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The National
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CLASSIFICATION OF LIVING ORGANISMS

Accredited by

معتمدة من

How Many living organisms do you thing there are on planet earth ?

Classification of living things

https://www.youtube.com/watch?v=HLnaIJm5wM4&t=80s

Nobody knows how many different kinds of species of living organisms there are on earth. About 1.4 million species have been described and named. But many biologists think that this is only about one tenth of all the species of earth! There are plenty of organisms that haven't been discovered yet. There are probably many animals living in the deep oceans which have never been seen by humans.

So to make it easier to study these organisms biologists have sorted them into groups this sorting is called "Classification".

- ✓ **Classification:** Separating or sorting living organisms according to their common characteristics and features.
- ✓ **Taxonomy**: is a system for classifying and identifying organisms. This system was developed by the scientist Carolos Linnaeus

Biologists used to classify living organisms into 2 groups (animals and plants) but it caused problems concerning (Fungi, Bacteria and Algae) which do not seem to fit into either kingdoms.

Here comes the scientist Robert

- **Robert Whittaker is the biologist that found the 5 kingdoms scheme which we are going to study in this topic.**


Classification of Living Organisms
Animals
Plants
Fungi
Prokaryotes
Protoctista

Kingdom

Phylum

Class

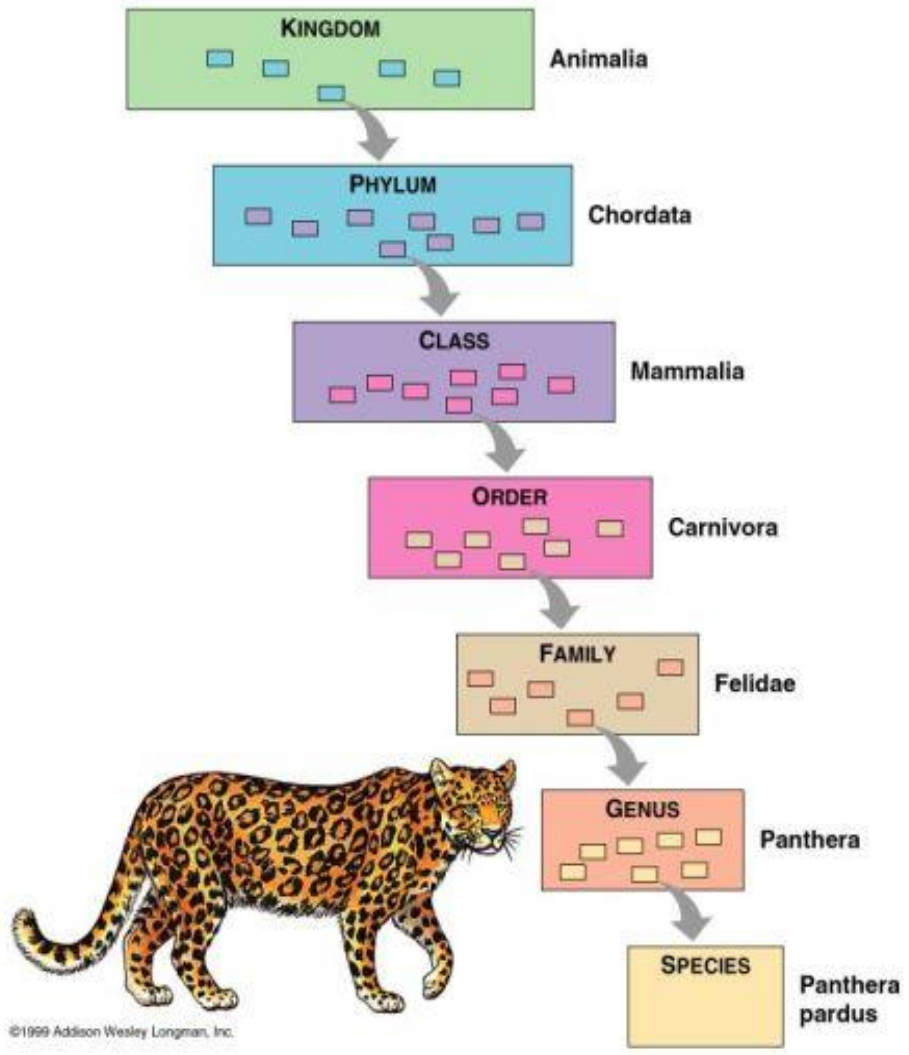
Order

Family

Genus

Species

King Phillipe came over for getting spaghetti



Species: Organisms of the same species which are almost identical in their anatomy, physiology and behavior. Members of the same species also often look similar to each other.

Living organisms of the same species are capable of breeding successfully and producing fertile offspring of the same species.

Genus: a group of organisms with a large number of similarities but whose different species usually unable to interbreed successfully

Closely related species are often grouped together into a genus.

