**BIOLOGY STUDY GUIDE: Semester 2 Final**

**Unit 5: Molecular Genetics**

**Chapter 8: From DNA to Proteins**

1. **Central Dogma** (the flow of information in a cell)
2. **Structure of RNA** (know the biological macromolecule)
   1. **Nucleotide** (know its 3 parts in RNA)
   2. **Nitrogenous Bases in RNA**
      1. **Complementary Base Pairs** (what nitrogenous bases pair together)
   3. **3 main differences** of RNA from DNA
   4. **3 types** of RNA (& what each type does)
3. **Protein Synthesis**
   1. **Overall Purpose** (Why does everything happen and what does it create?)
   2. **Genotype** vs. **Phenotype** (what they are/differences between the two)
   3. **Transcription**
      1. **Overall Purpose** (**Why** does everything happen?)
      2. **Where** transcription occurs in the cell
      3. **RNA polymerase** (what is its role?)
      4. **Overall Process** (**How** does everything happen?)
      5. **Be able to go through this process**
   4. **Translation**
      1. **Overall Purpose** (**Why** does everything happen?)
      2. **Where** translation occurs in the cell
      3. **Codons**
         1. **Where** they are found
         2. **Purpose** (**Think:** what does a codon specify?)
         3. **Start Codon** (its purpose)
         4. 3 **Stop Codons** (their purpose)
      4. Purpose of the **Codon table** (page 230) & be able to use it
      5. **Overall Process** (**How** does everything happen?)
4. **Mutations** (what it is/ what causes it)
   1. **Mutagen** (definition)
   2. **Point mutations, insertions, and deletions** (different types of mutations)
   3. **When a mutation does / doesn’t change the protein**
   4. **Silent mutation** (what has / hasn’t changed)
   5. **Chromosomal mutations** (gene duplication, translocation, nondisjunction, etc.)

**Chapter 5: Cell Growth and Division**

1. **Stem Cells**
   1. **Gene Expression** (what it is)
   2. **Cell Differentiation** (what it is/what it means when stem cells become differentiated)
   3. **Stem Cells** (what they are/differences between types of stem cells)
   4. **Controversy** (Why are some people concerned with stem cell research?)

**Chapter 9: Frontiers of Biotechnology**

1. **DNA Technology Applications**
   1. **Restriction Enzymes** (how they work)
   2. **PCR** (the purpose of this process/how it works)
   3. **Gel Electrophoresis** (the purpose of this process/how it works – specifically how the DNA moves)
   4. **DNA Fingerprint** (what it is/why all individuals have unique DNA fingerprints)
2. **Cloning** (explain how an entire animal can be cloned)
3. **Genetic Engineering** (define)
   1. **Recombinant DNA Technology** (definition)
   2. **How bacteria plasmids are engineered** (roles of restriction enzymes and ligase)
      1. **Products of this genetic engineering** (examples)
   3. **Genetically Modified Organisms (GMOs)** (what they are/where they are commonly seen)
      1. **Transgenic organisms** (what these are)
   4. **Controversy** (Why are some people concerned with the use of GMOs?)
4. **Human Genome Project** (main goals and current research)
   1. **Genomics** (definition)

**Unit 6: Classical Genetics**

**Chapter 6: Meiosis and Mendel**

1. **Mendel** (what he studied, discovered, & disproved)
2. **True breeding (Purebred) & Hybrid Organisms** (explain the importance of each)
3. **Patterns of Inheritance** (Mendel’s observations of P, F1, & F2 generations)
4. **Mendel’s Law of Segregation** (two main conclusions)
5. **Genotype** vs. **Phenotype** (meaning & how to make **ratios, percentages, or fractions** of each)
6. **Allele** (meaning, **Dominant** vs. **Recessive**)
7. **Homozygous** vs. **Heterozygous (and carriers)** (relate to phenotype; which allele is expressed?)
8. **Punnett Squares** (understand how to use them & how **probability** works with them)
9. **Monohybrid Cross** vs. **Dihybrid Cross** (meaning, purpose, & when/how to use them)
10. **Testcross** (what it is and how it is used)
11. **Law of Independent Assortment** (as related to meiosis and dihybrid crosses)

**Chapter 7: Extending Mendelian Genetics**

1. **Sex-linked** Genes (meaning, when traits are expressed, & why different genders are affected differently)
2. **Patterns of Inheritance** (meaning of each & able to perform crosses of each)
   1. **Incomplete Dominance** Inheritance
   2. **Codominant** Inheritance
   3. **Multiple Allele** Inheritance
   4. **Polygenic** Inheritance
3. **Environmental Influences** on Traits

