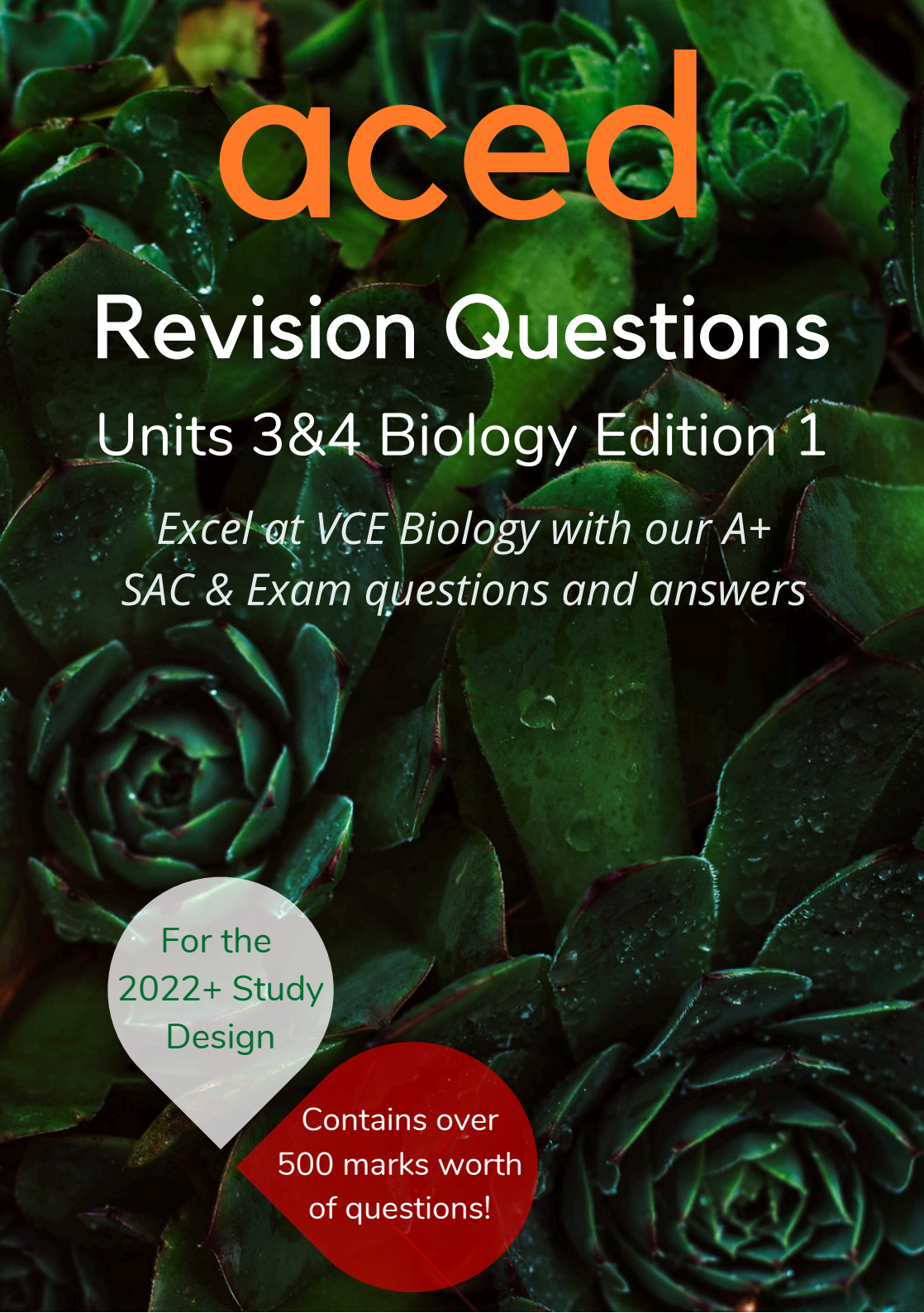




aced

Revision Questions

Units 3&4 Biology Edition 1

*Excel at VCE Biology with our A+
SAC & Exam questions and answers*

For the
2022+ Study
Design

Contains over
500 marks worth
of questions!

