

Trial Examination 2017

VCE Biology Units 1&2

Written Examination

Suggested Solutions

SECTION A – MULTIPLE-CHOICE QUESTIONS

1	<input type="checkbox"/> A	<input checked="" type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
2	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input checked="" type="checkbox"/> D
3	<input type="checkbox"/> A	<input type="checkbox"/> B	<input checked="" type="checkbox"/> C	<input type="checkbox"/> D
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9	<input type="checkbox"/> A	<input type="checkbox"/> B	<input checked="" type="checkbox"/> C	<input type="checkbox"/> D
10	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input checked="" type="checkbox"/> D
11	<input type="checkbox"/> A	<input checked="" type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
12	<input type="checkbox"/> A	<input checked="" type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
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28	<input checked="" type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
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38	<input type="checkbox"/> A	<input type="checkbox"/> B	<input checked="" type="checkbox"/> C	<input type="checkbox"/> D
39	<input checked="" type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
40	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input checked="" type="checkbox"/> D

Question 1 B

Vesicles bud off from the Golgi body to transfer the mucus glycoprotein to the plasma membrane for secretion. Ribosomes are involved in synthesis of protein, not secretion, so not **A**.

Question 2 D

The mucus glycoprotein is exiting out of the cells and is too large to pass through the plasma membrane, so the process must be exocytosis.

Question 3 C

The tissue fluid bathes all of the body cells and forms a very important part of the internal environment. Mucus and stomach fluid are in the external environment and cytosol is inside the cells, not surrounding them.

Question 4 C

The folded surface facing the inside of the stomach is a structural feature that increases surface area for mucus secretion out of the cells, not into the cells, so not **A**. The word adaptation is incorrectly spelt, therefore the answer cannot be **A** or **D**.

Question 5 C

A and **B** are correct statements, but cannot be deduced from the information in the diagram. The pH values on the diagram indicate the stomach fluid is very acidic so the cells would need the protective barrier of the mucus.

Question 6 A

Alcohol is lipid soluble so would readily pass through the phospholipid bilayer, not the protein channels. It would pass by diffusion from a higher concentration in the stomach fluid into the lower blood concentration.

Question 7 D

The hydrophilic ('water-loving') part of the membrane is important on the inside of cells as it faces the cytosol. It is important on the outside of the cell as it faces the external environment and needs to be moist for exchange of substances.

Question 8 C

The diagram shows only one of the phospholipid molecules, not the entire phospholipid bilayer. It consists of 1 glycerol/phosphate and 2 fatty acids, so **B** and **D** are incorrect as a triglyceride has 1 glycerol and 3 fatty acids.

Question 9 C

Both plant eukaryotic cells and bacterial prokaryotic cells have a cell wall and membrane, and must contain ribosomes (not surrounded by membrane) to be able to synthesise proteins. No nucleolus would be present in cyanobacterial cells as they have no nucleus.

Question 10 D

Green leaf cells can make their own complex organic molecules from simple inorganic molecules and are therefore classified as autotrophic. As they use light energy, not energy from chemical reactions, they carry out photosynthesis, not chemosynthesis.

Question 11 B

Two of the steps in aerobic cellular respiration occur in the mitochondria. As cyanobacteria are prokaryotic cells and have no mitochondria, they cannot carry out aerobic cellular respiration.

Question 12 B

Green leaf cells would carry out photosynthesis during the day in the presence of light, but would also carry out cellular respiration all of the time (day and night) to obtain energy for cell use from glucose breakdown.

Question 13 A

The kangaroos benefit from the shade of the trees to keep them cooler and therefore reduce heat gain and water loss. Furthermore, the trees benefit from the extra mineral nutrients from the faeces. As both organisms benefit from each other, this is called mutualism.

Question 14 D

The kangaroos are benefiting from acting in this way due to a feature of their behaviour, not from a structural or functional/physiological feature.

