VCE BIOLOGY 2013

YEAR 12 TRIAL EXAM

Unit 3 & Unit 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	12	12	70
			Total 110

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

Learning Materials *by Lisachem*
PO Box 2018, Hampton East, Victoria, 3188
Ph: (03) 9598 4564 Fax: (03) 8677 1725
Email: orders@learningmaterials.com.au or orders@lisachem.com.au
Website: www.learningmaterials.com.au

STUDENT NUMBER

									Letter
Figures									
Words									

Student Name.....…….....

VCE Biology 2013 Year 12 Trial Exam Unit 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 2013 Year 12 Trial Exam Unit 3/4

SECTION A – Multiple Choice Questions

Question 1
A university student was using an electron microscope to determine the presence of organelles in two slides. The cells of Slide 1 were collected by scraping the inside of his cheek. The cells of Slide 2 were collected from the roots of an onion plant. He recorded his results in **Table 1** below. For which organelle did the student make an error?

		Slide 1	Slide 2
		Cheek Cells	Onion Root Cells
A.	Chloroplasts	×	✓
B.	Nucleus	✓	✓
C.	Mitochondria	✓	✓
D.	Cell wall	×	✓

Table 1

Question 2
Which elements are found in sucrose?
A. Carbon, hydrogen, oxygen, nitrogen, phosphorus and sulfur only.
B. Carbon, hydrogen, oxygen and nitrogen only.
C. Carbon, hydrogen and oxygen only.
D. Carbon and hydrogen only.

Question 3
Polymers are complex molecules made of repeating subunits called monomers. What insoluble substance is formed when the monomer glucose is bonded together to form long unbranched chains?
A. Starch.
B. Glycogen.
C. Fatty acid.
D. Cellulose.

Question 4
Figure 1 below shows three ways that molecules can cross a plasma membrane.

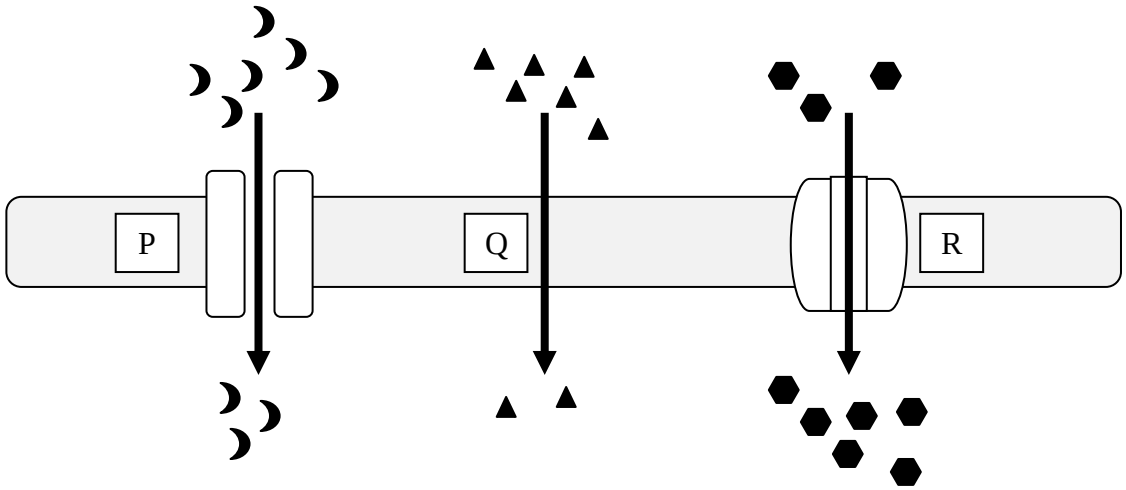


Figure 1

A source of energy is required for substances to cross the membrane in
A. P only.
B. Q only.
C. R only.
D. P, Q and R.

Question 5
Enzymes affect the chemical reactions that occur in organisms. Enzymes
A. are composed of carbohydrate.
B. are affected by the amount of acid in the solution.
C. work more efficiently at higher temperatures.
D. cause the substrate to be unchanged at the end of the reaction.

Question 6
The following equation is a summary of a process that occurs in some living organisms.

$$12H_2O + 6CO_2 \xrightarrow{\text{energy}} C_6H_{12}O_6 + 6O_2 + Q$$

The product Q in this reaction is
A. new water.
B. a monosaccharide.
C. chlorophyll.
D. ADP.

Question 7
Cellular respiration occurs in cells to release useful energy. Respiration occurs in stages and one of the stages is the Krebs cycle. The Krebs cycle
A. has oxygen as an input.
B. uses up ATP.
C. cannot occur in prokaryotic cells.
D. occurs after the electron transport stage.

Question 8
Figure 2 is a diagram of a chloroplast.

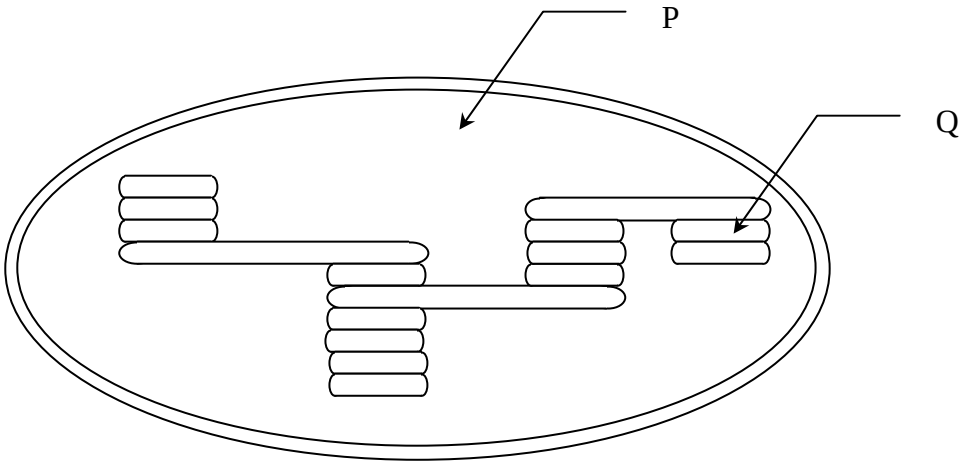


Figure 2

Light-independent reactions of photosynthesis occur at
A. P during the day only.
B. P during the day and night.
C. Q during the day only.
D. Q during the day and night.

Question 9
Cells can respond to hormones. Which one of the following is <u>not</u> a response to a lipid-soluble hormone?
A. Signal transduction.
B. Stimulation of a membrane receptor.
C. Activation of DNA.
D. Amplification of the signal.

Question 10
Figure 3 shows a grass coleoptile. It is being illuminated from the right. An impervious sheet has been inserted half-way through the coleoptile, just below the tip on the same side as the light.

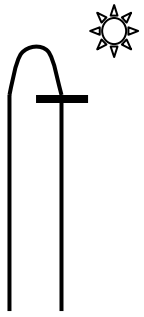


Figure 3

Which statement is true with regard to the phototropic response of this coleoptile?
A. Auxin is prevented from moving by the impervious sheet.
B. The impervious sheet stops the production of auxin.
C. Auxin is produced all along the illuminated side of the coleoptile.
D. Cells below the tip away from the light will elongate.

Question 11
Bananas in the same bunch ripen at different times. This makes selling the bananas difficult because some of the bananas on the bunch may be unripe and green or some may be over-ripe and black. This problem can be solved by picking the bunch just before they turn yellow.
The treatment to make all the bananas ripen at the same time includes
A. adding a cytokinin gas to the environment of the bananas.
B. injecting the bananas with a cytokinin.
C. adding ethylene gas to the environment of the bananas.
D. spraying the bananas with liquid ethylene.

