Mutations and Cancer Review Sheet Key

1. What is a mutation?
   Change in the sequence of the base pairs of DNA.

2. During which of the 4 stage cell cycle do most mutations occur and why?
   (G1 S G2 Cell Division)
   S (synthesis) because the DNA is being unzipped and rebuilt during DNA replication.

3. List the 3 types of mutations.
   single base substitutions, insertions and deletions, translocations

4. What are the three types of single base substitutions?
   i) missense  ii) nonsense  iii) silent

5. Describe a missense mutation. Rewrite the following strand of DNA to reflect a missense mutation.
   Missense Mutation - alters the codon to produce different protein
   Before Mutation
   DNA = AAT CTC ACC TTA
   mRNA = UUA GAG UGG AAU
   amino acids = leuc – glut – tryp – asparagine
   After Mutation
   DNA = GAAT CTC ACC TTA
   mRNA = UUA GAG UGG AAU
   amino acids = seri – glut – tryp – asparagine

6. Describe a nonsense mutation. Rewrite the following strand of DNA to reflect a nonsense mutation.
   Nonsense Mutation - alters codon to one of the STOP codons resulting in a shortened protein
   Before Mutation
   DNA = AAT CTC ACC TTA
   mRNA = UUA GAG UGG AAU
   amino acids = leuc – glut – tryp – asparagine
   After Mutation
   DNA = AAT CTC ACT TTA
   mRNA = UUA GAG UGG AAU
   amino acids = leuc – glut – stop

7. Describe a silent mutation. Rewrite the following strand of DNA to reflect a silent mutation.
   Silent Mutation - the altered codon happens to code for the same amino acid as the original therefore no change in the protein produced
   Before Mutation
   DNA = AAT CTC ACC TTA
   mRNA = UUA GAG UGG AAU
   amino acids = leuc – glut – tryp – asparagine
   After Mutation
   DNA = AAT CTC ACC TTA
   mRNA = UUA GAG UGG AAU
   amino acids = leuc – glut – tryp – asparagine

8. Describe an insertion mutation. Rewrite the following strand of DNA to reflect an insertion mutation.
   Extra base pairs are added from the DNA of a gene
   AAT CTC ACC TTA
   mRNA = UUA GAG UGG AAU
   amino acids = leuc – glut – tryp – asparagine

9. Describe a deletion mutation. Rewrite the following strand of DNA to reflect a deletion mutation.
   Extra base pairs are deleted from the DNA of a gene
   AAT CTC ACC TTA
   mRNA = UUA GAG UGG AAU
   amino acids = leuc – glut – tryp – asparagine

10. Explain why insertions or deletions of 1 base is more harmful than an insertions or deletions of 3 bases. An insertions or deletions of 1 would result in a frameshift.
11. Create a single “letter” deletion mutation in the sentence below.

THE BIG FAT CAT ATE THE RAT
THE BIG CAT ATE THE RAT

This results in a frame shift. Why would a deletion of 3 letters be less harmful? The rest of the sentence would still make sense.

12. Create an insertion mutation in both the sentence and DNA sequences below.

Base Sequence: A G A G C A T A G G A T

Single Insertion Mutation: Answers Vary

13. With a diagram, show what a translocation mutation would look like.


15. Explain the link between mutations and cancer. If a mutation happens by chance to occur in a section of DNA that codes for a protein that controls the cell’s cycle, the mutation could cause the cell to get stuck in full blown uncontrolled cell division mode.

16. What is the difference between a malign (malignant) and benign tumor.

17. What does “Metastasis” (ma tast a sis) mean in reference to cancer and why does it make cancer so difficult to treat? When cancer cells move through blood or lymph and establish themselves in other location in body. Difficult to treat because cancer has spread.

18. What is the Ames test? test used to determine if a chemical is a mutagen/carcinogen.

19. The plates below have been prepared for Ames tests. Explain the results. Is either chemical carcinogenic? Chemical A fails the Ames test and is a carcinogen because there are lots of bacterial colonies showing that lots of mutations occurred near Chemical A giving the bacteria lots of chances to mutate back to a viable form. Chemical B passes the Ames test and seems ok, the colonies of bacteria here are referred to as volunteer colonies that mutated back to a viable form on their own.