The SGS - Study Guide Slide – Chemical Fields

- **Students must KNOW:**
  1. What is Organic Chemistry? What are the 6 (SIX!) Elements crucial to life on Earth? What are the 4 Major Biomolecules, and which ones are also "Macronutrients"?
  2. What is a Solution? What are the two parts of a Solution? What is Osmosis and how does it relate to "Salt"?
  3. What is Nuclear Chemistry? How do scientists discover particles smaller than Protons, Neutrons, and Electrons? What is an example of an "Elementary Particle"?

- **Students must be able to DO:**
  1. Identify and Name Ionic and Covalent Compounds using the system of naming rules.
  2. Compare and Contrast Acids and Bases, and be able to identify them by pH.
  3. Compare and Contrast Nuclear Fusion and Fission and give an example of where/when each happens.

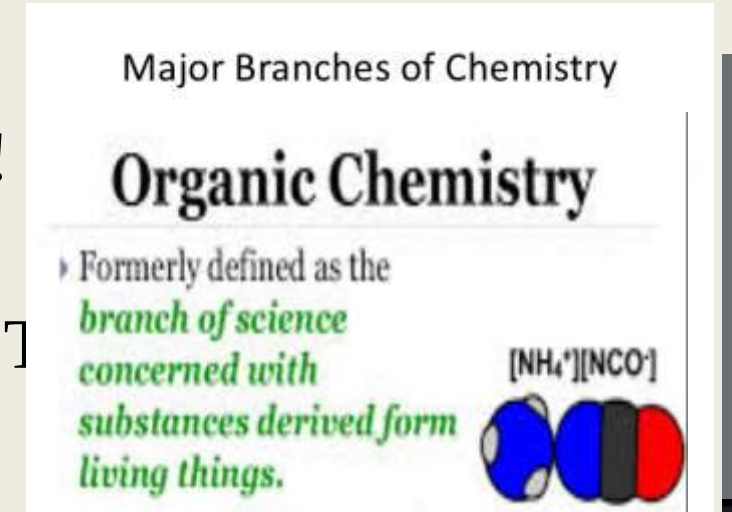
THE SGS - STUDY GUIDE SLIDE – CHEMICAL FIELDS

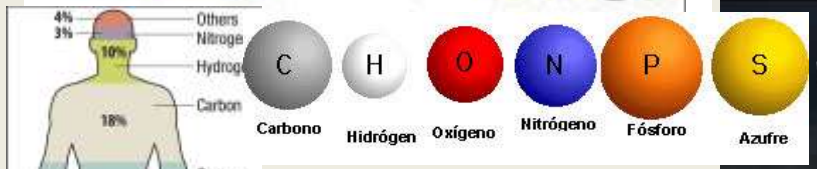
- **Students must KNOW:**
  1. The study of carbon-containing compounds, which can make up living (ex: humans) or non-living (ex: PVC pipes) things. Carbon, Hydrogen, Nitrogen, Oxygen, Phosphorus, and Sulfur aka CHNOPS. Nucleic Acids, Proteins, Lipids aka Fats, and Carbohydrates. Proteins, Lipids aka Fats, and Carbohydrates.
  2. A heterogeneous mixture aka a mixture in which one part fully dissolves in the other. Solute (what is dissolved) and Solvent (what does the dissolving). The movement of water from low amounts of solute to higher amounts. Salt is an example of a solute.
  3. The field of chemistry focused on processes that occur in and around an atom's nucleus. They smash them together using particle accelerators/colliders. Any particle not made of smaller particles, such as Quarks, Gluons, Electrons, Muons, Tau Particles, Photons, W & Z Bosons, Neutrinos, and the Higgs Boson.

