E

Free Exam
for 2013-16 VCE study design

Engage Education Foundation

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 A.

Question 3
The correct answer is A. Hormones travel through the bloodstream, not the nervous system, and peptide hormones bind to receptors on the cell membrane because, unlike lipid hormones, they cannot pass through the cell membrane.

Question 4
The correct answer is D. A hypotonic solution is one where there is a higher concentration of solute in the cell than outside the cell, so water enters the cell, leading to the potato cubes in Beaker A gaining mass.

Question 5
The correct answer is A.

Question 6
The correct answer is B.

Question 7
The correct answer is C. The thing labeled 'E' on the diagram is a receptor for a neurotransmitter.

Question 8
The correct answer is B.

Question 9
The correct answer is C. First transcription occurs in the nucleus, then translation occurs at the ribosomes on the rough endoplasmic reticulum, then the proteins are sent to the Golgi body to be prepared for exportation from the cell, then they leave the cell via the plasma membrane.

Question 10
The correct answer is D. In the mitochondria, oxygen is an input, not an output, of cellular respiration.

Question 11
The correct answer is C.

Question 12
The correct answer is B.

Question 13
The correct answer is C.

Question 14
The correct answer is D.

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 D.

Question 19
The correct answer is A. Bacteria reproduce via binary fission.

Question 20
The correct answer is B.

Question 21
The correct answer is D. RNA contains uracil, not thymine. The DNA must be single-stranded because if it were double-stranded it would have to contain equal amounts of C and G and equal amounts of A and T.

Question 22
The correct answer is C. The number of chromosomes in a species does not correlate to intelligence, size or complexity. Just because two species have the same number of chromosomes, this does not automatically mean they are closely related.

Question 23
The correct answer is A. Bacteria are prokaryotic, not eukaryotic, so one would expect mitochondria to resemble prokaryotic cells if they evolved from bacteria.

Question 24
The correct answer is A. A male carrier for an X-linked dominant disorder will pass the disorder on to his daughters but not his sons. Girls do not have Y chromosomes so C is incorrect. If both parents are heterozygous for an autosomal recessive disease, there is a 25% chance, not a 75% chance, that their child will inherit the disease.

Question 25
The correct answer is C.

Question 26
The correct answer is B. A test cross involves crossing an individual with a dominant phenotype but unknown genotype with a homozygous recessive individual.

Question 27
The correct answer is A

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 C

Question 32
The correct answer is C. Octopus eyes and human eyes evolved independently of each other and are examples of analogous structures and convergent evolution, as is the streamlined shape of sharks and dolphins.

Question 33
The correct answer is D. Half life is the amount of time it takes half the carbon-14 to decay. Therefore if only 1/4 of the original amount remains, two half-lives must have elapsed. (Original amount —> half the amount —> half of *that* amount a.k.a 1/4 of the original amount). 2 x 5,568 = 11,136 years ≈ 11,000 years.

Question 34
The correct answer is B. Only organic materials, not stones, can be dated using carbon-14, and the method is only accurate for specimens younger than 50,000 years old.

Question 35
The correct answer is B.

A is incorrect. Some species have the same number of chromosomes, yet are still separate species (they cannot produce fertile offspring together), hence C is correct. As donkeys and horses can mate successfully, and it is instead the infertility of the offspring preventing further reproduction, the species are separated by post-zygotic barriers, not pre-zygotic barriers, so D is incorrect.

Question 36
The correct answer is D. The other three characteristics we share with primates.

Question 37
The correct answer is C. All primates have forward facing eyes, not just humans.

Question 38
The correct answer is D.

Question 39
The correct answer is B.

Question 40
The correct answer is D.

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

Independent variable: angle/position of seed relative to the ground [1]
Dependent variable: direction of root and stem growth [1]

Question 1b

A hormone is a molecule secreted into the bloodstream that elicits a response from a target cell [1]

Question 1c

Having a control group of plants that are not rotated throughout the experiment [1], having more seeds [1], or any other reasonable answer.

