Name: _____

Teacher's name: _____

Victorian Certificate of Education 2018

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

BIOLOGY

Written examination

2018

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	10	10	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

During an experiment, a controlled variable is

A. kept constant.
B. only altered once.
C. also known as the independent variable.
D. the one factor that is not the same between the experimental and the control group.

Question 2

When graphing results from an experiment

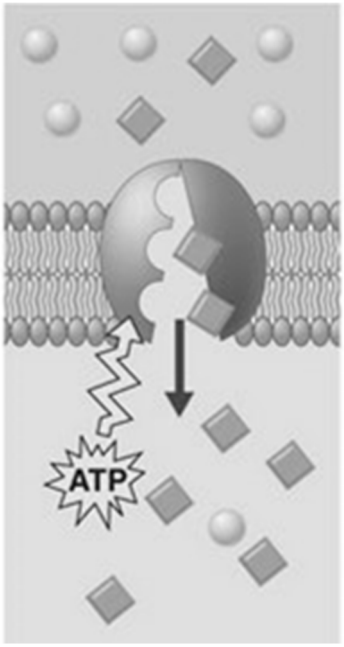
A. the existence of a correlation establishes that there is a causal relationship between two variables.
B. the independent variable is represented on the vertical axis while the dependent variable is represented on the horizontal axis.
C. the independent variable is represented on the horizontal axis while the dependent variable is represented on the vertical axis.
D. all experiments will show a correlation between variables.

Question 3

The size of a molecule influences its passage across a plasma membrane, which means that, generally,

A. large molecules cannot enter the cell.
B. small molecules enter the cell via a carrier protein.
C. water is too large to cross the phospholipid bilayer.
D. glucose is too large to cross the phospholipid bilayer.

Use the following information to answer Questions 4 and 5.



Source: http://kmbiology.weebly.com

Question 4

The image above represents a process that assists the diamond-shaped molecules to move across the plasma membrane into the cell. Which of the following is correct regarding the process depicted?

A. it is passive
B. it is required to move water across the plasma membrane
C. it occurs only in animals and not in plants
D. it moves molecules against their concentration gradient

Question 5

Given the information depicted in the image, it can be assumed that the round-shaped molecules are likely to cross the plasma membrane into the cell

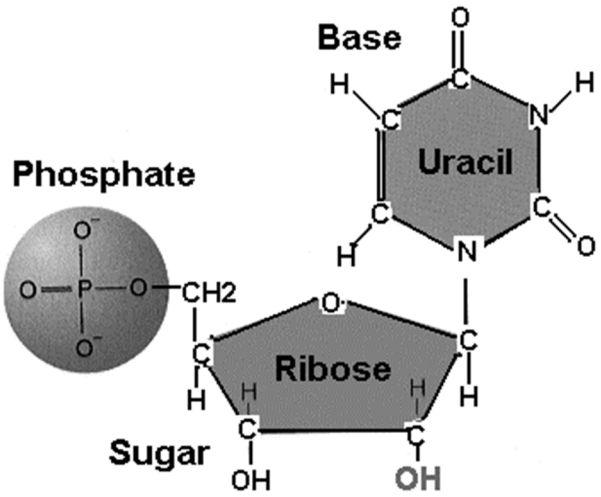
A. at a slower rate than the diamond-shaped molecules.
B. at a faster than the diamond-shaped molecules.
C. and requires energy to do so.
D. by moving between the phospholipid heads.

Question 6

Which of the following is not a possible function of the rough or smooth endoplasmic reticulum?

A. synthesis of carbohydrates
B. synthesis of proteins
C. transport of proteins
D. synthesis of lipids

Use the following information to answer Questions 7 and 8.