ACED Revision Questions

Units 3&4 Biology Edition 1

© ACED 2023

Contents

How to answer SAC and Exam questions in VCE Biology	2
Chapter 1: Nucleic acids and proteins	3
Chapter 2: DNA manipulation techniques	21
Chapter 3: Photosynthesis and cellular respiration	42
Chapter 4: Immunity	61
Chapter 5: Biological evolution	75
Chapter 6: Human change	92
Chapter 7: Scientific investigations	107
Chapter 8: Units 3&4 Biology Trial Exam	127
Chapter 9: Answer Guide	165
Nucleic acids and proteins	165
DNA manipulation techniques	168
Photosynthesis and cellular respiration	171
Immunity	175
Biological evolution	179
Human change	182
Scientific investigations	185
Units 3&4 Biology Trial Exam	189

© ACED, 2023

Except as provided by the Copyright Act 1968, no part of this publication may be photocopied, reproduced, stored in a retrieval system, or communicated without the prior written permission of ACED. VCE is a registered trademark of the VCAA. The VCAA does not endorse or make any warranties regarding this study resource and ACED cannot guarantee the sample questions contained in this book represent the quality of questions published by VCAA's Biology exams.

www.acedvce.com | ABN 44 152 372 983 | PO Box 4061, Richmond East, VIC 3121 | July 2023

Unit 3, Area of Study 1: What is the role of nucleic acids and proteins in maintaining life?

On completion of this unit the student should be able to analyse the relationship between nucleic acids and proteins, and evaluate how tools and techniques can be used and applied in the manipulation of DNA.

Chapter 1: Nucleic acids and proteins

Rate each Study Design dot point a 😊, 😐 or ☹

😊 = I know everything about it and could explain it to someone

😐 = I know most things, but would struggle to explain it to someone

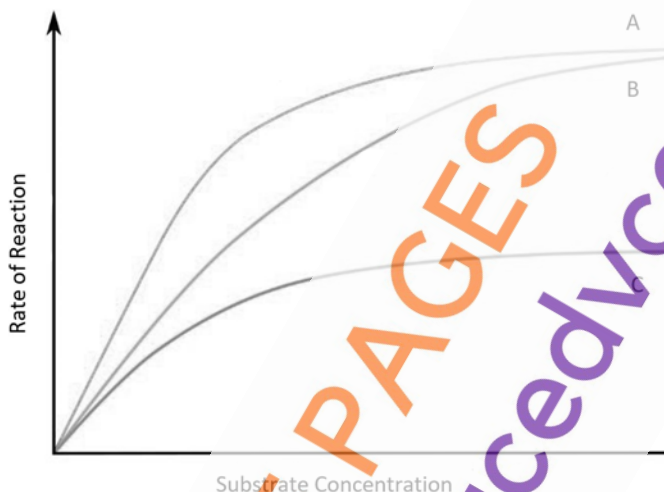
☹ = I don't know much about it

VCAA Biology Study Design Key Knowledge:

- | | |
|---|--|
| • nucleic acids as information molecules that encode instructions for the synthesis of proteins: the structure of DNA, the three main forms of RNA (mRNA, rRNA and tRNA) and a comparison of their respective nucleotides | |
| • the genetic code as a universal triplet code that is degenerate and the steps in gene expression, including transcription, RNA processing in eukaryotic cells and translation by ribosomes | |
| • the structure of genes: exons, introns and promoter and operator regions | |
| • the basic elements of gene regulation: prokaryotic trp operon as a simplified example of a regulatory process | |
| • amino acids as the monomers of a polypeptide chain and the resultant hierarchical levels of structure that give rise to a functional protein | |
| • proteins as a diverse group of molecules that collectively make an organism's proteome, including enzymes as catalysts in biochemical pathways | |
| • the role of rough endoplasmic reticulum, Golgi apparatus and associated vesicles in the export of proteins from a cell via the protein secretory pathway | |

Question 20

Enzymes are involved in catalysing biochemical reactions. The following graph demonstrates the effect of different inhibitors on the rate of enzyme reaction.

