LSEP_1_T1_Revision exercise_Ans

1. Which of the following bonds join amino acids together in a polypeptide chain?
   A. Disulphide bond
   B. Glycosidic bond
   C. Hydrogen bond
   D. Peptide bond
   E. Phosphodiester bond

   Disulphide bond occurs between 2 sulphur-containing cysteine residues in a polypeptide and contribute to the tertiary structure of a protein; glycosidic bond joins monosaccharides (single sugar); hydrogen bond exits between molecules and hold them together (e.g. between water molecules); phosphodiester bonds join nucleotides together to form nucleic acids. (Lecture 4: P.32-36)

2. How many single covalent bonds can a carbon atom form with other atoms?
   A. One
   B. Two
   C. Three
   D. Four
   E. Five

   Lecture 1: P.10&22

3. Which of the following involves the breaking of covalent bonds in water molecules?
   A. Absorption of heat
   B. Autoionization into H^+ and OH^-
   C. Display of strong surface tension
   D. Solvation of salt
   E. Vaporization at high temperature

   Lecture 3: P.15-16

4. Which of the following are secondary structures found in proteins?
   A. Alpha-helix and beta-pleated sheet
   B. Alpha-helix and double helix
   C. Beta-helix and double helix
   D. Beta-pleated sheet and double helix
   E. Beta strand and beta-pleated sheet

   Levels of proteins structure: primary (amino acid sequence), secondary (α-helix and β-pleated sheet), tertiary (final 3D structure of a polypeptide), quaternary (association of protein subunits) – Lecture 4: P.32-36

5. What is the first level of protein structure?
   A. Non-polar molecule
   B. Polar molecule
   C. Primary structure
   D. Quaternary structure
   E. Secondary structure

   Levels of proteins structure: primary (amino acid sequence), secondary (α-helix and β-pleated sheet), tertiary (final 3D structure of a polypeptide), quaternary (association of protein subunits) – Lecture 4: P.32-36

6. Which of the following involves the breaking of hydrogen bonds between water molecules?
   A. Absorption of heat
   B. Autoionization into H^+ and OH^-
   C. Display of strong surface tension
   D. Solvation of salt
   E. Vaporization at high temperature

   Water molecules are held together by a strong attraction force known as the hydrogen bonds. During vaporization/evaporation, a lot of energy is needed to break the hydrogen bonds to separate the water molecules so that water becomes a gas – Lecture 1: P31 & Lecture 3: P11

7. Which of the following correctly describes the quaternary structures in protein?
   A. It refers to the alpha-helix and beta-pleated sheet structures held together by hydrogen bond.
   B. It refers to the folding and bending of alpha-helix and beta-pleated sheet structures by forming covalent bonds.
   C. It refers to the interaction of polypeptide subunits to form the final structure of the protein.
   D. It refers to the interaction between alpha-helix and beta-pleated sheet structures to form the final structure of the protein.
   E. It refers to the sequence of amino acids linked together by peptide bonds.

   Levels of proteins structure: primary (amino acid sequence), secondary (α-helix and β-pleated sheet), tertiary (final 3D structure of a polypeptide), quaternary (association of protein subunits) – Lecture 4: P.32-36

8. Which of the following is a monosaccharide?
   A. Cellulose
   B. Glycogen
   C. Glucose
   D. Lactose
   E. Sucrose

   Cellulose is a polysaccharide formed by joining glucose, component of plant cell wall; glycogen is a polysaccharide formed by joining glucose, storage form of glucose in animal; lactose is a disaccharide made of glucose and galactose, sucrose is a disaccharide made of glucose and fructose – Lecture 3: P. 18-27

9. Which of the following is a disaccharide?
   A. Fructose
   B. Galactose
   C. Glucose
   D. Lactose
   E. Ribose

   Ribose, a 5 carbon monosaccharide (pentose), is a component of nucleotides for forming RNA. Deoxyribose in DNA – Lecture 3: P.41-45

10. Which of the following best describe polar molecule?
    A. It is uncharged.
    B. It carries negative charge.
    C. It carries positive charge.
    D. It is has uneven charge (electron) distribution over the molecule.
    E. It is uncharged and any charges present are evenly distributed over the molecule.

