I. Best match (20%)

Based on correlations, select the most appropriate choice from the "Answer set" for each of the following items:

1. conjugation	2. Transduction	3. tortoiseshell cat
4. karyotype	5. endopolyploidy	6. Down syndrome
7. kinetochore	8. Charles Darwin	9. Ds and Ac
10. synapsis		

Answer set:

A. duplication	B. transposable element	C. deletion
D. Barr body	E. aneuploid	F. telomere
G. centromere	H. polytene chromosomes	I. metaphase chromosomes
J. maternal effect	K. translocation	L. evolution
M. natural selection	N. inversion	O. bacteriophage
P. sex pili	Q. homologous chromosomes	R. codominance

II. Simple answer questions (60%)

1. For a pea plant, the seed color is determined by the dominant *Y* allele and the recessive *y* allele, and the seed shape is controlled by the dominant *R* allele and the recessive *r* allele. The progeny of a cross between two pea plants displayed the following ratio in genotypes – 1 *RRYY* : 1 *RRYy* : 1 *RrYY* : 1 *RrYy*. Please list all the possible parental genotypes in pair that could produce this progeny ratio. (10 %)

2. The existence of a cell surface marker protein Ap is controlled by the *A* gene. In a population, there are three different alleles for the *A* gene: A1, A2 and A3, and their allele frequencies are 0.2, 0.3 and 0.5, respectively. The A1 and A2 alleles are codominant in their function. Both A1 and A2 alleles are dominant to A3. If this population is in Hardy-Weinberg equilibrium, please list all different phenotypes in the population regarding to Ap. Additionally, what are the frequencies of these different phenotypes, respectively? (10 %)

3. If a plant has the diploid number = 4, please draw pictures to show chromosomes alignment at the metaphase plates of (1) mitosis, (2) meiosis I, and (3) meiosis II, respectively. Use different chromosome sizes to distinguish between non-homologous chromosomes. (10 %)

4. What are the differences between prokaryotes and eukaryotes in gene transcription? (10 %)

5. Describe briefly what are the miRNAs, siRNAs and RNA interference (RNAi). (10 %)

6. If you already know the DNA sequence of a plant gene, discuss briefly how you can identify the function of this gene. (10 %)

III. Define the following terms (20%)

1. ribosome 2. telomere 3. spliceosome 4. housekeeping gene 5. consensus sequence
6. retrotransposon 7. epigenetics 8. polymerase chain reaction 9. Ti plasmid 10. cis element

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