



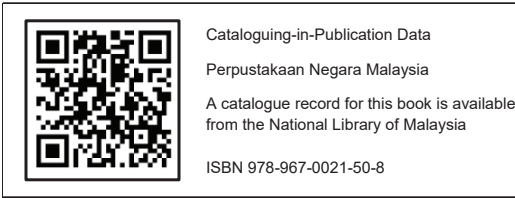
MPT 00303

**SCIENCE
PRE-DEGREE
BIOLOGY**

Aainaa Syazwani Mohamad Amir Hamzah
Nor Shahirul Umirah Idris
Nurul Irene Hanie

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Executive Producer: Azman Hashim. Copy Editor: Amirul Firdaus Zilah,
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Concept & Typesetting: Siti Aishah Mokhtar. Proof Reader: Zaliha Noor
Technical Assistant: Mohd Suhairi Mohamad.

Published by:
UMK Press
Universiti Malaysia Kelantan
Office of Library and Knowledge Management
16300 Bachok, Kelantan
(Member of Malaysian Scholarly Publishing Council (MAPIM))
(Member of Malaysian Book Publishers Association (MABOPA))
Membership Number : 201903)

Printed by:
Visual Print Sdn Bhd
No 47, 47-1
Jalan Damai Raya 1
Alam Damai, Cheras
56000 Kuala Lumpur

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LIST OF ABBREVIATIONS

ADP	Adenosine diphosphate
AIDS	Acquired immunodeficiency syndrome
ANS	Autonomic nervous system
ATP	Adenosine triphosphate
C ₂ H ₆ O	Ethyl alcohol
C ₃ H ₆ O ₃	Lactic acid
C ₆ H ₁₂ O ₆	Glucose
CBD	Convention on Biological Diversity
CDC	Centre for Disease Control and Prevention
CH ₃	Methyl group
CNS	Central nervous system
COOH	Carboxyl group
COVID-19	Coronavirus disease 2019
DNA	Deoxyribonucleic acid
ETC	Electron transport chain
HFMD	Hand, foot, mouth disease
IUB	International Union of Biochemist
IUCN	International Union Conservation of Nature
K	Potassium
MHC	Major histocompatibility complex
Na	Sodium
NAD	Nicotinamide adenine dinucleotide
NADH	Nicotinamide adenine dinucleotide hydride
NADPH	Nicotinamide Adenine Dinucleotide Phosphate Hydrogen
NH ₂	Amino group
NPBD	National Policy on Biological Diversity
NSAIDs	Non-steroid anti-inflammatory drugs
OH	Hydroxyl group
PAV	Population viability analysis
PNS	Peripheral nervous system
RAMSAR	Convention on Wetland
RNA	Ribonucleic acid
SARS	Severe acute respiratory syndrome
SNS	Somatic nervous system
WHO	World Health Organization

PREFACE

Welcome to the first edition of Biology textbook for Science Pre-Degree. We are honoured to present this book which has been created to increase student access to quality learning materials. Our starting point, as always, is our passion for teaching Biology and to help student in acquiring and reinforcing Biology concepts and especially the difficult ones, more easily and effectively. You will find this book interesting as it is specially written and provide instant facts to ease learning and stimulate interest in Biology. Visual aids such as annotated diagram are integrated to make the concepts easier to understand and remember. This book complements all the topics in Biology for Science Pre-Degree syllabus and will certainly help in your preparation for the examination.

AAINAA SYAZWANI MOHAMAD AMIR HAMZAH
NOR SHAHIRUL UMIRAH IDRIS
NURUL IRENE HANIE

CHAPTER 1

BIOLOGY MOLECULES

WATER

Water is the most abundant, smaller molecular and typically makes up between 60-95 % of the new mass of an organism. Water is essential for two reasons:

1. It is a vital chemical constituent of living cells.
2. It provides an environment for those organisms that live in water.

Polarity and the formation of hydrogen bonds between water molecules are water's two most essential features.

Structure of Water Molecule

One oxygen atom bonds to two hydrogen atoms to form the water molecule. Due to oxygen's strong electronegativity, the bonds are polar covalent (Figure 1.1).

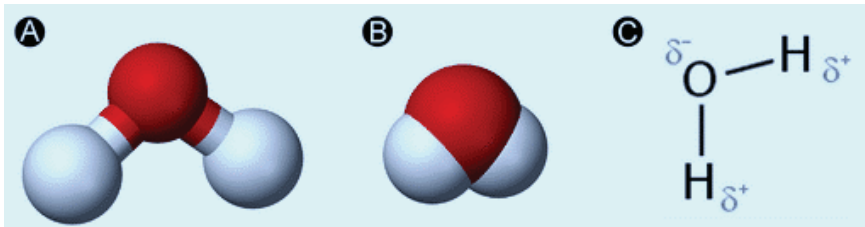


Figure 1.1: The water molecule is visualized in three ways: ball-and-stick, space-filling, and the structural formula with partial charges.

The oxygen atom's attraction has for the shared electrons in the covalent bonds is substantially more potent than the hydrogen atoms. As a direct consequence, the oxygen atom oxygen must take on a partial negative charge (δ^-), whereas each hydrogen atom must take on a partial positive

charge (δ^+), as shown in Figure 1.1. The angle formed by the H-O-H bond is approximately 104.5° . Because of this, the molecule takes on a curved shape due to the two lone electron pairs found on the oxygen atom.

Polar molecules are attracted by dipole-dipole forces, with one molecule's positive end attracting the opposite end of a neighbouring molecule.

Hydrogen Bonds

Highly polar O-HO-H bonds reduce electron density around water's hydrogen atoms. Each hydrogen atom is drawn to the lone pair of electrons on a nearby oxygen atom (Figure 1.2). Water molecules have a weak affinity for one other because opposing charges make them 'sticky'. These weaker bonds are hydrogen bonds.

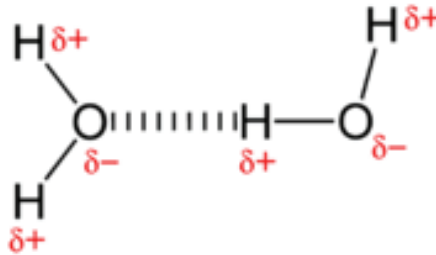


Figure 1.2: A hydrogen bond is the attraction between a lone pair of oxygen electrons and an electron-deficient hydrogen atom.

A positively charged portion of one molecule forms a hydrogen bond with a negatively charged region of another molecule through electrostatic attraction between the two regions. They undergo a continuous process of formation, destruction, and reformation in the presence of water. Only 20% of these hydrogen bonds are created when water molecules are allowed to dwell in a liquid state at ambient temperature. When the temperature drops below 0°C , all water molecules combine to create the three-dimensional