VCE BIOLOGY 2018

YEAR 12 TRIAL EXAM

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

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	40	40	40
B	10	10	80
			Total 120

An Answer Sheet is provided for Section A
Answer all questions in Section B in the space provided

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STUDENT NUMBER									Letter
Figures									
Words									

Student Name....…….....

VCE Biology 2018 Year 12 Trial Exam Units 3/4

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

Question 1	A	B	C	D	*Question 2*	A	B	C	D
Question 3	A	B	C	D	*Question 4*	A	B	C	D
Question 5	A	B	C	D	*Question 6*	A	B	C	D
Question 7	A	B	C	D	*Question 8*	A	B	C	D
Question 9	A	B	C	D	*Question 10*	A	B	C	D
Question 11	A	B	C	D	*Question 12*	A	B	C	D
Question 13	A	B	C	D	*Question 14*	A	B	C	D
Question 15	A	B	C	D	*Question 16*	A	B	C	D
Question 17	A	B	C	D	*Question 18*	A	B	C	D
Question 19	A	B	C	D	*Question 20*	A	B	C	D
Question 21	A	B	C	D	*Question 22*	A	B	C	D
Question 23	A	B	C	D	*Question 24*	A	B	C	D

Question 25	A	B	C	D	*Question 26*	A	B	C	D
Question 27	A	B	C	D	*Question 28*	A	B	C	D
Question 29	A	B	C	D	*Question 30*	A	B	C	D
Question 31	A	B	C	D	*Question 32*	A	B	C	D
Question 33	A	B	C	D	*Question 34*	A	B	C	D
Question 35	A	B	C	D	*Question 36*	A	B	C	D
Question 37	A	B	C	D	*Question 38*	A	B	C	D
Question 39	A	B	C	D	*Question 40*	A	B	C	D

VCE Biology 2018 Year 12 Trial Exam Units 3/4

SECTION A – Multiple Choice Questions

Question 1
In a eukaryotic cell which organelle would be present in the largest numbers?
A. Chloroplasts.
B. Mitochondria.
C. Golgi complexes.
D. Ribosomes.

Question 2

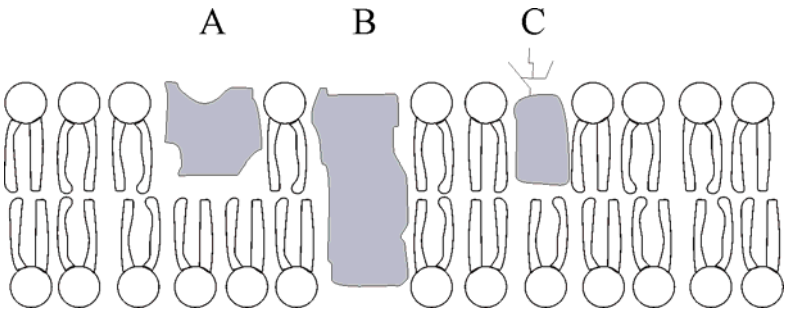


Figure 1

The plasma membrane incorporates a number of different proteins. In **Figure 1** above the diagram letters A, B and C would represent respectively.
A. Integral protein, peripheral protein and glycoprotein.
B. Peripheral protein, integral protein and glycoprotein.
C. Glycoprotein, integral protein and peripheral protein.
D. Glycoprotein, peripheral protein and integral protein.

Question 3
Which of the following is not found in cells?
A. Messenger RNA.
B. Ribosomal RNA.
C. Transfer RNA.
D. Transport RNA.

Question 4
An alpha helix would first be visible during which level of protein structure?
A. Primary structure.
B. Secondary structure.
C. Tertiary structure.
D. Quaternary structure.

Question 5
In the process of producing a protein from a DNA sequence, which would be the correct order of events?
A. Transcription - introns removed - translation.
B. Transcription - exons removed – translation.
C. Translation - introns removed – transcription.
D. Translation - exons removed – transcription.

Question 6
Globular enzymes work because they possess an active site that is
A. identical in shape to the substrate it acts on.
B. similar in shape to the substrate it acts on
C. perfectly complementary to the shape of the substrate it acts on.
D. approximately complementary to the shape of the substrate it acts on.

Question 7
An enzyme that normally functions in an alkali environment would work best at a
A. pH of 9.
B. pH of 7.
C. pH of 5.
D. pH of 3.

Question 8
The inputs in the second stage of photosynthesis are
A. ATP and $NADP^+$.
B. ADP, P_i and NADH.
C. ATP and NADPH.
D. ADP, P_i and NAD^+.

Question 9
The protein ATP synthase is found in
A. mitochondria only.
B. chloroplasts only.
C. neither mitochondria nor chloroplasts.
D. both mitochondria and chloroplasts.

Question 10
What is the minimum level of structural organisation needed for an enzyme to form a functional active site?
A. Primary structure.
B. Secondary structure.
C. Tertiary structure.
D. Quaternary structure.

Question 11
Cuttings taken from many species of plants can be placed in the ground to grow new plants identical to the parent plant. Rooting powder is a mixture of hormones designed to stimulate this new growth. Rooting powder is likely to be a mix of
A. auxins and cytokines.
B. gibberellic acid and cytokinins.
C. ethylene and auxins.
D. abscisic acid and indole acetic acid.