Question 15 B

Although **A** and **D** would contribute to heat loss from the kangaroo, most of the heat loss would be by evaporative cooling. This would occur when the saliva from licking changes from liquid water to water vapour using the kangaroo's body heat, as mentioned in the information at the start of the question.

Question 16 C

Although it is an example of homeostasis, this thermoregulation process is specifically called homeothermy. This is because the internal temperature of the kangaroo will be maintained relatively constant within a very narrow range, fluctuating around an optimum temperature.

Question 17 B

Foreleg blood vessels do not move/migrate in the skin, but dilate/expand in response to higher body temperature. This vasodilation will bring more blood nearer the surface so more heat is lost by conduction and radiation. **C** and **D** would increase, not decrease.

Question 18 A

B, **C** and **D** have all occurred in the last 200 years and had a major impact on mammalian extinction, and it has been a lack of planning and land management (**A**) that has contributed to each.

Question 19 B

The question information indicates that predation, especially by dingoes and foxes, has contributed drastically to the reduction in bilby population size. Monitor lizards do not compete, but rather eat bilbies, so **A** is incorrect.

Question 20 D

If the burning worked to provide more food for bilbies when Indigenous Australians lit fires, then regulated burns in arid grasslands today would be the most successful strategy. Furthermore, the other three alternatives are impossible or unreasonable.

Question 21 C

Bacteria are prokaryotes with no distinct nucleus; therefore they do not carry out mitosis and have no cell cycle. The other three cell types are eukaryotes and their dividing cells do go through the cell cycle.

Question 22 B

As they are prokaryotes, bacteria will have no membrane-bound organelles, including centrioles. Binary fission is a rapid process often resulting in slightly genetically different cells, but overall the daughter cells show little genetic diversity, so **A**, **C** and **D** are incorrect.

Question 23 D

Z shows the production of haploid (n) spores from a diploid ($2n$) cell; therefore it must involve meiosis. Budding is shown by the fungus yeast, X is asexual reproduction and Y is sexual reproduction.

Question 24 A

Dispersal by wind or animals will spread the spores, so **A** is correct. This may lead to an increase in species diversity. **C** is incorrect and **D** is unrelated to the information given.

Question 25 C

The diagram shows the homologous chromosomes paired up. This only occurs in meiosis, the process occurring in the mature testis of a male fly. All the other choices involve mitosis.

Question 26 A

Homologous chromosomes pair up in prophase 1 of meiosis. If the diagram showed metaphase 1 of meiosis the chromosomes would be lined up across the middle of the cell, and if metaphase 2 of meiosis were shown, they would be single-stranded, not double.

Question 27 B

DNA replication occurs before meiosis begins, so it cannot be point W, as the amount of DNA is still increasing. Once division 1 of meiosis begins, the amount of DNA will stay the same in the cell until it divides into two cells, so point X would correspond to the amount of DNA in the cell shown.

Question 28 A

At the end of meiosis the daughter cell will contain one of each type of chromosome from the parent cell. This is shown in cell diagram A. All the other choices have two of at least one type of chromosome, which is incorrect.

Question 29 D

A is incorrect as gametes are not produced in mitosis. **B** happens in prophase 1, not prophase 2. Homologous pairs separate in anaphase 1, so **C** is incorrect. Fusion of two gametes from two different parents at random would result in offspring with unique characteristics (except for identical twins) due to different combinations of alleles of the genes.

Question 30 C

X-rays, ultraviolet and gamma radiation can all cause changes in DNA and so are called mutagens. White light is the visible light used for sight and photosynthesis, and is certainly not mutagenic.

Question 31 B

Chromosomal DNA controls the structure and functioning of the cell, so if it is altered it could result in cells dividing rapidly, or not undergoing cell death. This in turn could result in cancer. Changes to structures in **A**, **C** or **D** would not cause cancer.

