



Classification Systems

> Section A) Learning to Classify

1. Why Do We Classify Information?

To better understand something, it often helps to organize information into groups. For instance, at school you study different subjects at different times. One lesson might teach you about math, another tests your spelling, and another helps you learn geography.

What would happen if you were trying to do a math problem, and your teacher suddenly asked you a geography question? You'd probably get confused. Our brains find it easier to remember information if it is classified into groups.

Librarians organize books to help you find what you're looking for more easily. Without the library's system, you'd have to look through hundreds or even thousands of books to find what you needed. Imagine how much more time you'd have to spend doing homework!

2. Creating a Classification System

- i) How does a librarian organize books? Organize a stack of about 25 books into several groups. What groupings would be most helpful to you if you were trying to find the book? The colour of the cover? The title of the book? The number of pages?



Name: _____

In the box below, create a diagram to show how you would organize the 25 books into various groups:

ii) What type of grouping did you choose to organize the books?

iii) In a stack of 25 books, one type of grouping might be enough to help you find what you're looking for. But in a huge library full of books, you often need groups within groups, or sub-categories, to help you narrow down your search. What are some of the sub-categories that libraries use to organize books? Visit your school or local library to find out.





> Section B) Classifying Living Things

To learn more about biology (the science of life), biologists classify living things into groups to help them understand how they are similar or different from one another. To do so, living things are arranged into groups within groups until you arrive at a single species.

To begin, biologists divide all living things into eight main groups in a process called scientific classification. As we are constantly learning more about the plants and animals around us, scientific classification is not a perfect system. Classifications often change as we discover more about species, or because scientists can't agree about how to sort them. In this lesson you will learn about the first four groupings that many scientists use to classify species:

- **Domain**
- **Kingdom**
- **Phylum**
- **Class**
- Order
- Family
- Genus
- Species

A clever way to remember the order of these groups is to memorize this sentence that uses the first letter of each of the groups: **D**ead **K**ings **P**lay **C**hess **O**n **F**ancy **G**lass **S**ets. You can always create your own memory device for this and other things that you need help to remember.



Name: _____

1. Domains

i) What are the three domains that biologists use to classify all life?

ii) Name each of the four kingdoms in the domain Eukarya:





Name: _____

2. Kingdoms

Every organism from the domain Eukarya can be classified into one of four kingdoms:

- Animalia (animals)
- Plantae (plants)
- Fungi (mushrooms, lichen)
- Protista (red, green, golden, brown algae)

Up until the 1960's, biologists thought that all living things fit into two kingdoms: Plantae and Animalia. Eventually, scientific tools like the microscope helped us understand that fungi, algae, and bacteria are very different types of life.

i) Here is a list of living organisms from the boreal forest in Canada. Do a little research and draw a picture of each organism in its kingdom (plant or animal) on the following page.

- White birch
- Balsam fir
- Black fly
- Fisher
- Northern hawk owl
- Fireweed

Canon



Name: _____

Animalia

All animals need to consume food for energy.

Plantae

All plants convert carbon dioxide, water, and sunlight into food.





Name: _____

3. Phyla and Divisions

Living things from each kingdom are further divided. Animals are divided into phyla (phyla is the plural of phylum). Plants are divided into divisions. There are over forty phyla and divisions.

- In kingdom Animalia, animals are grouped into different phyla. For example, those with backbones (vertebrates), are usually sorted into a different phylum than animals without backbones (invertebrates).
- In the kingdom Plantae, plants are grouped into different divisions. For example, plants that produce flowers are grouped in a different division than non-flowering plants.

A few of the most common phyla and divisions:

- Arthropoda: a phylum that includes insects, spiders, and many more animals.
- Chordata: a phylum that includes the vertebrates that have spinal chords. Chordata means “chord”.
- Mollusca: a phylum that includes a variety of animals from tiny snails to giant squid.
- Nematoda: a phylum of over 20 000 species, including roundworms.
- Porifera: a phylum that includes some of the simplest animals, like sponges.
- Anthophyta: a plant division that includes most of the flowering plants.
- Pinophyta: a plant division that includes coniferous trees.

Canon



Name: _____

i) Redraw one boreal forest plant or animal from Section B in the box that represents its phylum. It might take a little more research.

