Name _____ **Period** _____

AP Biology **Date** _____

REVIEW UNIT 4 & 5: HEREDITY & MOLECULAR GENETICS — "TOP TEN"

A. Top "10" — If you learned anything from this unit, you should have learned:

1. Meiosis produces haploid gametes
   a. Meiosis 1 separates homologous pairs: reduction division
      - crossing over in Prophase 1
   b. Meiosis 2 separates sister chromatids: produces 4 sex cells
2. Different versions of same gene are called alleles
   a. dominant vs. recessive
   b. homozygous vs. heterozygous
   c. phenotype vs. genotype
3. Mendelian inheritance
   a. monohybrid crosses
      - Aa x Aa = 3:1 ratio
      - Law of Segregation
   b. dihybrid crosses
      - AaBb x AaBb = 9:3:3:1 ratio
      - Law of Independent Assortment
   c. test cross
      - determine genotype of individual showing dominant phenotype
      - unknown (A_) x aa (homozygous recessive)
4. Non-Mendelian inheritance
   a. incomplete dominance (pink flower color), co-dominance (blood type), sex linked (mainly X-linked: color blindness, hemophilia), epistasis (coat color), pleiotropy (dwarfism, giantism), polygenic (skin color)
5. Chi-square analysis
   a. determining if observed results are significantly different from expected results
   b. know how to use formula when given & how to interpret results
      - degrees freedom (1 less than number of classes of results)
      - less than p=.05, then difference can be due to random chance alone & null hypothesis is accepted
6. DNA & RNA
   a. DNA: ACTG nitrogen bases, double helix
      - A : T, C : G
   b. RNA: ACUG nitrogen bases, single helix

7. Central Dogma
    a. DNA → RNA → protein → trait
    b. transcription (DNA → mRNA)
        - in nucleus
        - RNA polymerase copies coding strand & produces mRNA
    c. translation (mRNA → protein)
        - in cytoplasm
        - codons on mRNA read by ribosome
        - matched to anticodons of tRNA
        - tRNA carries amino acids to mRNA & ribosome assembles polypeptide chain
        - start codon (Met) & stop codons, redundancy in code
        - universal code (single common ancestor)
8. Regulation of genes
    a. operons
        - prokaryotes
        - cluster of genes for enzymes in a pathway
        - controlled by repressor protein
        - repressible operon (synthesis pathway = tryp operon) vs. inducible operon (digestive pathway = lac operon)
    b. transcription factors
        - eukaryotes
        - proteins which enable bonding of RNA polymerase to gene
9. Mutations
    a. fuel for evolution = variation, genetic change
    b. gene duplication, point mutation, insertions, deletion
10. Biotechnology
    a. Scientists can modify an organism's genome by inserting foreign DNA
        - bacterial transformation (human insulin gene in E. coli)
        - possible because of universal genetic code
    b. Techniques
        - restriction digest: restriction enzymes, sticky ends
        - transformation: restriction enzymes, sticky ends, ligase, amp selection, lacZ screening
        - gel electrophoresis: DNA moves in an electrical field (negative → positive), small pieces move further

- PCR: DNA amplification
- RFLP: DNA fingerprinting
- Sanger sequencing: Human Genome Project

B. Labs

1. Genetics of Organisms (Fly Lab)

   Be sure to review the procedures and the conclusions, and understand:

   a. How to determine genotype of individuals through crosses
   b. How to calculate Chi square values

2. Bacterial Transformation & Restriction Analysis

   Be sure to review the procedures and the conclusions, and understand:

   a. How to set up a similar experiment
   b. How to interpret transformation results on LB vs. LB+amp plates
   c. How to interpret gel electrophoresis results in restriction analysis
   d. Controls vs. Experimental