarded the Nobel Prize in Physiology or Medicine in 1965 for their contributions. Thereafter, the lac operon became the classic teaching case of the gene regulation mechanism in microbiology, genetics, and molecular biology.

Source: https://www.ncbi.nlm.nih.gov/pubmed/31257202

a. Draw and label a diagram that demonstrates what occurs at the lac operon in the absence of lactose. The following should be included in your diagram: 4 marks

- Operator
- Promoter
- RNA polymerase
- Repressor molecule
- Structural genes
- Regulatory gene

b. With reference to the lac operon, why is it beneficial for prokaryotic cells to regulate gene expression? 2 marks

c. If a significant mutation was to occur in the regulatory gene associated with the lac operon, how could this be detrimental to the bacteria cell? 2 marks

Question 5 (11 marks)

Although scientists have been working on developing a vaccination for HIV for many years, this has not yet been created, unlike a condition such as measles where an effective vaccination exists. People who contract HIV are required to take anti-retroviral medication in an attempt to prevent HIV from developing into AIDS, a form of immunodeficiency disease.

a. Are vaccinations an active or passive strategy for acquiring immunity? Justify your answer. 3 marks

b. Describe how a vaccination contributes to developing immunity to a health condition such as measles. 3 marks

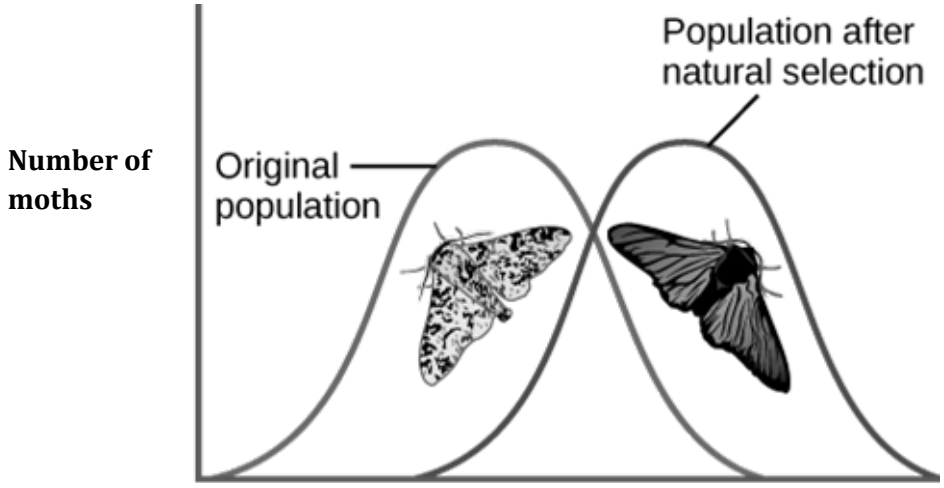
c. Outline why it may be difficult for scientists to develop an effective vaccination for a virus such as HIV. 2 marks

d. How does HIV contribute to a person developing an immune deficiency disease if antiretroviral treatment (ART) is not available? In your answer, reference the following: 3 marks

- Helper T cells
- Host cell
- Viral replication
- Weakened immune response

Question 6 (4 marks)

In eighteenth and nineteenth-century England, the peppered moth evolved due to natural selection. Prior to the Industrial Revolution, before factories began polluting the air with dark soot, there were dark and light peppered moths. At this time, the moths were predominately light in colour, similar to the light-coloured trees and lichens in their environment. During the Industrial Revolution, there was a change in the predominant colour of the peppered moth population, as indicated in the diagram below.



Shade of moths before and after the Industrial Revolution (light to dark)

Source: https://courses.lumenlearning.com/wm-biology2/chapter/adaptive-evolution/

a. Describe natural selection. 1 mark

b. Outline how natural selection contributed to the changes observed in the graph for the peppered moth population. 3 marks

Question 7 (7 marks)

Martha's Vineyard is an island off the east coast of the United States. It was first settled in the seventeenth century by a group of English immigrants. During the 1700s and 1800s, the island had an extraordinarily large proportion of individuals with genetically inherited deafness. At this time, the US mainland had approximately a 1 in 6000 deaf population, while Martha's Vineyard had approximately a 1 in 155 deaf population.

In the last century, the difference between the proportion of the deaf population in Martha's Vineyard and mainland USA has diminished. Today, Martha's Vineyard does not have a significantly large deaf population.