Animalia

Phylum: Chordata

Phylum: Arthropoda

Plantae

Division: Anthophyta

Division: Pinophyta





Name: _____

4. Classes

Next, biologists further organize organisms from each phylum into classes.

i) Some different classes of the Chordata phylum include:

- Mammalia (mammals)
- Aves (birds)
- Reptilia (reptiles)
- Amphibia (amphibians)
- Osteichthyes (bony fish)

Do some research to define some characteristics of each of these five classes of Chordata. Give one example of an organism in each class.

Phylum: Chordata
Class: Mammalia _____ _____
Example: _____
Class: Aves _____ _____
Example: _____





Name: _____

Class: Reptilia

Example: _____

Class: Amphibia

Example: _____

Class: Osteichthyes

Example: _____





Name: _____

ii) Over three quarters of the world's named species fit into the phylum Arthropod. Animals in this phylum have a hard exoskeleton (like a shell), and a segmented body with appendages (legs, antennae, mouthparts, reproductive parts, or claws).

Some different classes of Arthropods include:

- Arachnida (includes, among others, spiders, scorpions, ticks, mites)
- Chilopoda (includes centipedes)
- Malacostraca (includes, among others, lobsters, shrimp, crabs)
- Insecta (includes all species of insects)

Do some research to define some characteristics of each of these classes of Arthropods. Give one example of a species from each class.

Phylum: Arthropod
Class: Arachnida _____ _____
Example: _____
Class: Chilopoda _____ _____
Example: _____





Name: _____

Class: Malacostraca

Example: _____

Class: Insecta

Example: _____





Name: _____

iii) If you look back through this exercise, you'll see how far you've come through the first four levels of scientific classification. The last four groupings get more and more specific. Organisms of the same family often look very similar. For example, the family Felidae includes all cats from lions to house cats. And individuals of the same species are so similar that they sometimes even appear to be almost identical.

Do some research: What is your species name? Are you of the same species as everyone else in your classroom?

Why do biologists use such long, funny names to classify living things?

Scientific names are usually in Latin and Greek. Today, scientists still use the Latin and Greek ancient names so they are the same in any part of the world.

For instance, in Spanish, the blue whale is called *la ballena azul*. If a Canadian biologist was in Cuba, and didn't speak Spanish, he might have a hard time figuring out if the blue whale and *la ballena azul* are the same animal just by using the common name. But both a Cuban biologist and a Canadian biologist would know the whale's classification: *Balaenoptera* (its genus) *musculus* (its species). Therefore, biologists all over the world use its scientific name: *Balaenoptera musculus*.

Often animals from different regions have different common names but are of the same species. For instance, we call animals of the species *Rangifer tarandus* from Europe "reindeer" but we call *Rangifer tarandus* from Canada "caribou". Using the scientific name reveals that animals we may think are different, are actually of the same species.



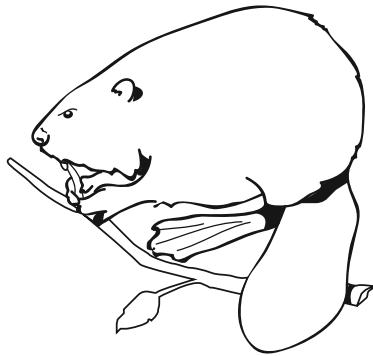


> **Section C) Organisms of the Boreal Forest in Canada and the Cuchillas del Toa Biosphere Reserve in Cuba**

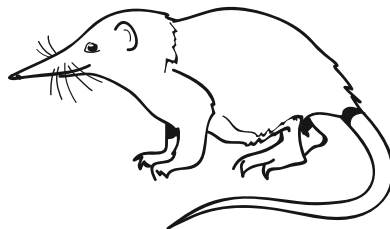
1. Take A Wild Guess

The Boreal Forest in Canada and the Cuchillas del Toa Biosphere Reserve in Cuba are both homes to thousands of different species of plants and animals. These species rely on the forest as habitat, for food and/or shelter, sometimes in some unexpected ways. For instance, in Canada, the black fire beetle relies on the remains of trees that have been burned by forest fires. They lay eggs in the dead wood, safe from predators that would inhabit a live tree. Read about some more animals from Cuban and Canadian forests. Do you think any of the plants or animals from Cuba might be classified as similar to any of the plants and animals from Canada?