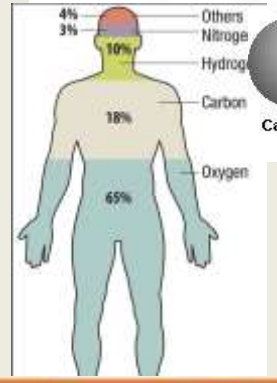
- **Students must be able to DO:**
  1. We were already assessed on this during our last Vocal Quiz.
  2. Acids tend to be corrosive, sour-tasting, and possessing a “pH” less than 7. Bases aka Alkalines are also corrosive, but bitter/soapy-tasting, slippery, and possessing a “pH” greater than 7! pH is a measure of the acidity or basicity/alkalinity of a substance, and this scale goes from 1 (CRAZY ACIDIC) to 14 (CRAZY BASIC).
  3. Nuclear Fusion occurs when two smaller nuclei fuse into a larger one, releasing a ton of energy. Nuclear Fission occurs when a larger Atomic Nucleus breaks into two smaller nuclei along with a whole lot of energy. Nuclear Fusion occurs in the sun and in some man-made devices/weapons. Nuclear Fission can be induced by Neutrons when it occurs in power plants and nuclear weapons, but it also occurs spontaneously in nature when heavy atomic nuclei undergo “radioactive decay”. Note also that “radiation” refers to the transfer of energy as particles/waves!

Organic Chemistry – Jot This Down!

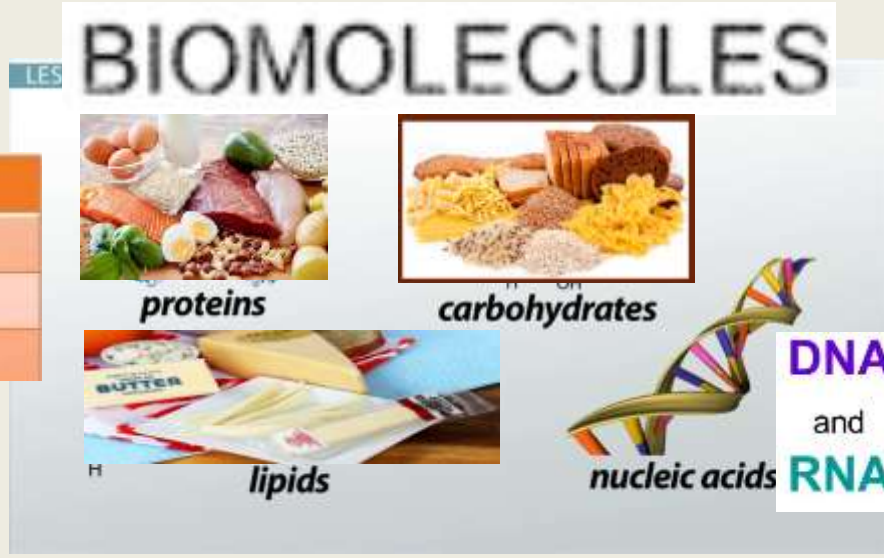
- ORGANIC Chemistry is the study of **CARBON CONTAINING COMPOUNDS**!
- There are SIX (6!) main Elements VITAL to life on Earth and thus most abundant in MOST living things!
  - CARBON (C), HYDROGEN (H), OXYGEN (O), NITROGEN (N), PHOSPHORUS (P), AND SULFUR (S) AKA **CHONPS**!
- These Elements are found BONDED inside living things as the FOUR Major Biomolecules!
  - Nucleic Acids, Carbohydrates, Proteins, and LIPIDS!
  - The last three are also known as "Macronutrients"!