Question 12
Pheromones are chemical signalling molecules. Pheromones
A. are emitted by plants and animals.
B. have no effect over long distances.
C. are emitted by male moths to attract a mate.
D. are species specific.

Question 13
Figure 4 is a diagram of a neuron.

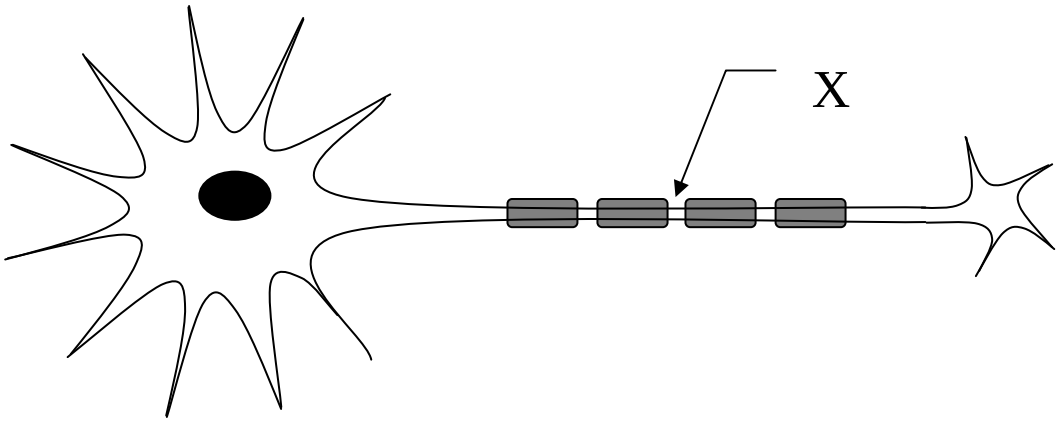


Figure 4

At X, the nerve impulse is travelling
A. left to right along the axon.
B. left to right along the dendrite.
C. right to left along the axon.
D. right to left along the dendrite.

Question 14
Malaria kills approximately 3 million people each year. The protozoan *Plasmodium falciparum* has a complex lifecycle, spending some of its lifecycle in humans and part in female mosquitoes of the genus *Anopheles*. *Plasmodium falciparum* produces male and female gametes in the gut of *Anopheles*. A human may catch malaria when bitten by an infected mosquito.
The primary host for the pathogen is
A. *Plasmodium falciparum.*
B. malaria.
C. *Anopheles.*
D. humans.

Question 15
Immunity includes both specific and non-specific defences. Which of the following would be an example of a non-specific defence?
A. Immunoglobulins.
B. Antibodies.
C. Natural killer (NK) white blood cells.
D. B lymphocyte.

Question 16
B and T cells are an important part of the immune response. Which statement is incorrect?
A. B cells and T cells have self antigens, self receptors and non-self receptors.
B. B cells have immunoglobulins on their surface.
C. T cells make antibodies that react with antigens.
D. Cytotoxic T (Tc) cells kill body cells that have been infected with a virus.

Question 17
Allergic responses result in the contraction of smooth muscle which can result in the reduction in the diameter of airways. The antigens that cause an allergic response react with
A. IgE antibodies on mast cells which release histamine.
B. B cells in bone marrow to release antibodies to the antigen.
C. histamine to activate mast cells in smooth muscle.
D. T cells which release histamine.

Question 18
A doctor injects Rh antibodies into a mother shortly after she gives birth. This is because
A. the baby is Rh negative.
B. the mother is Rh positive.
C. the antibodies will increase the immune response of the mother.
D. future babies of the mother could be at risk.

Question 19
Autoimmune diseases are caused by the body mistakenly attacking its own cells. Which of the following is not an example of an autoimmune disease?
A. Rejection of a kidney by a transplant recipient.
B. Destruction of myelin sheaths in a person with MS.
C. Attack of joint cartilage in a person with rheumatoid arthritis.
D. Destruction of beta cells in the pancreas of a Type 1 diabetic person.

Question 20
People with the Human Immunodeficiency Virus may develop symptoms of AIDS. This occurs because
A. the antigens on the surface of the virus can change rapidly and thus avoid detection.
B. opportunistic pathogens cannot pass non-specific immune defences.
C. the virus attacks helper T cells, leaving the person vulnerable to certain diseases.
D. the virus attacks certain organs of the body without which it cannot function.

*Questions 21 - 23 refer to **Table 2**.*
A doctor swabbed the mouth of Chris and collected some cells. The chromosomes of one of the cells was photographed and arranged in a table. **Table 2** is a simplified representation.

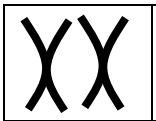
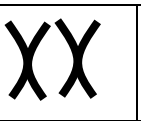
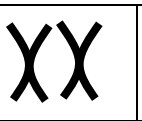
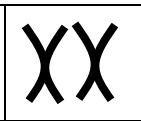
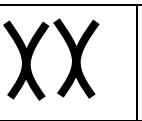
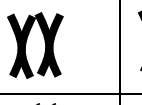
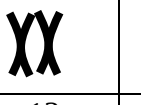
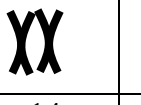
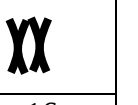
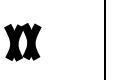
							
1	2	3	4	5	6	7	8
							
9	10	11	12	13	14	15	16
							
17	18	19	20	21	22	23	

Table 2

Question 21
Arrangement of the chromosomes as shown in **Table 2** is called a
A. eukaryote.
B. karyotype.
C. chromatograph.
D. prokaryote.

Question 22
The chromosomes shown in **Table 2** indicate that Chris
A. is female.
B. has Turner's syndrome.
C. has Klinefelter's syndrome.
D. has Down syndrome.

Question 23
Chris produced gametes. Which statement is true?
A. All of the gametes will contain two X chromosomes.
B. All of the gametes will contain an X chromosome.
C. Only half of the gametes will contain an X chromosome.
D. All of the gametes will contain 46 chromosomes.

Question 24
Figure 5 shows a molecule undergoing replication.

