



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 C.

Question 2

The correct answer is D.

Question 3

The correct answer is B. A glycosidic bond is a bond that joins a carbohydrate molecule (such as the ribose sugar in RNA) to any other molecule.

Question 4

The correct answer is C. Enzymes are examples of globular proteins.

Question 5

The correct answer is B.

Question 6

The correct answer is B.

Question 7

The correct answer is D. A glycopospholipid is a carbohydrate, shown by the hexagonal shapes, attached to a phospholipid.

Question 8

The correct answer is C. Steroids are lipid soluble, and thus can diffuse directly through the phospholipid bilayer.

Question 9

The correct answer is A. Hexokinase is an enzyme, enzymes are proteins, and proteins are created in the rough endoplasmic reticulum.

Question 10

The correct answer is A.

Question 11

The correct answer is B.

Question 12

The correct answer is C.

Question 13

The correct answer is D.

Question 14

The correct answer is A.

Question 15

The correct answer is B. The protein is tertiary, not secondary, because the alpha helices and beta sheets are folded into an arrangement.

Question 16

The correct answer is A.

Question 17

The correct answer is C.

Question 18

The correct answer is A. The mRNA codon in the image is GCC and is complementary to the DNA triplet. Thus the DNA triplet must be CGG.

Question 19

The correct answer is B.

Question 20

The correct answer is D. Anita's blood is type O. She does not have A or B antigens on her 'self' blood cells, so her blood would agglutinate when placed in type A or B blood due to antigen-antibody complexes.

Question 21

The correct answer is D

Question 22

The correct answer is C

Question 23

The correct answer is B. The question asked for the incorrect statement.

Question 24

The correct answer is B. Being morphologically similar does not necessarily mean an evolutionary connection, and can just be the result of analogous features.

Question 25

The correct answer is A

Question 26

The correct answer is B

Question 27

The correct answer is B

Question 28

The correct answer is D

Question 29

The correct answer is B

Question 30

The correct answer is C

Question 31

The correct answer is B

Question 32

The correct answer is D

Question 33

The correct answer is A. There is a $\frac{1}{2}$ chance that the child will be a boy, and a $\frac{1}{2}$ chance that he will receive the colour blind recessive allele that his mother is carrying on ONE of her X chromosomes. $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

Question 34

The correct answer is D. The daughter cannot be colour blind as her phenotypically normal father gives her his normal in terms of colour blindness X chromosome.

Question 35

The correct answer is B. The beginning of the G1 phase is the beginning of interphase, when the single chromosomes will become double.

Question 36

The correct answer is A. The end of the G2 phase is also the end of interphase, so chromosomes have doubled.

Question 37

The correct answer is A

Question 38

The correct answer is C

Question 39

The correct answer is A. This is an F1 x F1 dihybrid cross, with a 9:3:3:1 phenotypic ratio in offspring.

Question 40

The correct answer is D. Both parents must be 'Ff'. Ff x Ff gives a phenotypic ratio of 3 freckles: 1 without freckles. $\frac{12}{16}$ can be simplified to $\frac{3}{4}$.

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

Glutamic acid to valine [1]

Question 1b

A point mutation [1] OR a substitution mutation [1]

Question 1c

The process is called transcription. The DNA strands are unzipped. [1] RNA polymerase lines up on promoter area of the DNA, and begins adding the ribose nucleotides A, U, C and G to their complementary base pairs on the DNA [1]. At a STOP sequence, RNA polymerase stops adding nucleotides, and the pre-mRNA undergoes post-transcriptional modification before export out the nuclear pores [1].

Question 1d

One amino acid change means that the properties of the polypeptide are changed, as each amino acid contains a different charge, size and pH [1]. The interactions between the primary and secondary structure would thus be altered, and the protein would ultimately fold into a differently shaped tertiary structure [1].

Question 2a

1: Mitochondrion [1]

2: Vesicle or neurotransmitters [1]

3: Receptor [1]

4: Synapse [1]

Question 2b

Answers may vary. [1 for each row]

	Nervous responses	Endocrine Responses
1.	Message travels via neurons and neurotransmitters	Message travels via bloodstream
2.	Response is faster	Response is slower
3.	Response is short-lived	Respond may last a long time

Question 3a

Terry's immune system recognizes the pollen particles as 'non-self' antigens, which bind to his plasma cells [1]. They produce specific antibodies, which bind to his mast cells [1], stimulating them to release large amounts of histamine [1] as a defence mechanism, which is responsible for his watery eyes.

Question 3b

Answers may vary.

'If the mice are administered a lower dose of TSLP, then they will become more sensitive to the allergens present' [1]

Question 3c

Answers may vary.