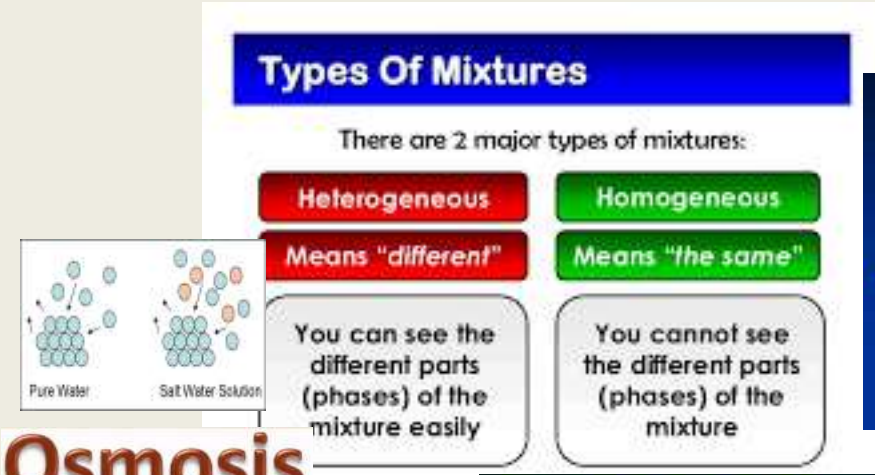


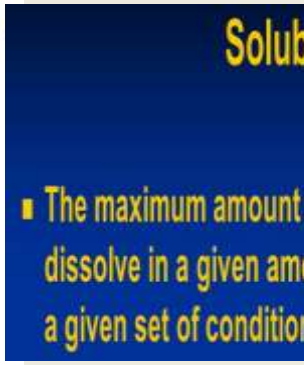
Calorie Content of Macronutrients
Fat: 9 calories per gram
Protein: 4 calories per gram
Carbohydrates: 4 calories per gram

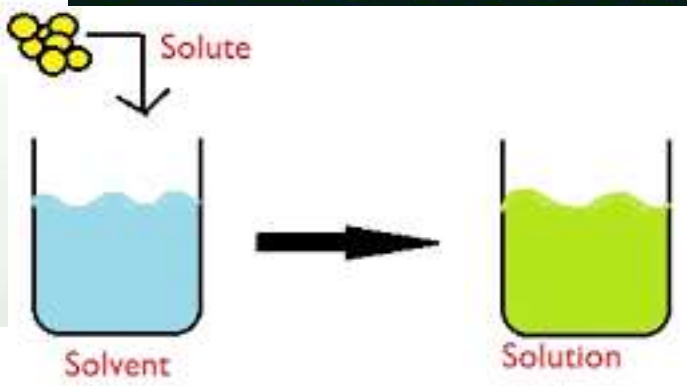


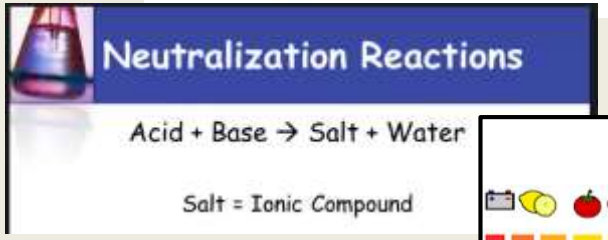
Solutions, Salts, Acids, Bases, AND pH – Jot This Down!

- SOLUTIONS are "homogenous" mixtures in which one component (called the "Solute") is DISSOLVED in another component (called the "Solvent")!
  - SALTS, crystalline compounds that dissolve into ELECTROLYTES (Ions!) are often found as SOLUTES in a Solution where WATER is the SOLVENT!
- Water is DRAWN towards Salts in a process called "Osmosis", and SALTS are more formally defined as a SOLID compound produced from a NEUTRALIZATION reaction between an "Acid" and a "Base"!
- ACIDS tend to be corrosive, sour-tasting, and possessing a "pH" LESS than 7!
- BASES aka ALKALINES are also corrosive, but bitter/soapy-tasting, slippery, and possessing a "pH" GREATER than 7!
  - pH is a measure of the ACIDITY or BASCITIY/ALKANLINITY of a substance, and this scale goes from 1 (CRAZY ACIDIC!) to 14 (CRAZY BASIC!)



