Background Chemistry

protons
neutrons
electrons
nucleus
orbit
ionic
covalent
salts
share
transfer

Atoms of elements have various numbers of _____(+), _____(neutral) and _____(-).

Protons and neutrons are found in the _____of the atom. Electrons are found in _____around the outside of the nucleus.

In an _____ bond, the oppositely charged ions are attracted to each other.

The compounds formed from this type of reaction are generally called _____.

When two or more non-metal elements _____ electrons so that each atom can have access to a full outer shell of electrons then a _____ bond is formed.

Water:

In water, each hydrogen atom is bonded with a single _____ bond. Oxygen is a larger atom than hydrogen, the shared pair of electrons end up spending more time around the oxygen atom than the hydrogen.

polar
covalent
negative
positive
hydrogen bond
Proteins
DNA

The oxygen in water has a slight _____ charge, and the hydrogens have a slight _____ charge. A water molecule is a _____ molecule.

When two water molecules are near each other, they form a _____ _____.

In _____, it is _____ _____ that holds the two sides of the twisted ladder together in its helical shape.

_____ are folded chains of amino acids, and _____ _____ are responsible for maintaining certain folds of proteins. Without a very specific fold, a protein (enzyme) may become inactive.

Properties of water that benefit life.

Ions
thermoregulator
cohesive
solvent
lubricants

1. Water is the universal _____ for polar (charged) molecules and helps chemical reactions within our bodies. _____ would not form like Na^+ or Cl^- ions if not dissolved in water.
2. Water molecules are _____ or 'sticky', and therefore liquids fill vessels, such as blood vessels. Water is an excellent transport medium. Water's cohesiveness also makes it a suitable component of _____ for epithelial tissues (gut lining) as well as inbetween joints.
3. It has a very high specific heat capacity, and therefore prevents drastic temperature changes. It is an ideal _____.
4. Water has a high heat of _____ due to the energy needed to break all of the hydrogen bonds. When one sweats (sweat is mostly water) a large amount of body heat is required to <u>evaporate</u> that sweat. Heat loss = keeping cool.

Acids, Bases & Buffers

6.023×10^{23}
1.0×10^{-7}
base
hydrogen bonding
alklalinity
acid
acidic
basic
neutral
buffers
7.4
2
8
7.5
6

Water itself dissociates to H^+ and OH^- ions in very small quantities. For each litre of water there are _____ moles of H^+ ions and _____ moles of OH^- ions

A 'mole' is _____ of something just like a 'dozen' is 12 of something or a 'couple' is 2 of something.

An _____ is a compound that will increase the number of H^+ ions when put into solution.

A _____ is a compound that will decrease the number of H+ ions when put into solution OR increase the number of OH- ions.

The opposite of acidity is _____.

A pH of 7 to 14 is _____.

A pH of 7 is _____.

A pH of 0 to 7 is _____.

If the H^+ or OH^- ions in a solution are not regulated they may disturb _____ _____ in important proteins and DNA molecules.

Combinations of compounds called _____ are compounds that can take up excess H^+ or OH^- ions.

Optimum pH in the blood is about _____.

Stomach Acid (HCl) has a pH of about _____.

In the small intestine the optimum pH is about _____due to the excretions of the pancreas.

Sperm are more viable in a slightly basic solution, and seminal fluid is found to have a pH of _____.

Our kidneys help keep blood pH at approximately 7.4 on a long term basis by excreting H^+ ions and reabsorbing HCO_3^- ions as needed. Urine usually has a pH of _____ or lower because our diet has many acidic foods.

The major categories of Biological molecules are:

- _____
- _____
- _____
- _____

Complete the following chart.

Nucleotide
Carbohydrates
Nucleic Acids
Monosaccharide
Proteins
Lipids
hydrolysis
condensation
synthesis

Polymer	*Monomer*
Carbohydrate	_____
_____	Amino acid
Nucleic Acid	_____

Monomers join together to make polymers through a _____ reaction.

Polymers can break down into their monomers through a _____ reaction.

Carbohydrates

adhere
structural
storage
recognition
CH_2O
$C_6H_{12}O_6$
polysaccharides
monosaccharides
disaccharides
lactose
maltose
sucrose
glycogen
starch
cellulose
glycosidic
liver
muscle

Functions

- for quick and short-term energy _____ in all organisms.
- have _____ function in plants, bacteria and insects.
- have cell _____ roles as in the A, B, O blood groupings
- The glycocalyx also help cells _____ to each other.

Structure

- _____ is the empirical formula for a carbohydrate
- _____is the structural or molecular formula for glucose.

- Simple carbohydrates include the _____ and the _____.
- Complete the following table

_____	**Disaccharides**
glucose	_____ (glucose + glucose)
fructose	_____ (glucose + fructose)
galactose	_____ (glucose + galactose)

- Complex carbohydrates (aka:_____) are polymers and are made up of many _____ joined together.
- _____ is a storage form of glucose in plants. There is some side branching so.
- _____ is a storage form of glucose in animals. It has considerably more side branching than starch molecules.
- _____ is a structural polysaccharide found in plant cell walls. Cellulose is also long chains of glucose monomers, but every second _____ bond is invertedjoining monomers is upside down.

