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# 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, then email [practiceexams@ee.org.au](mailto:practiceexams@ee.org.au).

## Section A – Multiple-choice questions

### Question 1

The correct answer is C. The cell would crenate because the solution would be hypertonic to the cell, so water would flow out of it via osmosis in order to decrease the concentration gradient.

### Question 2

The correct answer is A. The cell would become turgid because the distilled water would be hypotonic to the cell, and thus water would flow out of it via osmosis in order to decrease the concentration gradient.

### Question 3

The correct answer is D. Enzymes are three dimensional tertiary proteins, which means they are globular, not fibrous.

### Question 4

The correct answer is C. There would be 27 percent thymine in the cell as well as 27 percent adenine, due to base pairing rules. Thus, 54 percent of the nitrogenous base material would be adenine and thymine, leaving 46 percent for cytosine and guanine. Due to base pairing rules, this means that 23 percent of the DNA would have to be guanine.

### Question 5

The correct answer is B. Proteins are synthesised at the rough endoplasmic reticulum in eukaryotic cells.

### Question 6

The correct answer is A. Organelle A is a mitochondrion, responsible for cellular respiration, which is the conversion of 3 carbon glucose into useable ATP molecules.

### Question 7

The correct answer is A. The final acceptor molecule in the electron transport chain is oxygen.

### Question 8

The correct answer is D. The outputs of the light dependent phase of photosynthesis (the splitting of water) are 2 ATP, Hydrogen ions which are bound to acceptor molecules, 'loading them', and oxygen.

### Question 9

The correct answer is A. The thylakoid membrane in the grana contains embedded chlorophyll molecules, which absorb sunlight in the light dependent phase.

### Question 10

The correct answer is C. Substrate B would have nothing to bind to and would thus build up in the cell. As a consequence, enzyme X would not be produced and so the cell would continue to initiate the process, resulting in a build-up of enzyme Y.

### Question 11

The correct answer is B.

### Question 12

The correct answer is D. Receiving anti venom from a horse is means the affected organism is not creating antibodies to combat the antigen, and thus is an example of passive immunity.

### Question 13

The correct answer is B. The desert mouse would need to conserve water, so would have a lengthened loop of Henle in the nephrons of its kidneys to allow for maximum water reabsorption from waste. Consequently, the mouse would have very concentrated urine.

**Question 14**

The correct answer is A. Fish produce the highly toxic ammonia as waste, as in nature it is diluted in the large bodies of water they inhabit. Within the confines of a fish tank, the levels of ammonia become too concentrated, and unless proper filtration and nitrogen fixation occur, the fish will die.

**Question 15**

The correct answer is B. Rate of reaction increases with enzyme concentration to a point, when all the substrate has been used up, and then rate of reaction will drop.

**Question 16**

The correct answer is C. The role of fibrin is covered in studies of the immune response.

**Question 17**

The correct answer is C. The smooth endoplasmic reticulum synthesises lipids.

**Question 18**

The correct answer is A. The electron transport chain generally produces 32 ATP, but in certain cells with a high energy requirement (e.g. heart muscle cells) 34 ATP can be produced. The reason D is wrong is that when it is written as 32-34 ATP this implies that 33 ATP can be produced, which is impossible.

**Question 19**

The correct answer is C. Fermentation in plants produces ethanol and carbon dioxide, and occurs when oxygen is not available to undergo aerobic respiration.

**Question 20**

The correct answer is B. 2 pyruvate molecules, broken down from glucose in glycolysis enter the mitochondrion to initiate cellular respiration.

**Question 21**

The correct answer is C.

**Question 22**

The correct answer is A. Xerophytes are adapted to very dry conditions, and are prevalent in the Australian bush.

**Question 23**

The correct answer is B. When a large enough difference is caused by depolarisation along the axon, an action potential is generated and the nervous impulse is thus sent along the neuron and to the synapse, where it will be carried by neurotransmitters to the following neuron's dendrites.