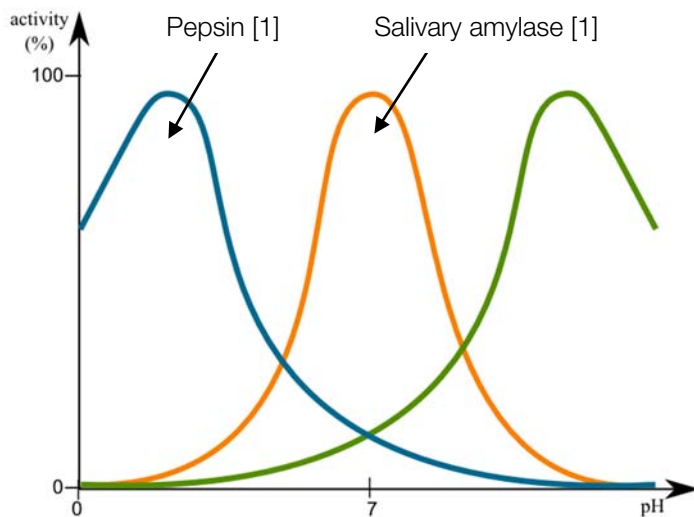
Set up three groups of mice, all in exactly the same environment and all exposed to the allergen [1]

Administer the first group a low dose of TSLP, the second group a moderate dose of TSLP and the third group a high dose of TSLP, and monitor and record any responses to the allergens over a period of 3 weeks. [1]

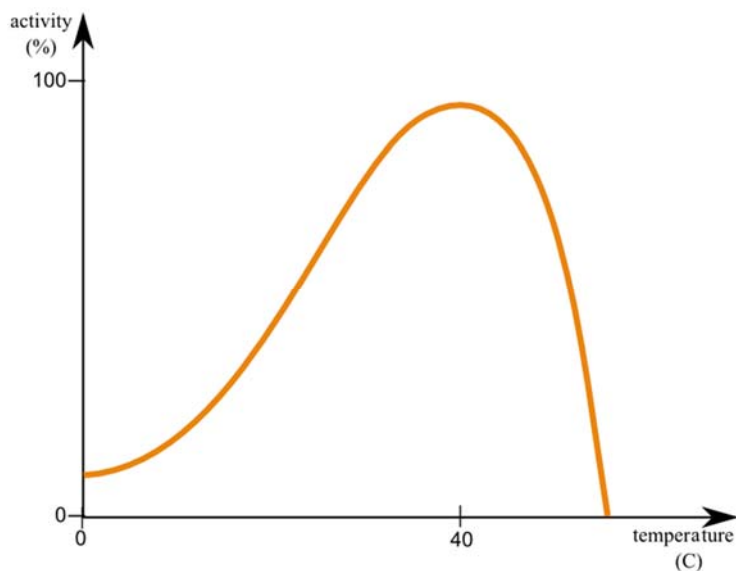
Repeat the experiment 3 times for conclusive results [1]

Question 3d

Answers will vary, but should relate to the hypothesis from part b. Mice administered a lower dose of TSLP are recorded to have a higher number of allergic responses to the allergens. [1]

Question 4a**Question 4b**

Pepsin enzyme activity versus temperature



Source: Wikimedia Commons

Question 4c

When an enzyme is heated past its optimum temperature the bonds holding it in its tertiary structure are broken [1], and it is denatured [1]. An irreversible change to its shape occurs, meaning that it can no longer fit substrates in a 'lock and key' formation [1], and thus its activity is drastically lowered.

Question 5a

'Memory' is information stored about the antigen on the disease-causing agent, and information on how to create an antibody for that antigen [1]. It is stored as plasma memory cells in the bone marrow [1].

Question 5b

Plasma memory cells are activated upon recognition of the antigen [1]. Clonal expansion of plasma cells occurs, and they rapidly produce the specific antibody [1] to agglutinate with the antigen.

Question 5c

These organelles are vital for protein synthesis, and antibodies are proteins. [1]

Question 5d

Answers will vary. For example:

A natural form of active immunity is Chicken Pox [1]. Upon first exposure, illness occurs as the B lymphocytes undergo clonal expansion and begin to produce antibodies. Upon subsequent exposures, no symptoms are seen as the antibodies are quickly produced [1] and the disease is removed from the system.

Artificial active immunity answers would likely be involving vaccines.

Question 6a

Answers may vary.

- Feature one: Increased cranial space above eyes [1]. Reason for evolution: Allowed space for the brain's frontal lobes to develop, increasing problem solving ability. [1]
- Feature two: Smaller, sharper teeth [1]. Allowed early humans to obtain nutrition from a wider variety of sources, and to move from an herbivorous to an omnivorous diet [1].

Question 6b

Early humans with larger craniums were able to more efficiently solve problems and were selectively fitter [1] than those who had smaller craniums. They chose to interbreed with each other to produce fitter offspring [1]. As a result of this and other differences, the early humans with smaller craniums and those with larger craniums eventually ceased to interbreed altogether, and speciation occurred [1].

Question 7a

Individuals should be numbered across the rows from left to right, each row starting from one in Arabic numerals (1, 2, 3 etc.). A number should be assigned to each row counting in roman numerals (I, II, III, IV etc.) starting from the top row.

Question 7b

Recessive [1]. Parents II7 and II8 are not affected, but have had affected offspring III7 and III8 [1].