A mule is the offspring of a male donkey and a female horse. Horses and donkeys are different species mules are infertile

→

Binomial nomenclature

- Any living organism must be named in such a way that the name is recognized all over the world. That's why the scientist Linnaeus constructed a new system that recognizes organisms by scientific names that are known all over the world despite of all the language barriers. In those days, most educated people could read and write Latin, so this was the language he chose.

- Each organism has a Latin name made up of two names that's why it was called binomial (meaning two names). The first name is the genus (generic name) and the second name is the species (specific name).

Binomial system: An internationally agreed system in which the scientific name of an organism is made up of two parts showing the genus and species

There is a specific way for writing the scientific names:

- ✓ First, the Genus is written, the first letter must be capitalized.
- ✓ Second, the species name is written, the first letter must be written using small letters.

Both the generic name and the species name must be either underlined or written in italics.

For example :

Genus: Homo

Species: sapiens Is written as

Homo sapiens or *Homo sapiens*

***Homo sapiens* is the scientific name for humans (Homo sapiens means Wise Man)**

Describe the binomial naming system

Genus species

All in italics (or underlined if it is handwritten)

E.g. Homo sapiens

Homo sapiens

Which shows an organism that has been named using the binomial system?

A *Bacterium*

B *Flowering plant*

C *HIV*

D *Homo sapiens*

The table shows the classification of four vertebrate animals.

	animal 1	animal 2	animal 3	animal 4
phylum	Chordata	Chordata	Chordata	Chordata
class	Mammalia	Mammalia	Mammalia	Mammalia
order	Dermoptera	Dermoptera	Dermoptera	Dermoptera
family	Lemuridae	Indridae	Lemuridae	Indridae
genus	*Eulemur*	*Propithecus*	*Eulemur*	*Avahi*
species	*fulvus*	*diadema*	*coronatus*	*laniger*

Which two organisms are **most** closely related?

A 1and 2 **B** 1 and 3 **C** 2 and 3 **D** 2 and 4

B

Fig. 6.1 shows three different insects.

Vespula flavopilosa
insect 1

Vespula rufa
insect 2

Callicera rufa
insect 3

Fig. 6.1

(a) Insects 1 and 2 are more closely related to each other than to insect 3.

(i) Explain how the binomial names indicate that insects 1 and 2 are more closely related.

.....

.....

.....

..... [2]

Question	E answers	Mark	Additional Guidance
4 (a (i)	*either* insects 1 and 2, are in the same genus / have the same generic name ; (both have) *Vespula* ; *or* insect 3 is in a different genus ; (its name is) *Callicera* ;	[max 2]	***ignore*** any references to the species

Methods of classification :

Scientists used the physical features of living organisms to identify how similar they were and therefore decide how to classify them. These features include:

- ✓ **Morphology: the study of how organisms look like**
- ✓ **Anatomy: the study of the body structure of organisms**
- ✓ Analysis and comparison of DNA or RNA can be used as a more accurate method for classifying living organisms and studying relationships between them.

This is a good way when organisms share similar features because they evolved from a shared ancestor, but it fails when organisms share features that are adaptations to particular habitats.

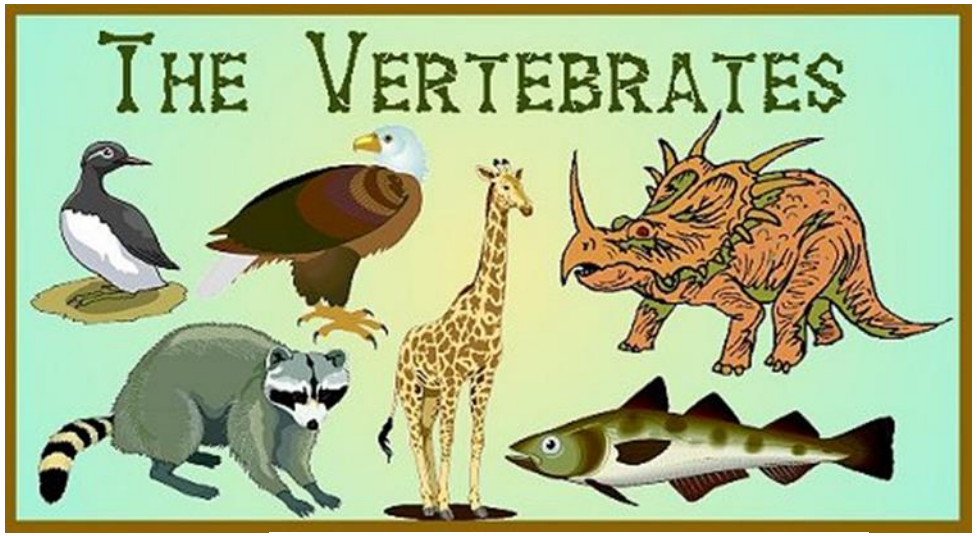
Organisms which share a more recent ancestor (are more closely related); have base sequences in DNA and amino acid sequences in proteins that are more similar than those that share only a distant ancestor.