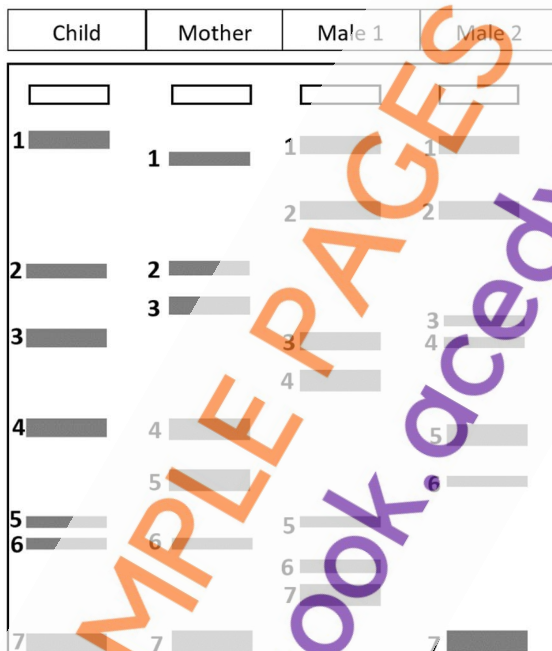


Which of the following best describes the trends in the graph above?

- A. Line A represents normal enzyme functioning; Line B represents competitive inhibition; Line C represents non-competitive inhibition
- B. Line A represents normal enzyme functioning; Line B represents non-competitive inhibition; Line C represents competitive inhibition
- C. Line A represents non-competitive inhibition; Line B represents normal enzyme functioning; Line C represents competitive inhibition
- D. Line A represents competitive inhibition; Line B represents normal enzyme functioning; Line C represents non-competitive inhibition

Use the following information to answer Questions 47 and 48.

There is a dispute over the paternity of a child. In order to determine who the child's biological father is, a DNA profile has been completed for the child, the mother, and the two potential fathers. An electrophoresis gel was produced to compare the DNA of each individual. Each band has been numbered for reference.



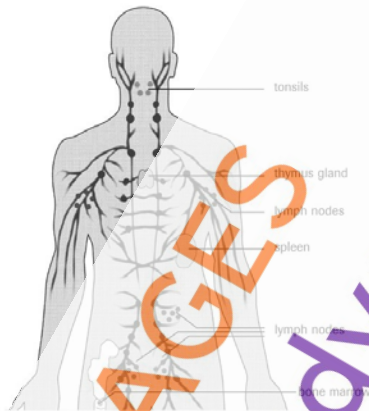
Question 47

Which of the following is a correct statement about this technique of DNA profiling?

- A. the fragments of DNA that are placed in the wells all have a positive charge and move toward the negative electrode
- B. the DNA from each individual is first cut by a ligase enzyme
- C. band 1 represents larger fragments of DNA than band 7
- D. each band represents a different gene

Use the following information to answer Questions 155 – 159.

The diagram below provides a diagrammatic representation of several structures of the lymphatic system.



Question 155 (2 marks)

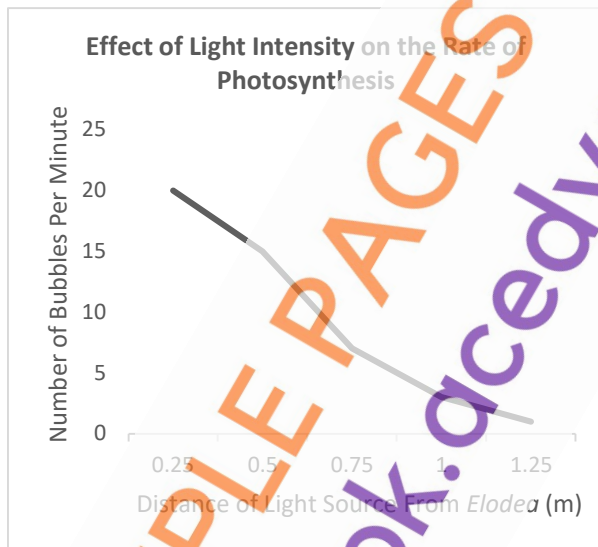
Referring to two structures in the diagram above, describe their role in the innate (non-specific) immune response.