Question 12
Antibiotics would only be effective against
A. influenza viruses.
B. tetanus toxins.
C. cholera causing bacteria.
D. prions responsible for causing scrapie.

Question 13
The intrinsic apoptosis pathway relies on factors released by the
A. nucleus.
B. mitochondria.
C. golgi bodies.
D. ribosomes.

Question 14
Quarantine is based on the historical practice of requiring ships to stay offshore for forty days during times of plague epidemics before allowing crew and passengers to disembark. This period of forty days was needed to ensure that
A. all sick individuals had died from the plague.
B. the rats carrying the plague would all drown when trying to reach port.
C. anyone exposed to the plague had time to show symptoms.
D. all contaminated food was eaten before crew and passengers could come ashore.

Question 15
In a nerve, depolarization occurs when sodium ions
A. enter due to the relatively negative charge within the nerve.
B. exit due to the relatively negative charge within the nerve.
C. enter due to the relatively positive charge within the nerve.
D. exit due to the relatively positive charge within the nerve.

Question 16
Which of the following is **not** involved in the communication process between two cells?
A. Plasmodesmata.
B. Autocrine hormones.
C. Gap junctions.
D. MHC class II markers.

Question 17
Two components of the innate immune system include
A. intact skin and plasma cells.
B. antibodies and complement proteins.
C. platelets and cytotoxic-T cells.
D. stomach acid and macrophages.

Question 18
Which of the following cellular organelles lacks ribosomes?
A. Smooth endoplasmic reticulum.
B. Rough endoplasmic reticulum.
C. Mitochondria.
D. Chloroplasts.

Question 19
Cells infected with a virus will release
A. histamines.
B. interferon.
C. perforin.
D. cytokinins.

Question 20
A section of double stranded DNA was found to contain 20 adenine nucleotides and 40 guanine nucleotides. The total length of this DNA section is likely to be
A. 30 base pairs long.
B. 60 base pairs long.
C. 120 base pairs long.
D. indeterminable from the information.

Question 21
The four o'clock plant, *Mirabilis jalapa,* can produce flowers that are white, red or pink. This trait is most likely to be considered
A. monogenic.
B. polygenic.
C. polyploidy.
D. monomorphic.

Question 22

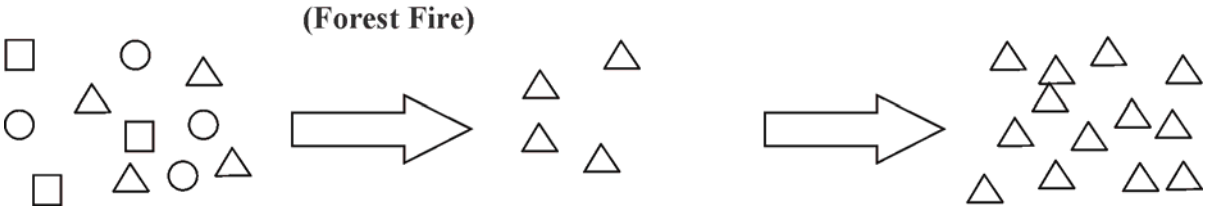


Figure 2

Figure 2 illustrates the concept of
A. the bottle neck effect.
B. the founder effect.
C. gene flow.
D. genetic drift.

Question 23
The Hardy-Weinberg equation $\mathbf{p^2+2pq+q^2=1}$ is used to determine the
A. number of individuals in a given gene pool.
B. number of alleles in a given gene pool.
C. frequency of a particular gene in a given gene pool.
D. effect of changes like genetic drift and gene flow.

Question 24
The DNA sequence for a section of an important gene is

CGGATTACATGACA

Which of the following mutations is likely to have the greatest effect on the protein that is produced by this gene?
A. **CGGAATACATGACA**.
B. **CGGATACAATGACA**.
C. **CGGAATACATGCCA**.
D. **CGGATACATGACA**.

Question 25
If a sample of wood that was uncovered during an archaeological dig was found to contain $1/16^{th}$ the expected amount of carbon-14, how many half-lives have occurred since the wood was last growing?
A. 2 half-lives.
B. 4 half-lives.
C. 8 half-lives.
D. 16 half-lives.

Question 26
Which of modern man's ancestors was considered to be the first to use fire in a controlled way?
A. *Homo erectus*.
B. *Australopithecus afarensis*.
C. *Homo floresiensis*.
D. *Homo neanderthalensis*.

Question 27
Which enzyme/enzymes can be used to join DNA nucleotides?
A. Ligases.
B. Endonucleases.
C. Helicase.
D. Proteases.

Question 28

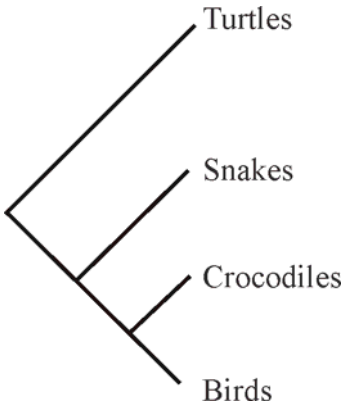


Figure 3

According to the cladogram shown in **Figure 3**
A. turtle and crocodile embryos would have the greatest similarity.
B. birds evolved before snakes.
C. the primary structure of bird proteins would be most similar to crocodile proteins.
D. turtles and snakes share three nodes.

