Animal Bag #: _____

Name: _____ Period: _____

Lab 22: Classification of Species

CLASSIFICATION

INVERTEBRATES   VERTEBRATES

FISH   REPTILES   MAMMALS

AMPHIBIANS   BIRDS
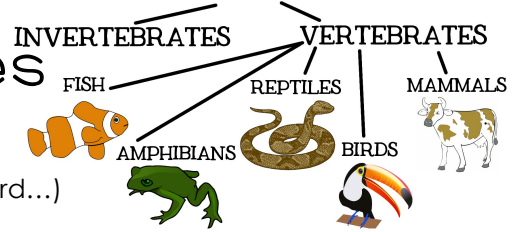
Instructions:

1. Pick up a bag of plastic toy animals (note: these are a choking hazard…)
2. At the top of this page, note which bag number you have
3. Set these aside and complete part A first, then use the animals in part B

Part A: Analyzing Cladograms

1. Observe the cladogram below and answer the following analysis questions:

   A. What is a character on a cladogram? _____

   _____

   B. Make a list of all possible characters included on this cladogram: _____
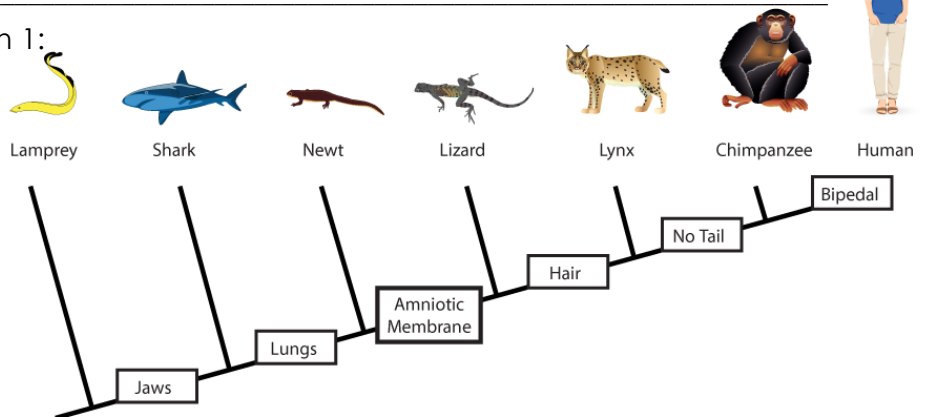
   _____

   C. Which organism would be called the outgroup? Why? _____

   _____

   D. What are some shared characters between lynx and newts? _____

   _____

   E. What are some shared characters between lynx and chimpanzees? _____

   _____

   F. If a mouse were added to this cladogram, where would it be placed? Why? _____

   _____

   Cladogram for question 1:

   Lamprey   Shark   Newt   Lizard   Lynx   Chimpanzee   Human

   Bipedal

   No Tail

   Hair

   Amniotic Membrane

   Lungs

   Jaws

2. Examine the table below. For each character present in the organism, place a check mark. Then use the table to create a simple cladogram in the blank space below. Answer the questions that follow.

Organism	Characters		
	Backbone	Legs	Hair/Fur
Earthworm			
Cod Fish			
Frog			
Gorilla			

A. How many characters do earthworms have? _____

B. Which organism is the outgroup for this cladogram? _____

C. How many characters are shared between the frog and the gorilla? _____

D. Which two organisms do you think are most closely related given the characters? Explain.

   _____

   _____

E. Which two organisms do you think are most distantly related given the characters? Explain.

   _____

   _____

Part B: Building a Cladogram

A. Open your bag of animals. There should be 11 animals. Please do not lose any of them or lose the bag. Also, please do not draw or write on the animals.

B. In the data table below, list the animals in the row across the top. They can be listed in any order you choose, or just randomly.

C. With your partner, observe your animals. Discuss the different characters you will use to create a cladogram for these animals. (Note: if you have 11 organisms, bare minimum you will need 10 or 11 characters!) You may first draw out your cladogram or you may draw a classification tree if you remember all the way back to 7th grade. It helps to continuously divide the pile animals into two new groups.