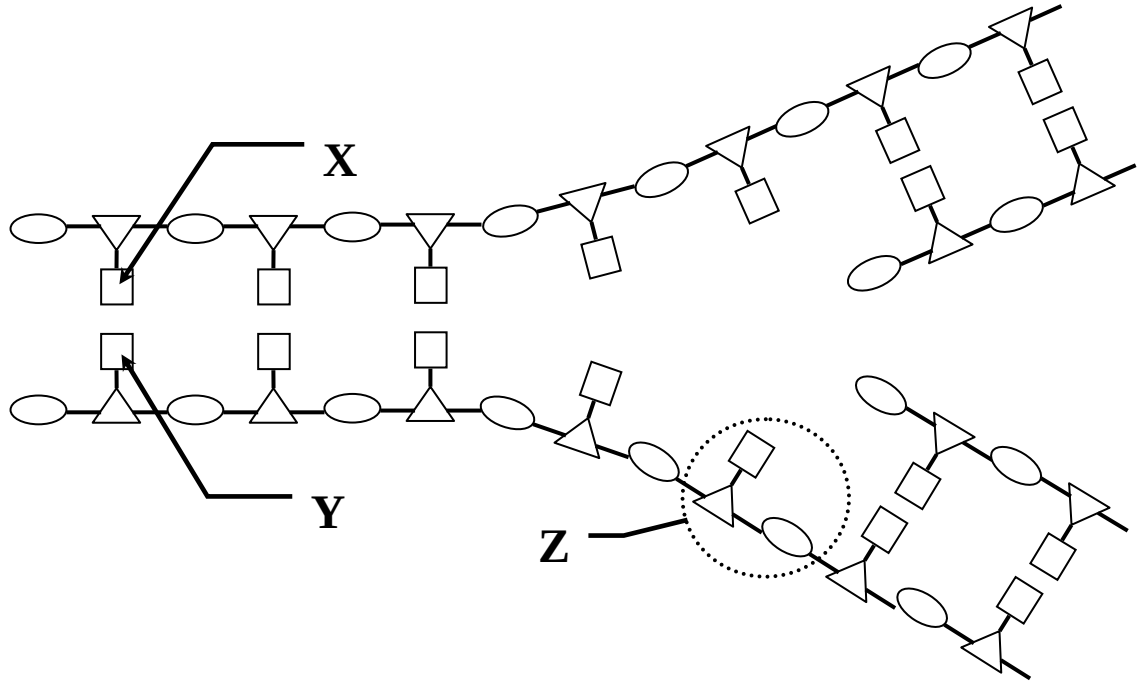


Figure 5

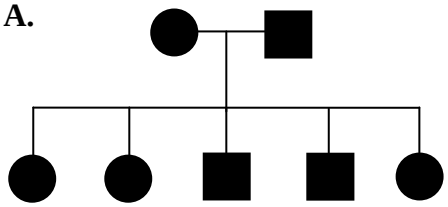
Regarding **Figure 5**, which statement is correct?
A. X and Y could be adenine and uracil.
B. Z is a triplet codon.
C. The triangles represent phosphate groups.
D. After replication, half the old molecule is conserved.

Question 25
Genes control various structures and functions in a cell. A gene might code for a structural protein, an enzyme that controls a chemical reaction or might control other genes. Which statement concerning genes is correct?
A. A gene has a position on a chromosome called a locust.
B. There are approximately 200,000 different genes in a human cell.
C. Genes are composed of chromosomes.
D. The minimum number of alleles for a gene is one.

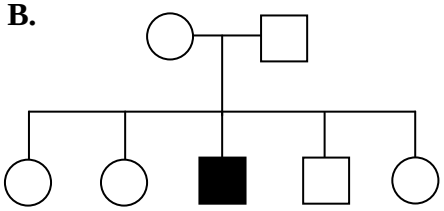
Question 26
Julia's red hair is an example of an autosomal recessive trait. With regard to Julia's hair colour, which statement is true?
A. Julia is homozygous.
B. Julia's genotype is red.
C. Both of Julia's parents must have red hair.
D. The gene is located on the X chromosome.

Question 27
Which one of the following pedigrees cannot be a sex-linked recessive pattern of inheritance? Shaded individuals have the trait.

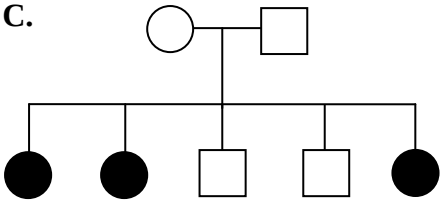
A.



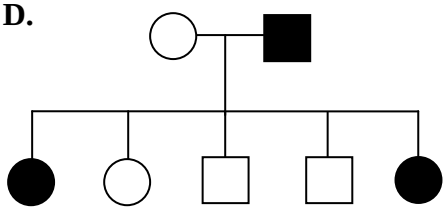
B.



C.



D.



Use the following information to answer Questions 28 and 29.
In pea plants, the genes for seed pod texture and pod colour are on separate chromosomes. The allele for inflated pod (I) is dominant over the allele for constricted pod (i); while the allele for green pod (G) is dominant over the allele for yellow pod (g).

Question 28
A student has a pea plant with pods that were inflated and green, and wished to cross that plant with another to determine if the plant is homozygous or heterozygous for the two genes. The other plant should have the genotype
A. IIGG.
B. IIGg.
C. IiGg.
D. iigg.

Question 29
Another student decided to cross two plants. The genotypes of the two plants were IIGg and IiGG.
With regard to the seed pods of the offspring, what would be the phenotypic ratio in a large number of offspring that result from this cross?
A. 1 inflated/green : 1 inflated/yellow : 1 constricted/green : 1 constricted/yellow.
B. 9 inflated/green : 3 inflated/yellow : 3 constricted/green : 1 constricted/yellow.
C. All inflated/green.
D. There is not enough information provided to determine the phenotypic ratio.

Question 30
Sarah became pregnant and there was a chance that her male foetus had inherited the gene for haemophilia on his X chromosome.
An amplified sample of the foetal DNA was denatured so that it became single stranded. The DNA strands were cut into fragments. The fragments were separated and then some fragments were made visible when a complementary strand with a radioactive marker was added.
Four genetic tools were used in this process. In order, they are

A. polymerase chain reaction, restriction enzyme, electrophoresis, probe.
B. ligase, polymerase chain reaction, vector, probe.
C. restriction enzyme, probe, polymerase chain reaction, vector.
D. ligase, plasmid, probe, polymerase chain reaction.

Question 31
Transgenic canola plants are being grown in various locations around Australia. The inserted gene comes from a bacterium and codes for an enzyme that destroys glyphosphate.
Glyphosphate is the active ingredient of a common herbicide. The transgenic canola plants are controversial. One of the main arguments against the transgenic plants is

A. the cost of inserting the bacterial gene.
B. wild plants will be killed by the glyphosphate.
C. the foreign gene may end up in related, wild, plant species.
D. the plants cannot be controlled by the herbicide.

Question 32
A certain species of bird shows variation in the length of its bill. The bills of a large number of birds were measured and the results were graphed as shown in **Figure 6**.

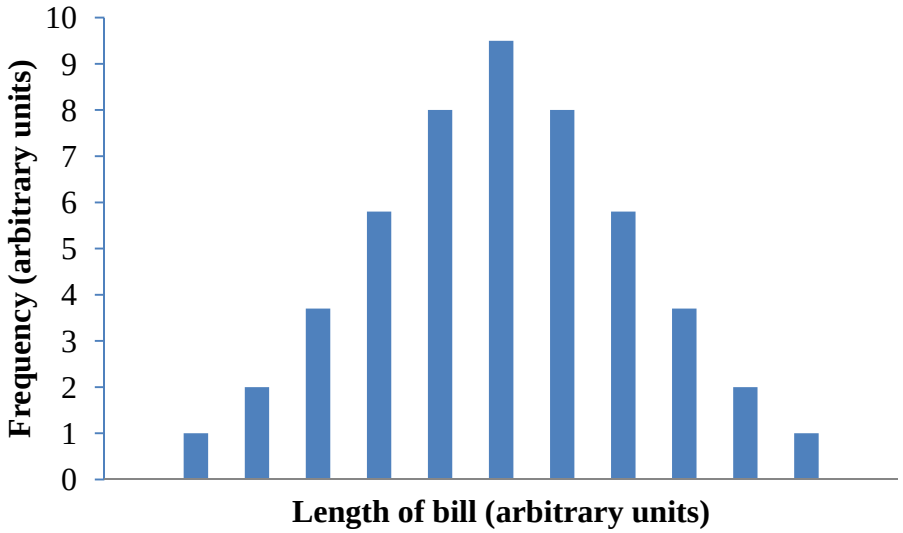


Figure 6

Which statement regarding the bill length of the birds is correct?