**Unit 7: Ecology**

**Chapter 13: Principles of Ecology**

1. **Five Levels of Organization** (define each & explain biotic/abiotic interactions at each level)
2. **Observation, Experimentation, & Modeling**
3. **Biotic & Abiotic Factors** (definition & examples)
4. **Biodiversity** (define & explain its importance)

**Chapter 14: Interactions in Ecosystems**

1. **Niche** (define & explain what happens when two organisms occupy the same niche)
2. **Competitive Exclusion** (define & explain how it can lead to loss of a population)
3. **Interspecific & Intraspecific Competition** (explain the difference)
4. **Predator-prey Interactions** (explain & provide examples of adaptations of successful predators and prey)
5. **Symbiotic Relationship** (define & explain the difference between the three main types)
6. **Population Density**  (define, be able calculate, & explain why density is used to describe a population)
7. **Techniques to Estimate Population Size** (explain 3 methods & understand accuracy limitations)
8. **Population Growth - Exponential & Logistic** (compare & explain environmental factors leading to each)
9. **Carrying Capacity** (define & explain role of limiting factors in determining carrying capacity)
10. **Density-Dependent & Density-Independent Factors** (know the difference & give examples)
11. **Population Size Cycles** (why a population’s size might cycle & how two species may affect each other’s cycles.)
12. **Ecological Succession** (explain the two types & identify examples of each)

**Chapter 15: The Biosphere**

1. **Local Climate & Microclimate** (define & explain how they change environments that are near to one another)
2. **Biomes** (define , give two factors that determine their classification & give examples)
3. **Uneven Heating of Earth** (why it happens & how it affects the environments around the world)
4. **Aquatic Ecosystems** (understand their importance in the biosphere & know different types)

**Chapter 16: Human Impact on Ecosystems**

1. **Human Population Growth** (name factors contributing to exponential growth & list scientists’ concerns)
2. **Human Impact** (provide both positive & negative impacts humans have on communities)
3. **Negative Impacts** (define & explain effects of global warming, eutrophication, acid rain, pollution, & ozone damage)
4. **Impacts on Biodiversity** (explain effects of habitat destruction, introduced species, & overexploitation)
5. **Introduced Species** (define & provide an example that has had a negative impact on a community)
6. **Conservation Biology** (explain the goals of focusing on hot spots, understanding habitats, balancing resource demands, and planning for a sustainable future)

**Unit 8: Evolution & Natural Selection**

**Chapter 10: Principles of Evolution**

1. **Theory of Evolution** (definition & how these theories were developed)
   1. **Observations Darwin made on the *Beagle***
   2. **Artificial Selection** (definition & its role in Darwin’s theories)
2. **Natural Selection** (be able to define, explain, and apply this theory)
   1. **Descent with Modification** (pertaining to Natural Selection)
   2. **4 main principles of Natural Selection**
      1. Be able to define **Variation**, **Adaptation**, and **Heritability**
   3. **Biological Fitness** (definition & explanations of populations over time)
   4. **Environmental Changes** (and their influence on a population)
   5. **Explain why natural selection doesn’t lead to “perfect organisms”**
3. **Evidence for Evolution** (name, describe, and give examples of the types of evidence)
   1. **Fossil Record**
   2. **Biogeography**
   3. **Embryology**
   4. **Homologous Structures**
      1. **Analogous Structures** (explain how these are NOT evidence of evolution)
   5. **Vestigial Structures**
   6. **Molecular Biology / DNA**

**Chapter 11: The Evolution of Populations**

1. **Genetic Variation** (definition and significance within a population)
   1. **Two main sources of new genetic variation**
2. **Evolution without Natural Selection** (explain how other events can occur to change allele frequencies)
   1. **Allele Frequency** (definition)
   2. **Gene Flow**
   3. **Genetic Drift** (definition, two main types, and examples of each)
   4. **Sexual Selection**
3. **Speciation** (define **Species** and explain the three types of isolation that lead to speciation)
   1. **Isolation** (define and give examples of all three types)
4. **Patterns and Rates of Evolution and Extinction**
   1. **Extinction** (define and distinguish between background and mass extinction)
   2. **Convergent vs. Divergent Evolution** (explain differences and relate to homologous/analogous structures)
   3. **Coevolution** (definition and examples)
   4. **Punctuated Equilibrium vs. Gradualism** (distinguish between the two)
5. **Adaptive Radiation** (define and explain)

**Chapter 12: The History of Life**

1. **Endosymbiosis** (explain the evolution of eukaryotic cells)

**Chapter 17: The Tree of Life**

1. **Classification of Organisms (Taxonomy)** (why it is necessary & why it has changed throughout history)
   1. **Binomial Nomenclature** (proper usage & what the two names mean)
2. **Cladogram** (explain purpose, understand how to create, & read cladograms to determine relationships)
3. **Domains** (name & describe the three domains: **Bacteria**, **Archaea**, and **Eukarya**)