D. Then list the characters that you will use to create your cladogram down the far left column. (There are extra rows for a characters if needed.) Check the boxes for the organisms that have each character. Leave them blank if they do not have that character.

	Animals										
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Characters											

E. Use the data table you created to build a massive super awesome cladogram below. Make sure you have all 11 animals accounted for and all characters shown on your cladogram!

Answer the analysis questions in regards to your cladogram:

A. Which organism is your outgroup? _____

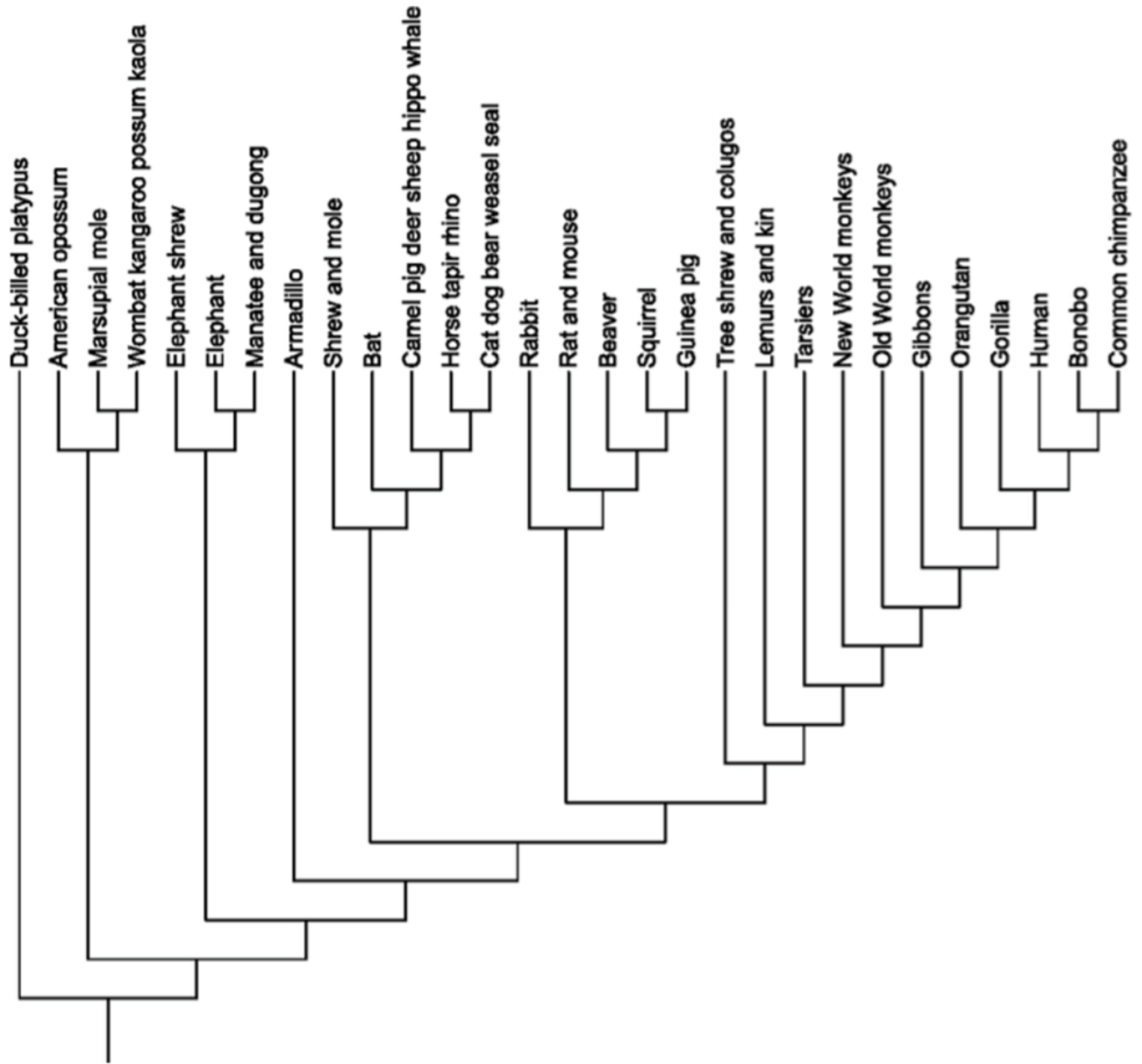B. Give two organisms that are closely related and list their common characters: _____