Question 29
Which of the following is **not** an example of cultural evolution?
A. The use of fire for cooking.
B. People from a European background having a greater tolerance to lactose.
C. Chinese and Japanese cultures having the same written symbol language.
D. Nursery rhymes.

Question 30
An example of a trace fossil is a/an
A. fossilised tooth from a woolly mammoth.
B. insect trapped in amber.
C. sample of coprolite (dinosaur faeces).
D. piece of shell from a velociraptor egg.

Question 31
A primary feature that separates primates from other mammals is
A. the production of breast milk.
B. the presence of stereoscopic vision.
C. having opposable thumbs.
D. the lack of a tail.

Question 32
Examples of transgenic organisms would include
A. salmon modified to continually produce growth hormone.
B. tomatoes modified to silence the gene that causes rotting.
C. daffodils modified to produce polyploid plants.
D. carnations modified with a gene from an iris to produce blue flowers.

Question 33
In order for a virus to 'jump' between species
A. a host cell must be infected with two different viruses at the same time.
B. the species involved must be closely related.
C. there must be new mutations in the viral DNA of the original strain.
D. there must be no immunity to the infecting virus in either species.

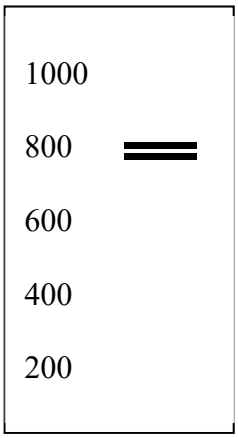
Question 34
Remains of WWI soldiers recovered from the battlefields of France often contain mDNA that can be used towards identifying the deceased individuals. The most suitable person to compare the isolated mDNA to would be the soldier's
A. son.
B. daughter.
C. brother's son.
D. sister's daughter.

Question 35
Which of the following properties have **not** been introduced into plants via genetic engineering?
A. Resistance to pests.
B. Resistance to competitors.
C. Greater nutritional value.
D. Delayed ripening time.

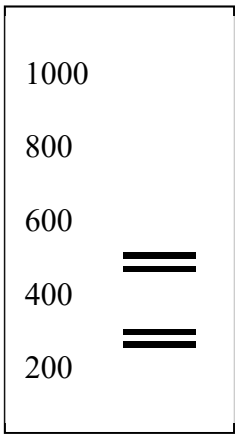
Question 36
The feature of early hominids which indicates that they were walking upright is the presence of
A. long narrow hips and a big toe in line with the other toes.
B. a big toe in line with the other toes and a large arm to leg ratio.
C. flared hips and a small arm to leg ratio.
D. a big toe further away from other toes and flared hips.

Question 37
Beta thalassemia is an autosomal recessive genetic disorder. Genetic screening is now available that can test for one common genetic mutation that causes this disorder. A restriction enzyme is used which cuts the defective gene into two strands of length 280 base pairs and 520 base pairs respectively. Which of the following results would indicate the person tested was a carrier of beta thalassemia?

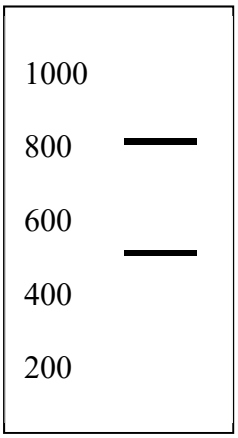
A.



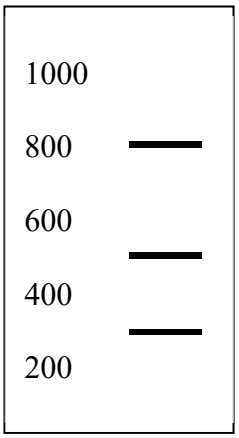
B.



C.



D.



Question 38
mtDNA differs from nuclear DNA in that mtDNA
A. does not contain introns.
B. is inherited from both parents.
C. contains microsatellites, also known as short tandem repeats.
D. is packaged into distinct chromosomes.

Question 39
Penicillin is a common antibiotic that works by interrupting the synthesis of the peptidoglycan cell wall of many bacteria. Some individuals are allergic to penicillin because
A. it attacks the cell walls of some individual's cells, causing an immune reaction.
B. some individuals have never been exposed to penicillin before.
C. some bacteria do not have a peptidoglycan cell wall.
D. some individuals have IgE antibodies with binding sites that match penicillin.

Question 40
Chromosome banding would show the highest level of similarity between species that have the same
A. number of chromosomes.
B. environment.
C. genus.
D. number of genes.