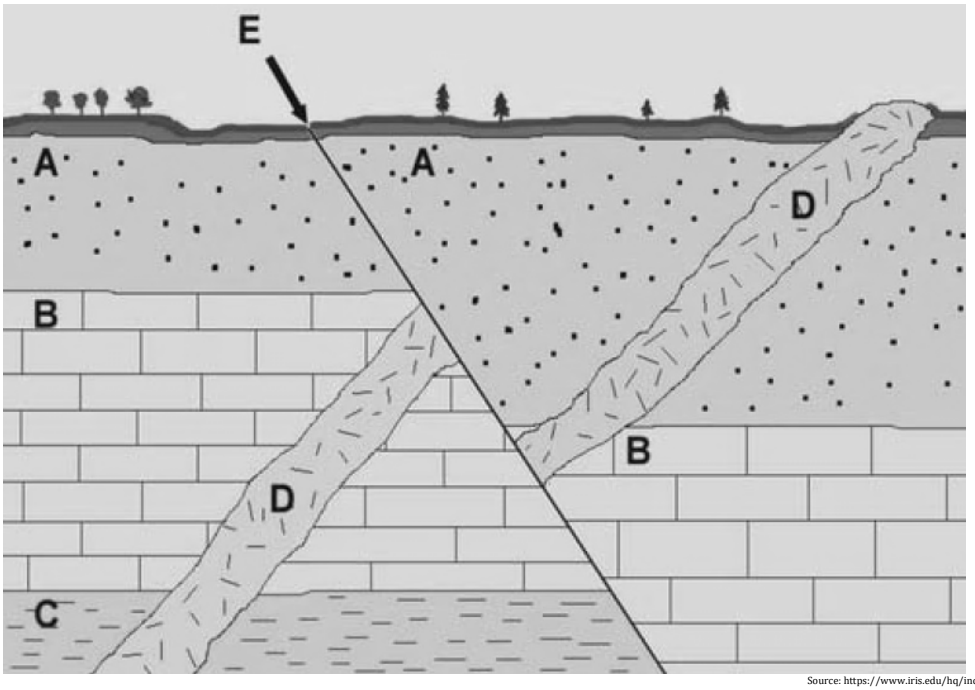
Source: https://www.verywellhealth.com/deaf-history-marthas-vineyard-1046546#citation-1

a. Identify and describe the type of genetic drift that was likely to have contributed to the disproportional number of people with deafness on Martha's Vineyard in the 1700s and 1800s. 2 marks

b. Explain how your answer to Question 7a would have contributed to the extraordinarily large proportion of individuals with genetically inherited deafness on Martha's Vineyard. 3 marks

c. Outline what may have contributed to the reduction in the difference in the numbers of people with genetically inherited deafness on Martha's Vineyard and the USA mainland over the last century. Reference gene flow in your answer. 2 marks

Question 8 (7 marks)



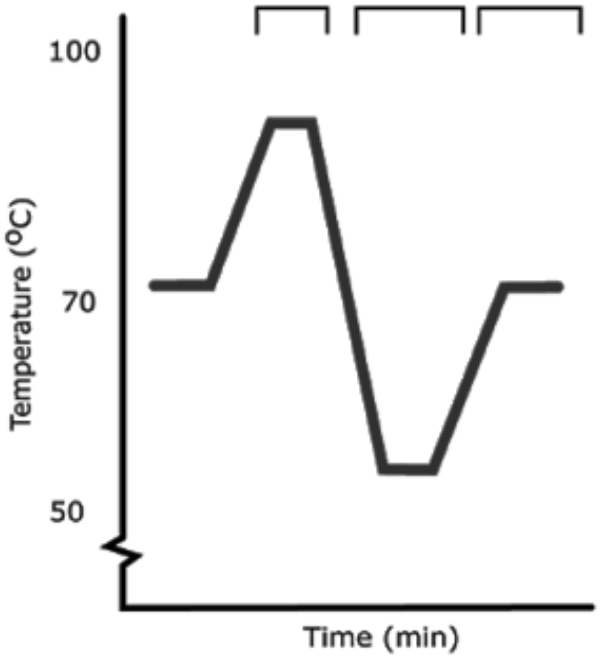
Source: https://www.iris.edu/hq/inclass/downloads/optional/235

a. What is stratigraphy, and how is this linked to the relative dating of fossils? 2 marks

b. Based on the diagram above, from oldest to youngest, list the order of the likely age of the layers of rock A, B, C, and D. Justify your response. 2 marks

c. With reference to E in the stimulus material, describe a limitation of dating fossils using relative dating. Suggest a fossil dating technique for overcoming this limitation. 3 marks

Question 9 (6 marks)



Source: https://virologydownunder.blogspot.com/2015/05/

a. Name the process used to amplify DNA that is represented in the graph above. 1 mark

b. There are three stages that make up the process used to amplify DNA in Question 9a. The first letter of these stages is represented by the letters A, D and E. In chronological order, label these on the graph. 1 mark

c. With reference to the graph and your labelling, describe each of the stages in this process. 4 marks

Question 10 (7 marks)

Golden bananas high in pro-vitamin A developed

Ugandan bananas that are high in pro-vitamin A have recently been developed by researchers. The decade-long research, led by Professor James Dale, involved extensive laboratory tests, as well as field trials in north Queensland.

Professor Dale said the genetic modification process had resulted in the identification and selection of banana genes that could be used to enhance pro-vitamin A in banana fruit. The research ultimately aims to improve the nutritional content of bananas in Uganda, where the fruit is a major staple food in their diet. The consequences of vitamin A deficiency are severe, and it has been estimated that approximately 700,000 children world-wide die from pro-vitamin A deficiency each year, with a further several hundred thousand going blind.

"What we've done is take a gene from a banana that originated in Papua New Guinea and is naturally very high in pro-vitamin A but has small bunches, and inserted it into a Ugandan banana," Professor Dale said.

Source: https://www.sciencedaily.com/releases/2017/07/170707095806.htm

a. Based on the information provided, identify whether the Ugandan bananas high in pro-vitamin A are best described as genetically modified organisms or transgenic organisms. Justify your response. 3 marks

b. Outline a potential positive and negative social implication of growing bananas high in pro-vitamin A for distribution in Uganda. 2 marks

c. Describe how the Ugandan bananas high in pro-vitamin A could potentially lead to a reduction in crop productivity. 2 marks

END OF QUESTION AND ANSWER BOOK

Extra space for responses

Clearly number all responses in this space.

VCE BIOLOGY
Written Examination
ANSWER SHEET – 2020

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