Question 156 (1 mark)

What is the function of the lymphatic system organ, the thymus gland?

Use the following information to answer Questions 267 and 268.

A class of biology students were investigating the impact of light intensity on the rate of photosynthesis in Elodea, an aquatic plant. To do this, a stem of Elodea is placed in a beaker of water. Sodium hydrogen carbonate is added to the water as a source of carbon. A light is placed at various distances to mimic light intensity and the number of gas bubbles that are released from the plant are counted in a one-minute period. The results were graphed and are shown below.



Question 267 (4 marks)

Using data, describe the change in the dependent variable as the independent variable is altered. Name each of these variables in your answer.

Chapter 8: Units 3&4 Biology Trial Exam

aced

Victorian Certificate of Education

STUDENT NUMBER

Letter

BIOLOGY

Written examination

Reading time: 15 minutes

Writing time: 2 hours 30 minutes

QUESTION AND ANSWER BOOK

Structure of book

Section	Number of questions	Number of questions to be answered	Number of marks
A	40	40	40
B	33	33	80
			Total 120

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, and rulers.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.
- No calculator is allowed in this examination.

Materials supplied

- Question and answer booklet.

Instructions

- Write your student number in the space provided above on this page.
- All written responses must be in English.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

Chapter 9: Answer Guide

Nucleic acids and proteins

- 1 A 100 guanine bases pair with 100 cytosine bases, leaving 300 thymine bases to pair with 300 adenine bases.
- 2 D DNA and RNA are both made up of nucleotide monomers which each contain a pentose sugar, a nitrogen-containing base and a phosphate group.
- 3 B DNA is a double-stranded molecule containing the nucleotide thymine, whereas RNA is single-stranded and instead contains uracil. RNA nucleotides are found in both the nucleus and cytoplasm. The last option does not describe a difference.
- 4 D Both DNA and RNA are composed of nitrogen-containing bases – adenine, guanine, cytosine, thymine or uracil. Water does not contain nitrogen.
- 5 B X is a nucleotide monomer, Y is a hydrogen bond, Z is the nitrogen base guanine due to it being a purine (having a double ring) and as it is bonded to a base pair with three hydrogen bonds.
- 6 B A line of exons and introns is pre-mRNA; when the introns are spliced out, this will become mRNA.
- 7 D A codon is a three-base sequence of mRNA; several codons can code for the same amino acid.
- 8 B The ribosome reads mRNA codons in a 5' to 3' direction during translation.
- 9 C Alternative splicing leads to variations in the exon order of mRNA; this contributes to a single gene being able to code for the production of different proteins.
- 10 D Exons are the sections of pre-mRNA that code for the amino acid sequence in a protein.
- 11 D Energy and time can both be conserved via gene regulation.
- 12 A Genes that are under the control of a regulatory gene are structural genes; structural genes code for proteins that play a structural role in a cell.
- 13 C The promoter region is where RNA polymerase attaches before it attempts to read the structural genes.
- 14 A The bonding between amino acid side chains contributes to the 3D shape that signifies tertiary protein structure.
- 15 C Peptide bonds are used in the primary level of protein synthesis, connecting amino acids; hydrogen bonds are formed when 2D folds are produced in the secondary level. Di-sulphide bridges are used to bond two independent peptide chains together, such as the light and heavy arms of an antibody. 'Hydrophobic interactions' is incorrect for the secondary level of protein synthesis.
- 16 C The allosteric site is where a molecule such as a non-competitive inhibitor may bind to an enzyme.
- 17 C The diagram depicts a typical graph where enzyme activity is represented on the y-axis and either temperature or pH on the x-axis.
- 18 D Design D only alters one variable – the pH. Design D also monitors the effect of pH on the substrate without the presence of enzymes; this acts as a control that then allows the effect of pH on enzyme activity to be measured.
- 19 D Extremes in temperature and pH can denature an enzyme. This is irreversible.