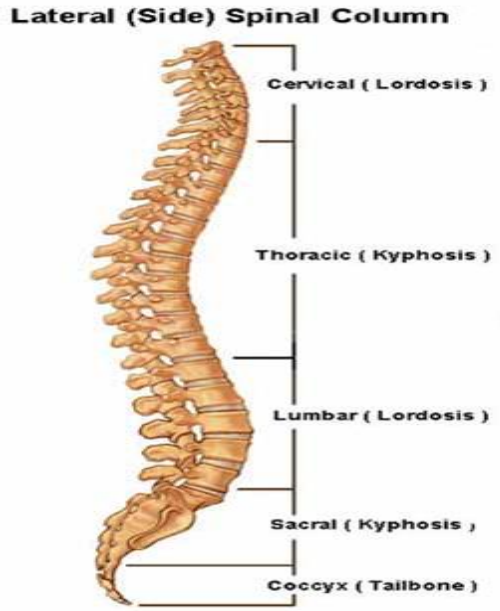
The Animal Kingdom

Animal Kingdom is divided into:	
Vertebrates Phylum Chordates: organisms that have a backbone	Invertebrates: organisms that lack a backbone

Characteristics of vertebrates

- All vertebrates have a vertebral column which is a chain of bones called vertebrae. Inside the vertebral column there is a spinal cord that runs along almost all its length.
- They have a skull that encloses and protects the brain.
- There is a pair of jaws in the skull (upper and lower), most of the time they contain teeth.
- All vertebrates have a post-anal tail.





Vertebrates can be classified according to their body temperature into:

Homoeothermic animals : Endotherms

Warm-blooded animals, ex. humans/birds. Their body temperature is constant (does not depend on the temperature of the surrounding).

Poikilothermic animals : Ectotherms

Cold blooded animals, ex. fish/reptiles. Their body temperature changes according to the temperature of the surrounding environment (not constant / variable).

Adaptations:

Lizards and snakes stay in the sun in the early morning and seek shelter around noun.

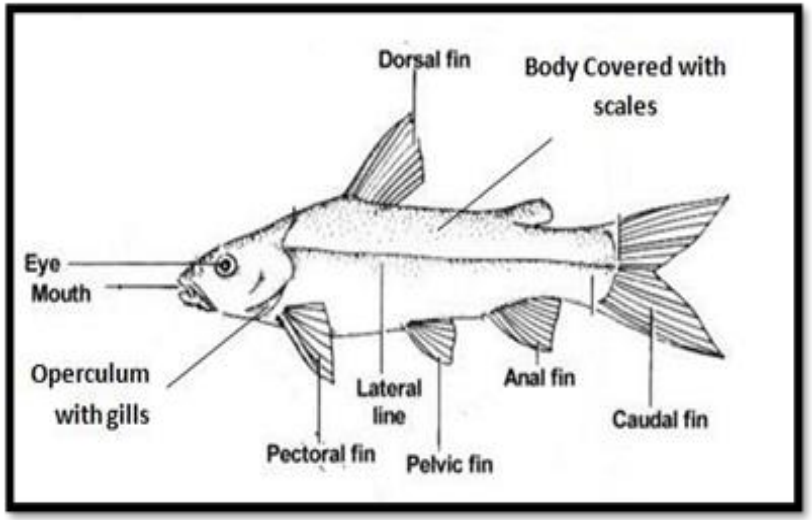
Phylum Chrodates

- Class : Fish
- Class: Amphibians
- Class: Reptiles
- Class: Birds
- Class: Mammals

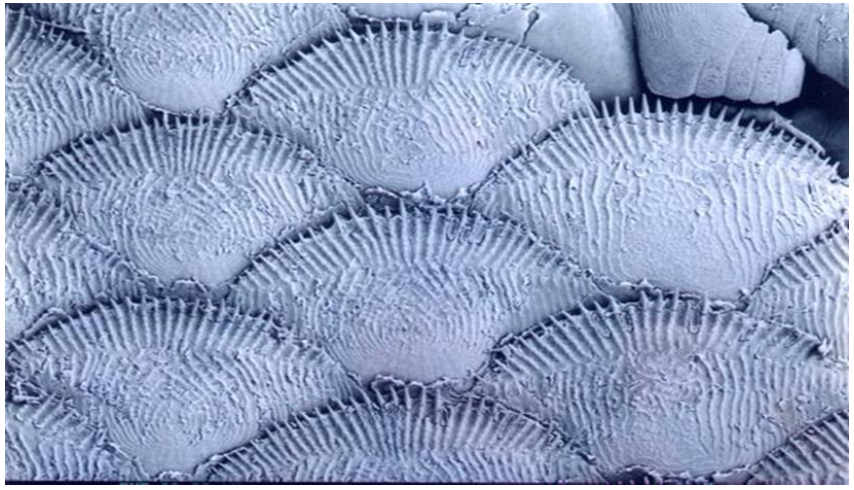
Class: Bony Fish https://www.youtube.com/watch?v=pNZQEmGp11k

