



Units 3 and 4 Biology

Practice Exam Solutions

Stop!

Don't look at these solutions until you have attempted the exam.

Any questions?

Check the Engage website for updated solutions, then email practiceexams@ee.org.au.

Section A – Multiple-choice questions

Question 1

The correct answer is B.

Question 2

The correct answer is A.

Question 3

The correct answer is A.

Apoptosis and necrosis are both forms of cellular death. However, apoptosis is cell death used for regulation whereas necrosis is a cell death that is in response to irreversible cellular damage.

Question 4

The correct answer is A.

When two monosaccharides combine they undergo a condensation reaction whereby a molecule of water is lost. Hence the chemical formula of the disaccharide is a combination of the two monosaccharides formulas minus 2 hydrogens and 1 oxygen due to the loss of water.

Question 5

The correct answer is D.

A and B are true for the primary structure of proteins, while C applies to tertiary structure.

Question 6

The correct answer is B.

Glycogen plays an energy storage role in animals, whereas cellulose plays a structural role in plant cells.

Question 7

The correct answer is B.

Amylase is an enzyme, immunoglobulins are proteins used in the humoral immune response and histones are proteins involved in the compaction of DNA. Whereas Adenine is a nitrogenous base found in DNA that is not a protein.

Question 8

The correct answer is A.

Question 9

The correct answer is B.

Question 10

The correct answer is C.

Question 11

The correct answer is B.

Question 12

The correct answer is D.

Question 13

The correct answer is C.

Question 14

The correct answer is B.

Question 15

The correct answer is C.

Options A and D are characteristic of the endocrine system.

Question 16

The correct answer is B.

When the person has not eaten for several hours their blood glucose levels will decline resulting in the production of cortisol. Cortisol has a negative feedback mechanism in response to its production, resulting in the inhibition of the hypothalamus. The hypothalamus produces CRH, so when cortisol levels are high less CRH is produced due to the inhibition.

Question 17

The correct answer is B.

Question 18

The correct answer is A.

The parasympathetic division of the nervous system is colloquially known as the “rest and digest” system. Meaning that whilst a person is sleeping the parasympathetic nervous system predominates.

Question 19

The correct answer is A.

Vasodilation occurs in the inflammatory response to bring extra blood into the site of injury, so phagocytes and chemical mediators can work at the site of injury. Option B is another second line of defence response, which may occur in conjunction to inflammation but is not strictly a part of the inflammatory response. Options C and D are concerned with the third line of defence.

Question 20

The correct answer is D.

Question 21

The correct answer is D.

Question 22

The correct answer is B.

Option B is a mechanism in the first line of defence.

Question 23

The correct answer is B.

Question 24

The correct answer is D.

Decreasing the temperature of a reaction to a temperature below optimal will reduce the enzyme's catalysing ability, but it will not permanently damage the enzyme.

Question 25

The correct answer is C.

The double stranded DNA with 200 base pairs means there is in total 400 bases. If 90 adenine bases are present there must be 90 thymine bases as well leaving 220 bases to be divided equally between cytosine and guanine which will have 110 bases in the sample each.

Question 26

The correct answer is C. Students are not expected to understand epigenetics as it is beyond the scope of VCE Biology, but there is enough information in the stem of the question that should allow students to answer the question.

Question 27

The correct answer is C. This is a dihybrid cross. Of BbEe x BbEe

	BE	Be	bE	be
BE	BBEE	BBEe	BbEE	BbEe
Be	BBEe	BBee	BbEe	Bbee
bE	BbEE	BbEe	bbEE	bbEe
be	BbEe	Bbee	bbEe	bbee

Question 28

The correct answer is A.

Question 29

The correct answer is C.

Question 30

The correct answer is D.

Question 31

The correct answer is D.

Question 32

The correct answer is C.

Question 33

The correct answer is A.

Question 34

The correct answer is B.

Question 35

The correct answer is A.

Option A represents analogous structures.

Question 36

The correct answer is A.

Question 37

The correct answer is D.

Question 38

The correct answer is B.

Mitochondrial DNA is passed on maternally, so you will have the same mitochondrial DNA as your mother and she will pass on that same mitochondrial DNA to any of your siblings.

Question 39

The correct answer is B.

Question 40

The correct answer is A.

Section B – Short-answer questions

Marks allocated are indicated by a number in square brackets, for example, [1] indicates that the line is worth one mark.

Question 1a

The cytoskeleton is a structural component of the cell used to provide the cell with support [1].

Question 1b

One of:

- Microtubules [1] are responsible for binding motor proteins that are used to transport vesicles around in the cell.
- Microfilaments/ Actin filaments [1] are involved in movement of the cell [1], modifying cell shape or rearranging organelles in the cell [1].

First mark awarded for identifying a cytoskeletal component other than intermediate filaments. Second mark awarded for a correct function of the component named (maximum of one mark). Full marks cannot be awarded if the function is correct but is not affiliated with the cytoskeletal component named or if function was described but no cytoskeletal component was named.