End of Section A

VCE Biology 2018 Year 12 Trial Exam Units 3/4

SECTION B – Short Answer Questions

Question 1 (10 marks)

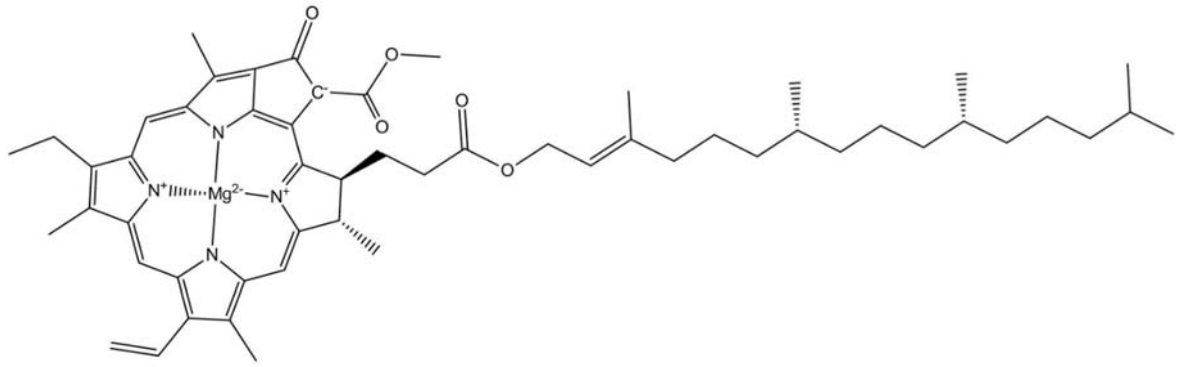


Figure 4: Structural formula of Chlorophyll A

Chlorophyll is a complex molecule found in plants and photosynthetic bacteria. It consists of a polar head enclosing a magnesium ion and a long nonpolar hydrocarbon tail.

a. What term is given to the magnesium ion in the chlorophyll molecule in **Figure 4**?

_____

1 mark

b. What stage of photosynthesis is the chlorophyll molecule involved in?

_____

1 mark

c. Using **Figure 4** and the above information explain where the chlorophyll molecule is situated in regards to the photosynthetic cell.

_____

_____

3 marks

d. Write a chemically balanced equation for photosynthesis.

_____

1 mark

e. Explain in detail, the role chlorophyll plays in photosynthesis.

_____

_____

_____

2 marks

f. What differences would you expect to see if a plant was grown in a magnesium deficient soil?

_____

_____

_____

2 marks

Question 2 (10 marks)

5' – GAATTACAAG – 3'

a. For the DNA sequence above, write the corresponding nucleotide sequence for the complementary strand of DNA that is produced during DNA replication.

_____

2 marks

b. Which enzyme is responsible for forming this second strand?

_____

1 mark

c. Name a nucleotide that is **not** a part of the above genetic sequence.

_____

1 mark

d. DNA replication is said to be 'semi conservative' in nature. What is meant by this term?

_____

_____

2 marks

Dideoxynucleotides are similar to deoxynucleotides in that they can both attach to the preceding nucleotide, however the chemical composition of dideoxynucleotides makes it impossible for the next nucleotide to attach. This means that when a dideoxynucleotide is used it will become the last nucleotide in the DNA strand.

e. If a dideoxynucleotide carrying a guanine base was used in the above DNA replication write the sequence that would be produced.

_____

2 marks

f. What applications could the use of dideoxynucleotides be put to, in terms of genetic research?

_____

_____

2 marks

Question 3 (8 marks)

Inflammation is part of the body's defence system and is a localised response to an invading pathogen. It occurs after cells are damaged, for example by a cut or a splinter. Blood flow to the affected area increases, causing redness, swelling and heat.

a. Name the process that produces the increase in blood flow to the wound.

_____

1 mark

b. Explain the benefits inflammation may have in fighting an invading pathogen.

_____

_____

_____

_____

_____

3 marks

c. Apoptosis is intentional cellular death. What name is given to the accidental death of cells such as that which occurs when a person is wounded?

_____

1 mark

d. Name the cell of the immune system that is primarily responsible for destroying invading bacteria and explain how it accomplishes this task.

_____

_____

_____

3 marks

Question 4 (6 marks)
Acquired immune deficiency syndrome (AIDS) is caused by a retrovirus known as human immunodeficiency virus (HIV). This virus replicates inside cells of the immune system, in particular T-helper cells, destroying them in the process. This in turn leads to a weakened immune system seen in patients with AIDS.

a. What line of defence of the immune system are helper-T cells part of?

_____

1 mark

b. Explain the normal function of the helper-T cells and how the lack of them leads to a weakened immune system.

_____

_____

_____

3 marks

c. Since HIV is a retrovirus what type of nucleic acid is found in particles of this pathogen?

_____

1 mark

d. Name the enzyme that would also need to be incorporated into the host cell to allow the HIV virus to replicate successfully.

_____

1 mark

Question 5 (6 marks)
Amongst many tribes of the Amazon rainforest that have had little or no contact with western society, there is a fear of cameras and a belief that having your photo taken will steal your soul. The basis for this belief seems to have been a number of incidents where tribespeople meet with western film crews and were filmed for television only to have large numbers of the tribe die within the year.

a. Using concepts studied in Units 3 and 4 Biology this year, explain a possible reason for the high mortality rate of Amazonian tribe members soon after their initial contact with westerners.

_____

_____

_____

_____

_____

_____

4 marks

b. Write down **two** suggestions you might give to future film crews to avoid recurrences of this kind of tragedy.