Question 1d

Any three of: exposure to sunlight, amount of water received, temperature, type of plant seed used

Question 1e

Positive feedback [1]

Question 2a

3 of: Heat, change in pH, presence of heavy metals [1]

When a protein is denatured, bonds are broken in the enzyme causing it to change its shape. [1]
Because the active site needs to be a specific shape in order to bond with its substrate and catalyse a reaction, changing the shape of the enzyme will prevent the active site from functioning properly. [1]

Question 2b

Protein primary structure: sequence of amino acids in the chain [1]
Protein secondary structure: formation of alpha helices and beta pleated sheets [1]

DNA primary structure: sequence of nucleotide bases [1]
DNA secondary structure: formation of double helix [1]

Question 2c

Competitive inhibition is when a molecule with a similar shape to the substrate binds to the active site of the enzyme, [1] preventing it from acting on the substrate, whereas in non-competitive inhibition, the molecule binds somewhere other than the active site [1] which causes the enzyme to change shape and thus altering the shape of the active site and so preventing it from functioning.

Question 3a

The Wrights are the true parents. [1]
All bands in the baby's profile correspond either to bands in Mrs Wright's profile or Mr Wright's profile, but not to the Browns' profiles.

Question 3b

To cut DNA [1] at specific points

Question 3c

After being treated with restriction enzymes, the DNA is loaded onto the gel at the same end as the negative electrode [1]. The DNA is subjected to an electric current, and because the DNA fragments are negatively charged they move towards the positive electrode [1]. The shorter, lighter fragments move more quickly through the gel than larger pieces [1], so the DNA becomes sorted by size.

Question 3d
Virus [1]

Question 3e
DNA first has to be heated to a high temperature (around 95 degrees Celsius) in order to break the hydrogen bonds between the two strands and so separate the strands. [1]
It then has to be cooled so that the chemical bonds required for primers to anneal to the DNA can form. [2]

Question 3f
32 strands. [1]
With each cycle, the number of strands of DNA doubles. After one cycle: 2 strands. After two cycles: 4 strands. After three cycles: 8 strands. After four cycles: 16 strands. After five cycles: 32 strands.

Question 4a
When anti-fungal agents are used, any fungus who is susceptible to it will die, and hence no longer be able to contribute to the gene pool of the next generation. [1]
However, due to variation between individual fungi in the population, some fungi have a genotype that allows them to survive the treatment. [1]
As these are the only individuals who survive to reproduce, the individuals in the next generation will inherit their genes for anti-fungal resistance [1], so there is a high frequency of alleles conferring resistance.
Note: remember that variation already occurs in the existing population and the presence of anti-fungal resistant individuals is not caused *by the presence of the treatment.*

Question 4b
Related individuals are more likely to carry the same alleles for genetic disease [1], so when they are bred together, the chances of the offspring being homozygous recessive for a genetic disease (and thus having a diseased phenotype) [1], is much higher than if the parents had been less closely related.

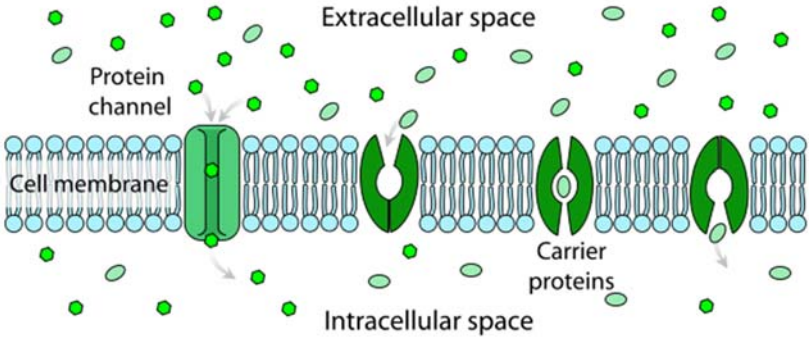
Question 4c
If there is reduced genetic diversity, there will be less variation within the population. If the environment changes, there is then less chance that any individual will possess a characteristic that confers a selective advantage and would allow them to survive. [1] Hence it is much less likely that the population will be able to adapt and evolve in response to a changing environment. [1]

Question 4d

The melting temperature for the two white tigers would be higher [1]
This is because they are more closely related and hence have more similar DNA sequences. [1]
This means that the two strands would be able to form more hydrogen bonds between strands, so a higher temperature would be required to separate the two. [1]

Question 5a

Example diagram below:



Source: Wikimedia Commons

[2] Correctly drawn and labeled phospholipid bilayer
[1] Protein channel
[1] Carrier protein