Question 2a

Secondary structure [1]

Question 2b

The secondary structure of a protein is maintained through hydrogen bonding between amide bonds of different amino acid residues [1]. The hydrogen bonding is between the oxygen of the carbonyl group in one residue and the hydrogen from the amino group of another residue [1].

Question 2c

Amino acid [1]

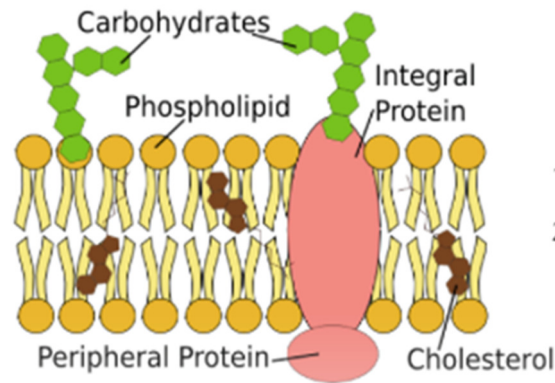
Question 2d

Free ribosomes or ribosomes on rough endoplasmic reticulum [1].

Question 3a

A diagram such as the one depicted below, that must include labels. Each bullet point represents one mark.

- Phospholipid bilayer [1]
- Proteins embedded within the bilayer [1]
- One mark for cholesterol or glycoproteins/carbohydrate groups [1] - maximum one mark.



Sample image obtained from study.com

Question 3b

Any one of:

- Diffusion [process - 1] - The net movement of particles from an area of high concentration to an area of low concentration, down a concentration gradient [description-1].

OR

- Osmosis [process - 1] – the net movement of water from an area of low solute concentration to an area of high solute concentration across a semipermeable membrane [description-1].

AND

- Bulk Transport [process - 1] – Solid or liquid particles entering the cell via the fusion of the plasma membrane.

OR

- Endocytosis [process - 1] - the plasma membrane of a cell forms a vesicle around a particle, which moves into the cytosol [description - 1].

OR

- Exocytosis [process - 1], vesicles in the cytosol join with the plasma membrane as the vesicle contents are released outside of the cell [description - 1].

Question 4ai

An autoimmune disease is one in which the body identifies some self-cells as non-self and attacks them [1]. (VCAA 2008)

Question 4aii

Major Histocompatibility Complex (MHC) markers are proteins found on most cells in an individual [1]. They are referred to as “self” markers, as they are different in all individuals, with the exception of identical twins [1].

Question 4bi

An allergy is a hypersensitive immune response to non-harmful substances (allergens) that enter or come into contact with the body [1].

Question 4bii

An allergic response begins with the detection of an allergen. When the individual becomes sensitized to the allergen, they produce IgE antibodies for a particular antigen [1]. On the next exposure, these antibodies, which are attached to mast cells, form cross links with the allergen [1]. Mast cells are activated, and release histamines [1], which cause vasodilation, and smooth muscle contraction responsible for the inflammation.

Question 4c

No, they are not the same thing. Allergies are oversensitivity reactions to foreign antigens, while autoimmune diseases are caused by the inability of an individual's immune system to recognize "self" markers on their cells.

Question 4d

Cell-mediated immunity is immunity that involves T lymphocytes that initiate a response without antibodies but rather with antigen-specific cytotoxic T cells and the release of cytokines [1]. Whereas the humoral response involves B lymphocytes and antibodies recognizing antigens that are circulating the blood and lymph [1].

Question 5a

Transcription occurs in the nucleus of the cell [1]. A DNA template is copied during transcription or RNA polymerase joins complementary nucleotides [1] to form a pre mRNA [1].

Description of the process consistent with the answers provided by VCAA in the 2013 examiner's report.

Question 5b

Translation occurs in the cytoplasm of the cell, more specifically on the ribosomes [1]. In this process, the mRNA strand is decoded in order to produce an amino acid chain [1], with each amino acid being brought to the mRNA on the ribosomes by transfer RNA (tRNA) molecules [1].

Question 5c

Cell nucleus

Question 5d

Any one of:

- Removal of introns, *non-coding regions of primary mRNA*, and the joining together of exons, *coding regions of primary mRNA* [1], which ensures that the correct protein is encoded in the mRNA strand [1].
- Addition of a poly A tail at the 3' end of the mRNA strand [1], for stability [1].
- Capping of the 5' end with a methyl cap [1] for protection and stability [1].

Worth [2] each- must be from the same bullet point.

Question 6a

5' – U A U U C C G A U C C G A U A A C G U A G – 3' [1]

Being an RNA strand there should be no Thymine present in the sequence.

Question 6b

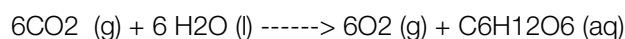
Redundancy in the genetic code is due to amino acids being associated with more than one codon [1].