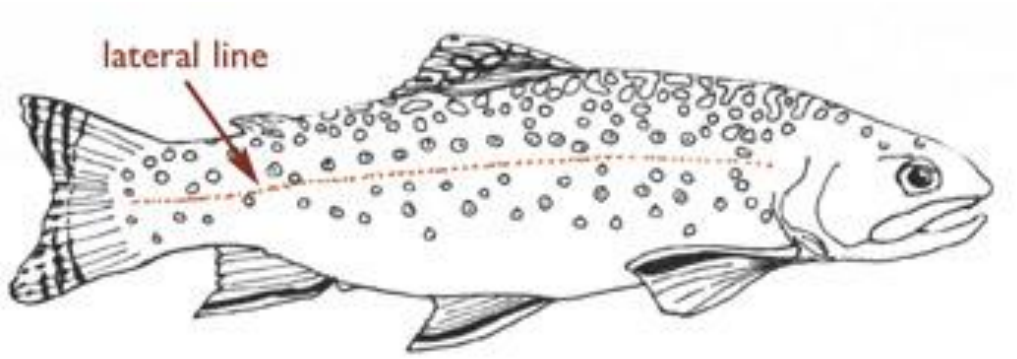
External features:

- Stream-lined shape, which is important to decrease water resistance during swimming.
- The body is covered with over- lapping scales that give a smooth surface to reduce friction.
- They have fins (to control direction of movement and balance) :
  - Dorsal fins
  - Anal fins
  - Caudal fins (tail)
  - Pectoral fin.
- The tail is bilateral (on each side) which helps during forward movement.
- They have filamentous gills (for breathing). Gills are protected by a bone plate called **operculum.**
- They have a pair of eyes with no eyelids.



- They have lateral lines (sense organs) on each side of the body which sense vibrations of nearby fish prey.
- They have a swim bladder, which allows them to float.
- They reproduce sexually, fertilization occurs externally (outside the female body); sperms are shed on the eggs.
- Fertilized egg (jelly like) has no hard covering because it is found in water, so there will be no risk of dehydration





Class: Amphibians https://www.youtube.com/watch?v=u-LqS5AVRio

Amphibians have a double life; they spend part of their lives in water (in the beginning of their life cycle) and the other part on land (when they become adults) ex: frog, toad, salamander, newts.

Frogs

Salamanders

Toads

Newts

- ✓ Most toads, frogs and newts spend much time on land in moist conditions, and then return to water only to lay eggs.
- ✓ Amphibians are poikilothermic (cold –blooded) vertebrates.

External Features:

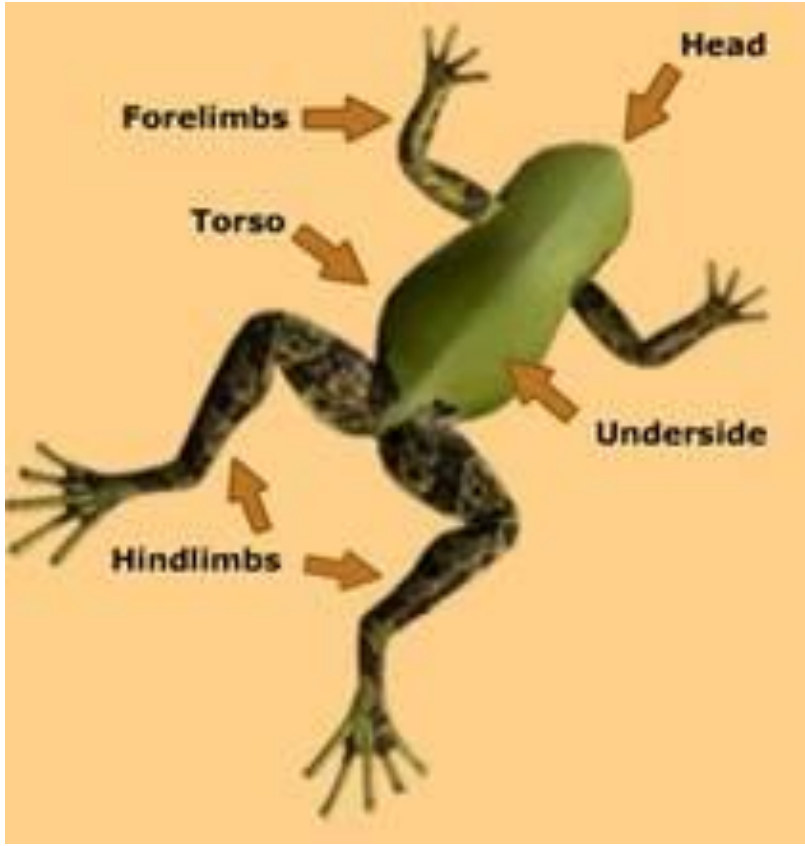
1. They have a smooth moist skin, with no scales; amphibians breathe through their lungs when they are on land, however when they get in water, the uptake of oxygen takes place by gaseous exchange through the skin that's why the skin has a good supply of blood capillaries for exchange of oxygen and carbon dioxide.