**Question 24**

The correct answer is A. Schwann cells can be found on the axon, as part of the myelin sheath.

**Question 25**

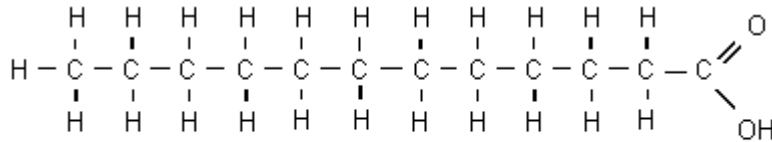
The correct answer is C.

## Section B – Short-answer questions

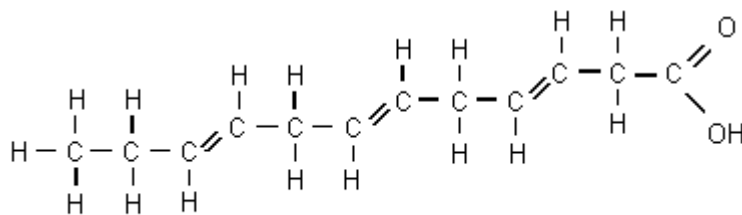
Marks allocated are indicated by a number in square brackets, for example, [1] indicates that the line is worth one mark.

### Question 1a

Monounsaturated fats and polyunsaturated fats contain double bonds in their fatty acid chains.



Saturated Fatty Acid



Unsaturated Fatty Acid

[1]

Health experts encourage us to eat them because our body has to use energy in breaking the double bonds in digestion, thus they increase our energy output and reduce the likelihood that the acids will be unused and converted to adipose tissue [1]

### Question 1b

A potato and a liver are similar in that they are both storage organs of complex carbohydrates [1]. In animals, this is glycogen, and in plants (i.e., a potato plant) this is starch [1].

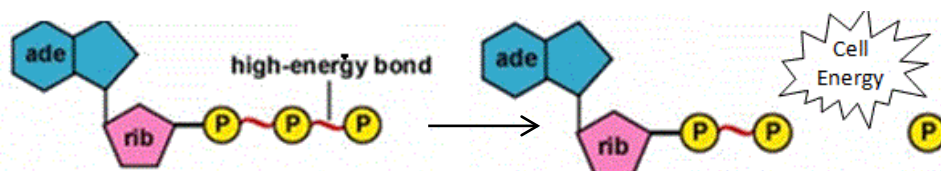
### Question 1c

Various answers accepted, for example:

mRNA (messenger RNA) [1], is a copy of the genetic material that codes for proteins which is able to enter the cytosol and provide the information for translation to occur [1].

### Question 1d

The bond joining the third phosphate group to the adenine and two phosphates is broken, releasing energy [1]. 1 mark for a suitable diagram, such as the example below:



### Question 2a

An enzyme is a three dimensional tertiary protein that works as a biological catalyst [1] to speed up reactions in the body to a rate that will sustain life [1]

**Question 2b**

Various answers accepted, however each would gain three marks for discussing:

- A hypothesis;
- A method, including repetition, variables and controls; and
- Results that would support or not support the initial hypothesis