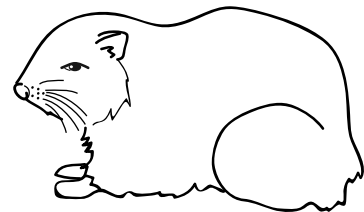
i) The beaver from Canada's boreal forest:



Circle the Cuban animal that you think would be classified as most closely related to the beaver:



Cuban solenodon



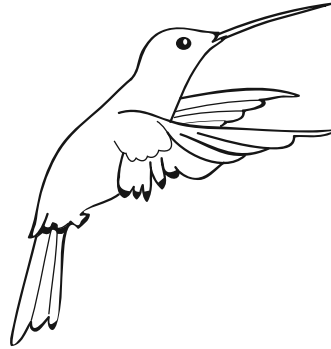
Desmarest's hutia



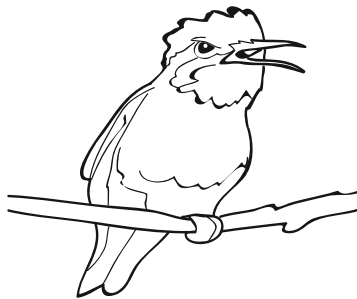


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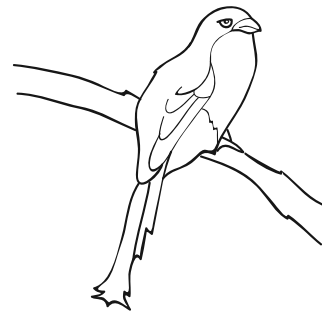
ii) The ruby-throated hummingbird from Canada's boreal forest:



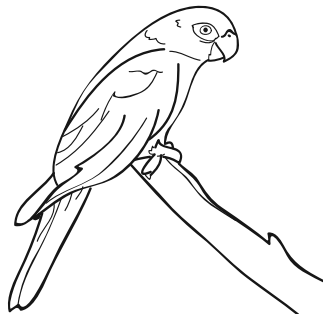
Circle the Cuban bird that you think would be classified as most closely related to the ruby-throated hummingbird:



Bee hummingbird



Cuban trogon



Cuban parakeet



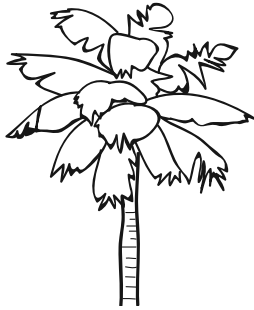


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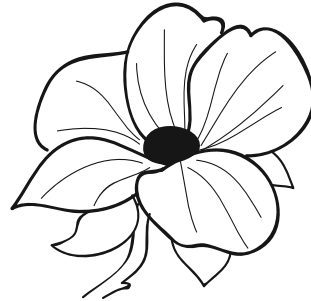
iii) The mayflower from Canada's boreal forest:



Circle the Cuban plant that you think would be classified as most closely related to the Canada mayflower:



Royal palm



Kenaf hibiscus



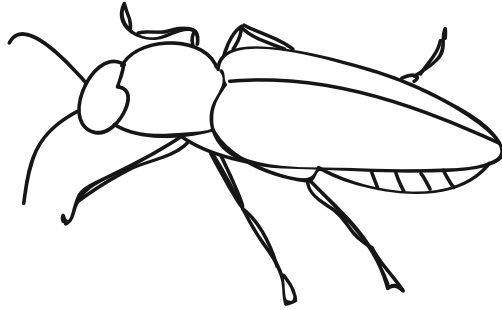
Butterfly jasmine



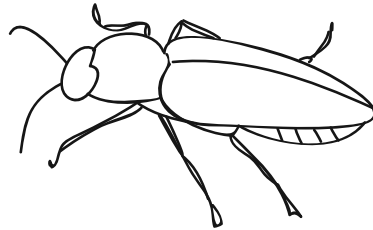


Name: _____

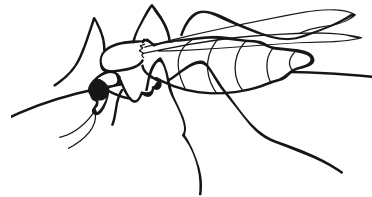
iv) The black fire beetle from Canada's boreal forest:



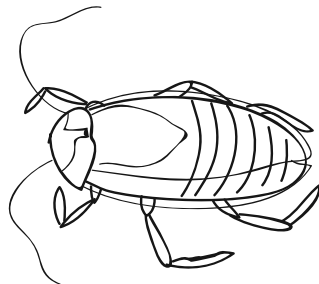
Circle the Cuban insect that you think would be classified as most closely related to the black fire beetle:



Jewel beetle



Anopheles mosquito



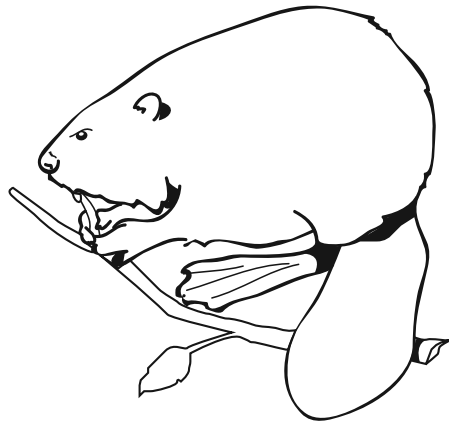
Camaguey cockroach



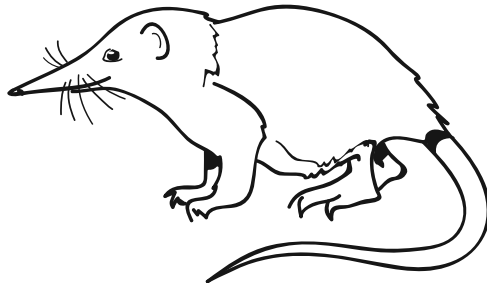


Name: _____

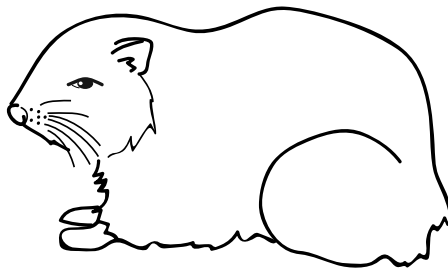
2. Now, take a look at the scientific classifications for each of the organisms in part 1 to see if you were right.



Common name: Beaver
Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Rodentia
Family: Castoridae
Genus: *Castor*
Species: *Castor canadensis*



Common name: Cuban Solenodon
Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Soricomorpha
Family: Solenodontidae
Genus: *Solenodon*
Species: *Solenodon cubanus*



Common name: Desmarest's hutia
Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Rodentia
Family: Capromyidae
Genus: *Capromys*
Species: *Capromys pilorides*

Canon



Name: _____

i) What Cuban animal is most closely related to the beaver?

ii) What classifications do they share, if any?

iii) What is a rodent? Research some of its defining characteristics.

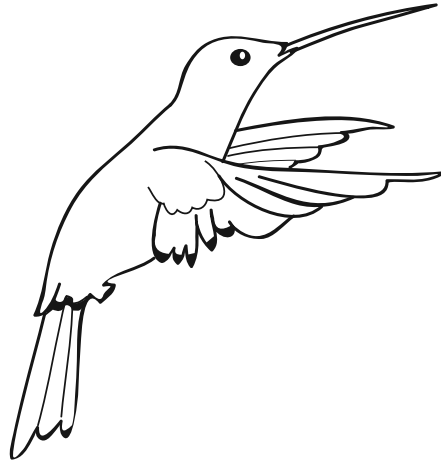
iv) Can you name another Canadian animal that's a rodent?

You may need to do some research.