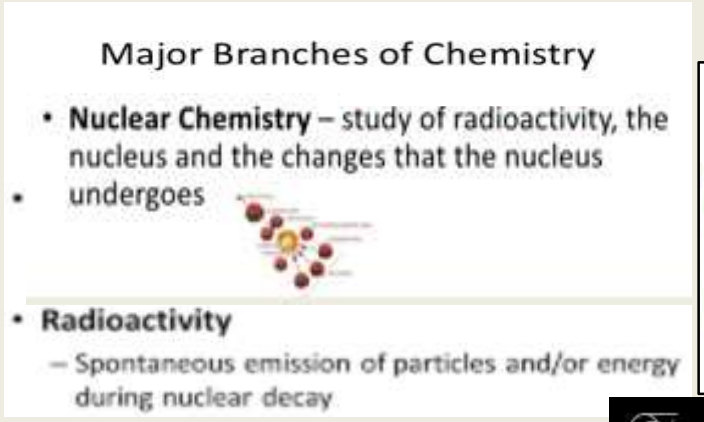


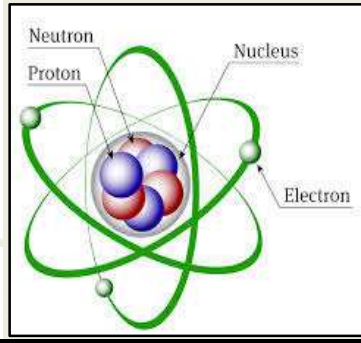


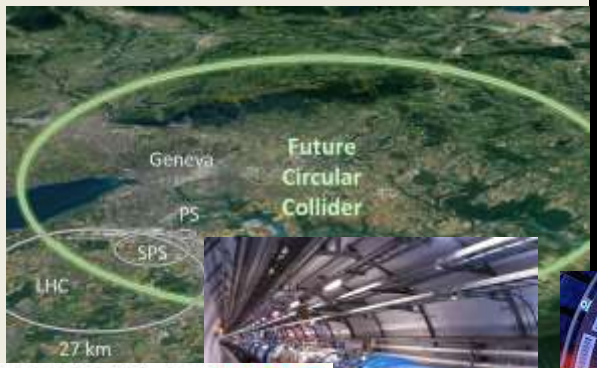


Nuclear Chemistry – Jot This Down!

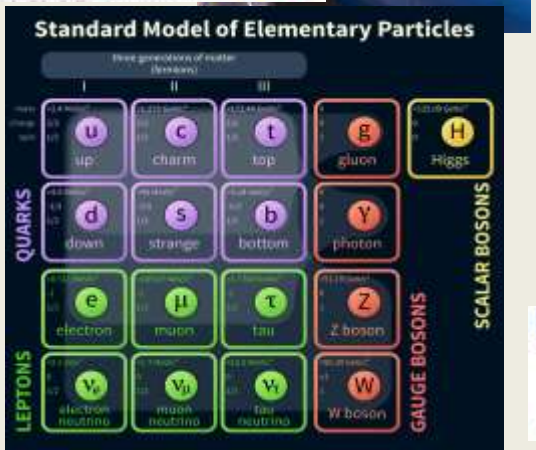
- NUCLEAR Chemistry is the study of the PARTICLES making up the NUCLEUS (Protons and Neutrons!) of the ATOM!
- Scientists have used PARTICLE ACCELERATORS to SMASH APART these particles and DISCOVER a whole "zoo" of "Elementary Particles" that make up Protons and Neutrons though!
- These particles are divided into two groups; FERMIONS and BOSONS!
  - "Quarks" (6 types), "Muons", "Tauons", "Neutrinos", "Electrons", and "Positrons" (sorta!) are the "MASS-HAVING" Fermions!
  - "Photons", "Gluons", "Z & W Bosons", and the famous "Higgs Boson" are the "FORCE-CARRYING" Bosons!