**Question 2c**

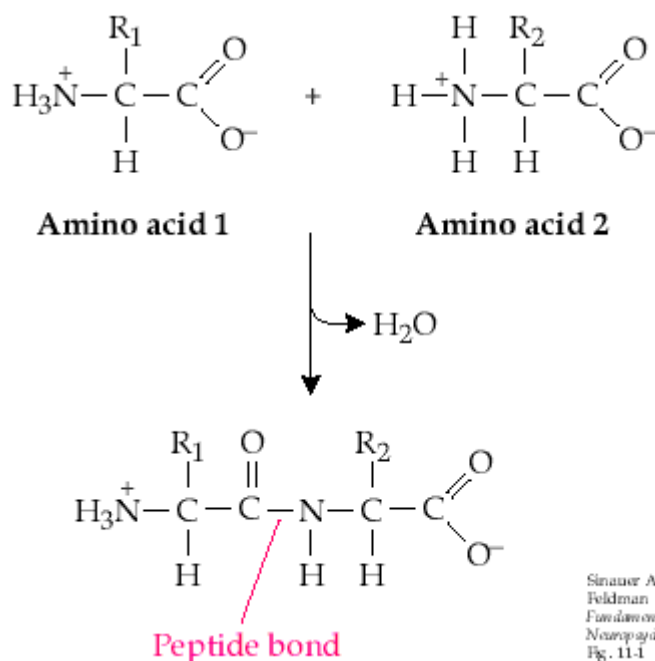
Mythase may exist in the stomach where the pH is low [1]. A mark is given for any acidic environment in the digestive system.

**Question 2d**

In an acidic environment, the three-dimensional structure would be stable [1]. However, when the pH increases, hydrogen bonds and other attractive forces holding together this shape would degrade, and the enzyme would denature [1].

**Question 2e**

Two amino acids join to form a peptide bond when there is a condensation reaction [1] between the amino and the carboxyl groups. One mark for a suitable diagram, an example is below:



Sinauer Associates, Inc.  
Feldman  
*Fundamentals of  
Neurophysiology*  
Fig. 11-1

**Question 3a**

The yellow banana will become brown so quickly because the overripe orange produces the hormone ethylene [1], which is a gaseous hormone [1] and thus can travel to the banana and initiate the ripening response.

**Question 3b**

In order to gain each of the 4 marks, the entire row for each plant tropism or hormone response needs to be filled out correctly.

Plant tropism or hormone response	Positive/Negative/Not applicable	Hormone(s) responsible	Brief function of this/these hormones
Phototropism towards sun light of plant tip	Positive	Auxin, Cytokinins	Apical dominance (required for the 1 mark), lateral growth, root growth
Geotropism up out of the ground	Negative	Auxin, Cytokinins	Shoot growth (required for the 1 mark) Levels of auxins to cytokinins in a plant determine whether it will undergo positive or negative geotropism.
Growth of lateral buds	Not applicable	Cytokinins	Lateral bud growth, (required for the 1 mark) senescence, root and shoot growth.
Flowering	Not applicable	Gibberellins	General plant growth, flowering, (required for the one mark) reproduction, germination, elongation

**Question 4a**

This response is both a nervous and a hormonal response. Initially it is a hormonal response, as the adrenal gland secretes the hormone adrenalin into the bloodstream and it binds to target cells to affect the fight or flight response [1]. However, the effects that occur as a result are nervous responses, [1] such as shaking, which are controlled by a nervous pathway involving the involuntary twitching of muscular cells.

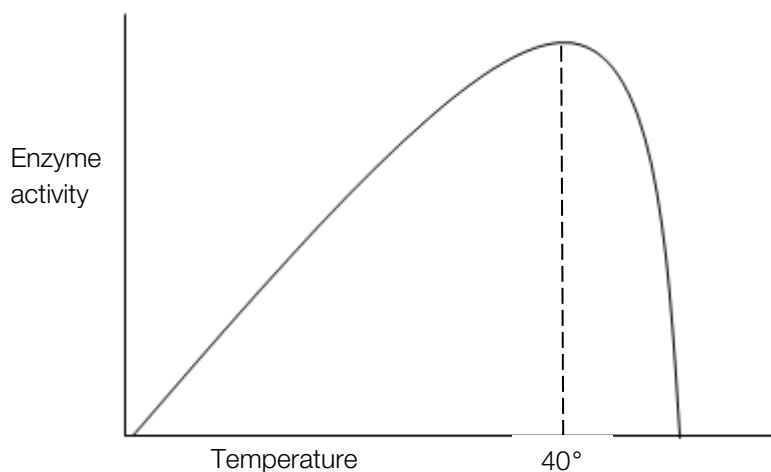
**Question 4b**

Various answers accepted, but all have to deal with the idea of synthesising a compound that has the same specific shape as a molecule in the pathway for the production of adrenaline, to work as an inhibitor molecule. An example could be:

A drug could be synthesised that fitted the active site [1] of the noradrenaline hormone, and would thus bind to it and inhibit it from aiding in the synthesis of adrenaline [1]. The result of this would be a reduced production of adrenaline, [1] ideal as the sufferer is over producing adrenaline.