_____

_____

2 marks

Question 6 (9 marks)

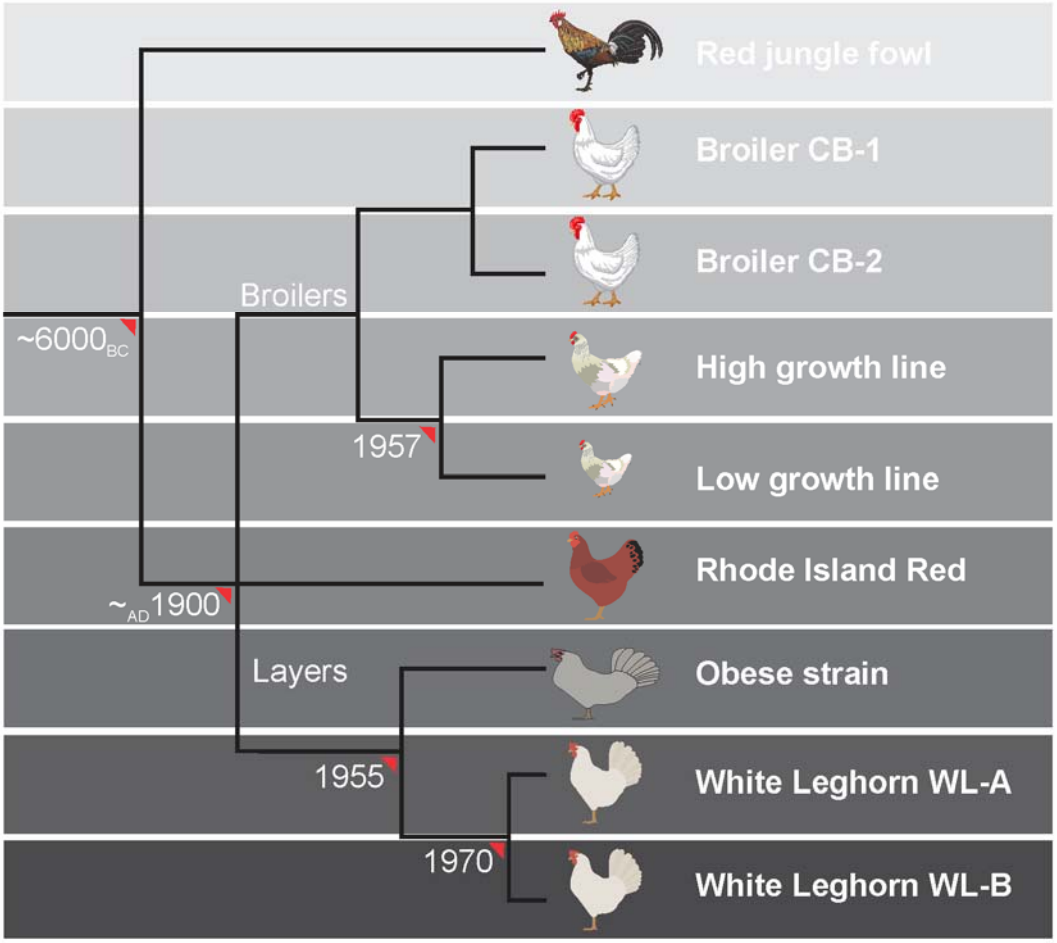


Figure 5: Development of the modern chicken

Modern chickens come in a variety of shapes and sizes but are split into two main groups. Broilers, which are raised for their meat, and Layers which are kept to produce eggs. The original ancestors of modern chickens were able to fly short distances, but many more recent breeds of chickens have lost this ability.

a. Modern chickens are said to have been artificially selected over time. Using the information provided above and displayed in **Figure 5** explain, in terms of modern chickens, what the process of artificial selection is.

_____

_____

2 marks

b. What effect does artificial selection have on genetic diversity in species like chickens?

_____

_____

2 marks

c. White leghorn chickens are usually bred with other white leghorn chickens. List **two** possible effects that such selective mating practices could have on allelic frequencies within this gene pool.

_____

_____

2 marks

d. Using the information supplied in **Figure 5**, choose which breed of chicken the farmers would select to breed with the leghorn chickens, to maintain genetic diversity. Justify your selection.

_____

_____

2 marks

e. Are the different breeds of poultry outlined in **Figure 5** considered to belong to the same species? Justify your answer.

_____

_____

1 mark

Question 7 (8 marks)