A. The population is monomorphic and the trait shows continuous variation.
B. The population is polymorphic and the trait shows discontinuous variation.
C. The population is monomorphic and the trait shows discontinuous variation.
D. The population is polymorphic and the trait shows continuous variation.

Question 33
Tyrosinase is the enzyme responsible for producing the dark pigment, melanin, in the fur of rabbits. A mutant allele results in an enzyme that is only active below a critical temperature. Himalayan rabbits have the mutant form of the enzyme and have extremities coloured with a dark pigment, while the rest of the animal is light in colour.
A scientist shaved off a patch of white fur from the back of a Himalayan rabbit. He then attached a chilled pad to the shaved area. The temperature of the pad was below the critical temperature. After a period of time new fur grew back under the chilled pad. The new fur will be

A. black because the chilled pad will cause a mutation in the tyrosinase gene.
B. black because the cells under the chilled pad will produce active tyrosinase.
C. white because the shaved area was not on the extremities.
D. white because the genotype cannot be altered by the environment.

Question 34
In the nineteenth century, the rate of deafness on Martha's Vineyard (an island off the coast of Massachusetts, USA) was thirty times that of the mainland population. Most deaf islanders were descendants of a small handful of English families who settled there around 1700.
The situation described above is an example of

A. the founder effect.
B. a population bottleneck.
C. a selection pressure.
D. artificial selection.

Question 35
The fossil record shows that the necks of giraffes became longer over time. This is most likely as a result of natural selection. Which of the following statements is <u>not</u> a part of natural selection as described by Alfred Russel Wallace and Charles Darwin?

A. The "factor" for a longer neck was passed onto offspring.
B. A parent who stretched their neck produced offspring with longer necks.
C. The environment provided a selection pressure against short necks.
D. Sexual reproduction produced a variation in neck length.

Question 36
Archaeologists were digging in two separate regions of undisturbed sedimentary rock and found fossils at different depths. The fossils at different depths are represented in **Figure 7**.

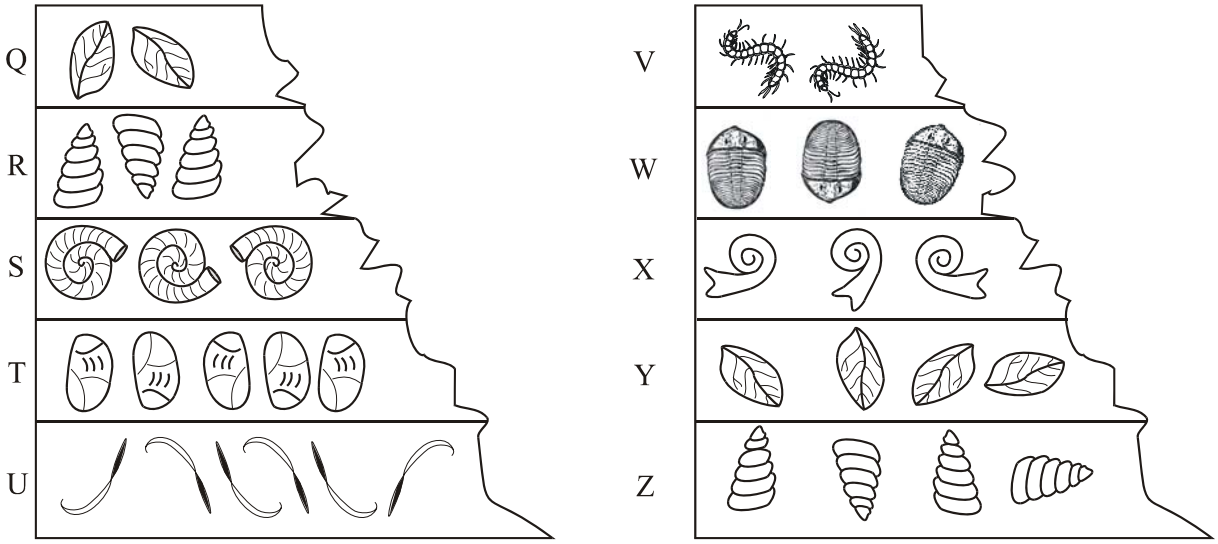


Figure 7

From the data provided, it could reasonably be concluded that
A. stratum Z contains the oldest fossils.
B. stratum Q contains the youngest fossils.
C. stratum S contains fossils the same age as stratum X.
D. stratum S contains fossils older than stratum Y.

Question 37
The half-life of the radioisotope Carbon-14 is approximately 5500 years. A fossil of a mammal was found in a cave on the Nullarbor Plain. The fossil was dated and found to be about 22,000 years old.
The amount of Carbon-14 left in the bones of the remains would be approximately
A. 6%.
B. 13%.
C. 23%.
D. 36%.

Question 38
Which one of the following pairs of primates associated with human evolution is the most closely related?
A. Human and chimpanzee.
B. *Homo sapiens* and *Australopithecus africanus*.
C. Gorilla and human.
D. Chimpanzee and orangutan.

Question 39
Human evolution occurred over a long period of time. Nomadic scavengers became hunters and gatherers. Subsequently the development of agriculture meant that these people could settle in one place. Settlement gave the opportunity for development of rituals, tools and art. The changes in rituals, tools and art are examples of

A. convergent evolution.
B. co evolution.
C. genetic drift.
D. cultural evolution.

Question 40
Humans diverged from other primates about 6 million years ago. The characteristic that appeared first in these early hominins was

A. an opposable thumb.
B. ritual burials.
C. bipedal gait.
D. language.

End of Section A

VCE Biology 2013 Year 12 Trial Exam Unit 3/4

SECTION B – Short Answer Questions

Question 1 (6 marks)
Figure 8 shows two neurons that form part of a neural pathway.

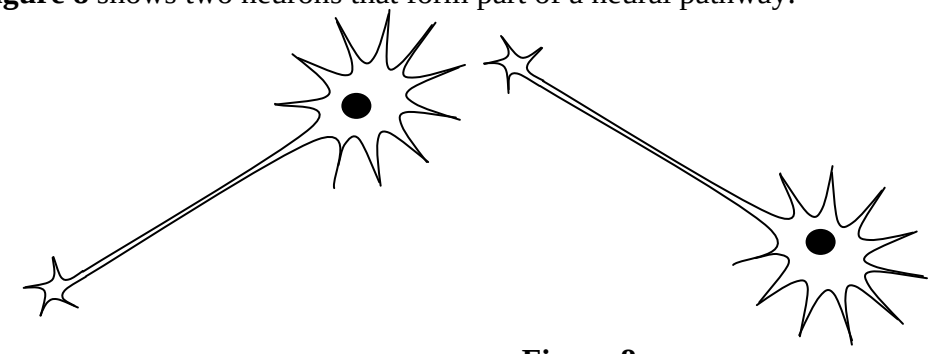


Figure 8

a. The two neurons are not touching. Explain how the nerve impulse can move from one neuron to the next. **2 marks**

_____

_____

_____

_____

b. Describe the change in electrical charge on a cell membrane as a nerve impulse passes along it. **2 marks**

_____

_____

_____

_____

c. How are stimuli of different strengths distinguished from one another by the nervous system? **2 marks**

_____

_____

_____

_____

Question 2 (7 marks)

Enzymes are organic catalysts that speed up reactions. Lactase is an enzyme responsible for the digestion of the disaccharide lactose, which breaks down into two monosaccharides, galactose and glucose. Lactase generally operates in the small intestine and has an optimal pH of 6.