2. They have lungs, no ribs and no diaphragm.

3. They have 4 limbs: 2 forelimbs + 2 hindlimbs

4. In frogs and toads, the hind limbs are taller, and they have webbed feet (skin between toes) the skin will make it easier and offer a larger surface area to thrust against the water during swimming.

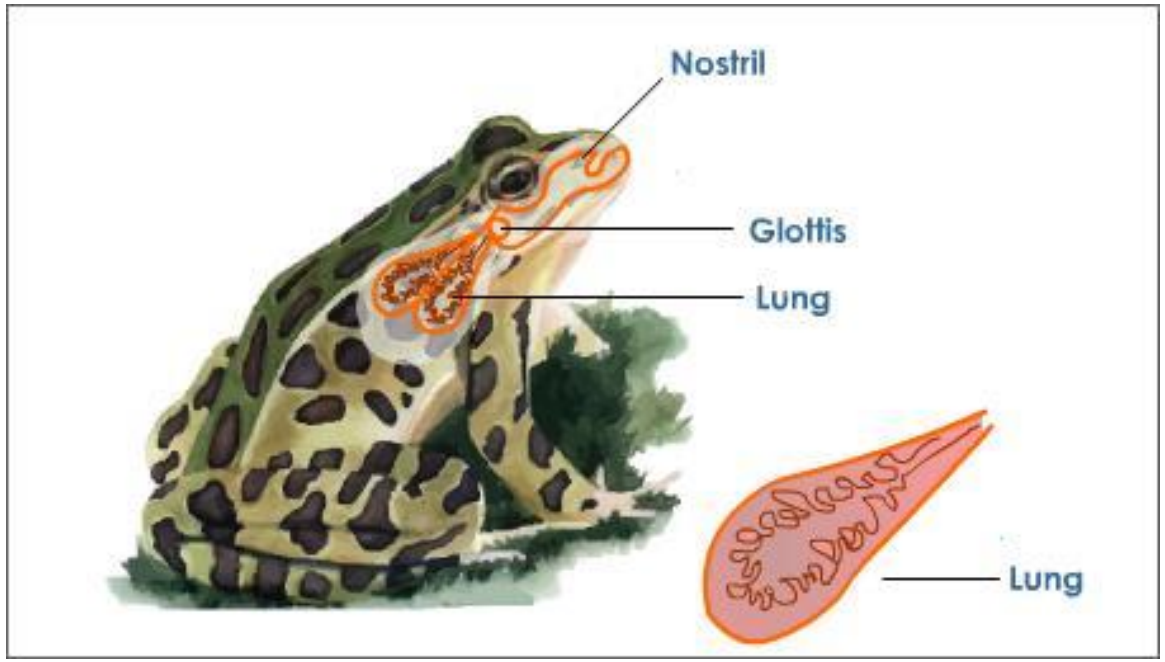
5. Newts don't use their limbs; they swim like fish (using their tail).

