

## AP Biology: Midterm Outline

Part A: 70 Multiple Choice (65-75%) Part B: Free Response (25-35%)

### I. Topics Covered

#### Unit TWO: The Cell

##### Chapter 6: A Tour of the Cell

- 1) Importance of cells maintaining a large surface area to volume ratio.
- 2) Basic structure & function of eukaryotic organelles.
- 3) What is the endomembrane system? What is the relationship between components of this system? How has this system led to an increase in metabolic diversity in eukaryotes?
- 4) \*Compare & contrast the characteristics of the 3 major groups of organisms: Bacteria, Archaea, & Eukarya.

##### Chapter 7: Membrane Structure & Function

- 1) Fluid mosaic model of the plasma membrane.
- 2) Methods for maintaining membrane fluidity in plant & animal cell membranes.
- 3) What properties of a solute influence the ease at which it can travel across the phospholipid bilayer of a membrane?
- 4) Methods of passive transport: simple diffusion, facilitated diffusion, & osmosis (be able to explain osmosis in terms of WATER POTENTIAL).
- 5) Methods of active transport: endo/exocytosis, sodium-potassium pump.

##### Chapter 8: Introduction to Metabolism

- 1) How can spontaneous/nonspontaneous reactions be described in terms of  $\Delta G$ ?
- 2) Structure of the ATP molecule.
- 3) What is a phosphorylation reaction? What is the effect of this reaction on the spontaneity of a process?
- 4) What is activation energy & how do enzymes affect the amount of activation energy associated with a reaction (i.e. reaction rates)?
- 5) Enzyme cofactors vs coenzymes.
- 6) What environmental factors affect enzyme/protein structure & level of activity?
- 7) Allosteric enzyme inhibition (noncompetitive) vs competitive enzyme inhibition. How is allosteric inhibition an example of negative feedback?

##### Chapter 9: Cell Respiration

- 1) Structure of the mitochondria.
- 2) General formula -what is oxidized & what is reduced?
- 3) What is the function of a dehydrogenase? What coenzymes are they associated with? Distinguish between the oxidized & reduced forms of these coenzymes.
- 4) **Glycolysis:** 2ATP's invested, 4ATP's formed, 2NADH's, & 2 pyruvates.
- 5) **Acetyl Coenzyme A:** 2NADH's, 2CO<sub>2</sub>'s, & 2 acetyl coenzyme A's
- 6) **Krebs Cycle:** 4CO<sub>2</sub>'s, 6NADH's, 2FADH<sub>2</sub>'s, 2ATP's. Why is this reaction a "cycle"?
- 7) Oxidative Phosphorylation:
  - a) **Electron Transport:** NADH & FADH<sub>2</sub> recycled to NAD<sup>+</sup> & FAD<sup>+</sup>, 6O<sub>2</sub> (final e<sup>-</sup> → 12H<sub>2</sub>O), H<sup>+</sup> gradient established.
  - b) **Chemiosmosis:** H<sup>+</sup> through ATP synthase, 32-34 ATP's formed.
- 8) Distinguish between oxidative phosphorylation & substrate-level phosphorylation.

##### Chapter 10: Photosynthesis

- 1) General formula -what is oxidized & what is reduced?
- 2) Leaf anatomy & chloroplast structure.
- 3) **Light Reactions:** photosystems I & II, 12H<sub>2</sub>O's consumed (photolysis), 12ATP's & 12 NADPH's formed.

- 4) **Calvin Cycle:**  $6\text{CO}_2$ 's fixed & reduced to  $2\text{PGAL}$ 's.  $18\text{ATP}$ 's &  $12\text{NADPH}$ 's consumed. What enzyme is responsible for carbon-fixation? Why is this reaction a "cycle"?
- 5) Noncyclic vs Cyclic electron flow.
- 6) Photorespiration & alternate methods of carbon fixation:  $\text{C}_4$  & CAM metabolism.

### Chapter 12: The Cell Cycle

- 1) What is chromatin? Distinguish between euchromatin & heterochromatin.
- 2) Distinguish between double stranded & single stranded chromosomes? What can be said about the chromatids that comprise a double stranded chromosome?
- 3) Distinguish between diploid & haploid cells.
- 4) What types of cells reproduce mitotically? What affect does mitosis have on the chromosome number of the daughter cells compared to the original parent cell?
- 5) **Cell Cycle (90%):** interphase (G1, S, G2) -what are some of the major activities that occur during these stages? How would you describe the degree of chromatin packing of chromosomes during this period of the cell cycle?
- 6) **Cell Cycle (10%):** M phase (prophase, prometaphase, metaphase, anaphase, telophase) - what are some of the major activities that occur during these stages?
- 7) Contrast the methods of cytokinesis between plant & animal cells.
- 8) How do cyclins & cyclin-dependent kinases (Cdk's) influence the cell cycle?