Source: http://onwe.bioinnovate.co

Question 7

The image above depicts

A. a monomer of DNA.
B. a nucleic acid.
C. a monomer of protein.
D. a monomer of RNA.

Question 8

The molecule above would be found in the depicted form in the

A. ribosome.
B. golgi apparatus.
C. nucleus.
D. vesicles.

Question 9

During translation

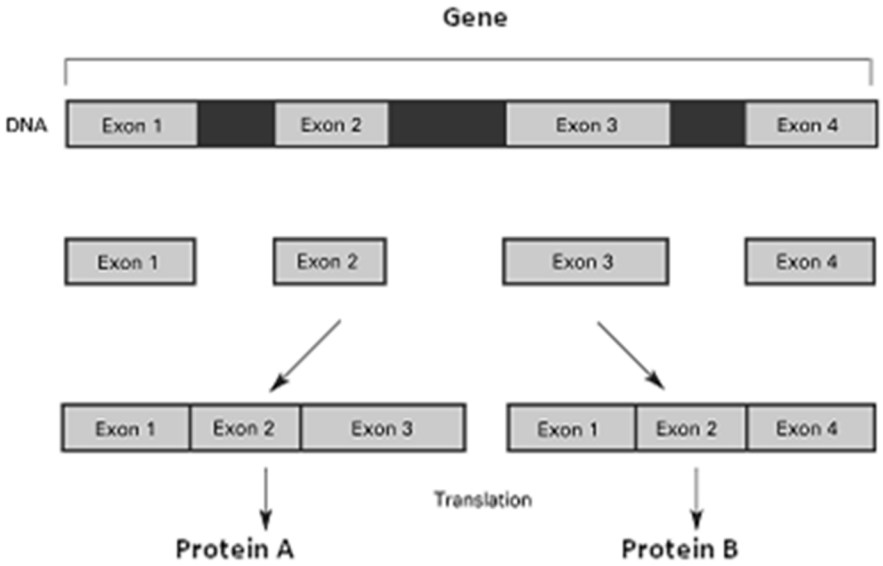
A. mRNA is read in a 3' to 5' direction by the ribosome.
B. mRNA is read in a 5' to 3' direction by the ribosome.
C. the tRNA molecule has the codon on one end.
D. amino acids are joined to one another by polypeptide bonds.

Question 10

Which of the following is not a possible example of the functional diversity of proteins?

A. an enzyme
B. an antibody
C. a neurotransmitter
D. a plasmid

Use the following information to answer Questions 11 and 12.



Source: https://study.com/academy/lesson/

Question 11

What process does the above diagram depict?

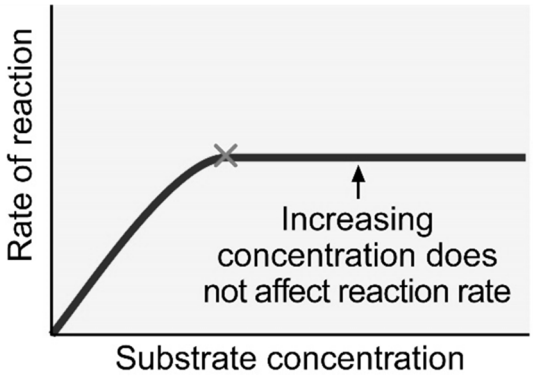
A. Alternative splicing
B. Translation
C. Transcription
D. Condensation polymerisation

Question 12

This process can explain

A. how enzyme inhibition occurs.
B. the concept of rational drug design.
C. how the expression of a single gene can lead to the production of different proteins.
D. why antigens and antibodies agglutinate and are removed from the body.

Question 13



Source: http://www.rsc.org/Education/Teachers/Resources/cfb/enzymes.htm

The diagram above represents the rate of an enzyme catalysed reaction. At point 'X'

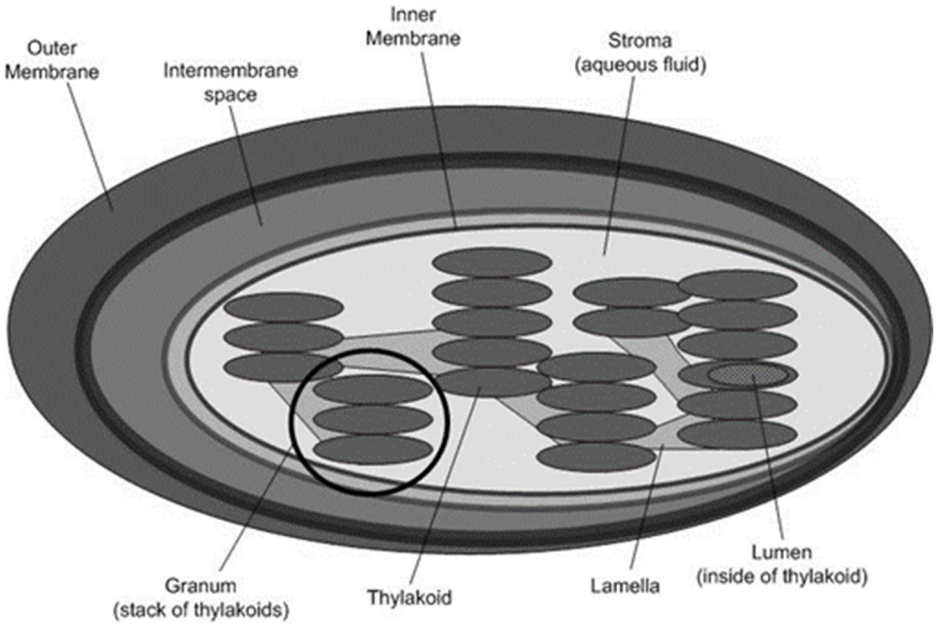
A. the enzymes are denatured.
B. the enzymes are saturated.
C. no substrate remains.
D. no product is being produced.