Question 5b

Method of transport	Description of method	Active or passive?	Example of a molecule that is transported by this method
Diffusion	Net movement of a substance from area of high to low concentration	*Passive*	*O_2, CO_2, alcohol, glucose*
Endocytosis	*When membrane folds inwards (invaginates) to bring substances into the cell*	*Active*	*Proteins, large molecules*
Active transport	*Movement of substance against its concentration gradient*	*Active*	*ions (e.g. K^+, Na^+)*
Osmosis	Net movement of water through a semipermeable membrane from an area of low to high solute concentration.	*Passive*	*Water*

Question 5c

Cholesterol maintains the integrity of the membrane, [1] preventing it from falling apart while also preventing it from becoming too rigid. [1]

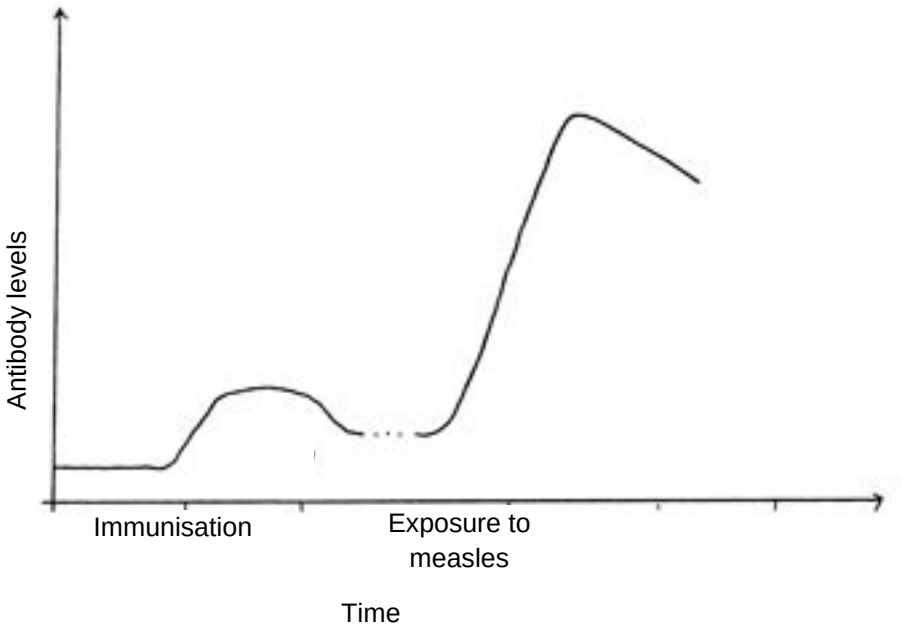
Question 6a

Two of the following (one mark for each): Airborne, food, water, sexual contact, contact with bodily fluids (blood, saliva, etc.),

Question 6b

Viruses are much smaller than bacteria [1]. Viruses are acellular, consisting only of genetic material (DNA or RNA) and a capsid or protein coat, whereas bacteria are cells with genetic material, a cell membrane, cell wall and ribosomes. [1] Viruses replicate by injecting their genetic material into a host cell and using that cell's chemical processes to produce new viruses, whereas bacteria reproduce by binary fission. [1]

Question 6c



[1] small peak after immunisation, [1] larger peak after exposure

Question 6d

Herd immunity [1]. Because so many children are vaccinated, the chances of a child that is not vaccinated coming into contact with an infectious individual is much lower than in communities where no one is vaccinated and many children are infected. [1]

Question 7a

It suggests that the hominids who left the footprints were bipedal. [1]

Question 7b

Any one of the following [2]:
Homo sapiens DNA from Asia or Europe is more similar to DNA of African *Homo sapiens* fossils than to *Homo erectus* fossils in the same area.
There are more differences in DNA sequences between modern African populations than between humans in any other part of the world.

Question 7c

Mitochondrial DNA is better preserved than nuclear DNA. [1]
As mtDNA is inherited via the mother only, there is no recombination so it is easier to work with. [1]
The mutation rate in mtDNA is higher than in nuclear DNA.[1]

Question 8a

A somatic cell is any cell in an organism apart from reproductive cells.

Question 8b

Three reasonable answers, including at least one advantage and one ethical concern about cloning.
For example:
Cloned human cells could be used to produce transplant organs without the need for immunosuppressant drugs. [1]
Reproductive cloning could help infertile couples. [1]
It is inhumane to create a human only to then kill it and harvest its organs. [1]