**I. Basic Bio** 1. Q: Define biology and evolution. A: Study of life. Process of change that has transformed life on earth. 2. Q: What are the differences between a producer, consumer, and decomposer? A: Producer-makes own food. Consumer-eats producers and other consumers. Decomposer breakdown dead matter and recycle it for consumers. 3. A: Observation. Question. Hypothesis. Prediction. Experiment. Results. Conclusion. (Only Queen Hilda Promises Elegant Raspberry Cake.) 4. Q: What is the difference between a hypothesis, theory, and a law? A: Hypothesis-possible answer to research question. Theory-hypothesis withstood vigorous testing and generally accepted by scientific community. Law-description of natural phenomenon. 5. Q: Name and define the different levels of biological organization. A: Atom. Cell. Tissues. Organs/Organ systems. Organism. Population. Community. Ecosystem. Biosphere. (Adam must celebrate the outstanding organ-players creative electronic beats.) **II. Basic Chemistry** 1. Q: What are the four most important elements in biology? A: Carbon. Nitrogen. Hydrogen. Oxygen. (Top six would add Phosphorus and sulfur to this list) 2. Q: Define an acid and a base. A: Acid-increases hydrogen ions. Base-decreases hydrogen ions, increases hydroxide ions. 3. Q: List and define the four types of bonds in order of increasing strength. A: Van der Waals. Hydrogen bonds. Ionic. Covalent (polar and nonpolar). 4. Q: Why cause atoms to interact or be reactive? A: Desire to fill the valence shell with all possible valence electrons. 5. Q: Diagram Phosphorus and say how many electrons,protons, neutrons, and valence electrons it has. Atomic mass=31 (bottom) and atomic #=15(top). 3 valence electrons. A: Answer will be done in class**. III. Chemistry** 2. Q: What is the difference between an isotope and an isomer? A: Isotope-same atom differs in neutron #. Isomer-same molecular formula with different skeletal structures. (length branching, double bonds, ringa) 1. Q: Are hydrophilic substances polar or nonpolar? Why? A: Polar. Charged and react with hydrogen bonds in water. 3. Q: What are the four extraordinary properties of water? A: Cohesive/adhesive behavior. Ability to moderate temperature(high specific heat). Expansion upon freezing. Versatility as a solvent(hydrophilic-polar and hydrophobic nonpolar) 4. Q: What are structural isomers? (differ in covalent arrangements around central atom) linear vs. branching, cis trans (H varies around double bond), and enantiomers (mirror image) 5. List functional groups. A: hydroxyl. Carbonyl. Carboxyl. Amino. Sulfhydryl. Phosphate. Methyl. **IV. Biological Molecules** 1. Q: What is the difference between a dehydration and a hydrolysis reaction? A: Dehydration-join substances/monomers together by removing water. Hydrolysis-break monomers apart with addition of water. 2. Q: What are the four large bio molecules and what are their monomers? What are their covalent bonds? A: Carbohydrates(sugars)-mono, di, poly saccharides, with glycosidic linkage. Lipidsglycerol + 3 fatty acid tails with ester linkage. Proteins(di or polypeptide)-amino acids forming peptide bond. Nucleic acids-(DNA and RNA) with nucleotides joined by phosphodiester bond. 3. Q: What is the difference between saturated and unsaturated fats? A: Sat.-animal fats, solid at room T., has all H bonded to it as possible, unhealthy. Unsat.-fish and plant fats/oils, liquid at room T., kinks prevent close packing (don’t have all H) 4. Q: What are the four levels of protein structure? A: First-Amino acid sequence(chain). Second-alpha helix or beta pleated(folded) sheet(hydrogen bonds). Tertiary(globular/tangled web-all bonds + disulfide bridge) Quarternarycombo of multiple tertiary tangled webs. 5. Q: What is most common sugar? A: (glucose C6H12O6) **V. Cell Biology** 1. Q: What do all cells have in common (prokaryotes and eukaryotes) A: DNA. Ribisome. Cytoplasm. Plasma Membrane (phospholipid bilayer) 2. Q: What organelles/features do plants cells have that animal cells do not? Animals? A: Central vacuole(digest, detoxifies, stores pigment). Chloroplast(photosynthesis). Cell wall(protection, shape, and support). (3 Cs) Lysosomes(posess digestive enzymes), centrosomes and Extracellular Matrix (ECM)(additional meshwork of proteins and polysaccharides surrounding animal cells). 3. Q: What are the membrane protein(integral/peripheral) functions? A. Transport. Enzymatic activity. Signal Transduction. Cell-cell recognition. Intercellular joining. Attachment to cytoskeleton. 4. Q: Compare and contrast passive and active transport. A: Passive(no energy)-diffusion-low to high conc. Facilitated diffusion-help of channel/carrier proteins. Active(energy)-proton pump/carrier proteins. 5. Q: Explain hypotonic, isotonic, and hypertonic. A: Hypo-(animal lyse and plant turgid) less inside than outside, water goes in. Is(animal normal and plant flaccid-same so equal amt. water flow. Hyper-more outside than inside so water flows out. (animal/plant crenation) **VI. Metabolism-all chemical processes within a cell.