**Pre-Lab Questions**

1. Use the following data to construct a cladogram of the major plant groups.

**Table 1: Characteristics of Major Plant Groups**

|  |  |  |  |
| --- | --- | --- | --- |
| **Organism** | **Vascular Tissue** | **Flowers** | **Seeds** |
| Mosses | 0 | 0 | 0 |
| Pine trees | 1 | 0 | 1 |
| Flowering plants | 1 | 1 | 1 |
| Ferns | 1 | 0 | 0 |
| Total | 3 | 1 | 2 |

1. GAPDH (Glyceraldehyde 3-phosphate dehydrogenase) is an enzyme that catalyzes the sixth step in glycolysis, an important reaction that produces molecules used in cellular respiration. The following data table shows the percentage similarity of this gene and the protein it expresses in humans versus other species. For example, according to the table, the GAPDH gene in chimpanzees is 99.6% identical to the gene found in humans, while the protein is identical.

**Table 2. Percentage Similarity Between the GAPDH Gene and Protein in Humans and Other Species**

|  |  |  |
| --- | --- | --- |
| **Species** | **Gene Percentage Similarity** | **Protein Percentage Similarity** |
| Chimpanzee (*Pan troglodytes*) | 99.6% | 100% |
| Dog (*Canis lupus familiaris*) | 91.3% | 95.2% |
| Fruit fly (*Drosophila melanogaster)* | (72.4% | 76.7% |
| Roundworm (*Caenorhabditis elegans*) | 68.2% | 74.3% |

1. Why is the percentage similarity in the gene always lower than the percentage similarity in the protein for each of the species?
2. Draw a cladogram depicting the evolutionary relationships among all five species (including humans) according to their percentage similarity in the GAPDH gene.