_____

C. Give two organisms that are distantly related and list their common characters: _____

_____

Part C: Analyzing Phylogenetic Trees

1. Observe the phylogenetic tree below. Note that it has three *current* organisms shown on the tree, organisms 1, 2, & 3.

2. Place a star at the common ancestor that organisms 1, 2, & 3 share.

3. Place a triangle on the *most recent* common ancestor organisms 2 and 3 share.

4. How many speciation events occurred in this tree? _____

5. Which of the symbols represents the *oldest* organism on the tree (star or triangle?) _____
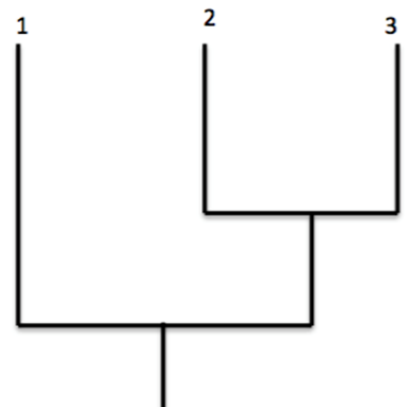
Using what we know about phylogenetic trees, answer the following questions by examining the tree below.

Duck-billed platypus
American opossum
Marsupial mole
Wombat kangaroo possum kaola
Elephant shrew
Elephant
Manatee and dugong
Armadillo
Shrew and mole
Bat
Camel pig deer sheep hippo whale
Horse tapir rhino
Cat dog bear weasel seal
Rabbit
Rat and mouse
Beaver
Squirrel
Guinea pig
Tree shrew and colugos
Lemurs and kin
Tarsiers
New World monkeys
Old World monkeys
Gibbons
Orangutan
Gorilla
Human
Bonobo
Common chimpanzee

Write True (T) or False (F) in the space provided for the following statements. If a statement is false, cross off a word or words and rewrite a new word(s) to make the statement true.

6. _____ In this tree, the closest descendant of the most common ancestor is the duck-billed platypus.

7. _____ Shrews and moles are closely related to elephant shrews.

8. _____ Squirrels are most closely related to rabbits.

9. _____ Humans share a common ancestor with bonobos and chimpanzees.

10. _____ This tree suggests that all of these organisms share a common ancestor from long ago.

Part D: Create a Key & Build Phylogenetic Trees

1. For this activity, you will create a key that will help you to build a phylogenetic tree.
2. Open your bag of animals. There should be 11 animals. Please do not lose any of them or lose the bag. Also, please do not draw or write on the animals.
3. Line up your animals. Identify one way to divide your animals into two groups (mammals vs. non-mammals, four legs vs. two legs, etc.). This will be your first speciation event. In your groups, you may have only one animal! In fact, you ultimately are going to be dividing your animals over and over until they are the only animal in the group.
4. As you separate/divide your organisms, maintain a list of the characters that you use to divide your organisms.
5. Example: you have a goose, a duck, a pig, dog, and a hippo. You separate your pile into birds vs. mammals. Then you separate the goose and the duck as separate species. You then separate the dog from the "hooved" animals (pig and hippos). Finally, you separate the pig and the hippo. So Mrs. H's phylogenetic tree and list of characters would look something like this:

Step/Division	Characters/Groups
1	Mammals vs. Birds
2	Duck vs. Goose
3	Dog vs. Hooved Animals
4	Hippo vs. Pig

6. Either as you build your tree or when you are done with your tree, **number the different steps or divisions** to show it they correspond to your list.
7. Below is a blank table for you to use to create your phylogenetic tree. It is recommended you either use scratch paper to create your tree or use a pencil in case you make mistakes. The next page provides space for you to create your phylogenetic tree. (Note: because you have 11 organisms, then you should have exactly 10 steps or divisions!)