a. Lactose and sucrose are both disaccharides. Why does lactase break down lactose but not break down sucrose? **2 marks**

_____

_____

_____

_____

b. 200 ml of lactose is placed in a beaker. Explain why only a very small amount of lactase is needed to be added to the beaker to break down all the lactose. **1 mark**

_____

_____

_____

_____

c. The pH of the stomach is approximately 2. Explain how the action of lactase would be affected if it were present in the stomach. **2 marks**

_____

_____

_____

_____

Prostaglandins are chemicals that cause pain and inflammation and are the product of a reaction that is catalysed by the enzyme cyclooxygenase. Ibuprofen is a common pain reliever that works by inhibiting the enzyme cyclooxygenase.

d. Explain how ibuprofen reduces pain and inflammation. **2 marks**

_____

_____

_____

_____

Question 3 (6 marks)

Life on planet earth is possible because of photosynthesis. This process occurs in plants and converts light energy into chemical energy.

a. One colour has minimal absorption by chlorophyll. What happens to that light? **1 mark**

_____

_____

b. What is the waste product formed in the light-dependent stage of photosynthesis? **1 mark**

_____

c. Briefly describe the process that occurs during the light-independent stage of photosynthesis. **2 marks**

_____

_____

_____

_____

A light is placed near a plant and the rate of photosynthesis is measured. The intensity of the light is increased over time as shown in **Figure 9**.

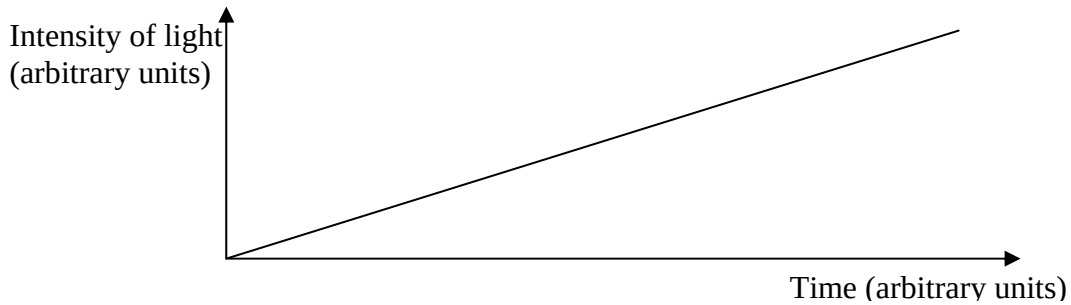


Figure 9

d. List the three possible limiting factors that may stop the rate of photosynthesis increasing, even though the light intensity continues to increase. **2 marks**

_____

_____

Question 4 (6 marks)

a. Write down the balanced chemical equation for aerobic respiration. **1 mark**

_____

_____

b. Name the three stages of aerobic respiration in the correct order. **2 marks**

_____

_____

Anaerobic respiration can occur in muscle cells and yeast cells.

c. Describe the difference between anaerobic respiration that occurs in muscles cells and anaerobic respiration that occurs in yeast cells. **2 marks**

_____

_____

_____

d. What specifically causes the difference in the reactions referred to in Question 4c? **1 mark**

_____

_____

_____

Question 5 (5 marks)

a. Define the term pathogen. **1 mark**

_____

_____

b. Describe the structure of a virus. **1 mark**

_____

_____

_____

c. Describe how a virus reproduces. **1 mark**

_____

_____

_____

_____

d. Describe how a vaccine can result in immunity against a pathogen. **2 marks**

_____

_____

_____

_____

_____

_____

_____

Question 6 (7 marks)

Legionella pneumophila and *Legionella micdadei* are two of a number of bacteria that cause Legionnaires' disease. Symptoms of the disease include fever, chills and coughing. The bacterium lives naturally in water and can enter humans by inhalation if the water forms an aerosol, such as in cooling towers in buildings and ornamental fountains. The mortality rate for Legionnaires' disease is in the range of 5-30%.

a. Describe a primary defence mechanism against the bacteria that cause Legionnaires' disease. **2 marks**

_____

_____

_____

A student tested three antibiotics, azithromycin, clarithromycin and roxithromycin, against *Legionella pneumophila* and *Legionella micdadei*. The antibiotics were infused onto paper discs and each disc was placed onto an agar plate covered with the bacteria being tested. After some time, the plates were examined for a zone of inhibition.
Table 3 shows the results of the tests.

Zone of Inhibition (mm)		
Antibiotic	***L. pneumophila***	***L. micdadei***
azithromycin	18	23
clarithromycin	6	8
roxithromycin	11	13

Table 3

b. According to the results, which antibiotic would be most effectively used against Legionnaires' disease? Use the data to support your answer. **1 mark**

_____

_____

_____

_____

c. A person became infected with *Legionella micdadei*, but recovered in 3 weeks. Four years later, the same person was reinfected with *Legionella micdadei* but recovered in 4 days. Briefly explain why the second recovery period was significantly shorter. **2 marks**

_____

_____

_____

_____

_____

_____

Figure 10 shows the structure of a bacterium.

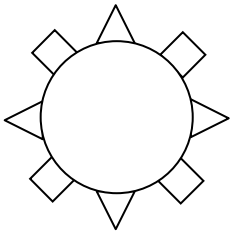
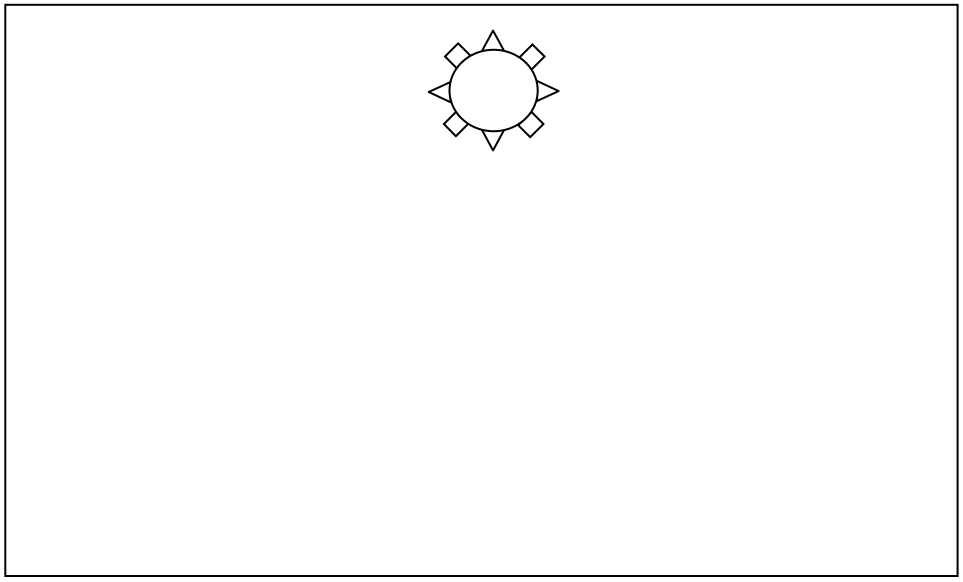


Figure 10

d. In the space provided, draw one antibody, specific for this bacterium. Show the light and heavy chains in your drawing. **2 marks**



