**AP Biology Memorize or DIE List!**

Note: Concepts highlighted in gray are concepts that students often forget!!!

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| **Unit** | **Packet #** | **Content to Memorize** |
| 1 (Microevolution) | 1 (Evolution Basics) | -Definitions of evolution, natural selection, and fitness  -The different piece s of evidence for evolution |
| 3 (The Importance of Genetic Variation as Fuel for Natural Selection) | -4 mechanisms that can increase genetic variation: crossing over, independent assortment, random fertilization AND mutation (the only way to create new gene sequences) |
| 4 (Hardy Weinberg Equilibrium) | -The new definition of evolution as a change in the frequencies of alleles (Ex: A and a) in a population across generations.  -Hardy-Weinberg Equilibrium – a state where allele frequencies are NOT changing in a population over time (Note: This would never happen in a REAL populations)  -Conditions required for Hardy-Weinberg Equilibrium  1) No genetic drift (genetic drift happens most often in SMALL populations… large populations can be drastically decreased in size due to the bottleneck effect or founder effect)  2) No gene flow (aka migration)  3) No mutation  4) No sexual selection (aka random mating)  5) No natural selection  -The difference between allele, genotype, and phenotype  -The two Hardy Weinberg Equations and the meanings of each term in the equations (p, q, p2, 2pq, q2) |
| 2 (Macroevolution) | 1 (Macroevolution and Speciation) | -The biological definition of a species  -The difference between geographic and reproductive isolation  -The difference between the two types of reproductive isolation: prezygotic and postzygotic (and examples of each)  -Definitions of divergent evolution, convergent evolution, and coevolution  -Definitions of gradualism and punctuated equilibrium |
| 2 (Classification and Biodiversity) | -How to analyze a cladogram (see Cladogram Tutorial Image on the Wiki page)  -Evidence for and characteristics of the universal common ancestor |
| 3 (Origin and History of Life) | -The methods, results, and conclusions of the Miller / Urey Experiment  -The RNA World Hypothesis |
| 3 (Ecology) | 1 (Population Ecology) | -The difference between exponential and logistic growth (+ know the definition of carrying capacity) |
| 2 (Community Ecology) | -How to analyze a food web  -The food sources for all the trophic levels shown in a food web  -The different types of symbiotic relationships  -Definition of the competitive exclusion principle  -The definition of a keystone species |
| 3 (Ecosystems) | -The processes of primary and secondary succession  -The difference between ectothermy and endothermy (two temperature regulation strategies)  -The characteristics of and effects of invasive species |
| 4 (Biogeochemical Cycles) | -Be able to answer questions about the cycles if provided with diagrams |
| 4 (Biochemistry) | 3 and 4 (Macromolecules A and B) | -The elements and functional groups found in all four macromolecules  -The names, structures, and examples of monomers for all four macromolecules  -The names, structures, and examples of polymers for all four macromolecules  -Be able to recognize images of monomers and polymers for all four macromolecules  -The difference between dehydration synthesis and hydrolysis (Be able to recognize images of the two processes) |
| 5 (Cell Structure and Transport) | 1 (Cell Structure) | -The differences between prokaryotic vs. eukaryotic and plant vs. animal cells  -The definition of the theory of endosymbiosis, names of organelles that evolved through this process, and evidence to support the theory  -Organelles and steps involved in the endomembrane system and purpose of the endomembrane system |
| 2 (Cell Membrane and Transport) | -The basic structure of the membrane  -The differences between the types of transport across the membrane (i.e. simple diffusion, facilitated diffusion, osmosis, active transport using protein pumps, endocytosis / exocytosis)  -The definitions of hypotonic, hypertonic, and isotonic solutions |
| 6 (Enzymes and Cell Respiration) | 1 (Enzymes and Introduction to Metabolism) | -The difference between exergonic and endergonic reactions and how these relate to anabolic and catabolic pathways  -The mechanism of enzyme action (lowering activation energy for a reaction)  -How factors like temperature, pH, and concentrations of substrate and enzyme molecules affect the rate of reaction  \*\*\*There are graphs associated with each of these concepts\*\*\*  -How enzymes interact with substrates (i.e. induced fit model)  -How enzyme activity can be regulated with competitive and noncompetitive inhibitors  -How enzyme activity can be regulated using allosteric regulation (includes noncompetitive inhibitors) |
| 2 (Aerobic Cell Respiration) | -The “Breaking Down the Steps of Cellular Respiration” chart (see Wiki page) |
