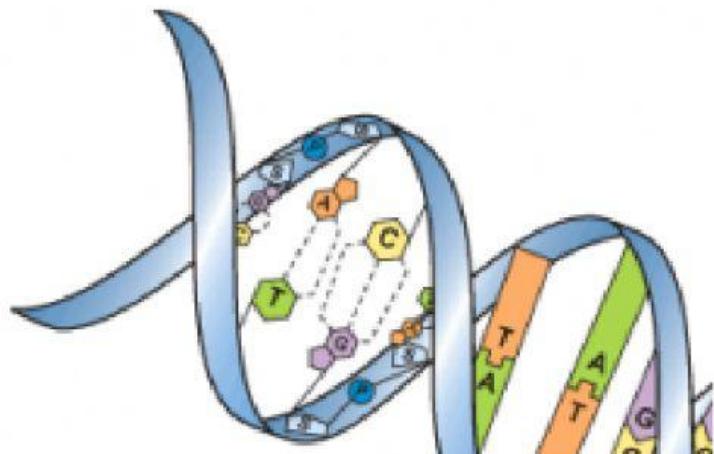


1. Two mutations occur in the same gene.
  - Mutation 1: involves a single nucleotide being inserted into the gene.
  - Mutation 2: involves a single nucleotide replacing a different nucleotide.
  - a. State which mutation is a frameshift mutation:
  
  - b. Predict which mutation is more likely to prevent the protein from being able to function properly. Explain your prediction.
  
2. A scientist is comparing the processes of DNA replication and transcription in Eukaryotes.
  - a. Explain two ways that DNA replication and transcription are different.
  
  - b. Explain one way that DNA replication and transcription are similar.
  
3. Give an example of an external factor that regulates gene expression and explain how it works.

4. The following image shows the current model of DNA, attributed to James Watson and Francis Crick. Label the diagram below with the following terms showing exactly where to find them on the diagram.

**Covalent bonds**  
**Hydrogen bonds**  
**Sugar ring**  
**Nucleotides**  
**Phosphates**  
**Nitrogenous bases**



5. Determine the amino acids that are defined by the portion of DNA shown below using the codon chart on the last page of this exam.

DNA	TAC	CTT	GGG	GAA	TAT	CTT	CGA	TGA	ATC
mRNA									
Amino Acid									

6. Robert and his wife are ready to start a family, but they are concerned about having a child inherit a disease. This disease is an **autosomal** recessive (d) disorder that requires both parents to contribute a recessive allele in order for the child to express the disorder. The uninfected condition has the allele (D) and the disease is the allele (d). If both Robert and his wife are heterozygous for this trait,

- a. Complete the punnett square for this cross.

- b. What is the probability that their child will have the disease?

Father's Genes			
Mother's Genes	D		
	D		

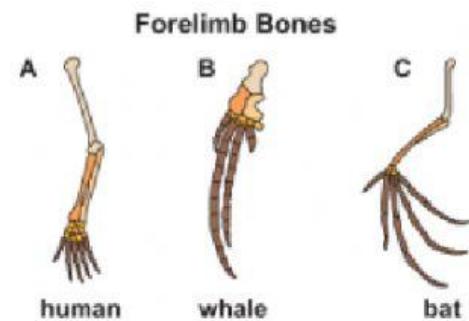
7. Charles Darwin observed that species have changed over time.
- Define natural selection.
  - Predict what effect natural selection might have on a population of deer if a drought killed most of the shrubs that were their favourite food and only the taller, more established trees survived. Explain your answer.
8. Set up a Punnett square using the following information:
- Dominant allele for a fast fox = F
  - Recessive allele for a slow fox = f
  - Dominant allele for a red fox = R
  - Recessive allele for a gray fox = r
- Cross a homozygous fast heterozygous red fox with a slow heterozygous red fox.
- \_\_\_\_\_ X \_\_\_\_\_
  - Complete the dihybrid cross in the table below


- c. What is the phenotype ratio for the offspring?

Fast/Red \_\_\_\_\_ : Fast/Grey \_\_\_\_\_ : Slow/Red \_\_\_\_\_ : Slow/Grey \_\_\_\_\_

9. The illustration shows forelimb bones for a human, whale, and bat.

- a. Describe one similarity and one difference between the 3 forelimbs.



- b. Describe how this information provides evidence of a common ancestry.

10. Consider the group of words: **groundwater, trees, solar energy, steel** Which does not belong to the group and why?