Name: _____



Common name: Ruby-throated hummingbird

Kingdom: Animalia

Phylum: Chordata

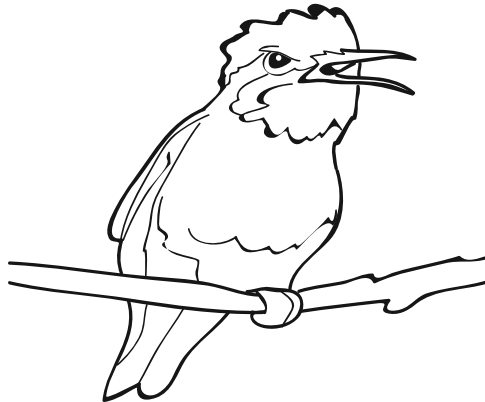
Class: Aves

Order: Apodiformes

Family: Trochilidae

Genus: *Archilochus*

Species: *Archilochus colubris*



Common name: Bee hummingbird

Kingdom: Animalia

Phylum: Chordata

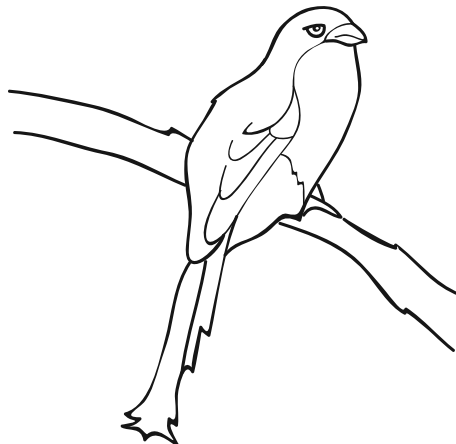
Class: Aves

Order: Apodiformes

Family: Trochilidae

Genus: *Mellisuga*

Species: *Mellisuga helenae*



Common name: Cuban trogon

Kingdom: Animalia

Phylum: Chordata

Class: Aves

Order: Trogoniformes

Family: Trogonidae

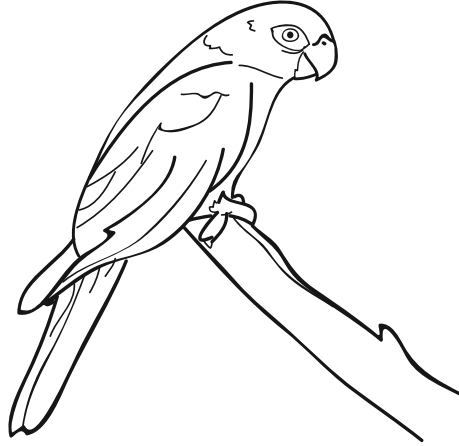
Genus: *Priotelus*

Species: *Priotelus temnurus*

Canon



Name: _____



Common name: Cuban parakeet

Kingdom: Animalia

Phylum: Chordata

Class: Aves

Order: Psittaciformes

Family: Psittacidae

Genus: *Aratinga*

Species: *Aratinga euops*

v) What Cuban bird is most closely related to the ruby-throated hummingbird?

vi) What classifications do they share if any?





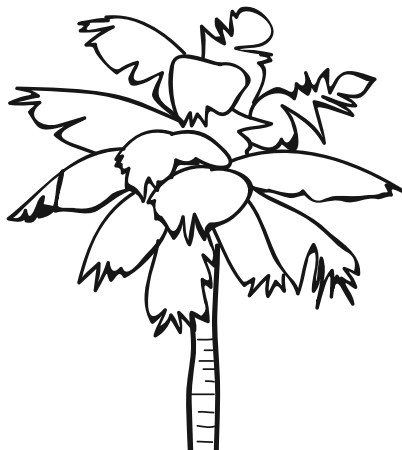
Name: _____



Common name: Canada mayflower
Kingdom: Plantae
Division: Magnoliophyta
Class: Liliopsida
Order: Asparagales
Family: Ruscaceae
Genus: *Maianthemum*
Species: *Maianthemum canadense*



Common name: Butterfly jasmine
Kingdom: Plantae
Division: Magnoliophyta
Class: Liliopsida
Order: Zingiberales
Family: Zingiberaceae
Genus: *Hedychium*
Species: *Hedychium coronarium*

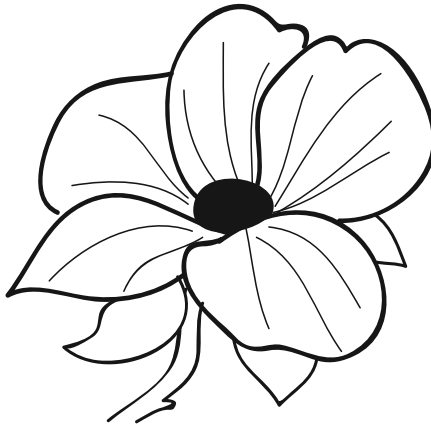


Common name: Royal palm
Kingdom: Plantae
Division: Magnoliophyta
Class: Liliopsida
Order: Arecales
Family: Arecaceae
Genus: *Roystonea*
Species: *Roystonea regia*

Canon



Name: _____



Common name: Kenaf hibiscus

Kingdom: Plantae

Division: Magnoliophyta

Class: Magnoliopsida

Order: Malvales

Family: Malvaceae

Genus: *Hibiscus*

Species: *Hibiscus cannabinus*

vii) What Cuban plant is most closely related to the Canada mayflower?

