Name: _____ Date: _____

WEB QUEST: PHYLOGENETICS

Part I: The Family Tree http://evolution.berkeley.edu/evolibrary/article/evo_04

By studying inherited characteristics and historical evidence, we can reconstruct evolutionary _____ and represent them on a "family tree" called a _____.

Observe the family tree. Click on the portion "Eukaryota".

- Note the location of tunicates and cnidarians. Which one do you think is more closely related to vertebrates? Why?

  _____

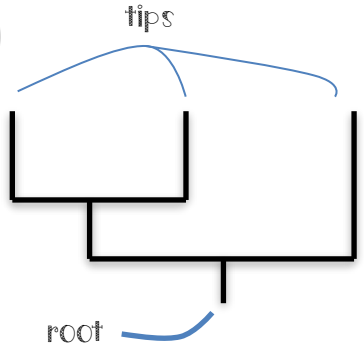
  _____.

- **Click on "Vertebrates".** Name two types of groups that you think are closely related.

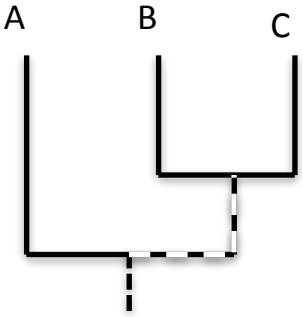
_____

Part II: Understanding Phylogenies ("Family Trees")

next



- The root of the tree represents _____.
- The tips of the tree represent _____
- Trees can represent time. As you move from root to tip, you are moving _____ in time.
- A branching represents _____. Draw stars where this event occurs on the tree to the right.



- Phylogenies trace _____ of _____ _____ between lineages.

Using the tree on the website as a guide, outline the lineage of organism B in green and C in blue (or another color of your choice). Then, make a key similar to the one found on the website that includes the colors and the dashed line.

KEY

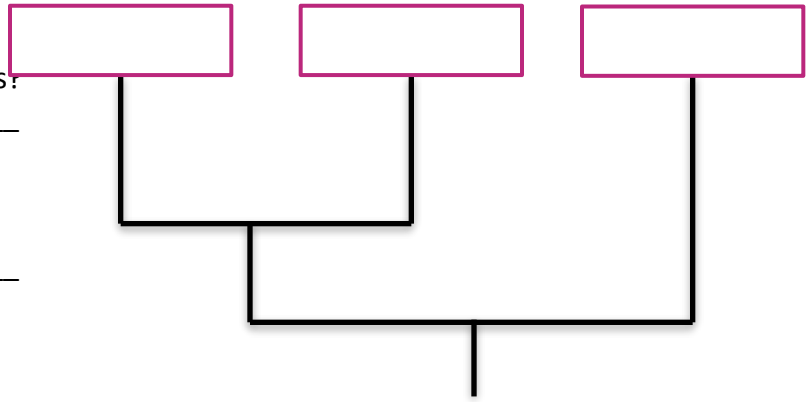
Part III: Reading Trees http://evolution.berkeley.edu/evolibrary/article/phylogenetics_02

- An evolutionary tree represents _____ _____ among a set of organisms or groups called _____ (singular: _____).
  - -The tip of the tree represents groups of _____ taxa.
  - -The nodes of the tree represent the _____ _____.
  - --Descendants split from the same group are called _____ _____.
  - -Many phylogenies include an _____, which is a taxon _____ _____.

What's the difference between a phylogeny, an evolutionary tree, a phylogenetic tree, and a cladogram?

^Please read this portion! As science progresses, biologists are beginning to use these terms interchangeably, but there are still some distinctions among them. *The last page of this web quest contains a space for you to write some notes.*

Label the tree accordingly, including the common ancestor.



- Why are taxon A and taxon B sister groups?
  _____
  _____.
- Why is taxon C the outgroup?
  _____
  _____.

Understanding phylogenies part 2 http://evolution.berkeley.edu/evolibrary/article/0_0_0/evo_06

- What is a clade? _____
- The examples given include those of clades and those that are not clades. The ones that are not clades (highlighted in pink and orange) are not clades because they do not share a common _____.
- Clades are nested within one another, forming a _____ _____.

next **Trees, not ladders**

When reading a phylogeny, it is important to keep these 3 things in mind:

1. Evolution produces _____
   _____.
2. Just because we tend to read phylogenies from left to right, _____
   _____.
3. For any _____ event on a phylogeny, the choice of which lineage goes to the right and which goes to the left is _____. (Look at the examples given where the tree is mirrored. The two trees are (circle one) [equal | not equal].

next **Building the tree**

When reading a phylogeny, it is important to keep these 3 things in mind:

To build a phylogenetic tree, biologists must collect data about the _____ of each organism. Characters can be:

- _____ traits (morphology)
- _____ sequences
- _____ traits

Our goal is to find evidence that will help us _____ organisms into less _____ (smaller) clades. Specifically, we are interested in _____ _____ characters.
Shared derived characters can be used to group organisms into _____.
Examine the cladogram that includes sharks → ray finned fishes.
What is the derived character highlighted in green? _____.

However, the presence of four-limbs is not useful in determining _____ _____ in green above, since all _____ _____.

What would you need to examine in order to determine relationships within the green clade?

_____.

next next **Using the tree for classification**

Biologist use phylogenetic trees for many purposes, including:

- _____ _____ about _____.
- Learning about the characteristics of _____ species and _____ _____.
- _____ organisms.

Most of us are accustomed to Linnaeus' system of classification, which was created long before scientists understood that organisms evolved; because this system is **not** based on _____, most biologists are switching to a classification system that reflects the organisms' _____ _____.

Examine the cladogram in its step-by-step description (notice it is the same cladogram, just highlighted differently depending on what the text is pointing out).

Using Linnaeus' system, why do reptiles not form a clade? (Hint: there is an organism included within the reptilian group that we do not classify as reptiles).

_____

What does this cladogram suggest about the evolutionary history of birds?

_____

Part IV: Using trees for Classification

http://evolution.berkeley.edu/evolibrary/article/0_0_0/phylogenetics_04

Using the phylogeny of birds as an example, how does the Linnaean classification of birds compare to phylogenetic classification? _____

_____

_____

_____

Click on the link that says "Linnaean system of classification" and read the description.

What are the two main advantages of using phylogenetics over Linnaeus' system?

- First, phylogenetic classification tells you something important about the organism:

_____

- Second, _____

Though the cat family (called "Felidae") and the orchid family (called "Orchidaceae") are both at the family level in Linnaean classification, how many cat species belong to the cat family? _____ How many orchid species belong to the orchid family? _____

- Are all families of the Linnaean system created equal? Why or why not?

_____

_____.

CLOSING NOTES

In the space below, take a moment to reflect upon the information gathered in the web quest (in no particular order) and write your thoughts:

As science progresses, how are the terms cladograms, evolutionary tree, and phylogenetic trees related?

What information can be found on phylogenetic trees?

What might a phylogenetic tree be used for?

What types of information are used to build phylogenetic trees?

Why might the Linnaean system need to be modified?