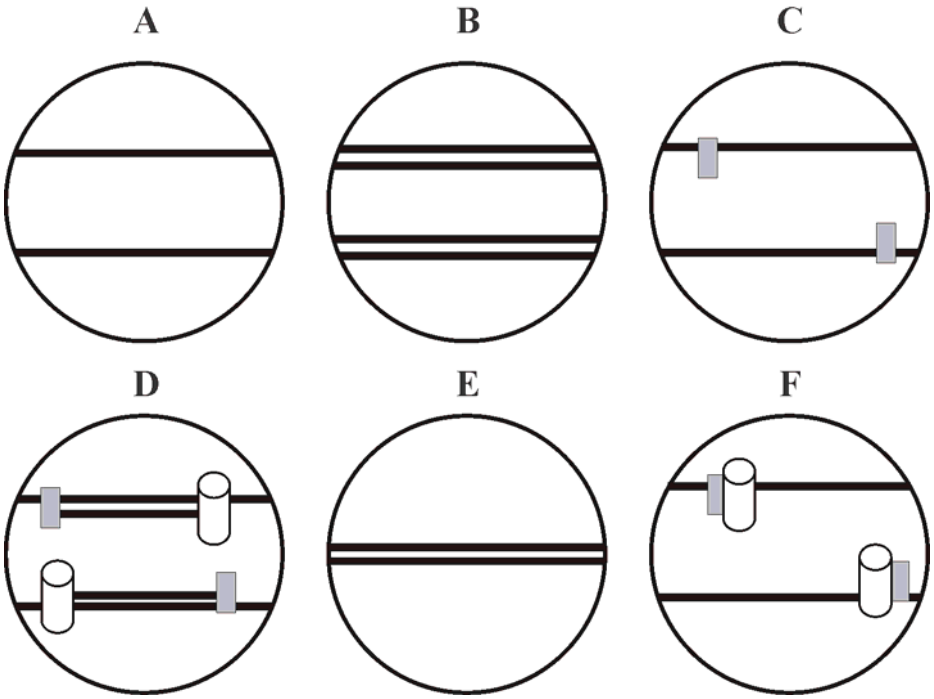


Figure 6

Figure 6 shows the different stages involved in one cycle of PCR.

a. What is meant by the term PCR?

_____

1 mark

b. Using the images shown in **Figure 6**, what is the correct sequence of images that would be seen in one cycle of PCR?

_____

1 mark

c. What name is given to the chemicals represented by the grey rectangles in images C, D and F in **Figure 6**?

_____

1 mark

d. Explain the key events which occur in the step of PCR outlined in image F as shown in **Figure 6**.

_____

_____

_____

2 marks

e. Name one other requirement for the process of PCR that is not shown in **Figure 6**.

_____

1 mark

f. The white cylinders shown in image D and F, represent a bacterial enzyme known as Taq DNA polymerase. Explain why Taq DNA polymerase is used during PCR rather than human polymerase.

_____

_____

_____

_____

2 marks

Question 8 (11 marks)

Human growth hormone (hGH) is a hormone that is secreted by the pituitary gland. Until the 1980s people with hGH deficiency relied on a replacement hormone derived from the pituitary glands of up to 16,000 cadavers. However, after a number of people who received such injections were diagnosed with Creutzfeldt-Jakob disease the practice was stopped. In 1985 the technique of gene cloning resulted in recombinant hGH becoming available for the first time. In gene cloning the hGH can be produced on a large scale by bacteria without the risk of infection by prions like the ones that cause Creutzfeldt-Jakob disease.

a. Name the monomer that the Creutzfeldt-Jakob disease prion is made from.

_____

1 mark

b. Since prions are not considered to be a living pathogen explain how prions replicate once within a host cell.

_____

_____

1 mark

c. Explain the steps that are taken to incorporate the hGH gene into a bacterial plasmid.

_____

_____

_____

_____

3 marks

d. What else might be included in the target DNA sequence generated to ensure that only the plasmids that have taken up the hGH gene are then used?

_____

_____

1 mark

e. Explain how this recombinant plasmid is then reinserted back into a bacterial cell.

_____

_____

_____

3 marks

f. Name **two** other proteins that have been commercially produced as a result of bacterial transformation.

_____

_____

2 marks

Question 9 (6 marks)

The megalodon is a species of shark, now extinct, that lived up to 23 million years ago. It was far larger than any living species of shark, with a single tooth reaching up to 18cm in length.

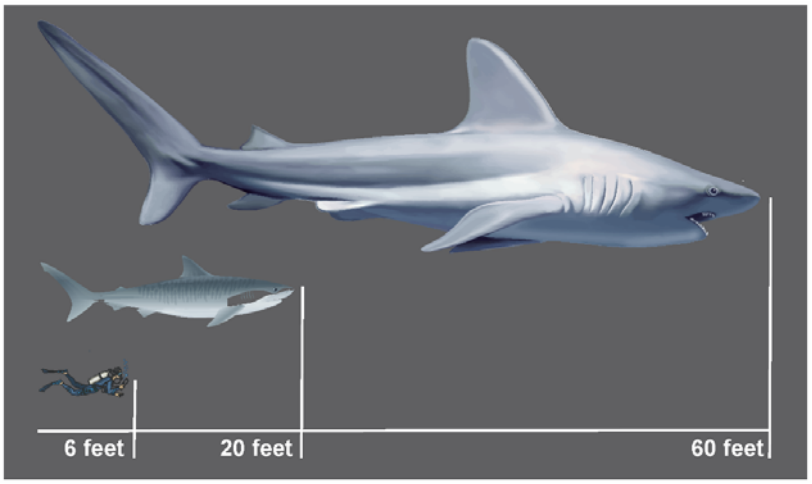


Figure 7

Unlike bony fishes, cartilaginous fish like the megalodon and the great white shark leave little in the way of fossil remains other than their teeth, so little is known about their evolution.

a. Explain the reason that despite its huge size there is little fossil evidence for the megalodon's existence.

_____

_____

2 marks

b. Since the megalodon teeth are basically formed from calcium explain how the scientists were able to determine the fact that megalodon existed 23 million years ago.