Question 14

Irreversible denaturation of enzyme action can occur through:

A. temperature.
B. pH.
C. neither A nor B.
D. both A and B.

Question 15



Source: https://commons.wikimedia.org/wiki/File:Cloroplast.png

The reaction that occurs in the structure circled is a reaction that involves

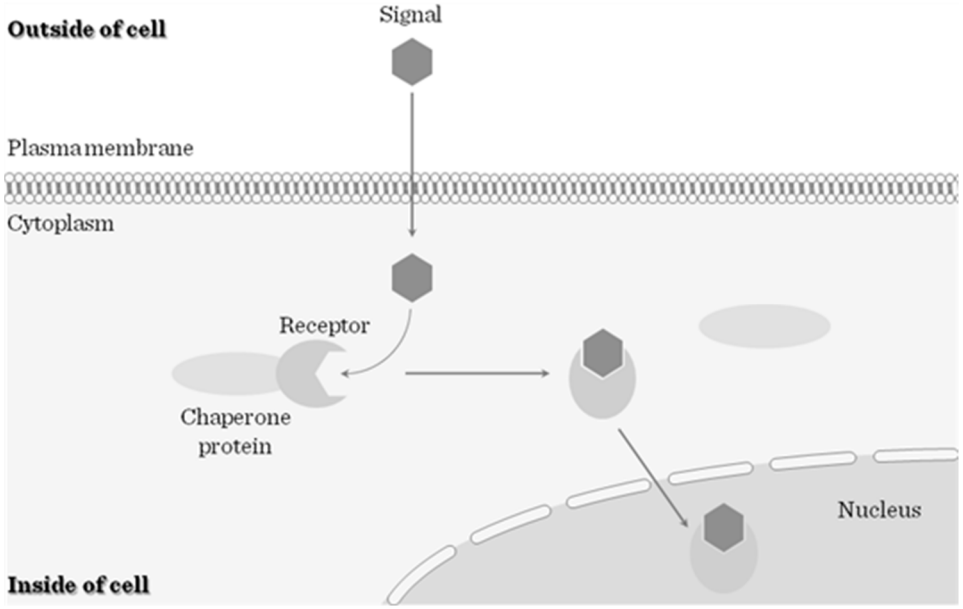
A. the splitting of water molecules.
B. the production of CO_2.
C. the use of O_2 to produce glucose.
D. CO_2 as an input.

Question 16

In reference to cellular respiration, a reduction in glucose availability would result in

A. no ATP production.
B. lowered O_2 production.
C. no O_2 production.
D. lowered CO_2 production.

Question 17



Source: http://www.tankonyvtar.hu/en/tartalom/tamop425/0011_1A_Jelatvitel_en_book/ch02.html

If the signalling molecule above led to this cell expressing a gene, it is likely that the end product of this response

A. would result in cell death.
B. would occur faster than a response caused by a signalling molecule with a receptor located on the cell membrane.
C. would occur slower than a response caused by a signalling molecule with a receptor located on the cell membrane.
D. could be enhanced by a drug with a shape complementary to that of the chaperone protein.

Question 18

Which of the following is not likely to be a successful drug designed to prevent the process of apoptosis?

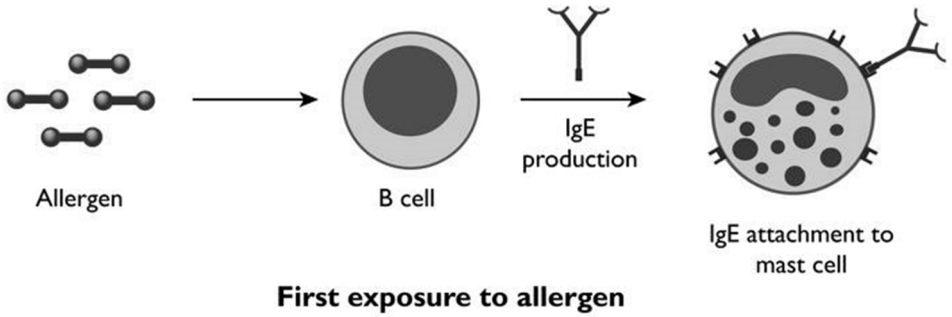
A. a drug that is complementary to active site of the caspase enzymes
B. a drug that is complementary to the death receptor
C. a drug that contributes to significant cell stress
D. a drug that contributes to reduced cell stress

Question 19

The natural microflora of the body are an example of

A. the innate immune response.
B. the adaptive immune response.
C. the third line of defence.
D. the second line of defence.

