



A non-profit organisation supporting students to achieve their best.

Unit 3 Biology

Practice Exam Solutions

Stop!

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

Found a mistake?

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

Section A – Multiple-choice questions

Question 1

The correct answer is C.

Enzymes are three dimensional tertiary proteins with globular structures.

Question 2

The correct answer is C.

Diffusion, active transport and osmosis are the three processes involved in the mammalian kidney as waste products are filtered from the blood and urine is formed.

Question 3

The correct answer is D.

Lysosomes are membrane bound organelles that contain enzymes involved in the destruction of cellular wastes and breakdown of unwanted molecules.

Question 4

The correct answer is A.

Biological engineering is the synthesis of specifically shaped drugs to fit the active sites of enzymes, receptor proteins or regulatory proteins involved in curing or treating a particular disease.

Question 5

The correct answer is C.

Question 6

The correct answer is B.

The high specific heat capacity of water means that heat energy is drawn from organisms onto water in their external environment such as sweat, or in their internal environment, such as water particles present in the lungs.

Question 7

The correct answer is D.

Safe laboratory techniques must always be adhered to, but are not as accurate as the other responses as a factor for ensuring conclusive (accurate) results.

Question 8

The correct answer is A.

At point X in the diagram, the amount of enzyme becomes the limiting factor and the amount of substrate added is irrelevant, and the graph levels off.

Question 9

The correct answer is C.

The most powerful aspect of the study of the proteome is that it encompasses an understanding of the interactions between proteins, as proteins rarely function alone, but form part of biological pathways.

Question 10

The correct answer is C.

If 31.5 percent of a particular sample of DNA is thymine, it follows that 31.5 percent is adenine according to base pairing rules. Thus, Cysteine and Guanine make up the remaining 37 percent, and as they are present in equal proportions due to base pairing rules, 18.5 percent of the DNA is cysteine.

Question 11

The correct answer is D.

Steroid hormones are hydrophobic and are therefore able to diffuse across the plasma membrane to their receptors in the cytosol.

Question 12

The correct answer is A.

Leaves with a large surface area mean that more of the plant is subject to sunlight, and is not an effective mechanism for cooling in plants.

Question 13

The correct answer is B.

Question 14

The correct answer is C.

This was a relatively easy question, and these should always be completed first in an exam to gain the maximum possible marks.

Question 15

The correct answer is C.

Question 16

The correct answer is A.

Question 17

The correct answer is B.

Question 18

The correct answer is C.

The stroma is the enzyme rich region of the chloroplast in which the light independent reaction (also referred to as the Calvin Cycle, though NEVER as the dark reaction) occurs.

Question 19

The correct answer is A.

Fibrin, the protein involved in the binding or coagulation of blood cells in blood clotting is a secondary protein with a strong, symmetrical structure that works not unlike a spider web to bind together white blood cells and create a clot.

Question 20

The correct answer is B.

The breaking down of large molecules to create smaller molecules (and thus, obtain energy through the energy stored in the bonds broken) is referred to as catabolic. Because a water molecule is used to split the molecule, the reaction can also be described as a hydrolysis reaction.

Question 21

The correct answer is C.

Enzymes can withstand some temperature and pH fluctuations, it is only when they are beyond a certain range that the enzyme is denatured. NB denaturing due to temperature fluctuations only occurs when the temperature becomes too hot.

Question 22

The correct answer is D.

Whilst it is not necessary to understand the intricacies of the electron transport chain for this course, it is worth being familiar with this fact. In the final step of the electron transport chain an oxygen molecule binds with two hydrogen molecules from the loaded acceptor molecules,

Question 23

The correct answer is C.

Substrate molecules are converted to products and the enzyme is not used up in the reaction.

Question 24

The correct answer is A.

This question is very similar to question 18 of this exam. It is a necessary skill to be able to draw parallels between photosynthesis and cellular respiration, and the Krebs cycle, which occurs in the enzyme rich mitochondrial matrix, can be thought of as the parallel process to the Calvin cycle in photosynthesis.

Question 25

The correct answer is A.

Pain is only our perception of a strong stimulus.

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 i

abscisic acid [1]

Question 1a ii

In plants, hormones travel either directly between cells or in the phloem, whereas in animals hormones travel in the bloodstream. [1]

Question 1b

- Hormones are specifically shaped molecules that only have their effect on certain cells with the specific receptor molecules for them. [1]
- This means that the cell that did not respond to the hormone didn't have the appropriate receptor molecule for that hormone, and the other cell did [1].

Question 1c i, ii and iii

Various responses are acceptable, see your teacher or tutor if unsure. However, in part ii, it must be noted that the hormone has its effect due to the molecular pathway that is signal transduction, where each molecule present (such as enzymes and regulatory proteins) activates the next to eventually achieve a response.