Question 6c

Redundancy can be beneficial as if there is more than one codon that codes for a particular gene and a mutation occurs at this particular point of the sequence, there is the potential that the new codon may still code for the same amino acid [1]. These type of mutations are known as silent mutations.

Question 7a

Sunlight



OR

Sunlight



OR

Sunlight

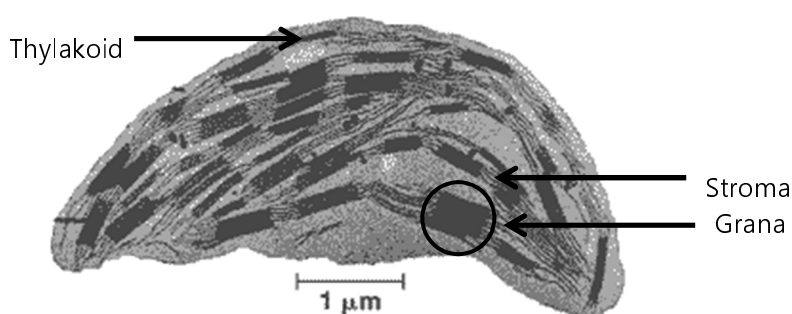
Carbon dioxide + Water -----> Oxygen + Glucose

Note the question asked for a balanced equation it did not specify a chemical equation so the words of reactants and products would suffice.

Question 7b

Stage	Location	What happens?
Light-dependent stage	Grana	Light is trapped by the chlorophyll allowing water to be split into hydrogen and oxygen, and the hydrogen ions allow NADP to form NADPH.
Light-independent stage/Calvin cycle	Stroma	The hydrogen ions from NADPH and ATP undergo a series of reactions to ultimately produce glucose.

Question 7c



Question 7d

You would not expect photosynthetic bacteria to have chloroplasts because bacteria are prokaryotes [1]. Prokaryotes do not contain membrane bound organelles and chloroplasts are a membrane bound organelle [1]. To photosynthesis, they have photosynthetic, light-capturing pigments such as chlorophyll.

Question 8a

- DNA is a negatively charged molecule due its phosphate groups in the sugar-phosphate backbone allowing it to migrate to the positive terminal [1].
- DNA strands of different sizes move at different rates in the gel when an electric field is applied, with smaller strands migrating faster than larger ones [1].

Question 8bi

Polymerase chain reaction (PCR) [1].

Question 8bii

During dissociation the DNA sample is denatured by heating it to 90 degrees for 2 minutes allowing the strands to dissociate into single strands [1]. During annealing, primers are added that anneal with regions on either end of the DNA strand of interest [1]. Finally, extension of the primers occur as Taq polymerase uses the primers as a point of initiation and extends them so that two complete strands are formed [1].

Question 8biii

Taq polymerase is a DNA polymerase that derives from a bacterial species that originates in hot springs so is able to withstand the high temperatures used in PCR without being damaged.

Question 9ai

Sex-linked recessive mode of inheritance [1].

Note that technically it can be seen as Autosomal recessive, but the question asked which is most likely to be the pattern of inheritance and because there are only males affected in the pedigree, sex-linked seems like a greater possibility.

Question 9aii

- Recessive as it is passed from an unaffected male and female to one of their offspring [1].
- Sex-linked as no daughters are affected in the pedigree [1].

Question 9bi

The insertion of a normal functioning allele from an unaffected individual into cells of an affected individual who has defective alleles of the same gene [1].

Question 9bii

If the DNA code for G6PD is known, it could be inserted into a plasmid vector [1], which is then inserted into bacteria, where they can replicate [1]. The inserted DNA, would then make G6PD in the bacteria, which could be isolated, purified and packaged so that it can be inserted in those with G6PD deficiency in order to treat them [1].

Question 10ai

Allopatric speciation is the formation of a new species when a population is separated and geographically isolated from one another [1].

Question 10aii

Allopatric speciation begins with one single population [1]. Generally, a smaller group of the population is geographically isolated from the original population, such as by a mountain range, a river, or islands [1]. The two populations in different environments are subjected to different selective pressures, where two different phenotypes are favoured [1]. After a period of time, they form two distinct gene pools, and eventuate into two different species [1].

Question 10aiii

Allopatric speciation has occurred when individuals within a population have become distinctive species. By obtaining members of a population that are believed to have undergone allopatric speciation and seeing whether or not they can interbreed and produce viable and fertile offspring will enable you to judge whether or not allopatric speciation has occurred [1].

Question 11a

Dating using fossils is a relative dating technique [1]. Fossils can only give information to allow for an approximate estimate of the age of a particular specimen on the basis of its position in sedimentation, unlike a more indicative date provided by absolute dating techniques [1].

Question 11b

The genera may have become extinct before the migration out of Africa occurred OR there was no selection pressures placed on the genera forcing them to move, so they remained in Africa until they become extinct [1].