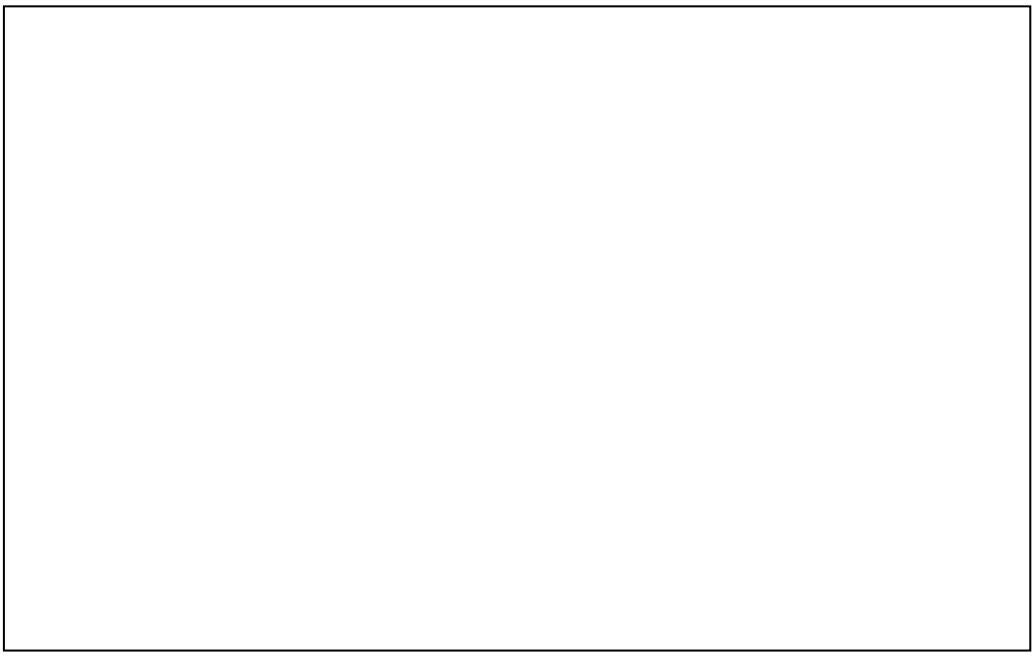
Question 7 (5 marks)

The ABO gene affects blood type. The Smith family had four children and each child had a different phenotype for their blood.

a. What are the phenotypes and genotypes of the parents? **1 mark**

	Phenotype	**Genotype**
Father		
Mother		

b. Draw a Punnett square in the space provided, showing the possible genotypes of the offspring for this family. **2 marks**



c. Explain the term co-dominance by referring to blood type alleles. **1 mark**

_____

_____

_____

_____

Blood typing is usually performed using anti-A antibodies and anti-B antibodies.
Observations are made when blood is mixed with the antibodies.

d. Explain what observations would be necessary to conclude that the blood of a person was type A. **1 mark**

_____

_____

_____

_____

Question 8 (5 marks)

mRNA CODE FOR AMINO ACIDS							
UUU	Phe	UCU	Ser	UAU	Tyr	UGU	Cys
UUC	Phe	UCC	Ser	UAC	Tyr	UGC	Cys
		UCA	Ser				
		UCG	Ser				
UUA	Leu			UAA	STOP	UGA	STOP
UUG	Leu			UAG	STOP	UGG	Trp
CUU	Leu	CCU	Pro	CAU	His	CGU	Arg
CUC	Leu	CCC	Pro	CAC	His	CGC	Arg
CUA	Leu	CCA	Pro	CAA	Gln	CGA	Arg
CUG	Leu	CCG	Pro	CAG	Gln	CGG	Arg
AUU	Ile	ACU	Thr	AAU	Asn	AGU	Ser
AUC	Ile	ACC	Thr	AAC	Asn	AGC	Ser
AUA	Ile	ACA	Thr	AAA	Lys	AGA	Arg
AUG	START/ Met	ACG	Thr	AAG	Lys	AGG	Arg
GUU	Val	GCU	Ala	GAU	Asp	GGU	Gly
GUC	Val	GCC	Ala	GAC	Asp	GGC	Gly
GUA	Val	GCA	Ala	GAA	Glu	GGA	Gly
GUG	Val	GCG	Ala	GAG	Glu	GGG	Gly

AMINO ACIDS	
Ala	Alanine
Arg	Arginine
Asn	Asparagine
Asp	Aspartate
Cys	Cysteine
Gln	Glutamine
Glu	Glutamate
Gly	Glycine
His	Histidine
Ile	Isoleucine
Leu	Leucine
Lys	Lysine
Met	Methionine
Phe	Phenylalanine
Pro	Proline
Ser	Serine
Thr	Threonine
Trp	Tryptophan
Tyr	Tyrosine
Val	Valine

Table 4

A peptide was found in the cytosol of a cell. It consisted of 3 amino acids: cysteine, phenylalanine and tyrosine.

a. Use **Table 4** to work out the order of bases in the DNA template strand that coded for the peptide. It was known that that section of DNA did not contain the base guanine. Include a START codon in the base sequence followed by the DNA codons for cysteine, phenylalanine and tyrosine. **1 mark**

_____

_____

b. The DNA segment that coded for the peptide was not an intron. What is an intron? **1 mark**

_____

_____

_____

c. In protein synthesis, explain why single base mutations that add or delete a base usually have a greater effect than a single base substitution. **2 marks**

_____

_____

_____

_____

_____

d. X-rays, ultra-violet radiation, nuclear radiation and certain chemical substances can cause mutations. What general term is given to agents that can cause mutations? **1 mark**

_____

Question 9 (6 marks)

DNA profiling often uses short tandem repeats (STRs) in DNA. **Table 5** shows some examples of STRs used in DNA profiling in Australia.

Locus	Number of repeats within STR	Number of alleles
1	8-12	5
2	10-25	16
3	12-51	40
4	7-19	13

Table 5

Hinda is a girl whose DNA was analysed for these STRs. One of her STRs is shown here within a section of DNA.

GTAGATTGCTTGCTTGCTTGCTTGCTTGCATAAGAT.

a. How many repeats are shown in the STR above? **1 mark**

_____

The scientist creating Hinda's DNA profile used restriction enzymes which resulted in DNA fragments with sticky ends.

b. In the box provided, sketch a fragment of DNA with sticky ends. **1 mark**

The scientist was interested only in the fragment that contained the locus of the STR. He created a probe to identify the fragment.

c. What are two ways that a probe can identify a particular fragment of DNA? **2 marks**

_____

_____

_____

The probe successfully identified the fragment containing the locus with the STR. The fragments were separated using electrophoresis. The graph of the data is shown in **Figure 11**.

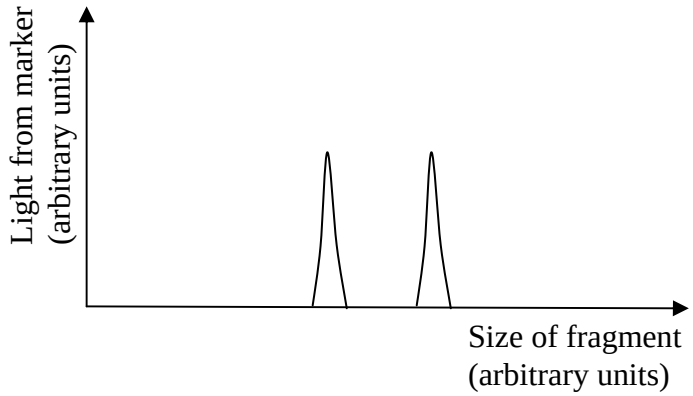


Figure 11

d. Explain why Hinda's DNA profile shows two peaks for her STR locus. **1 mark**

_____

_____

_____

Approximately 2 million Australians have the same profile as Hinda as shown in the graph.
One purpose of DNA profiling is to match a sample of DNA to only one specific person.

e. How is DNA profiling actually performed to match only one person in Australia to a sample of DNA? **1 mark**

_____

_____

_____

_____

_____

Question 10 (6 marks)

Some farmers include antibiotics in the food of their animals to maximise their profits. This controversial practice promotes faster growth and quickly stops diseases that may be caused by poor quality food and overcrowded conditions.