Question 20



First exposure to allergen

Source: https://www.dreamstime.com/royalty-free-stock-photo-mast-cells-allergy-image13000345

Upon second exposure to the same allergen, an allergic response will likely

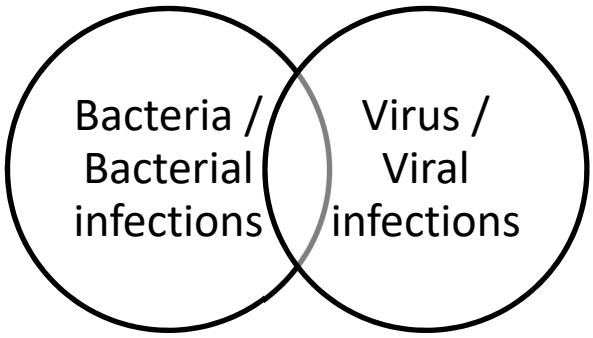
A. occur as the mast cell releases anti-histamines.
B. occur as a result of cross linking between the allergen and the IgE antibodies on the mast cell.
C. not occur as the mast cell has been primed.
D. occur as a result of the B cell producing new IgE antibodies.

Question 21

The lymphatic system does not contain

A. one way valves.
B. nodes that filter lymph tissue.
C. a pump similar to the heart.
D. white blood cells.

Use the following information to answer Questions 22 and 23.



Question 22

When considering the Venn diagram above, which of the following would be likely found in the region of overlap?

A. possible to be vaccinated against
B. are living cells
C. can reproduce independently
D. can be treated with antibiotics

Question 23

A distinct difference between bacteria and viruses is

A. their mode of transmission.
B. their size.
C. their ability to cause disease.
D. that one can contain DNA and the other cannot.

Question 24

Which of the following is not a type of mutation?

A. frameshift
B. block
C. point
D. aneuploidy

Question 25

What is the allele frequency for D, if the following genotypes existed in population?
Dd, DD, dd, Dd, dd, Dd, DD, DD, dd, dd

A. 0.45
B. 0.60
C. 45%
D. 60%

Question 26

Allopatric speciation is characterised by

A. the speed of speciation.
B. its isolation to bird species.
C. a geographic isolating mechanism preventing gene flow.
D. its occurrence being limited to the Cambrian period.

Question 27

Carbon dating

A. is used to determine the relative age of fossils.
B. is used for determining ages of fossils from the Jurassic period.
C. is most useful for organic remains under 50 000 years old.
D. is most useful for organic remains over 50 000 years old.

Question 28

During its dramatic 4.5 billion year history, Earth has gone through a series of major geological and biological changes. The timescale below highlights several notable prehistoric events and the approximate time in which they occurred.

3.8 billion years ago	**First life arises**
2.1 billion years ago	**Eukaryotes evolved**
1.1 billion years ago	**First sexually reproducing organisms**
530 million years ago	**The first fish**
475 million years ago	**First land plants**
370 million years ago	**The first amphibians**
320 million years ago	**The earliest reptiles**
225 million years ago	**The dinosaurs evolve**
200 million years ago	
150 million years ago	**First birds**
130 million years ago	
14 million years ago	**The first great apes appear**
2.5 million years ago	**Genus Homo evolves**
200 thousand years ago	**Our species, Homo sapiens evolves**
10 thousand years ago	**End of the last Ice Age**

Source: http://www.bbc.co.uk/nature/history_of_the_earth#periods

The two blank spaces in the table should be filled by

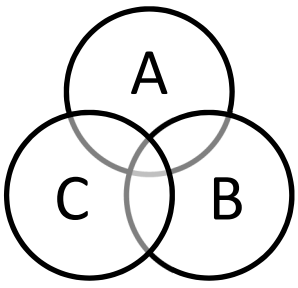
A. 200 million years ago – mammals evolve
130 million years ago – flowering plants evolve

B. 200 million years ago – flowering plants evolve
130 million years ago – mammals evolve

C. 200 million years ago – first animals on land
130 million years ago – flowering plants evolved

D. 200 million years ago – multicellular organisms evolve
130 million years ago – mammals evolve

Question 29



The diagram above represents three populations of moths, distinguishable by wing colour and pattern. Overlap between the population represents mating that occurs and results in viable offspring.

From the information above, it is reasonable to conclude that

A. similar selection pressures act on each population of moths.

B. there is one species of moth present.

C. there are three species of moth present.

D. differences between the moths is due to the moth changing to suit their environment.

Use the following molecular data to answer Questions 30 and 31.