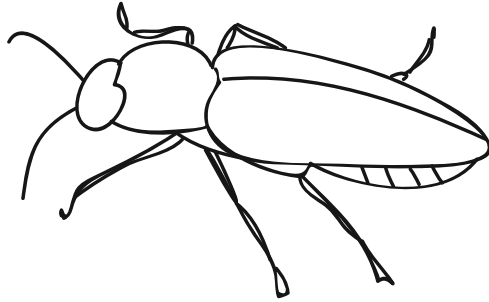
viii) What family are they from?

ix) Are they of the same division?

Canon



Name: _____



Common name: Black fire beetle

Kingdom: Animalia

Phylum: Arthropoda

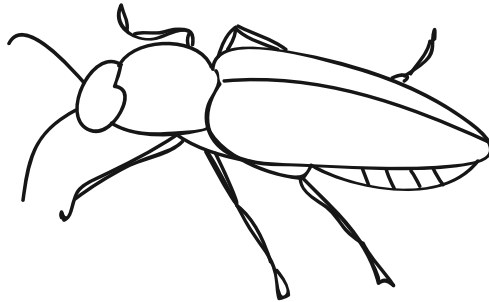
Class: Insecta

Order: Coleoptera

Family: Buprestidae

Genus: *Melanophila*

Species: *Melanophila acuminata*



Common name: Jewel beetle

Kingdom: Animalia

Phylum: Arthropoda

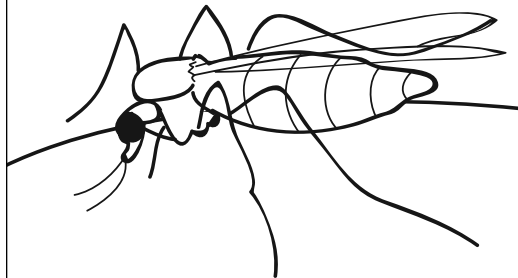
Class: Insecta

Order: Coleoptera

Family: Buprestidae

Genus: *Melanophila*

Species: *Melanophila acuminata*



Common name: Anopheles mosquito

Kingdom: Animalia

Phylum: Arthropoda

Class: Insecta

Order: Diptera

Family: Culicidae

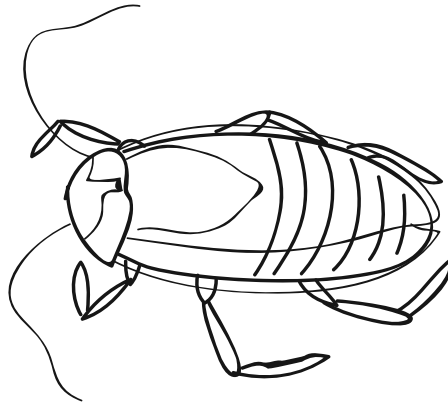
Genus: *Anopheles*

Species: *Anopheles stephensi*

Canon



Name: _____



Common name: Camaguey cockroach
Kingdom: Animalia
Phylum: Arthropoda
Class: Insecta
Order: Blattodea
Family: Blattidae
Genus: *Nesomylacris*
Species: *Nesomylacris fratercula*

x) Which animal has most in common with the black fire beetle?

xi) What classifications do these two share?

xii) How does the comparison between these two types of animal help you to understand why biologists prefer to use scientific names to identify different species, rather than common names?

3. Independent research

Compare a Cuban organism and its closely related Canadian organism from the lists above. Create drawings of each organism in its natural environment. Describe where it lives, what it eats, and what it needs to survive. Are either of these organisms threatened? If so, explain the factors threatening their habitats.





Answers: Classification Systems

Section A) Learning to Classify

2. Creating a Classification System

- i) Open – Groups may choose to organize books according to subject, or possibly author, or title.
- ii) Open – Students should begin to understand how to prioritize forms of classification. For instance, organizing books by colour wouldn't necessarily help you find a book you needed.
- iii) Open – Subject, title, author. Student might mention the necessity of sub-categories for subjects to further narrow down a search.