Question 320 (3 marks) One mark for recognising each way that a protein structure can be achieved, to a maximum of two marks. One mark for recognising that enzymes require specific active sites:

A specific protein structure could be achieved through its:

- Primary structure; this is the order of amino acids in a polypeptide chain.
- Secondary structure; this is the hydrogen bonding that forms alpha helices or beta-pleated sheets.
- Tertiary structure; this is when the secondary structures fold to form a 3D structure.
- Quaternary structure; this is when there are interactions of two or more polypeptide chains.

AND

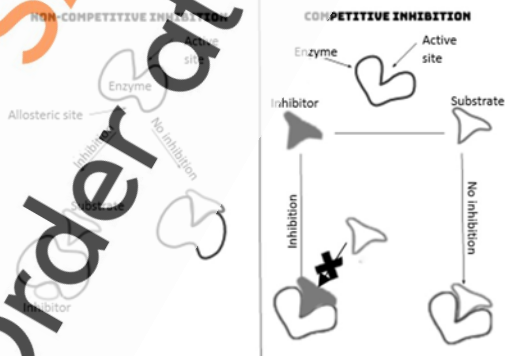
- As the SOD1 is an enzyme, it must have a specifically shaped active site that is complementary in shape to its substrate.

Question 321 (4 marks) One mark for each correct box, to a maximum of four marks.

Disease-Causing Factor	Biological Explanation
A genetic mutation in the SOD1 gene leading to the incorrect shape of the SOD1 antioxidant.	Mutations in the DNA lead to changes in the order of amino acids that are added to the peptide chain responsible for the formation of the SOD1 antioxidant; this leads to an incorrect protein shape, resulting in a non-functional enzyme.
Incorrect interactions between the SOD1 antioxidant and co-factors copper and zinc.	Cellular changes can lead to conformational changes in proteins. These changes can result in non-functional enzymes no longer being capable of binding to their necessary co-factors that are required for reactions.
Chromosomal mutation involving the number 21 chromosome.	This chromosomal mutation may remove all or part of the SOD1 gene; resulting in the production of a defective SOD1 protein, or if the gene is no longer present on the chromosome, this could lead to no SOD1 production.

Question 322 (4 marks) One mark for each of the following points:

- Labelled diagram showing non-competitive inhibition: the diagram must include an enzyme with an active and an allosteric site, a substrate, and an inhibitor.
- It must also show a change in the structure/shape of the active site due to the inhibitor binding to the allosteric site.
- Labelled diagram showing competitive inhibition: the diagram must include an enzyme with an active site, substrate and inhibitor.
- It must also show an inhibitor blocking an active site of an enzyme.



aced

Excel at Biology with over 500 marks worth of A+ questions and answers

- High-quality practice questions to help you prepare for Units 3&4 SACs and the end-of-year exam, tailored to the 2022+ VCE Biology Study Design
- Comprehensive mark-by-mark answer guides
- Explanations for each multiple-choice question
- Full Units 3&4 Trial Exam included!

ACED is a leading provider of quality VCE revision resources, with our **Units 3&4 Exam Revision Lectures** in the September holidays attended by thousands of students each year - do not miss out!

For more great revision, ask your teacher for the ACED Trial SACs and Exams that we publish each year, and check out our website for our latest VCE tips and advice at acedvce.com

Thank you for supporting our team of Victorian teachers at ACED.
Made in Melbourne, printed in Melbourne.

acedvce.com

ISBN 978-0-6454769-2-7



9 780645 476927 >