B4 analyse the structure and function of biological molecules in living systems, including
– carbohydrates
– lipids
– proteins
– nucleic acids

❑ demonstrate a knowledge of dehydration synthesis and hydrolysis as applied to organic monomers and polymers

❑ differentiate among carbohydrates, lipids, proteins, and nucleic acids with respect to chemical structure

❑ recognize the following molecules in structural diagrams:

– adenosine triphosphate (ATP), deoxyribonucleic acid (DNA), disaccharide, glucose, glycerol, hemoglobin, monosaccharide, neutral fat, phospholipid, polysaccharide (starch, glycogen, and cellulose), ribose, RNA, saturated and unsaturated fatty acids, steroids

❑ recognize the empirical formula of a monosaccharide as $C_nH_{2n}O_n$

❑ list the main functions of carbohydrates

❑ differentiate among monosaccharides (e.g., glucose), disaccharides (e.g., maltose), and polysaccharides

❑ differentiate among starch, cellulose, and glycogen with respect to
– function
– type of bonding
– level of branching

❑ describe the location, structure, and function of the following in the human body:
– neutral fats
– steroids
– phospholipids

❑ compare saturated and unsaturated fatty acids in terms of molecular structure

❑ list the major functions of proteins

❑ draw a generalized amino acid and identify the amine, acid (carboxyl), and R-groups

❑ identify the peptide bonds in dipeptides and polypeptides

❑ differentiate among the following levels of protein organization with respect to structure and types of bonding:

– primary, secondary (alpha helix, beta pleated sheet), tertiary, quaternary (e.g., hemoglobin)

❑ list the major functions of nucleic acids (RNA and DNA)

❑ name the four nitrogenous bases in ribonucleic acid (RNA) and describe the structure of RNA using the following terms:
– nucleotide (ribose, phosphate, nitrogenous base, adenine, uracil, cytosine, guanine)
– linear, single stranded
– sugar-phosphate backbone

❑ name the four nitrogenous bases in DNA and describe the structure of DNA using the following terms:
– nucleotide (deoxyribose, phosphate, nitrogenous base, adenine, thymine, cytosine, guanine)
– complementary base pairing
– double helix
– hydrogen bonding
– sugar-phosphate backbone

❑ compare the general structural composition of DNA and RNA

❑ relate the general structure of the ATP molecule to its role as the
– "energy currency" of cells

B5 describe DNA replication

❑ describe the three steps in the semi–conservative replication of DNA:
– "unzipping" (DNA helicase)
– complementary base pairing (DNA polymerase)
– joining of adjacent nucleotides (DNA polymerase)

❑ describe the purpose of DNA replication

❑ identify the site of DNA replication within the cell

B6 describe recombinant DNA ❑ define recombinant DNA

❑ describe a minimum of three uses for recombinant DNA

B7 demonstrate an understanding of the process of protein synthesis

❑ identify the roles of DNA, messenger RNA (mRNA), transfer RNA (tRNA), and ribosomes in the processes of transcription and translation, including initiation, elongation, and termination

❑ determine the sequence of amino acids coded for by a specific DNA sequence (genetic code), given a table of mRNA codons

❑ identify the complementary nature of the mRNA codon and the tRNA anti-codon

B8 explain how mutations in DNA affect protein synthesis

❑ give examples of two environmental mutagens that can cause mutations in humans

❑ use examples to explain how mutations in DNA change the sequence of amino acids in a polypeptide chain, and as a result may lead to genetic disorders