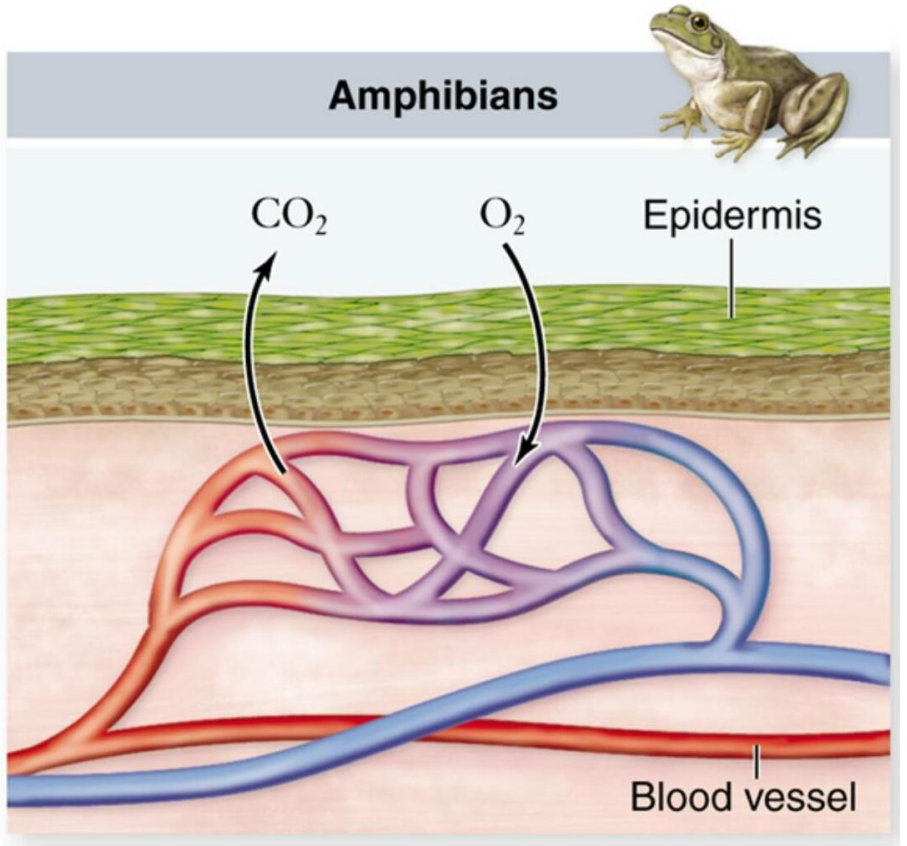


6. Newts and salamanders differ from frogs and toads in having a tail.

7. Amphibians have ears; unlike fish (visible eardrum).

8. They have nostrils for breathing.

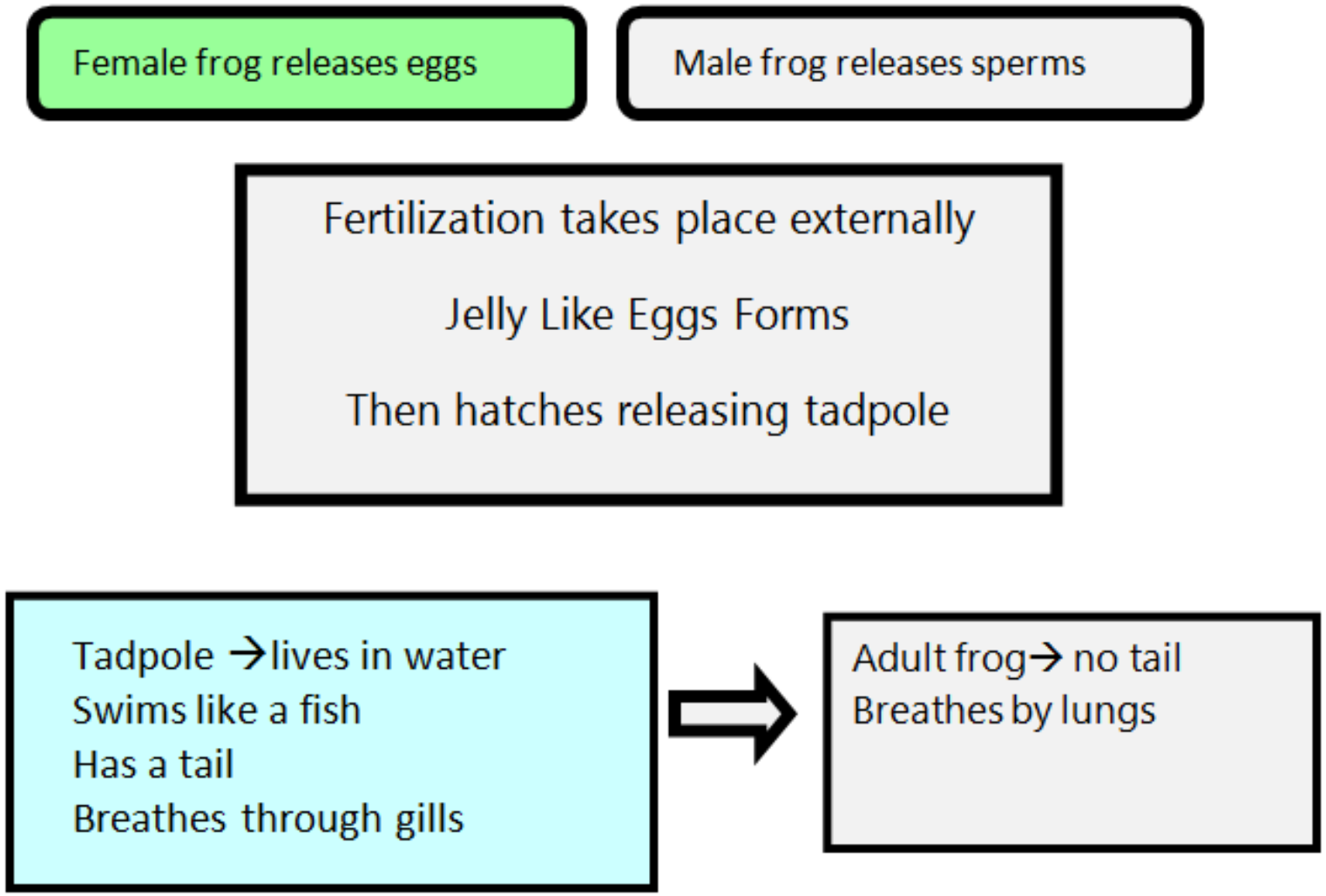




 frog	 salamander
 toad	 newt

How reproduction takes place:

Frogs & toads, in the spring migrate to ponds. Here the male climbs on the back of the female and is carried about her till she lays her eggs. When the male feels the eggs being laid, he releases his sperm which fertilize the eggs. Fertilization occurs externally. The male's behavior in remaining attached to the female makes sure that the sperms are released at the same time as the eggs.