Question 32 D

If the germ cell layers did not differentiate correctly in the embryo due to the effect of thalidomide, this could result in severe abnormalities in the developing baby.

Question 33 B

The genome is not defined in terms of chromosome or autosome number, so **A**, **C** and **D** are incorrect. It is defined in terms of base pairs, not individual bases, and in a haploid set of chromosomes. **B** is the correct answer.

Question 34 D

As there is no Y chromosome the person would be female. However, a female should have two X chromosomes and this karyotype only shows one. This is indicative of a female with Turner's syndrome.

Question 35 B

Epigenetic factors are compounds that attach to or 'mark' DNA. They interact with DNA but do not alter the underlying DNA sequence, or number or type of genes.

Question 36 A

A test cross is a cross between an individual which displays the dominant trait(s) crossed with an individual that is homozygous for the recessive trait(s). The only correct alternative is **A**.

Question 37 D

If genes are linked the expected ratio is < 1 recombinant offspring : 1 parental offspring : 1 parental offspring : < 1 recombinant offspring, so **D** is the correct answer. **A** and **B** are incorrect ratios and **C** is the ratio for genes that are not linked.

Question 38 **C**

The Y chromosome is small but has mostly genes for secondary sexual characteristics. Y-linked genes and diseases are rare, and Y-linked genes are passed on to all sons. As the Y chromosome has no pair/homologue, there can be no crossing over and recombination, so **C** is correct.

Question 39 **A**

Decoding genes is carried out by determining the sequence of bases of one strand of the DNA and is called DNA sequencing.

Question 40 **D**

DNA is a universal molecule and has the same basic structure of nucleotides with four different bases in all living organisms. This means that tomatoes and humans would have the same DNA structure in all their chromosomes. Tomatoes would not be more complex, nor would they have more proteins or more DNA in their cells than humans. Even though they may have more genes, these genes may be smaller and code for fewer proteins.

SECTION B**Question 1** (7 marks)

- a.** cell type X: chromosomes in cell separating to each end of cell 1 mark
 cell type Y: extension or 'root hair' elongation of cell 1 mark
- b.** **i.** tissue 1 mark
ii. xylem 1 mark
iii. *Any one of:*
- Cells of region S are living, whereas cells of region R are dead.
 - Cells of region S are empty/hollow, whereas cells of region R have cell contents/cytoplasm/nucleus.
 - Cells of region S have thickened walls, whereas cells of region R have a thin cellulose cell wall.
- Or any other reasonable answer* 1 mark
- c.** **i.** active transport 1 mark
ii. *Any one of:*
- protein channels/carriers in the plasma membrane: for sodium ions to attach to in order to aid in their movement against the concentration gradient into the cell
 - mitochondria: to provide energy in the form of ATP for the active process to occur
- 1 mark

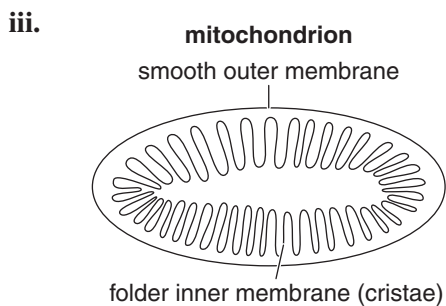
Question 2 (7 marks)

- a.** *For example:*
 If rhubarb cells are placed in sucrose solutions of 2 M or more, then they will begin to plasmolyse. 1 mark
- Note: Any appropriate hypothesis is acceptable.*
- b.** **i.** The independent variable is the different concentrations of sucrose solution used. 1 mark
ii. *Any one of:*
- A range of different sucrose solutions were used.
 - All pieces of rhubarb were taken from the same piece of epidermal peel.
 - Several pieces of rhubarb were placed in each sucrose solution.
 - Pieces of peel were left in solutions for the same length of time.
- Or any other reasonable answer* 1 mark
- c.** **i.** Plasmolysis does not occur in solutions isotonic to the cell sap, as the concentration of the solutions both inside and outside the cells are the same. Therefore, water movement occurs equally in both directions, so no shrinkage of the cell sap will occur; that is, no plasmolysis. 1 mark
ii. Plasmolysis does not occur in solutions hypotonic to the cell sap as water moves into the cell from a higher water concentration outside the cell. Therefore, the cell sap will swell slightly, pushing against the cell wall; that is, it will not plasmolyse. 1 mark