_____

_____

_____

_____

2 marks

Due to similarities between the teeth of the megalodon and the great white shark some scientists believe that the megalodon has, over time, evolved into the great white shark that is common in modern oceans.

c. Suggest a possible reason for how this evolution might have come about and the driving factor behind this evolutionary change.

_____

_____

_____

2 marks

Question 10 (6 marks)
Obesity is a medical condition that occurs as a result of both environmental and genetic factors. Under normal conditions adipose cells (fat cells) produce a hormone known as leptin. Leptin is detected by leptin receptors on the plasma membrane of cells within the hypothalamus. The hypothalamus in response sends signals to the brain of fullness which has the effect of suppressing hunger. One form of obesity has been identified as being caused by a point mutation within the gene on chromosome 1 that codes the leptin receptors. The result of this mutation is to produce leptin receptors that fail to bind with leptin.

a. Using the information above explain what class of hormone leptin belongs to.

_____

_____

_____

2 marks

b. What stage of cell signalling would be disrupted by the failure of leptin to bind to the leptin receptors?

_____

1 mark

c. What class of molecules would leptin receptors belong to?

_____

1 mark

d. Explain how a single nucleotide change in the DNA code could result in a non-functional leptin receptor.

_____

_____

_____

2 marks

End of Section B

End of Trial Exam

Suggested Answers

VCE Biology 2018 Year 12 Trial Exam Units 3/4

SECTION A – Multiple Choice Answers

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

SECTION B – Short Answer (Answers)

Question 1 (10 marks)

a. Cofactor **(1 mark)**.

b. The light-dependent stage **(1 mark)**.

c. Chlorophyll molecules are found on the plasma membrane surface of the **grana (1 mark)**.
The nonpolar 'tail' of the chlorophyll molecules are embedded amid the nonpolar tails of phospholipid molecules of the grana's thylakoid membranes **(1 mark)**.
The polar head of the chlorophyll molecules are exposed to the stromal fluid located near the surface of the grana in the chloroplasts **(1 mark)**.

d. $6\,H_2O + 6\,CO_2 \xrightarrow[(Chlorophyll)]{Light} C_6H_{12}O_6 + 6\,O_2$ **(1 mark)**

e. The chlorophyll molecule absorbs light energy **(1 mark)**.
It then sheds energised electrons into the **photosystem (1 mark)**.
or
It then uses this energy to split the bonds of a water molecule. **(1 mark)**.

f. You would expect the leaves of the plant to be a paler green colour or yellow **(1 mark)**. The plant would not be expected to grow as well as a plant with sufficient magnesium ions available **(1 mark)**.

Question 2 (10 marks)

a. **3' – CTTAATGTTC – 5'**
(1 mark for correct DNA sequence, 1 mark for correct 5' and 3' orientation.)

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

c. Uracil **(1 mark)**.

d. When the DNA is replicated each strand is kept in its entirety **(1 mark)** and is used as a template for the synthesis of a complementary strand **(1 mark)**.

e. GTTC – 5' (**2 marks** for correct answer. **1 mark** if the students started from the 3' end rather than the 5' end).

f. This can tell you exactly where the guanine nucleotides exist in the overall DNA sequence **(1 mark)**. Repeating this process several times using dideoxynucleotides attached to adenine, cytosine and thymine respectively you can determine the exact sequence of nucleotides found in the strand of DNA **(1 mark)**.

Question 3 (8 marks)

a. Vasodilation **(1 mark)**.

b. Any **three** of the following:

- Heat may damage or kill invading pathogens.
- Increased permeability allows movement of macrophages to the infected area.
- Increased permeability allows movement of clotting agents and complement proteins to the infected area.
- Histamines and prostaglandins attract phagocytes to the infection.
- Pressure limits the movement of pathogens.
- Flow of blood and fluid may push pathogens out of the body.

or any other reasonable answer **(1 mark for each correct - total 3 marks)**.

c. Necrosis **(1 mark)**.

d. Macrophages or neutrophils **(1 mark)** react to antigens that are not seen as 'self' (unless connected to a cell also displaying 'self markers') **(1 mark)**. They use phagocytosis to surround and engulf the bacterium and lysosomes to destroy the invading pathogens **(1 mark)**.

Question 4 (6 marks)

a. Third line of defence (also allow cell-mediated or humoral response of immune response) **(1 mark)**.

b. Helper-T cells respond to antigens presented by dendritic cells or macrophages (antigen presenting cells) **(1 mark)**. They in turn stimulate cytotoxic-T cells and B plasma cells within the lymph glands **(1 mark)**. Without the helper-T cells the infection may become lethal before B cells in the lymph glands or cytotoxic-T cells involved are activated **(1 mark)**.

c. Ribonucleic acid (RNA) **(1 mark)**.

d. Reverse transcriptase **(1 mark)**.

Question 5 (6 marks)

a. This high mortality rate amongst tribespeople following exposure to new pathogens is an example of the absence of herd immunity and thus protection in a community of people **(1 mark)**. The western film crews have been exposed to a variety of bacterial and viral infections and have developed an immunity to them **(1 mark)**. In contrast, the Amazon tribespeople have never encountered these pathogens meaning they would quickly spread throughout the tribe **(1 mark)**. Many from the tribe would die if simultaneously exposed to a range of new pathogens like measles, mumps, rubella etc. **(1 mark)**.