Female frog releases eggs
Male frog releases sperms
Fertilization takes place externally
Jelly Like Eggs Forms
Then hatches releasing tadpole
Tadpole →lives in water
Swims like a fish
Has a tail
Breathes through gills
Adult frog→ no tail
Breathes by lungs

- A toad's skin is drier than the frog; it has glands that secrete an unpleasant tasting chemical that discourages the predators.
- Fish and amphibians have external fertilization because they live in water (sperms can swim towards the egg).
- **Camouflage or blending in**:

The animal kingdom is a wild place; animals have to be clever in order to survive. Animals have the ability to mimic plants or any element in the environment e.g. rocks, branches of trees, in order to hide from their predators or hunt their prey.

Examples: Crocodile (in water), alligators (on land), snake, lizard, turtle (in water), tortoise (on lands).

External features: https://www.youtube.com/watch?v=fxcNRFiBg60

1. They have a dry scaly skin to avoid dehydration, because they live on land.

2. They have four limbs for locomotion each limb contains 5 toes except the snake (no limbs).

3. They have ears, but the eardrum is inside the head, it cannot be seen, unlike amphibians.

4. Internal fertilization; they reproduce sexually, fertilization occurs internally. The eggs are fertilized by the male placing sperms inside the body of the female. External fertilization here is impossible because:

a. There is no water for the sperms to swim in

b. The sperms would dry up when exposed to air

*In reptiles & birds the eggs are prevented from drying up by having a shell, so sperms have to get to the egg before the shell is formed.

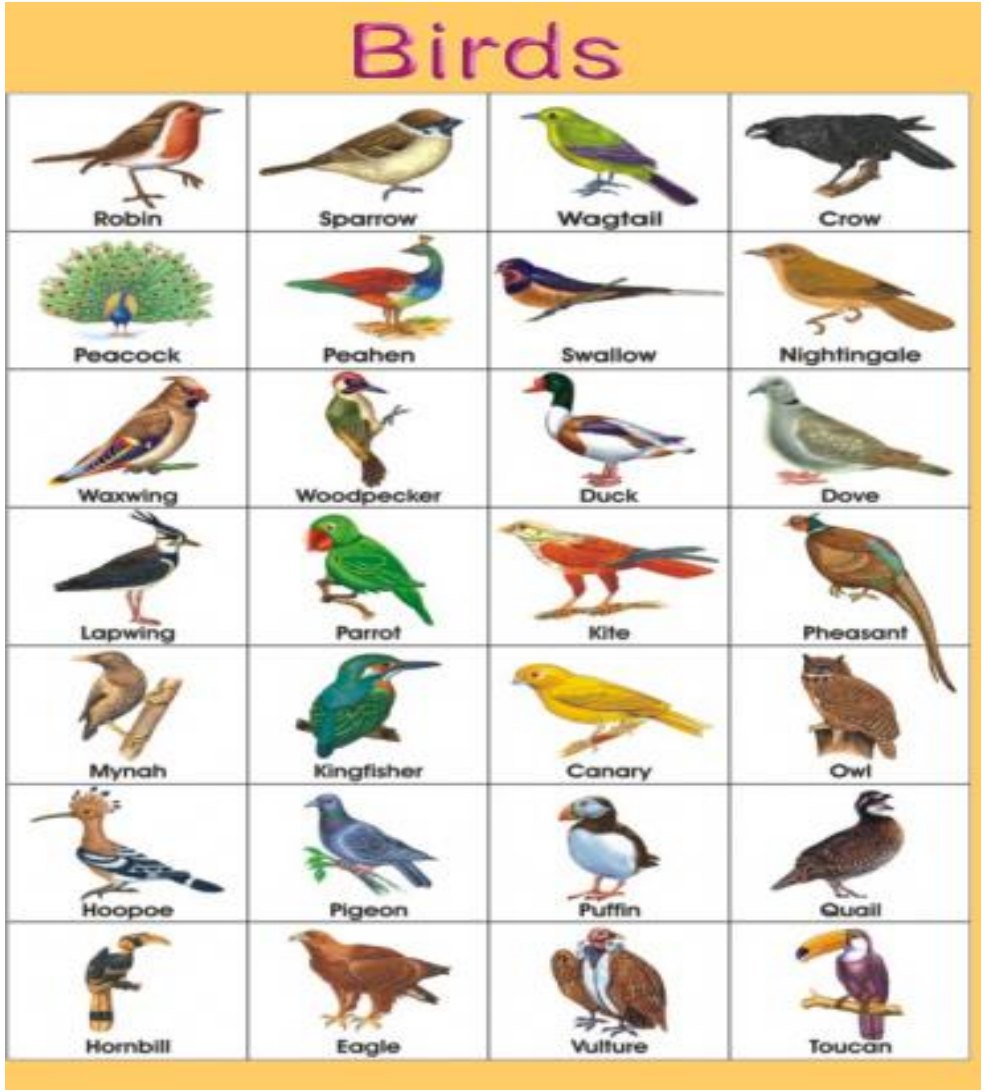
After fertilization the female lays hard-shelled eggs that are protected from predators and dehydration. In some species the female keeps the egg inside the body until they are ready to hatch.