- d.** 1.1–1.2 M sucrose solution (not 1 M as no plasmolysis had occurred) 1 mark
- e.** No, plasmolysis cannot occur in animal cells because when water moves out of the cells, the entire cell shrinks, as animal cells are surrounded by a cell membrane only and no cell wall. 1 mark

Question 3 (8 marks)

- a. i.** *Any one of:*
- carbon dioxide
 - ATP
 - water
- 1 mark
- ii.** $C_6H_{12}O_6 + 6O_2 + 36 \text{ or } 38ADP + 36 \text{ or } 38P_i \rightarrow 6CO_2 + 6H_2O + 36 \text{ or } 38ATP$ 2 marks



2 marks

- b.** *Any one of:*
- lower concentration of ATP
 - lower concentration of carbon dioxide
 - lower concentration of water
 - higher concentration of lactic acid
- 1 mark
- c.** disagree 1 mark
- All the systems of the body are interdependent and work together to maintain body functioning. In this example, the muscle cell would require inputs for cellular respiration and would need to remove waste. These would be transported in the circulatory system to and from the digestive, respiratory and excretory systems. All of this would be coordinated and regulated by the nervous and endocrine systems. 1 mark

Question 4 (5 marks)

- a.** The internal environment is made up of the tissue fluid (extracellular) bathing the cells of the body. 1 mark
- b. i.** The effector is the thyroid gland. 1 mark
- ii.** *Any one of:*
- increased heart rate
 - increased cell metabolism
 - higher body temperature
- 1 mark

- c. In a person with Grave's disease, this would be called negative feedback, as the response produced reduces the size of the original stimulus 1 mark
- In this case, an increased production of thyroid hormones will result in even greater inhibition of the hypothalamus and pituitary glands. 1 mark

Question 5 (6 marks)

- a. the sun 1 mark
- b. The arrows point in the direction of energy flow in the food web. 1 mark
- c. There may be a number of different food chains in the food web that lead to the killer whale as a top order consumer. 1 mark

For example:

In the food chain: Phytoplankton → krill → adelic penguin → killer whale;
the killer whale is a third order consumer.

In the food chain: Phytoplankton → herbivorous plankton →
carnivorous plankton → fish → emperor penguin → leopard seal → killer whale;
the killer whale is a sixth order consumer.

1 mark

Note: There are many different food chains ending with the killer whale from which students could select two in support of their answer.

- d. i. Massive reduction in whale numbers could upset the balance of the ecosystem. Seal numbers could increase markedly, leading to a decrease in penguin numbers. 1 mark
- ii. An effective strategy that was probably introduced would have been strict control measures to limit the number of Sei whales that could be caught annually. This would allow greater numbers to survive and reproduce increasing the size of the Sei whale populations. 1 mark

Question 6 (7 marks)

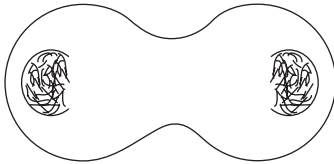
- a. This is called parasitism as it is a relationship in which one organism lives in or on another and benefits (the bacteria living on the shark's skin and gaining nutrients) while the other organism (the shark) is harmed. 1 mark
- b. biomimicry 1 mark
- c. i. binomial system of nomenclature 1 mark
- ii. they all belong to the same genus 1 mark
- d. i. free in the cytosol of the cell 1 mark
- ii. A and C 1 mark
- They both belong to the same genus and would therefore be more closely related and have more similar DNA in the sodA gene which was analysed. 1 mark