Section B) Classifying Living Things

1. Domains

- i) Bacteria, Archaea, Eukarya.
- ii) Plantae, Animalia, Fungi, Protista.

2. Kingdoms

- i)
 - Animalia: black fly, fisher, northern hawk owl.
 - Plantae: white birch, balsam fir, fireweed.

3. Phyla and Divisions

- ii)
 - Phylum: Chordata: fisher, northern hawk owl.
 - Phylum: Arthropoda: black fly.
 - Division: Anthophyta: fireweed.
 - Division: Pinophyta: white birch, balsam fir.

4. Class

- i) Answers may contain some or all of the following options:
Mammalia: Mammals: Example: North American red squirrel (*Tamiasciurus hudsonicus*).
 - Have hair or fur.
 - Females produce milk.
 - Are endothermic (warm-blooded).

Canon



Answers: Classification Systems (continued)

Aves: Birds: Example: White-throated sparrow (*Zonotrichia albicollis*)

- Are endothermic (warm-blooded).
- Have feathers.
- Have wings.
- Have two legs.
- Lay eggs.

Reptilia: Reptiles: Example: Common garter snake (*Thamnophis sirtalis*)

- Are ectothermic (cold-blooded).
- Do not have fur or feathers.
- Have skin with scales.
- Most reptiles lay eggs.

Amphibia: Amphibians: Example: Wood frog (*Rana sylvatica*)

- Are ectothermic (cold-blooded).
- Do not have fur or feathers.
- Have skin that's rough, smooth or slimy but must remain moist to breathe.
- They lay eggs in the water.
- They hatch into a temporary state during which they usually breathe with gills, then transform into an air-breathing adult.

Osteichthes: Bony fish: Example: Coho salmon (*Oncorhynchus Kisutch*)

- Have an internal bony skeleton.
- Have bony scales.
- Have a single external gill opening.

ii) Answers may contain some or all of the following options:

Arachnida: Example: Northern black widow (*Latrodectus variolus*)

- Usually terrestrial.
- Have lungs and/or trachea as gas exchange organs.

Canon



Answers: Classification Systems (continued)

- Have eight leg appendages.
- Have two body segments head (fused with thorax) and abdomen.

Chilopoda: Example: House centipede (*Scutigera coleoptrata*)

- Numerous pairs of legs (from 15 to 117, always an odd number of pairs).
- The first set of appendages is a pair of venomous fangs.
- Numerous body segments with one pair of appendages per segment.

Malacostraca: Example: Atlantic lobster (*Homarus americanus*)

- Head has six segments.
- Five pairs of leg appendages, first set is often pincers.
- Six abdominal segments, often used for swimming.

Insecta: Example: Praying mantis (*Mantis religiosa*)

- Three body parts, head, thorax, abdomen.
- Six leg appendages.
- They have wings.
- They all go through some form of metamorphosis (change of state/stages).

iii) Yes, all humans are *Homo sapiens* (Latin for “wise man”).

Section C) Organisms of the Boreal Forest in Canada and The Cuchilas del Toa Biosphere Reserve in Cuba

1. Open – These answers are guesses based on observation. Accurate relations between species according to classification will be established in the next exercise. The point of this exercise is to illustrate that observation can sometimes be helpful in determining the relationships between living things, but not always.

Canon



2. i) Desmarest's hutia.
- ii) Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Rodentia
- iii) A rodent is a small mammal with a single pair of chisel-shaped teeth. They are known for constant gnawing.
- iv) Open – Rat, mouse, squirrel, porcupine, chipmunk, muskrat, gopher, groundhog, prairie dog.
- v) The bee hummingbird.
- vi) Kingdom: Animalia
Phylum: Chordata
Class: Aves
Order: Apodiformes
Family: Trochilidae
- vii) The royal palm.
- viii) Liliaceae.
- ix) No, the royal palm is of the Tracheophyta division, and the mayflower is of the Magnoliophyta division.
- x) The jewel beetle.
- xi) All of them. They are of the same species.
- xii) The common name for this species of beetle is different in Canada than it is in Cuba. You might mistake them for different types if you didn't know the correct scientific classification.

Canon