** 1. Q: What are different forms of energy? A: Kinetic. Potential. Chemical(stored in bonds). Thermal(random movement of atoms/molecules) 2. Q: What are catabolic and anabolic pathways? A: (cata-destroy and release energy by breaking down complex molecules, ana-build and absorb energy to build complex molecules) 3. Q: Differences between exergonic and endergonic? Is breakdown of ATP exer or ender? (photophosphorylation) A: Exergonic-downhill, release energy, spontaneous, neg change in G. Endergonic-uphill, absorbs energy, non-spontaneous, pos change in G. 4. Q: How do enzymes(catalysts) speed up a chemical reaction? A: Lower activation energy. 5. Q: What is the difference between competitive and non-competitive enzyme inhibition? A: Inhibitor binds to active site. Inhibitor binds to allosteric site and changes shape of molecule. **VII. Cell Respiration and Photosynthesis** 1. Q: What is oxidized and what is reduced in the following the chemical equation: C6H12O6 + 6O2 → 6CO2 + 6H2O + ATP + Heat? A: Glucose is oxidized and oxygen is reduced. 2. Q: What are the four steps of aerobic cellular respiration? A: Glycolysis, Pyruvate Oxidation, Citric Acid (or Krebs) Cycle, and Oxidative Phosphorylation. 3. Q: What two products of the light reactions enter the Calvin Cycle? A: ATP and NADPH. 4. Q: How many turns of the cycle are required to make one molecule of glucose? Why? A: 6. 3 carbons enter (3 turns) to produce 1 G3P. 1 G3P (3 Carbons) + 1 G3P (3 Carbons) = 1 glucose (6 Carbons). 5. Q: Explain the two phases that take place in glycolysis. A: Energy investment phase (invest 2 ATP) to Energy Payoff phase (4 ATP) are produced with a total net of 2 ATP. **VIII. Cell Cycle** (Mitosis and Meiosis) 1. Q: What are the five steps of mitosis? Three steps of interphase? A: Prophase, prometaphase, metaphase, anaphase, telophase (with cytokinesis). First growth phase, S phase (duplication of DNA), and Second growth phase. 2. Q: How do prokaryotic cells reproduce? A: Binary fission. 3. Q: In which phase does synapsis and crossing over occur? A: Prophase I. 4. Q: What is independent assortment and in what phase does it occur? A: Random orientation of homologous chromosomes at metaphase plate. Metaphase I. 5. Q: Compare and contrast mitosis from meiosis. A: Mitosis-offspring are identical to each other and parent cell, 1 division, 2 daughter cells (diploid-somatic cells), and used for repair. Meiosis-offspring are genetically different from each other and parents, 2 cell divisions, 4 daughter cells (haploid-gametes), and used for fertilization (sexual reproduction). **IX. Genetics** 1. Q: Define genotype and phenotype. Give an example of dominant, heterozygous, and recessive genotypes. A: Genotype-represents genes (both alleles). Phenotype-represents physical appearance. Fully Dominant=BB, Fully Recessive=bb, Heterozygous=Bb. 2. Q: What is the phenotypic ratio for a monohybrid cross? A dihybrid cross? A: Monohybrid cross= 1:2:1. Dihybrid cross=9:3:3:1. 3. Q: Give one example of an exception to Mendelian genetics. A: Codominance-more than one allele is fully expressed. Example: AB blood type. 4. Q: What is a carrier? Why can a male never be a carrier? A: A carrier is a female who is heterozygous for a sex-linked genes such as a gene for a disease(note: most sex-linked diseases are recessive.) A male can only inherit his alleles on his X chromosome and not on his Y chromosome. 5. Q: Define monosomy and trisomy. A: Monosomy-individual has only 1 of a particular type of chromosome → 2n-1. Trisomy-individual has 3 of a particular type of chromosome → 2n+1. **X. DNA** 1. Q: What is the central dogma of molecular biology? A: DNA→ RNA → Proteins. First arrow=transcription. Second arrow=translation. 2. Q: What are Chargraff’s rules about bases? A: Always together-adenine bonds to thymine. (A2T). Great company-guanine bonds to cytosine. (G3C). Always good and pure-adenine and guanine are purines. C the pyramids cytosine and thymine are pyrimidines. Additionally, amounts of bases in an organism should be A=T and G=C. 3. Q: List and describe proteins in DNA replication in order. A: Helicase-unzips DNA, Single-strand binding proteins-hold strands apart, Topoisomerase (DNA gyrase)-relieves supercoiling, Primase-lays down RNA primers(landing strips), DNA polymerase III-creates new DNA, DNA polymerase I-replaces RNA nucleotides in primer with DNA nucleotides, and DNA ligase-joins fragments of DNA(Okazaki fragments) together. 4. Q: What are the three steps of RNA processing in eukaryotes? A: 5 prime cap. Poly-A tail. RNA splicing. 5. Q: What are the different types of RNA and what role do they play in translation? A: mRNA-messenger RNA, contains codons, acts as blueprint. tRNA-transfer RNA, contains anti-codons and amino acids, acts as delivery truck. rRNA-Ribisomal RNA, brings mRNA and tRNA together, acts as construction site.