Question 7 (7 marks)

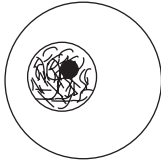
- a. i. chromosomes attached along centre/equator of cell 1 mark



- ii. cell membrane squeezing in to divide cell into two 1 mark



- iii. no chromosomes visible, just chromatin mass inside nuclear membrane 1 mark



- b. If it was a plant cell it would have a rigid cell wall, so could not divide into two cells by constriction. Instead, a new cell wall would be laid down across the middle, dividing the cell into two smaller new cells. 1 mark

c.

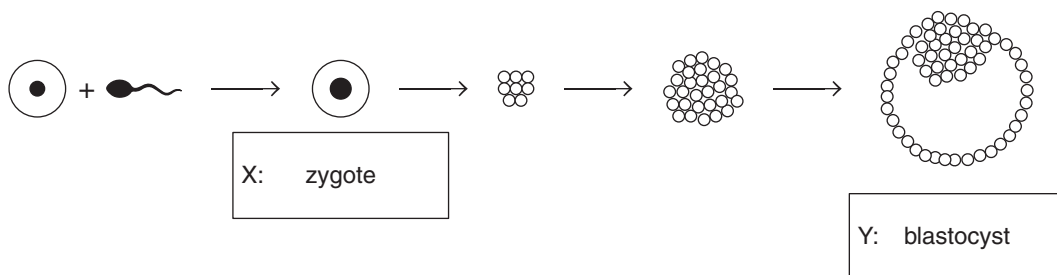
Chemical substance and its effect	Letter representing stage affected by substance	Result in the cell
colchicine prevents spindle formation	P	Chromosomes would be scattered in the cell and no spindle network would be present.
methotrexate prevents successful DNA replication	S	Chromosomes would not be replicated as DNA replication is inhibited.

2 marks

- d. These other drugs also inhibit DNA replication or mitosis, so no production of new cells at a rapid, uncontrolled rate would occur. Therefore there would be no excess cells causing cancer. 1 mark

Question 8 (8 marks)

- a.



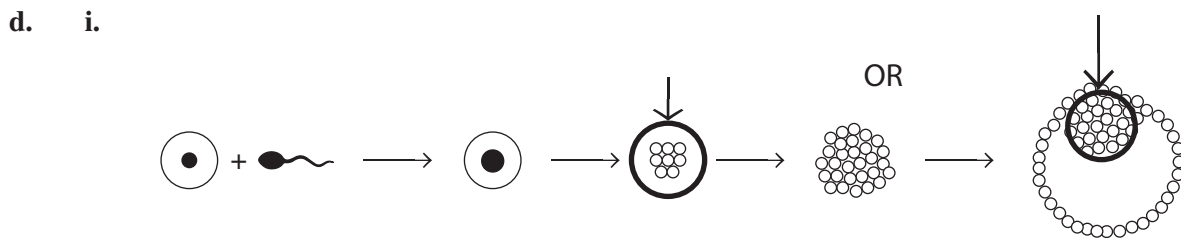
2 marks

b.

Name of germ layer	Some of the tissues and/or organs the germ layer will form
mesoderm	muscle, bone, blood, cartilage
ectoderm	skin, epidermis, hair, nails, teeth enamel
endoderm	lining of gut, bladder, lungs, liver, pancreas

1 mark

- c.**
- i.** eight weeks after the embryo stage **OR** ten weeks after conception 1 mark
 - ii.** General body form has been developed and the basic plan of organ systems is in place. The liver, brain and kidneys start forming. 1 mark