Amino acid position	*Human*	*Species 1*	*Species 2*	*Species 3*
10	*Phe*	*Phe*	*Phe*	*Phe*
11	*Glu*	*Glu*	*Glu*	*His*
12	*Val*	*Val*	*Ile*	*Val*
13	*Cys*	*Ile*	*Cys*	*Ile*
14	*Val*	*Cys*	*Val*	*Val*

Question 30

Based on this information, the species most similar to humans is

A. species 1 and 2. They are equally similar.
B. species 1.
C. species 2.
D. species 3.

Question 31

The differences in the molecular data are most likely due to

A. differences in their environment.
B. variation.
C. mutations in RNA.
D. mutations in DNA.

Question 32

Hominins and primates both share

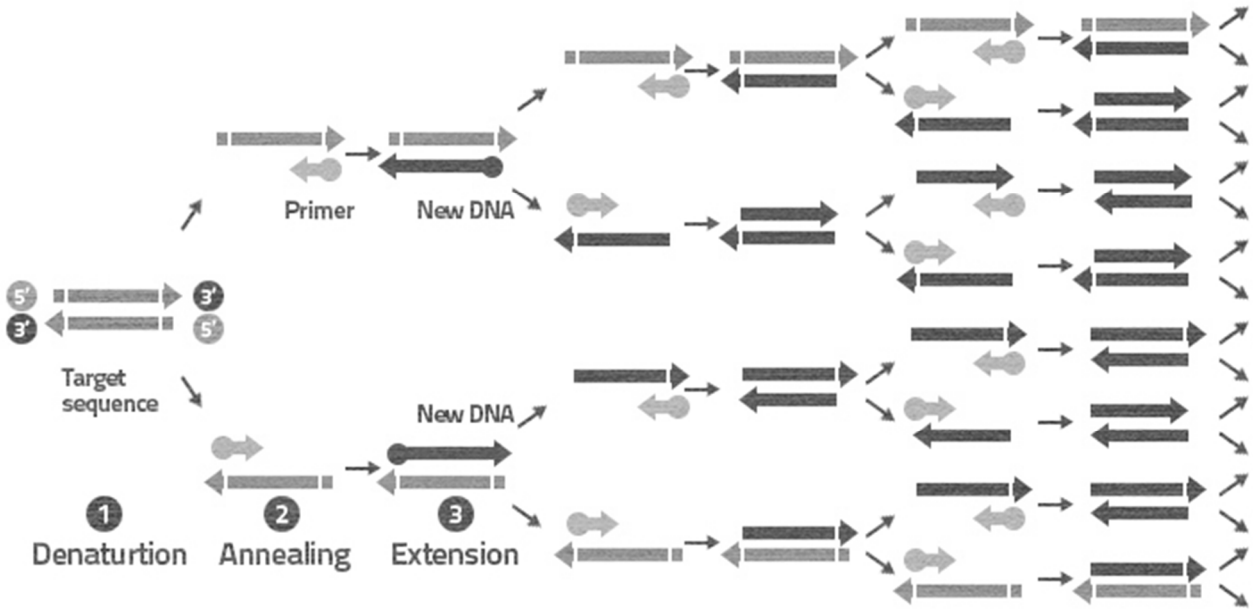
A. reduced body hair.
B. bipedal gait.
C. claws instead of nails.
D. opposable thumbs.

Question 33

Which of the following is not an example of a feature of cultural evolution?

A. can occur quickly
B. traits cannot be chosen
C. can occur within or between generations
D. traits can be transmitted to unrelated people

Use the following information to answer Questions 34 and 35.



Source: https://theory.labster.com

Question 34

During the extension stage, the most ideal temperature is typically

A. 72 degrees.
B. 50 degrees.
C. 82 degrees.
D. 95 degrees.

Question 35

The purpose of a primer in this reaction is

A. to act as a short sequence of nucleotides that provides a starting point for DNA synthesis.
B. to move along the original DNA strand and add complementary nucleotides.
C. to act as the 'glue' to join complementary nucleotides together.
D. to separate the DNA and prime it, ready for a copy to be made.

Question 36

Which of the following is not an ethical implication of genetic screening of a newborn baby?

A. the rights of the individual to this information in the future
B. whether there is certainty that this information can be kept secure
C. whether it is right to perform such a test on a baby that cannot consent
D. the cost of the genetic screening test

Question 37

Which of the following statements best describes an epidemic?