| 3 (Anaerobic Cell Respiration) | -The steps involved in anaerobic respiration (aka fermentation) and the difference between the two types of anaerobic respiration (i.e. lactic acid fermentation and alcoholic fermentation) |
| 7 (Photosynthesis) | 1 (The Light Reactions) | -How electron transport chains are used during the light reactions  -The difference between cyclic and noncyclic electron flow  -The “Breaking Down the Steps of Photosynthesis” chart (see Wiki page) |
| 2 (The Calvin Cycle) | -The connection between the light and dark reactions (i.e. NADPH and ATP)  -The definition of photorespiration and how C4 and CAM plants minimize photorespiration |
| 3 (Comparing Photosynthesis and Cellular Respiration) | -The types of organisms that use cellular respiration and/or photosynthesis  -The similarities and differences between the electron transport chains in chloroplasts and mitochondria |
| 8 (Cell Division) | 1 (The Cell Cycle and Mitosis) | -The events of the cell cycle and mitosis  -The differences between mitosis in eukaryotic cells and binary fission in prokaryotic cells |
| 2 (Meiosis) | -The events of meiosis I and II  -The similarities and differences between mitosis, meiosis I, and meiosis II  -The differences between oogenesis and spermatogenesis  -The advantages of using sexual reproduction vs. asexual reproduction |
| 3 (Cell Cycle Regulation) | -The timing of the three different checkpoints in the cell cycle  -The interaction between cyclins and CdK’s in regulating the cell cycle |
| 9 (Cell Signaling) | 1 (Basics of Cell Signaling) | -The events of the three steps in cell signaling—reception, transduction, and response—and the molecules involved in each step  -Quorum sensing in bacteria |
| 2 (The Nervous System) | -The steps of an action potential and the transmission of a signal across a synapse  -The structure of a neuron  -How a reflex loop works and the types of neurons involved in a reflex loop |
| 3 (The Endocrine System) | -The difference between steroid and protein / amine hormones  -The benefits and costs of using endocrine signaling vs. nerve signaling or signaling via direct physical contact  -How negative and positive feedback are used in the endocrine system |
| 10 (Classical Genetics) | 1 (Basic Mendelian Inheritance) | -How the Addition and Multiplication rules of Probability are used with Punnett Squares  -How to complete normal monohybrid crosses / Punnett squares associated with the following types of traits (incomplete dominance, codominance, sex-linkage)  -How to complete dihybrid crosses / Punnett Squares |
| 2 (Human Genetics) | -How to complete blood type monohybrid crosses / Punnett squares  -The difference between pleiotropy and polygenic inheritance  -How phenotype can be influence by genes AND the environment  -How to analyze pedigrees to determine the type of inheritance shown—autosomal recessive, autosomal dominant, X-linked recessive, X-linked dominant, or Y-linked |
| 3 (Chromosomal Genetics) | -Mendel’s Laws of Inheritance  -How nondisjunction during meiosis results in aneuploidy  -How offspring phenotype frequencies for linked genes differ from the frequencies for unlinked genes  -How to construct a linkage map showing the locations of genes on a chromosome based on recombination frequencies or map units |
| 11 (Molecular Genetics) | 1 (DNA) | -The structure of DNA (esp. its antiparallel nature)  -The steps and enzymes involved in DNA replication  -The Semiconservative Hypothesis of DNA replication  -The DNA scientists: Griffith, Avery / McCarty / Macleod, Hershey / Chase, Franklin, Watson / Crick |
| 2 (From Gene to Protein) | -How prokaryotic protein synthesis differs from eukaryotic protein synthesis  -The processes involved in transcription, mRNA processing, and translation  -How to use complementary base pairing and a codon chart to go from DNA 🡪 mRNA 🡪 protein  (Remember: Read from the 3 on the D! and Build from the 5 because build has 5 letters!)  -The different types of mutations and their effects on the resulting polypeptide  -The difference between the following terms: nucleotides, nitrogenous bases, DNA triplets, mRNA codons, tRNA anticodons, amino acids, polypeptides, and full proteins |
| 3 (Viral and Bacterial Genetics) | -The basic structure of a virus  -The two methods of viral infection / reproduction: the lytic and lysogenic cycles  -The unique method of retroviral infection  -How transformation, transduction, and conjugation increase genetic variation in populations of bacteria |
| 12 (Gene Regulation and Biotechnology) | 1 (Gene Regulation) | -The structure of prokaryotic operons  -The differences between repressible and inducible operons  -The different levels at which gene expression can be regulated in eukaryotic cells (i.e. DNA structure level, transcription, post-transcription, translation, and post-translation) |
| 2 (Biotechnology A) | -How restriction enzymes are used in gel electrophoresis  -The steps of gel electrophoresis  -How to analyze a DNA fingerprint (aka gel)  -How PCR and gene cloning using bacterial plasmids are used to make copies of a particular gene sequence |