    Lecture 1: P.19-21

11. What is the name of the disaccharide made of glucose + fructose (table sugar)?
    A. Hexose
    B. Lactose
    C. Maltose
    D. Pentose
    E. Sucrose

12. Which of the following is a type of chemical bond that involves the sharing of a pair of electrons between two adjacent atoms in a molecule?
    A. Double covalent bond
    B. Hydrogen bond
    C. Hydrophobic force
    D. Ionic bond
    E. Single covalent bond

13. Which of the following is a type of chemical bond that involves transfer of an electron from an atom to another atom?
    A. Double covalent bond
    B. Hydrogen bond
    C. Hydrophobic force
    D. Ionic bond
    E. Single covalent bond

    Lecture 1: P.26

14. Which of the following macromolecules has the most diverse function in the body?
    A. Carbohydrates
    B. Deoxyribonucleic acids
    C. Lipids
    D. Proteins
    E. Ribonucleic acids

15. In a water molecule, the bond between oxygen and hydrogen atoms is
    A. a covalent bond.
    B. a hydrogen bond.
    C. a polar covalent bond.
    D. a non-polar covalent bond.
    E. an ionic bond.

    Lecture 1: P.19-21, Lecture 3: P6-7

16. Which of the followings are the FOUR most abundant chemical elements in our body?
    A. C, H, O, P
    B. C, N, H, O
    C. C, P, N, O
    D. Ca, C, H, O
    E. Na, C, H, O

    Lecture 1: P.10

17. Substances dissolved in a liquid are known as:
    A. ions.
    B. polymers.
    C. solutes.
    D. solutions.
    E. solvents.

    The liquid that dissolves substance is the solvent and the dissolved substance is called solute. The liquid with dissolved substance is called a solution – Lecture 1: P.12

18. Which of the following molecules cannot be digested by our body?
    A. Cellulose
    B. Collagen
    C. Glycogen
    D. Peptides
    E. Triacylglycerol

19. Ionic bond is the
    A. attraction force between atoms.
    B. attraction force between ions of the same charge.
    C. attraction force between ions of the opposite charge.
    D. attraction force between molecules.
    E. repulsive force between molecules.

    Lecture 1: P.26

20. What is the name of the five carbon sugar found in DNA?
    A. Deoxyribose
    B. Hexose
    C. Oxyribose
    D. Polymer
    E. Ribose

    Deoxyribose, a 5 carbon monosaccharide (pentose), is a component of nucleotides for forming DNA. Ribose in RNA – Lecture 3: P.41-45

21. Which of the following biological molecules provides immediate chemical energy to power various cellular processes?
    A. Adenosine triphosphate
    B. Fibrous protein
    C. Globular protein
    D. Glucose
    E. Triacylglycerol

    ATP is the form of energy that cells uses. Glucose and triacylglycerol are fuel molecules that our body breaks down to form ATP. Proteins are not usually broken down to form ATP unless the body is depleted of carbohydrates and fat in starvation – Lecture 2: P.11-12, lecture 5

SAQ

1. Carbohydrates supply energy to body cells.
    (a) What are the chemical elements that make up glucose?
    (b) State one food that is rich in polysaccharides that can be digested and absorbed by the body.
    (c) Name the enzyme that digests dietary polysaccharides in our body.
    (d) Which kind of polysaccharide found in food cannot be digested by our body?
    (e) Excess glucose in our body can be linked up to form larger carbohydrate molecules. Name this form of carbohydrate and indicate where it is stored in the body.
    (f) The body can only store limited amount of carbohydrates. When the limit is reached, excessive carbohydrates will be converted into another type of macromolecule for long term storage. Name this macromolecule. Briefly describe is structure and state where is it stored in the body.