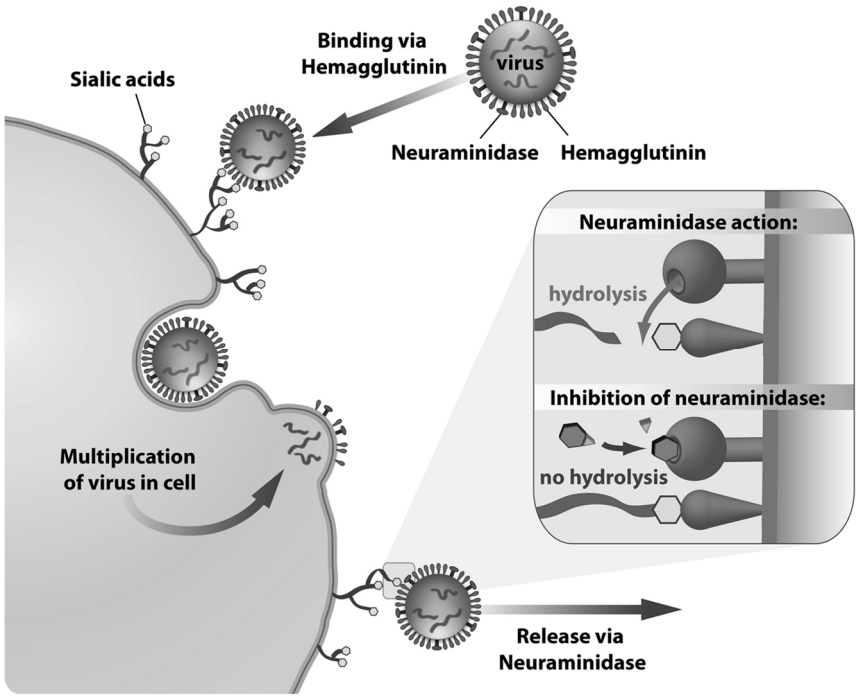
A. a new disease that has not yet had a vaccination developed for it
B. a disease affecting a large number of individuals within a population, community, or region at the same time
C. the spread of a disease between countries and continents
D. the spread of a disease that is limited to one family

Question 38

Rheumatoid arthritis is an autoimmune disorder that occurs when the immune system mistakenly attacks its own body's tissues. Rheumatoid arthritis affects the lining of the body's joints, causing a painful swelling that can eventually result in bone erosion and joint deformity. A new drug was designed to help people with this condition and is able to provide great therapeutic benefit. An example of a therapeutic benefit for the individual would be that

A. patients would only be required to take one pill per day instead of two.
B. the drug would prevent the condition from being inherited by the patient's children.
C. joints would swell less and the individual would experience less pain.
D. the drug would prevent the condition from being transmitted to other people who had come into contact with the affected person.

Question 39



Source: https://medicalxpress.com/news/2013-02-flu-drug-virus-tracks.html

The inhibition of neuraminidase occurs via the action of

A. an antiviral drug.
B. the drug Relenza.
C. a drug that is complementary in nature to neuraminidase.
D. all of the above.

Question 40

Which of the following is unlikely to contribute to antibiotic resistance?

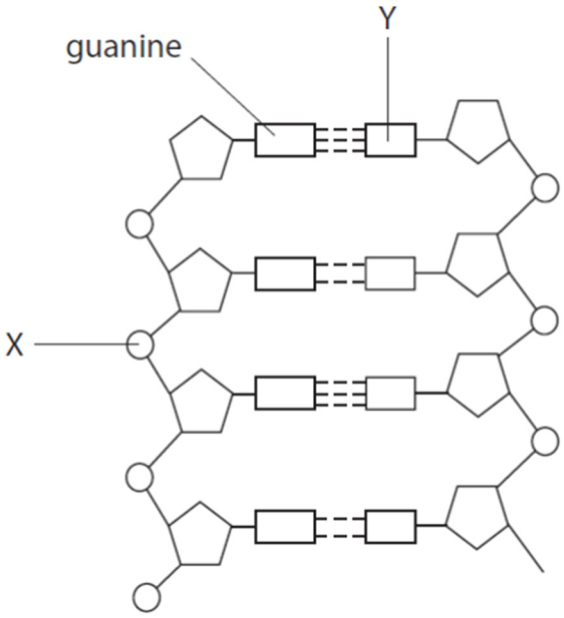
A. over-prescription of antibiotics
B. overuse of antibiotics in livestock and fish farming
C. patients finishing the entire antibiotic course
D. absence of new antibiotics being discovered

SECTION B – Short-answer questions

Instructions for Section B

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

Question 1 (13 marks)



Source: https://blogs.glowscotland.org.uk/gc/hyndsecbiohunit1

a. List the full name of the molecule in the diagram above. 1 mark

b. Identify the labels X and Y. 2 marks

X:

Y:

c. In reference to this molecule, explain the meaning of the term 'anti-parallel'. 2 marks

d. Identify three places in a plant cell where this molecule can be located. 3 marks

e. During protein synthesis this molecule is read and another molecule is created. Describe the steps in this process, including the name of the process and of the new molecule produced. 5 marks

Question 2 (13 marks)

Amylase is an enzyme that breaks down the polysaccharide starch into the monosaccharide glucose. The following results relate to three different experiments where amylase was tested to determine when its optimal activity was.

In Test 1 and 2, the temperature and pH were the only factors altered in either experiment as indicated in the table; the concentration of amylase and concentration of starch used remained the same. In Test 1, the pH was 7.0 and in Test 2, the temperature was 37.5^{o}C.