| 3 (Biotechnology B) | -How recombinant plasmids are created and used (ex: in the creation of human insulin)  -How to analyze the results of bacterial transformation experiments (ex: PGLO) |
| 13 (Organism Form and Function) | 1 (Development of Organisms) | -How transcription factors and activators are used to regulate eukaryotic gene expression at the transcription level  -How homeotic genes and cytoplasmic determinants like bicoid and caudal are used during pattern formation  -How apoptosis is used during morphogenesis  -How embryonic induction, transcription factors, and RNA interference are used during cell differentiation |
| 2 (Timing and Coordination) | -How cells are organized into larger structures (ex: tissues, organs, organ systems) to regulate physiological responses to the environment  -Examples of coordinated physiological responses: phototropism and photoperiodism in plants, human regulation of body temperature, formation of reproductive structures (i.e. fruiting bodies) in myxobacterial cells under ideal environmental conditions  -The proximate vs. ultimate causes for behaviors  -The difference between innate behaviors (ex: fixed action patterns) and learned behaviors (ex: imprinting)  -The benefit of cooperative behavior |
| 3 (Defense: The Immune System) | -Examples of nonspecific immune responses in plants and animals  -The cells and processes involved in the specific immune response in humans  -Why the specific immune response is so fast during secondary infection  -The definition of autoimmune diseases |
| Calculations | Standard Error of the Mean (SEM), 95% Confidence Limit, and Error Bars on Graphs | -The mean + or – 2SEM’s = 95% confidence limit (i.e. the error bar range on a graph of the mean)… in other words, we are 95% confident that the true mean for a larger sample of data would fall within this range |
| Chi Square | -A null hypothesis typically states: there is NO statistically significant difference between the observed and expected values OR two sets of data  -There is usually an alternate hypothesis that states: there IS a statistically significant difference between the observed and expected values or two sets of data  -expected and observed values are ALWAYS whole numbers  -the observed values are from your experimental data  -the expected values are the frequencies you expect based on your null hypothesis… you must multiply these expected decimal frequencies by the total sample size to get whole numbers for your expected values  -degrees of freedom = number of data sets (n) -1  -if your X2 value is above the critical value (from the chart, at a p value of 0.05 and the correct degrees of freedom) 🡪 reject the null hypothesis  -if your X2 value is below the critical value 🡪 accept the null hypothesis |
| Hardy Weinberg Equilibrium | -See Unit 1, Notes Packet 4 (first page) |
| Population Growth Equations | -The following terms in the Population Growth Equations are always expressed as whole numbers of organisms – dN / dt (change in the number of organisms over an amount of time, usually a year), B (the number of organisms born in a year), D (the number of organisms that die in a year), N (the initial population size), K (the carrying capacity)  -rmax is the maximum per capita growth rate (i.e. the number of people added to the population PER individual in the initial population), so it is a decimal value (rmax  = 1 means that there is one person added to the population per individual in the initial population over a year… so the population would double in size over that year) |
| Water Potential | -The highest possible value for water potential and solute potential is 0. This is the water and solute potential for distilled (pure) water, which has no solutes. For solutions of increasing solute concentration, the water and solute potentials become increasingly negative.  -For a solution in an open container, the pressure potential is “0,” so the water potential will equal the solute potential.  -The pressure potential of a solution inside a cell will increase (become more positive from a baseline of “0”) when water moves into the cell and the cell has a cell wall  -When water has moved from one solution to another across a membrane via osmosis so that two solutions are in equilibrium with each other (i.e. they have the same water and solute concentrations), they will have equal water potentials.  -Water will always move from a solution with a higher water potential to a solution with a lower water potential  -“i” in the solute potential equation stands for the ionization constant. For a solute that does not break apart in water (ex: sucrose or glucose), “i” is 1. For a solute that breaks into two parts (ex: NaCl breaks into Na+ and Cl-), “i" is 2. For a solute that breaks into three parts, “i" is 3… and so on, and so forth. |