Phylogenetic Tree Divisions/Steps	
Divisions/Steps	Characters/Groups

Animal Phylogenetic Tree:
- Be sure to number your steps or divisions!
- Answer the questions that follow on the back of this sheet!

Answer the analysis questions in regards to your phylogenetic tree:

A. Give two organisms that are closely related: _____

B. Give two organisms that are distantly related: _____

C. How many speciation events have occurred on your tree? _____

D. Draw a star on the **most recent common ancestor** on your phylogenetic tree.

E. Draw a triangle on the **oldest common ancestor** on your phylogenetic tree.

Turn over! One last thing!

Part E: Scientific Naming System

1. As organisms are identified, grouped, and classified, they must be named. Read the passage below about the scientific naming system called "binomial nomenclature". Then complete the table that follows.

The formal system of naming species is called **binomial nomenclature**. Bi = two, nomial = name, nomenclature = naming system. So this is a naming system where each species is identified using two names. The essence of this system of naming is this: each species name is made up of Latin or Greek (or versions of them) words and has two parts, the genus name and the species name, for example, *Homo sapiens*, the name of the human species. The two-part name of a species is popularly known as the **Latin** name or **scientific name**. The Latin or Greek words often give clues or hints as to the environment/habitat, color, shape, food source, etc. of an individual species. As stated before, it can also provide the name of the scientist who identified the species or the country or region it was found in. Carl von Linné (also known as Linnaeus), the scientist who developed this system, chose to use a two-word naming system, and did not use what over time came to be a full seven-category system (kingdom-phylum-class-order-family-genus-species.) Linnaeus chose a binomial nomenclature scheme, using only the genus name and the species name, which together form the whole name of the species. For example, humans belong to genus *Homo* and their species name is *sapiens*. Humans as a species are thus classified as *Homo sapiens*. The first letter of the genus name is <u>always</u> capitalized, while that of the species name is not, even when derived from a proper noun such as the name of a person or place. Conventionally, the binomial name is *italicized* or <u>underlined</u>. Biologists will often abbreviate the binomial name of a species by writing only the first letter of the genus and then the full word of the species name, for example the bacteria *Escherichia coli* is most often abbreviated as *E. coli* and the human binomial name would be *H. sapiens*.

Directions for the table below:
1. Use the **Key** to figure out which scientific name from the **Name Bank** goes with the common name for the organisms listed.
2. Look for clues within the names and similarities with names of other organisms to help you solve the puzzle!
3. After you write the scientific name in the second column, then write your translation for it in the third column.

KEY: dent = tooth   bi = 2   rubra = red   alba = white   cyano = blue

   nigrum = black   helia = sun   quadra = 4   saccharum = sugar

NAME BANK:

Acer rubrum	*Asclepis rubra*	*Egretta alba*	*Hydrophyllum virginianum*	*Piper nigrum*
Acer saccharum	*Cyanocitta cristata*	*Eurycea bilineata*	*Iris cristata*	*Saccharum officinarum*
Asclepis quadrifolia	*Dentaria maxima*	*Helianthus annuus*	*Leontodon autumnalis*	
Trillium grandiflorum				

Common Names	Scientific Name	Common Names	Scientific Name
1. Blue Jay		8. Red Milkweed	
2. Virginia Waterleaf		9. Large Toothwort	
3. Black Pepper		10. Sugar Cane	
4. Sugar Maple		11. Four-Leaved Milkweed	
5. Two-Lined Salamander		12. Red Maple	
6. Common Sunflower		13. Crested Dwarf Iris	
7. Snowy Egret		14. Large Flowered Trillium	
		15. Fall Dandelion	