In Test 3, the temperature and pH used were the optimal for the enzyme amylase; the concentration of starch was the same as in Test 1 and 2, but the concentration of amylase was increased as indicated in the table.

Test 1 - Temperature (^{o}C)	Arbitrary unit molecules of glucose produced after 1 minute.
33	50
35	70
37	80
39	60
41	40

Test 2 - pH	Arbitrary unit molecules of glucose produced after 1 minute.
4.5	35
5.5	65
6.5	85
7.5	75
8.5	40

Test 3 - Concentration of amylase in arbitrary units	Arbitrary unit molecules of glucose produced after 1 minute.
15	80
20	100
25	140
30	140
35	140

a. State two variables that would need to be controlled in Test 2 to ensure that valid conclusions can be drawn from the results. Outline why such variables need to be controlled, referencing the dependent variable and independent variable in your response. 3 marks

b. Graph the results for Test 1. 3 marks

c. Draw a conclusion regarding the optimal temperature for the action of amylase. Refer to data in your answer. 1 mark

d. Given your knowledge of enzyme structure and function, describe the likely reason for the results obtained at 41° C in Test 1. 2 marks

e. Given the experimental design of the temperature and pH tests, describe why it is difficult to compare the results between Test 1 and Test 2, and difficult to make a conclusion about the combined optimal temperature **and** pH for amylase function. 2 marks

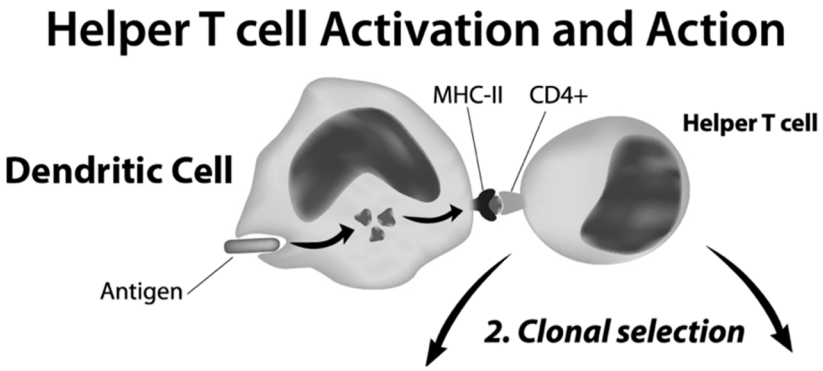
f. Explain a likely reason why the arbitrary unit molecules of glucose produced after one minute remained constant at 140 units for amylase concentrations 25-35. 2 marks

Question 3 (4 marks)

a. What is the functional difference between a regulatory gene and a structural gene? 2 marks

b. In relation to energy conservation, explain the importance of transcriptional factors in the lac operon. 2 marks

Question 4 (8 marks)



Source: https://immunecells21.com/dendritic-cells/dendritic-cells-immuncells21/

a. Which immune response do dendritic cells belong to? 1 mark

b. With reference to the image above, outline the role of a dendritic cell as messengers between the two types of immune responses. 2 marks

c. Describe clonal selection, expansion and differentiation, including a reference to Helper T cells. 3 marks

d. Name the immune deficiency disease that can result when large numbers of Helper T cells are destroyed. 1 mark

e. Is the form of immunity initiated by Helper T cells active or passive? Justify your response. 1 mark

Question 5 (10 marks)

Although the Cretaceous-Tertiary (or K-T) extinction event is the most well-known because it wiped out the dinosaurs, a series of other mass extinction events have occurred throughout the history of the Earth, some even more devastating than K-T. The most severe occurred at the end of the Permian period when 96% of all species perished. This along with K-T are two of the Big Five mass extinctions, each of which wiped out at least half of all species. Many smaller scale mass extinctions have occurred; indeed, the disappearance of many animals and plants at the hands of humans in prehistoric, historic and modern times will eventually be shown in the fossil record as mass extinctions.

Source: http://www.bbc.co.uk/nature/extinction_events

ai. What is a mass extinction? 1 mark

aii. Describe why, following mass extinctions, there may be significant differences in the fossil record. 1 mark