### Unit THREE: Genetics

#### Chapter 13: Meiosis & Sexual Life Cycles

- 1) What types of cells are produced meiotically? Where does this process occur in males? Females?
- 2) What affect does meiosis have on the chromosome number of the original ( $2n$ ) stem cell?
- 3) What affect does meiosis have on the combinations of alleles in the resulting gametes?
- 4) What are homologous chromosomes? What characteristics make chromosomes homologous? How many pairs of homologs are typically found in a normal human body cell?
- 5) **Meiosis I:** Prophase: Define synapsis. What is a chiasma? How does this lead to crossing over? What is the effect of crossing over on a chromosome? Metaphase: define independent assortment. How does this contribute to additional genetic recombination? Describe the chromosome number AND condition (double or single stranded) at the end of meiosis I.
- 6) **Meiosis II:** Describe the chromosome number AND condition (double or single stranded) at the end of meiosis II.
- 7) What is nondisjunction & what are its affect(s)? Differentiate between trisomy & monosomy & provide examples (i.e. Down Syndrome, Turners, etc)

#### Chapter 14: Mendelian Genetics

- 1) **General Vocabulary:** allele, genotype (homo vs heterozygous), phenotype, true-breeding,  $\text{F}_0$ ,  $\text{F}_1$ ,  $\text{F}_2$
- 2) Laws of dominance, segregation, & independent assortment.
- 3) What is the expected phenotypic ratio of a mating between two heterozygotes (assuming the alleles exhibit complete dominance & are unlinked)?
- 4) What is the expected phenotypic ratio of a mating between two dihybrids (assuming the alleles exhibit complete dominance & are unlinked)?
- 5) Apply the product & sum rules to predict the expected genotypes of offspring based on the parental genotypes (ex: what is the probability that  $\text{GgTt} \times \text{GGTt}$  will give rise to  $\text{GgTT}$ ?).
- 6) **Nonmendelian Traits:** incomplete (snapdragons) vs codominance (cattle coat color)
  - a) Traits associated with multiple alleles -human blood type ( $\text{I}^A$ ,  $\text{I}^B$ ,  $i$ )
  - b) Polygenic Traits -influenced by MANY alleles to produce an INFINITE number of varieties (skin tone, height). How might the distribution of these traits be represented if graphed across an entire population?
  - c) What is pleiotropy? Epistasis?

### Chapter 15: Chromosomal Inheritance

- 1) What are linked alleles? What effect does independent assortment have on such alleles? How can linked alleles be “unlinked”?
- 2) What is the relationship between the number of MAP units between linked alleles & the frequency of crossing over between them?
- 3) What are sex-linked alleles? Examples in humans? What gender is more likely to express recessive sex-linked alleles? Why is this so?
- 4) What is the probability of the inheritance of an allele coding for an autosomal dominant disorder (i.e. Huntington’s chorea)?

### Chapter 16: Molecular Basis of Inheritance

- 1) **DNA Structure:** components of a nucleotide, phosphodiester bonds between nucleotides (5’P to 3’OH) to form chains, H- bonding between chains to form double helix (A-T, G-C).
- 2) **DNA Properties:** is negatively charged & acidic due to phosphate groups of the backbone.
- 3) **DNA Replication (S phase):** semiconservative, roles of helicase, topoisomerase, SSBP’s, primase, polymerase & ligase. In what “direction” do new DNA chains grow as directed by DNA polymerase?

### Chapter 17: From Gene to Protein

- 1) **Transcription:** DNA to mRNA. Role of the promoter & terminator regions of a gene in the transcription process. In what ways is mRNA modified before being sent out of the nucleus?
- 2) **Translation:** mRNA to protein. Role of anticodon of tRNA in deciphering mRNA codons. Roles of the A, P, & E sites of the ribosome during translation. What is the importance of the AUG codon of mRNA? UAA, UAG, UGA codons?

### Chapter 20: Biotechnology

- 1) Function of restriction enzymes (endonuclease). What type of DNA sequences do they recognize?
- 2) Gene cloning method. What role do plasmids play in this process?
- 3) Sanger sequencing method & DNA fingerprinting (differences in the number of tandem repeats in noncoding DNA).
- 4) What is the function of PCR? How does gel electrophoresis separate DNA fragments of varying size?
- 5) Reproductive vs therapeutic cloning.

### Possible Topics for Free Response

- 1) Contrasting features of Bacteria, Archaea, & Eukarya
- 2)  $\chi^2$  analysis of null hypotheses involving Mendelian laws.
- 3) Biotechnology (endonucleases, electrophoresis, fingerprinting via STR’s, etc)

### II. Midterm Preparation

- 1) Each night review at least one of the chapters outlined in this document leading up to the midterm exam.
- 2) During your review of each chapter, it is suggested that you:
  - a) Use the outline I have provided you for each chapter as a guide in terms of what to focus on. When you review your student guides, pay special close attention to these concepts!
  - b) Following your review, practice the corresponding questions from the Pearson website test banks. This will give you an idea as to how well versed you are in each topic.