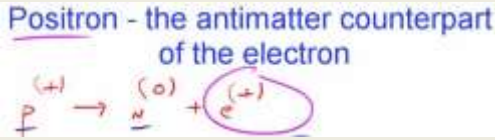






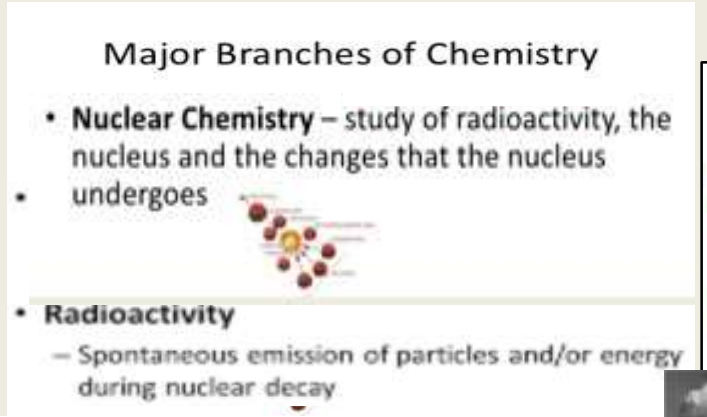
The PARTICLE ZOO

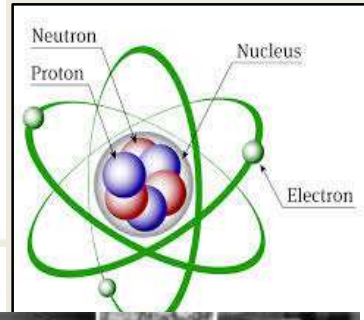




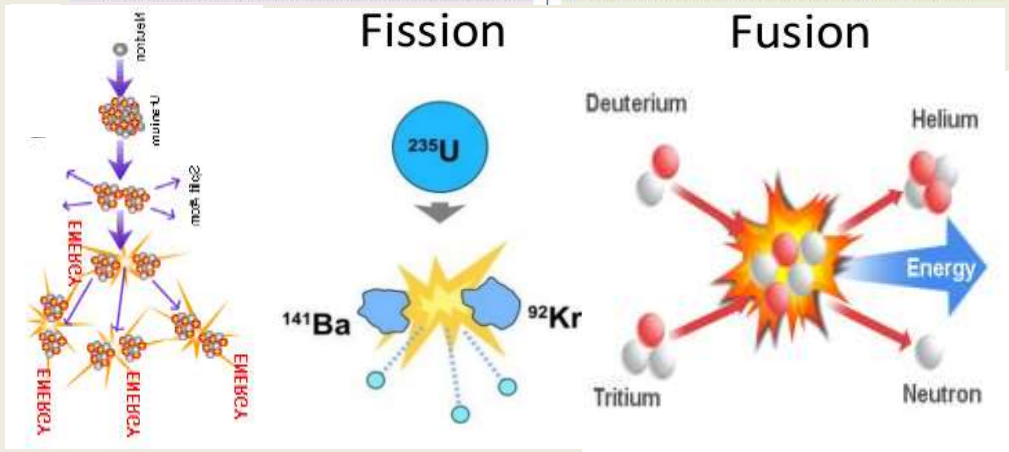
Nuclear Fission VS Fusion – Jot This Down!

- The NUCLEUS of Atoms can undergo TWO major processes; Nuclear FISSION and Nuclear FUSION!
- Nuclear FISSION occurs when a larger Atomic Nucleus BREAKS into two smaller nuclei ALONG with a whole lot of ENERGY!
  - When this happens spontaneously it is called "Radioactive Decay", but we humans can MAKE a nucleus undergo Fission by firing a NEUTRON into a heavy nucleus in a process called INDUCED NUCLEAR FISSION!
- Nuclear FUSION occurs when two smaller nuclei FUSE into a larger one, releasing a TON of ENERGY!
  - Nuclear FUSION of Hydrogen nuclei into Helium is the FUEL SOURCE behind stars like our SUN!





• **Radiation is energy in the form of waves or moving subatomic particles.**



- Humans cannot yet control Nuclear Fusion, but along with Fission BOTH have been used for Nuclear WEAPONS!