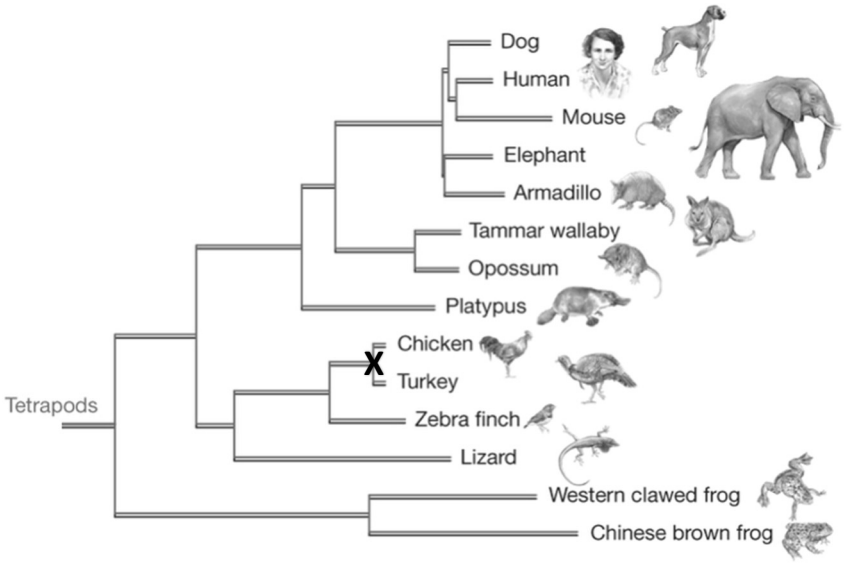
b. Identify two types of fossils that may be present in the fossil record of the earth. 2 marks

c. The fossil record is one piece of evidence of biological change over time. Name and describe two others. 4 marks

d. Using an example, outline why terrestrial animals are less likely to fossilise when compared to aquatic animals. 2 marks

Question 6 (8 marks)

Scientists can examine a range of evidence to create a phylogenetic tree. One such tree is depicted in the image below.



Source: Adapted from https://whyevolutionistrue.files.wordpress.com/2013/04/coelacanth-genome-tree.jpg

a. What is the purpose of a phylogenetic tree such as the one in the image above? 1 mark

b. According to the phylogenetic tree, which two species is the platypus most closely related to? 1 mark

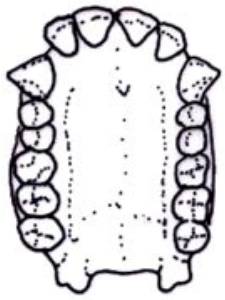
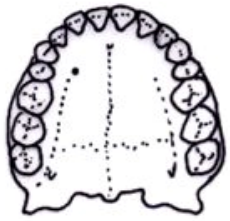
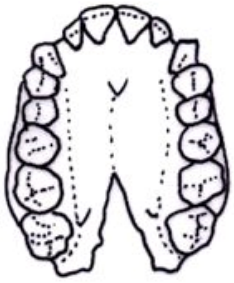
c. At point X on the diagram, the Chicken and Turkey diverged and eventually became separate species. Outline how this may have occurred using the following terms in your response: 4 marks

- Common ancestor
- Geographic isolating mechanism
- Generations
- Viable offspring

d. A phylogenetic tree can be created by comparing the similarities and differences between specific molecular sequences of different species. Identify two molecules that could be used in this manner. 2 marks

Question 7 (7 marks)

The dental arcade is the shape made by the rows of teeth in the upper jaw. This illustration shows the difference between the dental arcade of an ape, Australopithecus africanus and modern human, Homo sapiens.

A	*B*	*C*
		

Source: https://australianmuseum.net.au/image/dental-arcade

a. Which dental arcade is most likely to be that of Australopithecus africanus? 1 mark

b. Justify your answer to 7a. 1 mark

c. In addition to changes in the dental arcade from the genus *Australopithecus* to the genus *Homo,* structural changes in the pelvis occurred. Give an example of such a change and outline how this change was advantageous to members of the genus *Homo*. 2 marks

d. Describe cultural evolution and outline how it may have influenced the structures seen in the image. 3 marks

Question 8 (9 marks)

a. Name the technique used to sort DNA fragments based on their size. 1 mark

b. Describe the steps involved in sorting DNA fragments using the technique named in 8a. Include an explanation of how this technique works to sort such fragments. 4 marks

c. Outline how the technique named in 8a could be used by law enforcement officials in a case where there are multiple suspects and a blood sample from the crime scene. 4 marks

Question 9 (4 marks)

Orb-web spiders produce a variety of silks that have excellent mechanical properties. For example, their dragline silk proteins are among the strongest fibres, approximately five times stronger than steel. It is difficult however to produce an artificial fibre that can be as long and strong.

Transgenic silkworms have been created to produce the dragline silk protein in their cocoon silk. Using these silkworms, significant amounts of the silk can then be produced in a controlled environment.

Source: Adapted from http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0105325

a. Referencing the information provided, what is a transgenic organism? 2 marks

b. Some scientists are concerned with the potential negative biological implications that could arise from the creation of transgenic organisms such as the transgenic silkworm. In relation to the information provided, outline one biological implication and why it may be of concern. 2 marks

Question 10 (4 marks)

a. Explain the steps involved in rational drug design. You may use an illustration to support your response. 2 marks

b. Contrast the two types of inhibition of enzymes that may be the focus of drugs developed through rational drug design. 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 – 2018

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