Lipids

Functions

- _____ function as energy storage molecules, insulators against heat loss, and cushion tissue for organs.
- _____ are generally something in our diet, however they are converted to fats in our bodies and therefore only function as a nutrient.
- _____ are the main component of membranes.
- _____ generally act as hormones (messenger molecules) and are also components of cell membranes (cholesterol)

Fats
Steroids
Oils
Phospholipids
triglycerides
unsaturated
saturated
phosphate group
non-polar
polar

Structure

- _____ are all formed from one glycerol molecule reacted with three fatty acid molecules through a condensation synthesis reaction.
- In _____ fatty acids the carbon chain is completely surrounded by hydrogen; only single covalent bonds between the carbons.
- In _____ fatty acids the carbon chain is partially surrounded by hydrogen because of some double bonds between the carbon atoms.
- Phospholipids are similar to the triglycerides except there are only 2 fatty acids. Instead of a third, there is a _____.
- The head of a phospholipid is _____ and are hydrophilic while the tails are have non-polar hydrophobic regions.
- _____ have a basic structure of 4 fused carbon rings with various functional groups around the outside.
- _____ is a component of cell membranes and is an example of a steroid.

Proteins

- The _____ of proteins is the amino acid.
- Draw an amino acid & label its parts:

monomer
Non-essential
Essential
condensation synthesis
hydrolysis
Dipeptides
Polypeptides
peptide bonds
globular
beta-pleated
protein
alpha-helical
amino acids
tertiary

- _____ amino acids must be ingested since our bodies do not manufacture these molecules
- _____ amino acids can be made by our bodies from other amino acids.
- Polar vs. non-polar: This designation has implications about the different levels of structure that can be achieved as we will note later.
- Amino acids join together with _____ _____through _____ _____ reaction to form peptides
- _____ – two amino acids joined
- _____ – three or more amino acids joined
- _____ – when a peptide reaches has 50 or more amino acids then it is referred to as a protein.

Primary – the specific sequence or order of the _____ in a protein.

Secondary – includes the tendency for amino acid chains to form _____ shapes and _____ sheets.

Tertiary – the folding of the amino acid chain and it's secondary structures into a _____ shape

Quaternary – the joining of two _____ proteins determines a quaternary level of protein structure. Ex. hemoglobin

insulin
myosin
keratin
antibodies
hemoglobin
actin
collagen
channels
pepsin

Functions

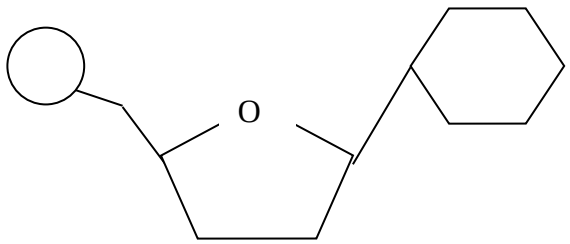
- **Structural roles**
  - _____: makes up hair and nails
  - _____: support in ligaments, tendons, and skin
  - _____ *and* _____: make up muscle fibres in muscle cells that allow contraction AND are a major component of the cytoskeleton of cells.
- Hormonal roles
  - _____: messenger molecule in blood from pancreas that signals for cells to absorb glucose.
- transportation roles
  - _____*: transports O2 in the blood.*
- cell recognition roles
  - _____: used by immune system to help identify foreign material or specific antigens in the blood
- Membrane proteins
  - act as _____ for specific molecules to cross membrane.
- enzyme proteins
  - _____*:* breaks protein down into small peptides in the stomach.

Nucleic Acids

Structure

pentose sugar
double helix
phosphate group
nitrogenous
pyrimidines
purines
deoxyribose
complimentary
rungs
single
C
U
A
Thymine
Uracil
ribose

- DNA (Deoxyribonucleic Acid) has a _____ shape
- A nucleotide has three parts:
  - A _____ ring: deoxyribose
  - A _____: PO_4
  - 1 of 4 _____ bases (ie. they raise pH):
    - The _____, guanine (G) and adenine (A), are double ring bases
    - The _____, thymine(T) and cytosine (C), are single ring bases
- Label the following diagram with the three parts listed above



- The _____ and the _____ _____ make up the sides of the ladder while the bases point inwards to make up the _____ of the ladder.

- The bases on opposite strands always pair accordingly:
  - G always pairs with ____with three hydrogen bonds
  - ____ always pairs with T with two hydrogen bonds

  This is **_____ base pairing**.

- RNA (Ribonucleic Acid) is also a sequence of nucleotides with the following differences from DNA (see table 2.3 pg. 41)
  - it is usually _____ stranded
  - it is not helical
  - it uses _____ sugar instead of deoxyribose
  - there is no _____ in RNA. _____ is used instead

Functions

code
transferRNA
ribosomal RNA
messenger RNA
RNA
adenosine triphosphate
glucose
three
phosphate groups
adenosine diphosphate

- The sequence of the bases in a DNA molecule provide the _____ for the amino acid sequences of all proteins made in cells.
- _____ is a copy of one strand of an unzipped DNA molecule and can have 1 of 3 different functions in eukaryotic cells.
  - _____ becomes a ribosome subunit out in the cytoplasm
  - _____delivers the genetic code from nucleus to the ribosome
  - _____ picks up amino acids in the cytoplasm and brings them to ribosomes.

(ATP) aka: _____

- referred to as the "energy currency of cells".
- a nucleotide with deoxyribose, adenine and _____ phosphate groups
- mitochondria makes ATP from _____

- energy is stored between the 2nd and the 3rd _____; when hydrolyzed to make _____ and inorganic phosphate the energy released is used for many cell processes such as:
  - macromolecule synthesis
  - muscle contraction
  - conduction of nerve impulses
  - membrane channel operation