Some scientists have argued that this practice puts antibiotics into the general environment and results in antibiotic resistance of bacteria. Antibiotic resistance puts human lives at risk and adds to health care costs.

Darwin and Wallace suggested natural selection, as the process whereby species change. The mechanism involved three steps.

a. In terms of the three steps of natural selection, explain how the farmers' use of antibiotics can result in antibiotic resistance of bacteria. **3 marks**

_____

_____

_____

_____

_____

_____

_____

b. Explain how evolutionary change in bacteria may occur quickly, but in other species evolutionary change may occur slowly. **1 mark**

_____

_____

_____

_____

c. Small populations of organisms may gain or lose favourable alleles because of genetic drift. Explain how genetic drift is different to natural selection. **2 marks**

_____

_____

_____

_____

_____

Question 11 (6 marks)

Figure 12 shows two cladograms. Each cladogram shows the evolutionary relationships of a number of different species up to the present time. The two groups have evolved independently from different ancestral forms.

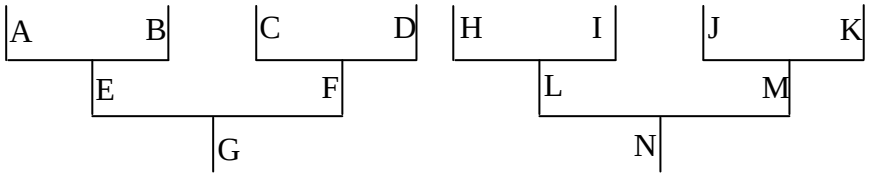


Figure 12

a. Species D and species H have evolved to have similar structural features. What biological term is used to describe the evolutionary relationship between species D and species H? **1 mark**

_____

_____

b. Explain how unrelated species can end up with similar characteristics. **1 mark**

_____

_____

_____

_____

c. Explain why species J and K are more closely related than species J and I. **1 mark**

_____

_____

_____

_____

d. Different theories exist of the speed of evolution. Explain the difference between "gradualism" and "punctuated equilibrium" theories. **2 marks**

_____

_____

_____

_____

_____

e. What term is used to describe the process of change in species when humans select the traits that they think are desirable? **1 mark**

_____

Question 12 (5 marks)

Paranthropus boisei lived 2 million years ago in Africa. **Figure 13** shows a diagram of the skull of *P. boisei* as seen from above. The diagram shows the zygomatic arches (cheek bones), the skull crest and eye brow ridges. Compared to *Australopithecus africanus*, the zygomatic arches, skull crest and eye brow ridges of *P. boisei* are much larger.

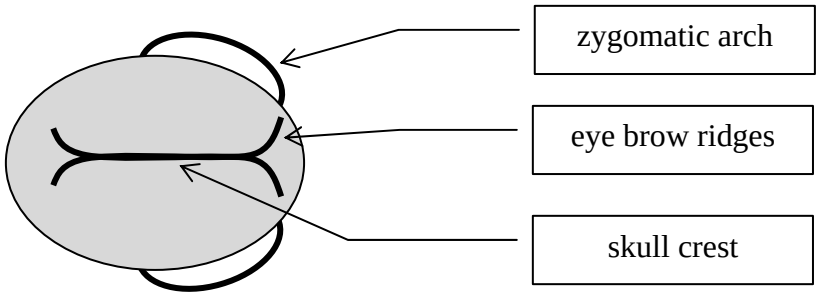


Figure 13

a. What inference can be made about the diet of *P. boisei* compared to *A. africanus*? Justify your inference. **2 marks**

_____

_____

_____

_____

_____

_____

b. It is generally believed that humans evolved in Africa. What evidence is there that humans evolved in Africa? **1 mark**

_____

_____

_____

_____

c. The evolutionary pathway of hominins is not clear. Why? **1 mark**

_____

_____

_____

_____

_____

d. Name the evolutionary factor that has had a significant impact on humans since the emergence of *Homo sapiens*. **1 mark**

_____

End of Section B

End of Trial Exam

Suggested Answers

VCE Biology 2013 Year 12 Trial Exam Unit 3/4

SECTION A – Multiple Choice Answers

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

SECTION B – Short Answer (Answers)

Question 1

a. When the impulse reaches the end of the axon, vesicles release a neurotransmitter which diffuses across the synaptic gap **(1 mark)**. The neurotransmitter reacts with membrane receptors in the next neuron, resulting in a nerve impulse **(1 mark)**.

b. The inside of a membrane of a resting neuron is negatively charged. During the passage of a nerve impulse, the inside of the cell membrane momentarily becomes positively charged **(1 mark)**. This occurs as a result of positive ions moving into the neuron. After the impulse has passed, the original distribution of ions is restored **(1 mark)**.

c. The nervous system can distinguish stimuli of different strengths by the frequency of the impulses travelling along a neuron **(1 mark)** or the number of neurons stimulated **(1 mark)**. An individual nerve impulse can only be one size, regardless of the strength of the stimulus.

Question 2

a. Each enzyme is substrate specific, only reacting with one particular substrate **(1 mark)**. The particular 3D shape of sucrose means that it cannot fit the active site on the enzyme lactase **(1 mark)**.

b. Enzymes are not consumed by a reaction and can be reused. After the lactase has broken down a lactose molecule, the lactase can be reused many times, and thus only a small amount is needed **(1 mark)**.

c. The optimal pH of lactase is 6. If the pH were reduced to 2, the shape of the active site would be altered **(1 mark)** and the active site would not fit the lactose molecules as well, reducing its efficiency **(1 mark)**.

d. The ibuprofen interferes with the normal substrate-enzyme reaction and inhibits the production of prostaglandins **(1 mark)**. With less or no prostaglandins being produced, the result is that there is both inflammation and pain relief **(1 mark)**.

Question 3

a. Green light is reflected **(1 mark)** which is why green plants look green.

b. Oxygen **(1 mark)**.

c. In the light-independent stage, carbon dioxide is converted to glucose **(1 mark)**. This process requires hydrogen and ATP, both of which are derived from the light-dependent reaction **(1 mark)**.

d. As the experiment provides unlimited light, the rate of photosynthesis is limited by the supply of carbon dioxide, the supply of water and the amount of chlorophyll (**2 marks** for all three, **1 mark** for two, otherwise **0 marks**).

Question 4

a. $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_20$ (inclusion of 36ATP in products is optional) **(1 mark)**.

b. Glycolysis, Krebs cycle (or citric acid cycle), electron transport (**2 marks** for three stages, **1 mark** for 2 stages, otherwise **0 marks**).

c. Anaerobic respiration results in lactic acid in muscle cells **(1 mark)** and results in carbon dioxide and alcohol in yeast cells **(1 mark)**.

d. The presence of different enzymes causes the different reactions **(1 mark)**.