**Question 5a**

At 40 degrees Celsius, human enzymes can continue to work, while the excess temperature may kill of pathogens [1]. However, if the temperature increases too much, or stays elevated for an extended period of time, bodily enzymes become irreversibly denatured and death may occur [1]. An example of a graph that could be used is below:

**Question 5b**

The process occurring is the non-specific immune response [1] of blood clotting. Platelets 'plug' the wound and blood plasma initiates the production of the string like secondary protein, fibrin, which binds the blood together [1].

**Question 6a**

There are 64 possible anticodons, and only 20 available amino acids in humans. Thus, there is some redundancy in the genetic code [1].

**Question 6b**

Due to two anticodons being given for phenylalanine and stop anticodons, various answers are possible. An example is below. A mark is given for correct DNA sequence of the 5 amino acids along with the stop codon.

TAC-AAA-TGG-ACT-AGA-ATT

**Question 6c**

Messenger RNA is synthesised during transcription. The template DNA strand is unwound and RNA polymerase bonds to the promoter area, initiating RNA synthesis [1]. When a stop sequence is reached, the RNA synthesis ceases and the messenger RNA is modified and sent out of the nucleus via the nuclear pores [1].

**Question 7a**

A reflex arc occurs when a stimulus response model occurs without the inclusion of the central processing unit (CPU) [1]. An example is the knee jerk reaction, where the sensory neurons detect the tapping below the kneecap and send a message straight to muscle effector neurons, bypassing the use of interneurons.

**Question 7b**

The extra time that is saved by avoiding sending a message to the brain is used to avoid the danger of the boiling water, saving Christina the possibility of getting burnt [1].

**Question 7c**

One mark is received for each row if both boxes are filled out correctly.

	<b>Part of the central nervous system, peripheral nervous system, or both?</b>	<b>Brief description of function</b>
Thermoreceptors on the skin	Peripheral	Detect levels of heat on the skin and send a message to the control centre
Hypothalamus	Central	The control centre for various involuntary homeostatic processes, located at the base of the brain

**Question 8a**

An autoimmune disease occurs when the body's immune system recognises certain body cells as being "non-self" and attacks them [1].

**Question 8b**

5 minutes after irradiation the healthy cells are at their peak of cytochrome c concentration, whereas the MAA cells are at their lowest concentration. After irradiation the healthy cells have been induced to undergo apoptosis, beginning with the release of cytochrome c, and therefore there is a high concentration of cyt c in the cytoplasm [1]. The MAA cells on the other hand, have begun undergoing apoptosis before the UV radiation was applied, and so cytochrome c will have dissipated into the extracellular matrix [1].

**Question 8c**

5 minutes after irradiation the healthy cells are beginning to undergo apoptosis, and so there is a high concentration of cytoplasmic cytochrome c [1]. After apoptosis has occurred and the cell has been broken down (20 minutes later), the cytochrome c has dispersed out of the cell [1].

**Question 8d**

A virus will inject its nucleic acid into the host cell, and the machinery of the host cell will be used in order to replicate the nucleic acid and protein components of the virus [1]. After multiple new viruses have assembled in the host cell, it will be lysed so the viruses may disperse and infect other cells [1].

**Question 8e**

A retrovirus uses RNA, instead of DNA, as its nucleic acid [1].

**Question 8f**

The MAA-inducing virus would infect T cells [1].

The information at the beginning of the question specified that T cells induce the muscle cells to undergo cytochrome c release.