Question 2a

- Reasonable diagram [1]
- Use of labels and inclusion of major macromolecules (phospholipid bilayer, including the hydrophilic phosphate heads and hydrophobic lipid tails, cholesterol molecules, glycoproteins, and protein channels should be included) [1]
- Brief description of the function of the phospholipid bilayer, it is a regulatory barrier between extracellular and intracellular environments. [1]

Question 2b

Beaker	Potato cube appearance	Type of solution (isotonic/hypertonic/hypotonic) that the potato was placed in	Biological term describing the cells of the potato cube
1	Swollen	Hypotonic	Turgid
2	Unchanged or slightly changed	Isotonic	Normal
3	Shrunken	Hypertonic	Plasmolysed

One mark is given for each three correct responses.

Question 2c

If a solution becomes too basic the plasma membrane is destroyed because it is composed of lipids with disintegrate in strong bases (think of oil in water when detergent is added) [1]

If a solution becomes too acidic protein channels in the plasma membrane can be denatured meaning gaps can be formed in the membrane and selective passage of molecules across the membrane cannot occur. [1]

Question 3a

Threshold, or threshold potential [1]

Question 3b

When there is no electrical impulse being transmitted in a neurone, the inside of the nerve cell has a negative charge in relation to the outside [1]. However, once an action potential is generated, the inside of the nerve cell momentarily becomes positively charged in relation to the outside, due to pumping of sodium and potassium ions against the concentration gradient (via active transport), which is how the electrical impulse is generated [1]. Once the action potential has passed the nerve cell again becomes negatively charged relative to the outside.

Question 3c

In a reflex arc neuron B [1] the interneuron, would be missing, as the defining characteristic of a reflex arc is that it does not need to pass through the central nervous system, as an innate response is in place [1]. However, it must be noted that the information of the stimulus and the response is still sent to the central nervous system, just after the reflex arc has occurred, and this allows the reflex arc to occur very rapidly.

Question 3d

- Stimulus – Internal temperature drops below the body's optimum range. [1]
- Receptors – Thermoreceptors on the skin [1] and then thermoreceptors in the hypothalamus of the brain [1], if enough of a response is not generated from the detection of the stimulus by thermoreceptors in the skin.

Question 3e

- When the electric potential comes to the synapse, the message is converted from electrical to chemical and neurotransmitters are released. [1]

- They travel via diffusion across the synaptic cleft to bind with specific receptor molecules on the dendrites of the post synaptic cells, which induces a new electric impulse. [1]

Question 4a

Independent variable: Changes to the coleoptiles tips

Dependent variable: Changes observed in coleoptiles growth

[1 mark for both correct, 0 otherwise]

Question 4b

The shoot left intact is provided as an experimental control. [1] To ensure that changes observed are due to changes imposed (ie, the dependent variable is due to the independent variable) a control is needed.

Question 4c

The first two plants should be drawn having elongated, the third should remain the same. [1]

Question 4d

- Plant one should be drawn having elongated whilst plant 2 should be drawn with no change. [1]
- The results for plant one are due to the auxin present in the ground up coleoptiles tips which has diffused through the plant and encouraged upwards growth. [1]

Question 4e

Any two of: [1 mark each]

- Repetition of the experiment
- Large Sample size
- Complete control and uniformity of all experimental conditions
- Inclusion of a control
- Any other reasonable suggestion

Question 5a i

Cells involved in the specific immune response include the T_c cell, the memory cell and the plasma cell. One of these is one mark. The function of the cell needs to be a sentence such as: 'The memory cell (a B lymphocyte) stores information about the specific immune response needed to combat a particular pathogen that the organism has previously encountered, and is stored in the bone marrow.' [1]

Question 5a ii

Cells involved in the non-specific immune response include the phagocyte, the neutrophil and the megakaryocyte. [1 for any of these]

Explanation: The phagocyte engulfs and destroys unwanted materials and pathogens.

Question 5a iii

T killer cell, or T helper cell [1]

Question 5b i

An autoimmune disease is one in which the body detects 'self' cells as 'non-self' and destroys them. [1]

Question 5b ii

Antibodies are present in the blood of a person with the autoimmune disease that bind to the antigens on the self-cell and cause a specific immune response. [1]

Question 5b iii

The top two ends of the antigen should be circled. [1]

Question 5c i

Active immunity is acquired through development of a specific response to a pathogen through exposure to that pathogen, whereas passive immunity is acquired through ingesting or being given the specific antibodies to a particular antigen from another organism that has formed them. [1]

Question 5c ii

Passive, active, passive [1 each]

Question 6a

- There are 64 possible combinations of nitrogenous bases coding for amino acids and only 20 amino acids [1].
- This means that there is some redundancy or 'doubling up' in the genetic code. [1]

Question 6b

AUG-UUU-CCA-UAA (STOP)

Due to doubling up of the genetic code as mentioned above, some of the amino acids may be coded for by more than one codon so other responses are acceptable.

[1 for the first 3 codons; 1 for the inclusion of the stop codon]

Question 6c

- This process is called transcription. In the nucleus, RNA polymerase unwinds the DNA through the breakage of bonds between complementary nucleotide base pairs. The template DNA bases are then paired with complementary RNA nucleotides. [1]
- The enzyme RNA polymerase aids this step and helps the formation of the sugar-phosphate backbone. The newly synthesised DNA RNA helix breaks apart and the RNA strand is freed. This is called messenger RNA (mRNA), and it exits the nucleus via the nuclear pores. [1]