1 mark

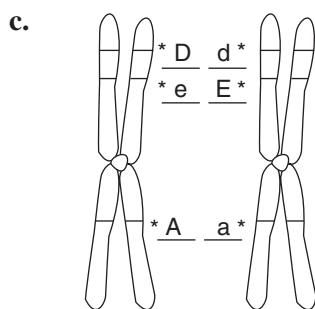
- ii.** The most significant ethical issue is the source of the embryonic stem cells, either from frozen discarded embryos or the inner mass of the blastocyst. In either case it requires destroying the embryo and to some people this is thought to be destroying life. 1 mark
- iii.** A major disadvantage is that embryonic cells are genetically different to the patient's cells and will most likely be recognised as 'non-self', and rejected by the patient's body. If they were from the patient themselves, this probably would not happen. 1 mark

Question 9 (7 marks)

- a.** autosomes / sex chromosomes / somatic chromosomes

As these chromosomes show a homologous pair of chromosome 1, they cannot be sex chromosomes. Also, sex chromosomes are not numbered. 1 mark

- b.**
- i.** a pair of homologous chromosomes 1 mark
as they are similar in size, shape and structure, and most importantly they have the same gene loci 1 mark
 - ii.** four chromatids 1 mark



1 mark

d. parents: Dd × dd

gametes:

	D	d
d	Dd	dd
d	Dd	dd

offspring: 50% chance of their second child being rhesus positive.

1 mark

1 mark

Question 10 (9 marks)

a. i. If Marfan syndrome was a dominant sex-linked trait, all the daughters of a male with Marfan syndrome would also have it. This is not so in this pedigree, as father I-2 has two unaffected daughters, II-3 and II-9, and father II-8 has one unaffected daughter, III-13.

1 mark

ii. Autosomal means the gene (in this case, for Marfan syndrome) is located on a non-sex chromosome.

1 mark

b. i. M = Marfan syndrome, m = non-Marfan syndrome

The genotype of father 2 would be Mm.

1 mark

ii. Father 1 could not be referred to as a carrier as Marfan syndrome is inherited as a dominant trait, so the presence of one allele for Marfan syndrome means the individual will show the trait.

1 mark

c. i. parent 7: mm × parent 8: Mm

gametes:

	M	m
m	Mm	mm
m	Mm	mm

1 mark

The chance of the next child having Marfan syndrome is 50%.

1 mark

ii. DNA sequencing test

1 mark

If the test was positive, it would show a change in the DNA (base sequence) of the FBH1 gene in the chromosomal DNA of the embryo.

1 mark

iii. *Any one of:*

- moral, religious and cultural beliefs if testing resulted in termination of the pregnancy
- inappropriate use of such testing for sex selection by parents, or choice of embryo for specific characteristics or enhancement
- ownership of the DNA sequencing results and availability if stored in DNA databases to employers or insurance companies, for example
- any other reasonable issue resulting from the use of DNA sequencing testing

1 mark

Question 11 (9 marks)

a. The Manx trait is dominant, as when pairs of Manx cats were mated they produced some long-tailed kittens. Therefore the long-tail trait is recessive to the dominant Manx trait. 1 mark

b. monogenic 1 mark

c. i. $b'b' DD$ or $b'b' Dd$ 2 marks

Note: Award 1 mark if only one correct genotype is given.

ii. parents: $BbDd \times bbDd$

gametes:		BD	Bd	bD	bd
	bD	BdDD	BbDd	bbDD	bbDd
	bd	BbDd	Bbdd	bbDd	bbdd
	bD	BdDD	BbDd	bbDD	bbDd
	bd	BbDd	Bbdd	bbDd	bbdd

2 marks

phenotypic ratio in offspring: 3 black : 3 chocolate : 1 blue : 1 lilac

1 mark

d. As the gene for red-based colours is on the X chromosome, a male can only have two genotypes, as he has only one X chromosome, so will either have the genotype X^0Y or $X^{0'}Y$. 1 mark

A female has two X chromosomes, so a female can have three genotypes: X^0X^0 or $X^0X^{0'}$ or $X^{0'}X^{0'}$.

1 mark