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

- Limit contact with tribespeople to just one representative.
- Use antibacterial hand wipes and masks to limit spread of infections.
- Avoid any direct physical contact between television crew members and tribespeople.
- Any sick member of the film crew is to completely avoid any contact with tribespeople.

(*or any other reasonable suggestion).*

(Accept vaccinations for the film crews if the answer also mentions allowing time for the body to produce the appropriate immune response.)

Question 6 (9 marks)

a. Artificial selection is where humans choose which chickens can breed and produce offspring **(1 mark)**. Chickens with desirable traits, for example the largest sized chickens, are allowed to breed, in turn producing generations of larger and larger chickens; the broilers **(1 mark)**.

b. Artificial selection limits genetic diversity **(1 mark)** since not all individuals are allowed to breed, the alleles that they carry may become lost **(1 mark)**.

c. Possible responses include **(2 marks for any two of the following)**.

- Certain alleles may become extinct from the gene pool.
- Certain alleles may become fixed in the gene pool.
- Recessive genes may become more common in a particular gene pool than in the wider chicken community.

d. Red jungle fowl **(1 mark)** since it has the oldest common ancestor compared to leghorn chickens it is most likely to have alleles that have been bred out of the leghorn gene pool **(1 mark)**.

e. All chicken breeds listed belong to the same species, since they can still interbreed and produce fertile viable offspring **(1 mark)**.

Question 7 (8 marks)

a. Polymerase Chain Reaction **(1 mark)**.

b. E-A-C-F-D-B **(1 mark)**.

c. RNA primers **(1 mark)**.

d. RNA primers have attached to the separated DNA strands **(1 mark)** and Taq polymerase has attached to the primers ready to start replicating a complementary strand **(1 mark)**.

e. Free nucleotides ***or*** heat ***or*** buffer solution **(1 mark)**.

f. The high heat needed to separate the DNA strands would warp the human DNA polymerase enzyme **(1 mark)**. Taq polymerase is able to withstand far greater levels of heat **(1 mark)**.

Question 8 (11 marks)

a. Amino acids **(1 mark)**.

b. Prions, once inside a host cell, bind to particular proteins on the cell membrane and induce them to fold into a new conformational / non-functional shape **(1 mark)**.

c. The plasmid is cut using a restriction enzyme that produces sticky ends **(1 mark)**.
A DNA fragment bearing the hGH gene is also cut with the same restriction enzyme used to cut the plasmid **(1 mark)**.
The restriction enzyme digests from step 1 and 2 are mixed together and DNA ligase is used to re-join the fragments of DNA to form recombinant sequences **(1 mark)**.

d. A gene which codes for resistance to an antibiotic or one that produces a colour change when exposed to certain chemicals should also be present **(1 mark)**.

e. The mixture of bacterial cells and plasmids is initially cooled to minimise phospholipid movement **(1 mark)**.
Calcium ions are added to this mixture to stop the negative charges on the phosphate groups of the plasmid DNA and the phospholipids of the bacterial cells repelling each other **(1 mark)**.
The mixture is heated quickly and since the plasmids are closer to the heat they are pushed inside the bacteria **(1 mark)**.

f. Any **two** of the following are acceptable responses **(1 mark each)**:

- Insulin.
- Follicle stimulating hormone.
- Factor VIII (blood clotting protein).
- Interferons.
- Monoclonal antibodies.

Question 9 (6 marks)

a. Hard materials like bone and teeth do not decay and readily form fossils **(1 mark)**. Cartilage is far softer and much harder to preserve **(1 mark)**.

b. Researchers would have used absolute dating on the rock the megalodon teeth were discovered in **(1 mark)**. Potassium / Argon dating could be used to accurately date the rock to within 1 million years **(1 mark)**.

c. There are a number of possible answers: **(1 mark)** for the process of evolution and **(1 mark)** for a reasonable factor behind it.

(Examples)

- Competition for food **(1 mark)**. Smaller sharks would need less food and be more likely to survive and pass their small size traits on to their offspring **(1 mark)**.
- Manoeuvrability. Since small sharks could turn and chase prey more easily than the larger sharks **(1 mark)** they survived and passed on their genes to the following generations of sharks **(1 mark)**.
- Climate change. Should the climate become colder or the shark's main source of food shift into colder waters, the smaller sharks would have a selection advantage **(1 mark)**. The smaller sharks would survive, and their offspring would inherit these genes, eventually evolving into a different, smaller, species of shark **(1 mark)**.

Question 10 (6 marks)

a. Leptin is a polypeptide / protein hormone **(1 mark)** as the receptor is found on the cell membrane **(1 mark)**.

or

Leptin is an endocrine hormone **(1 mark)** as it travels all the way to the hypothalamus **(1 mark)**.

b. Signal reception **(1 mark)**.

c. Proteins **(1 mark)**.

d. A different nucleotide in the DNA would result in a different RNA nucleotide during transcription. This in turn would produce a different amino acid in the polypeptide chain during translation **(1 mark)**. This different amino acid warps the leptin binding site of the leptin receptor meaning it can no longer function correctly **(1 mark)**.

End of Suggested Answers