    Ans
    (a) Carbon, hydrogen, oxygen
    (b) e.g. rice, potato, noodles
    (c) Amylase
    (d) Cellulose
    (e) Glycogen, in liver and skeletal muscles
    (f) Triglycerol/triacylglycerol; structure: 3 fatty acid chains linked to a glycerol molecule through ester bond, stored in adipose tissue

2. Nucleic acids are formed by linking nucleotides through phosphodiester bonds.
   (a) What atoms can be found in a nucleotide?
   (b) Name the 3 components of a nucleotide.
   (c) Name the 5 nitrogenous bases that are found in nucleic acids.
   (d) Name the 2 types of nucleic acids.
   (e) List 2 structural differences between the named nucleic acids.

   Ans
   (a) Hydrogen, carbon, oxygen, nitrogen, phosphorus
   (b) A nucleotide is composed of a ribose, a phosphate group and a nitrogenous base
   (c) Adenine, thymine, guanine, cytosine, uracil
   (d) DNA (deoxyribonucleic acid) and RNA (ribonucleic acid)
   (e) DNA – double-stranded; RNA – single-stranded
   DNA – contains bases ATGC; RNA – contains bases AUGC
   DNA – deoxyribose; RNA – oxyribose

3. Lipids are a diverse group of hydrophobic molecules, which includes fatty acids, triglycerols, phospholipids and steroids.
   (a) State the function of each type of lipid.
   (b) State the atoms found in each type of lipid.
   (c) State 2 structural difference between triglycerols and phosphoslipids.
   (d) What is the basic structure of fatty acid?
   (e) Fatty acids are classified into saturated and non-saturated fatty acids. What is the structural difference between saturated and non-saturated fatty acids?
   (f) Name the lipid molecule that all steroids are derived from.

   Ans
   (a) Fatty acid – can be metabolized by cells to produce ATP
   Triglycerol – long term storage of energy, major fuel store of the body
   Phospholipids – forms cell membranes
   Steroids – steroid hormones for regulation of body function (e.g. sex hormones), vitamin D3 for absorption of Ca^{2+} and bile acids for fat digestion and absorption.
   (b) Carbon, hydrogen and oxygen in fatty acid, triglycerol and steroids, carbon, hydrogen, oxygen and phosphorus in phospholipids
   (c) Triglycerols have 3 fatty acid chains linked to a glycerol molecule
   Phospholipids have 2 fatty acid chains and phosphate group like to a glycerol molecule
   (d) A long hydrocarbon chain with a carboxyl group (-COOH) at one end.
   (e) Saturated fatty acids contain single covalent bonds between the carbon atoms in the hydrocarbon chain while non-saturated fatty acids have one or more double covalent bonds between the carbon atoms.
   (f) Cholesterol

4. Protein has the most diverse functions in the body.
   (a) Name the monomer for building proteins and briefly describe its structure.
   (b) Name the bond that joins the monomers together in protein.
   (c) What is the primary structure of protein?
   (d) State the TWO types of folding pattern in secondary structure of protein and name the attraction forces that hold the structure in place.
   (e) What are the attraction forces that contribute to the final protein structure?
   (f) What are the difference between globular and fibrous protein? Give an example for each type.

Ans

(a) Amino acid consists of an amino group, a carboxyl group, a hydrogen atom and a side group linked to a central carbon atom.
(b) Peptide bond
(c) The specific sequence of amino acid molecules joined by peptide bonds
(d) Alpha-helix and beta-pleated sheet, hydrogen bonds
(e) Hydrogen bonds, ionic bonds, van da Waal's force, hydrophobic interaction
(f)

	Globular proteins	Fibrous proteins
Structure	Polypeptide coiled into compact spherical shape	Long linear polypeptide chains that are bundled together to form rods or sheets
Soluble in water?	Water soluble as the hydrophilic groups are on the surface of the protein	Water insoluble
Function	Diverse functions – e.g. transport proteins for carrying substances in blood, membrane carriers for transporting substance into or out of cells, enzymes for catalysing reactions, hormones	Serves structural roles to give strength and protection to tissues
Example	Haemoglobin, ferritin, Na^+/K^+-ATPase, amylase, insulin	Collagen, keratin, elastin