Question 7c

$\frac{1}{2}$ or 0. Child III9 is unaffected, but has affected siblings and unaffected parents. This means her parents are heterozygous, and she is either homozygous dominant (AA) or heterozygous (Aa). Her partner is homozygous recessive (aa).

If she is homozygous dominant: Then all offspring are heterozygous (Aa) and there is zero chance that they have albinism. [1]

	A	A
a	Aa	Aa
a	Aa	Aa

If she is heterozygous, half the offspring will be homozygous recessive (aa) so there is a $\frac{1}{2}$ chance that they will be affected. [1]

	A	a
a	Aa	aa
a	Aa	aa

Question 7d

Parental genotypes: AaBb and AaBb. Affected offspring are underlined. Chance: 7/16

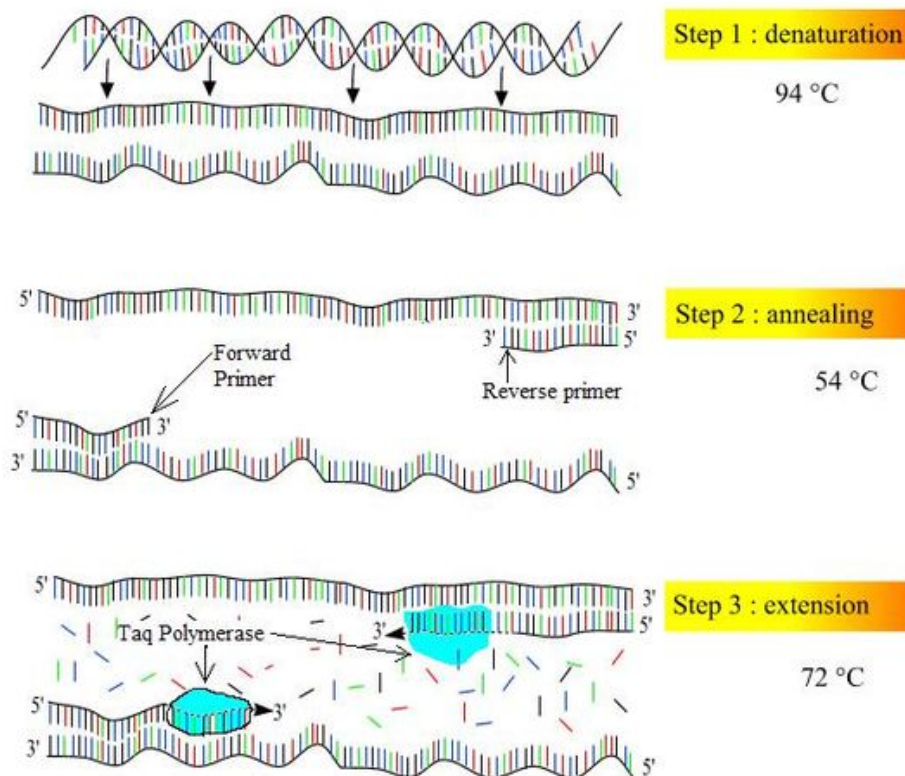
	AB	Ab	aB	ab
AB	AABB	AABb	AaBB	AaBb
Ab	AABb	<u>AAbb</u>	AaBb	<u>Aabb</u>
aB	AaBB	AaBb	<u>aaBB</u>	<u>aaBb</u>
ab	AaBb	<u>Aabb</u>	<u>aaBb</u>	<u>aabb</u>

Question 8a

Polymerase Chain Reaction [1]

Question 8b

[1] mark for each of the 3 steps (see diagram below) and [1] mark for reasonable diagram.



Source: Wikimedia Commons

Question 8c

Neither suspect [1]. Neither had DNA that completely matched with the strand found at the crime scene [1]. Note that suspect 2 did share some alleles.

Question 9a

The founder effect [1]. A small migrant population with allele frequencies not representative of their source population became reproductively isolated [1] and caused homozygosity of otherwise rare alleles, through lack of an adequate gene pool.

Question 9b

To begin to marry and have children outside the Afrikaner population [1]. This will allow gene flow and increase the gene pool [1].

Question 9c

Social aversion may be present amongst the Afrikaner people against marrying outside their population due to cultural differences [1].

Question 10a

Plasmid [1]

Question 10b

Answers may vary.

Characteristic one: Plasmids replicate readily and autonomously, allowing easy multiplication of the transformed gene. [1]

Characteristic two: Plasmids contain many restriction enzyme recognition sites [1], which makes cutting and pasting of genes easier.

Question 10c

Answers will vary.

Example technology: Genetically Modified crops [1]

Ethical arguments for use of technology

Can improve yields in crops for the same amount of land, increasing productivity for farmers and more sustainable land use [1].

Can reduce the need for farmers to use pesticides. [1]

Ethical arguments against use of technology

Farmers become forced into use of GM crops to keep up with the market. [1]

Consumers are not comfortable about eating the products of gene technologies. [1]