1. Explain the following terms (40%)

1)	DNA fingerprinting	6)	Epistasis
2)	Nucleosome	7)	Amphidiploid
3)	Ti plasmid	8)	Transcription factor
4)	Homeobox	9)	Pseudogene
5)	Shuttle vector	10)	Nonsense mutation

2. In *Drosophila*, the three gene pairs for red eye (cn^+) vs. cinnabar (cn), normal bristle (rd^+) vs. reduced (rd), and long wing (vg^+) vs. vestigial (vg) are known to have their loci on the chromosome II. Suppose that a three-factor testcross (the tester that was homozygous recessive for the three genes) yielded the following offspring:

Phenotype	Number
cinnabar, reduced, vestigial	406
cinnabar, reduced, long	46
cinnabar, normal, vestigial	28
cinnabar, normal, long	3
red, normal, long	438
red, normal, vestigial	45
red, reduced, long	33
red, reduced, vestigial	1

1) Draw a linkage map for the three genes (include map distances)

2) Calculate the interference value (coefficient of interference) (20%)

3. In a hypothetical population of 2000 people, 200 have the genotype AA blood type, 1200 have the genotype AB blood, and 600 have the genotype BB blood.

1) What is the frequency of the A gene?

2) If there are 4000 children produced by this generation, how many would be expected to have AB blood? (10%)

4. Bacterial operons concerned with the biosynthesis of amino acid are often controlled by a mechanism of attenuation. Please use the *trp* operon of *E. coli.* as an example, explain the regulation of gene expression in prokaryotes by attenuation. (20%)

5. Describe the following scientists made what contributions to genetics. (10%)

1) Beadle and Tatum
2) Watson and Crick
3) Hardy and Weinberg
4) Sanger and Gilbert
5) Meselson and Stahl