Question 5

a. An organism able to cause a disease in another organism **(1 mark)**.

b. A virus consists of genetic material (DNA or RNA) surrounded by a protein coat **(1 mark)**.

c. A virus reproduces by injecting its genetic material into a host cell. This results in the host cell being reprogrammed to produce new viruses **(1 mark)**.

d. A vaccine contains the antigens of the pathogen. The antigen meets up with a B cell that has a matching or complementary immunoglobulin. This B cell reproduces rapidly and these new plasma cells produce antibodies **(1 mark)**. Some of the new B cells become B-memory cells, which can survive for many years. Immunity occurs when the B-memory cells provide a rapid response to any future infection and destroy the pathogens before illness occurs **(1 mark)**.

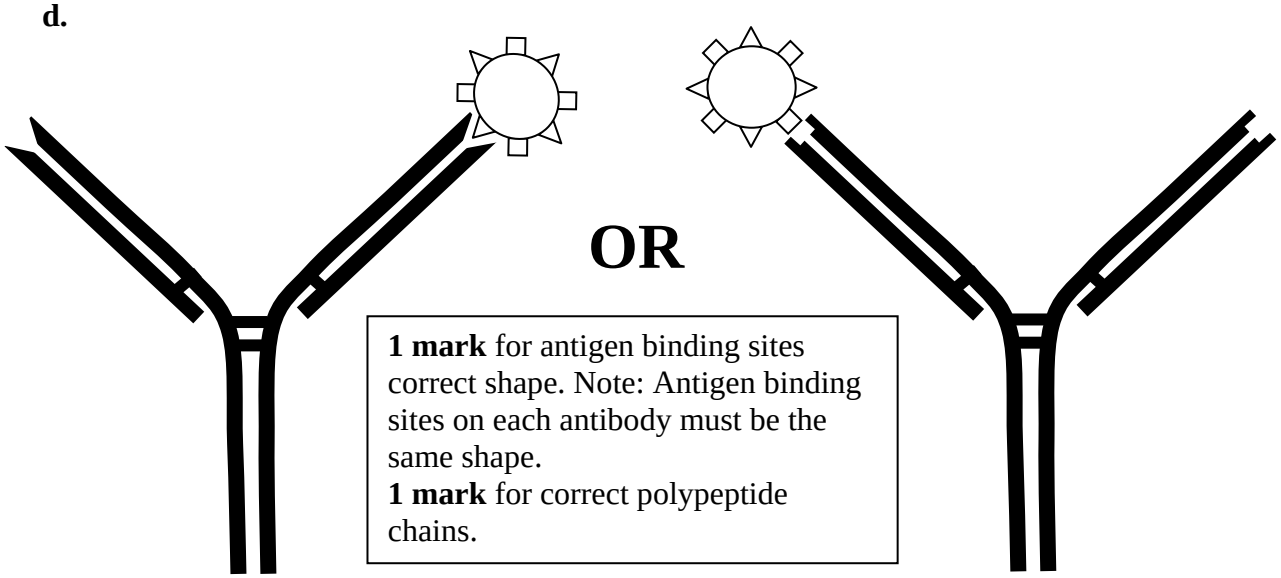
Question 6

a. One of: skin provides a physical barrier, mucus membranes trap the bacteria and the mucus moves them to safer places, natural secretions contain bactericidal agents, natural flora compete with the pathogens for space and nutrients (**1 mark** for defence mechanism, **1 mark** for explanation).

b. Azithromycin produces a larger zone of inhibition (18 and 23 mm), indicating a greater ability to inhibit growth in both of the bacteria **(1 mark**, need both antibiotic and explanation**)**.

c. The first infection results in the primary antibody response, and includes the time it takes for the B cells to divide and produce plasma cells which can produce the correct antibodies against *Legionella micdadei* **(1 mark)**. The second infection results in the much quicker secondary antibody response, because some of the cloned B cells form B-memory cells. B-memory cells last for many years and provide a ready response to *Legionella micdadei* **(1 mark)**.

d.



OR

1 mark for antigen binding sites correct shape. Note: Antigen binding sites on each antibody must be the same shape.
1 mark for correct polypeptide chains.

Question 7

a.

	Phenotype	**Genotype**
Father	Type A	I^Ai
Mother	Type B	I^Bi

Note: Parents may be reversed.

(1 mark)

b.

	I^A	i
I^B	I^AI^B	I^Bi
i	I^Bi	ii

1 mark for correct setting out, **1 mark** for correct genotypes.

c. The alleles I^A and I^B are said to be co-dominant because when they are both present, the alleles are both fully expressed **(1 mark)**.

d. Agglutination would occur with anti-A antibodies but not with anti-B antibodies **(1 mark)**.

Question 8

a. TAC ACA AAA ATA **(1 mark)**.

b. An intron in a non-coding section of DNA. It is not translated **(1 mark)**.

c. A single base substitution affects only one codon and a maximum of one amino acid **(1 mark)**. An addition or deletion of a base may affect all codons and the order of amino acids "downstream" of the mutation **(1 mark)**.

d. Mutagens **(1 mark)**.

Question 9

a. TTGC is repeated six times **(1 mark)**.

b.

(1 mark).

c. Probes can contain a section that is fluorescent **(1 mark)** or radioactive **(1 mark)**.

d. Hinda is heterozygous at that locus and the two alleles contain different numbers of repeating units. The two different sized alleles separate out during electrophoresis **(1 mark)**.

e. As the number of different STRs used is increased, the discriminating power of DNA profiling increases. If 20 STRs are used, 40 peaks may be generated. The chances of another person having the same 40 peak positions is very small indeed **(1 mark)**.

Question 10

a. Step 1: Because of their genotype, some of the bacteria are susceptible to the antibiotics and some are resistant **(1 mark)**. Step 2: The antibiotics kill the susceptible bacteria but leave the resistant bacteria **(1 mark)**. Step 3: The resistant bacteria reproduce and the subsequent generations all contain the allele for antibiotic resistance **(1 mark)**.

b. Each generation can undergo some evolutionary change. The time between generations affects the rate of evolutionary change. In the time it takes for a plant or animal to produce one new generation with a small amount of change, bacteria have reproduced millions of times with a potential significant change **(1 mark)**.

c. Genetic drift is the change in a population caused by random events and is more pronounced in smaller populations **(1 mark)**. In natural selection, the environment selects particular individuals according to their suitability to fit into the environment **(1 mark)**.

Question 11

a. Convergent evolution or adaptive convergence **(1 mark)**.

b. Similarities occur because of similar selection pressures in a given habitat **(1 mark)**.

c. Species J and K are more closely related than species J and K because they have a more recent common ancestor **(1 mark)**.

d. Gradualism suggests that evolutionary change is slow and continuous **(1 mark)**. Punctuated equilibrium (punk ekk) suggests that evolutionary change within a species occurs in rapid bursts with periods of little change in between **(1 mark)**.

e. Artificial selection **(1 mark)**.

Question 12

a. Compared to *Australopithecus africanus*, *Paranthropus boisei* has larger zygomatic arches and larger ridges on the skull. The ridges on the skull indicate larger surface area for muscle attachment and the larger zygomatic arches leave more room for larger muscles to pass underneath. These muscles are used in chewing and so the diet probably consisted of hard objects or objects that needed forceful chewing to break it down. In contrast, *A. africanus* may have eaten softer fruit and leaves (**1 mark** for difference in diet, **1 mark** for justification including muscles).

b. All early hominin (australopithecine) fossils have been found in Africa **(1 mark)**.

c. The fossil record of hominins is incomplete. This is because the early humans lived in habitats where dead remains did not readily form fossils **(1 mark)**.

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

End of Suggested Answers