Reptiles are poilkilothermic vertebrates but they can regulate their body temperature by sitting in the sun until their bodies warm up.

Class Birds:

External Features:

1. The body is covered with feathers, except for hind limbs and toes, which are covered with scales.



Types of feathers:

- Flight feathers (for flying):
  Long
  The barbs are joined together with no space in between to thrust through air and fly easily.
  Long quill
- Down feathers:
  Small in size
  Barbs are away from each other (not joined – have space)
  Short quills

Functions of down feathers:

keep their body temperature constant since warm air can be trapped between spaces (they work as insulators)

****Young birds have mainly down feathers, because they can't fly.***

2. The body of birds is stream-lined (to minimize air resistance during flying).

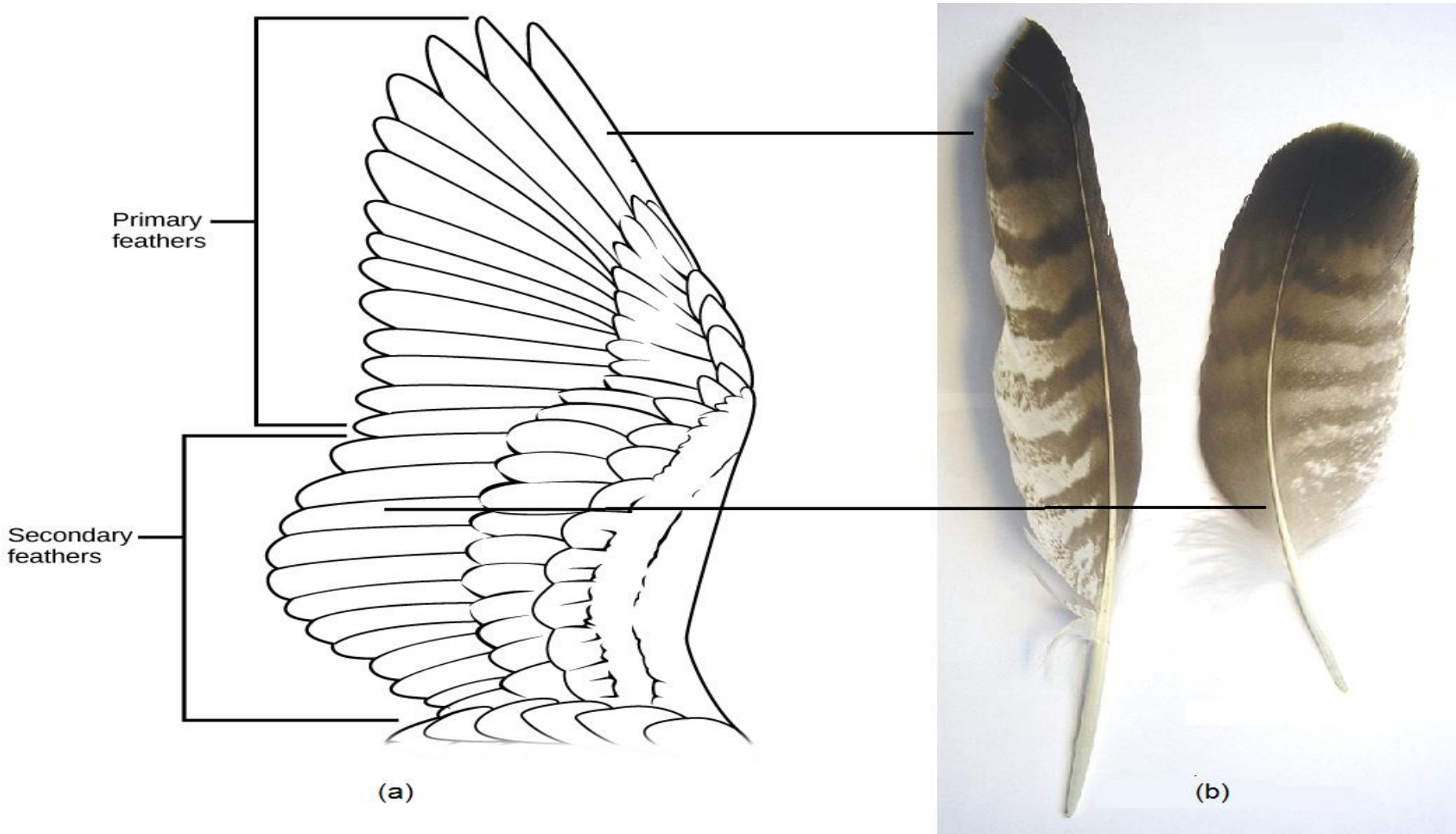
3. They have 4 limbs:

The forelimbs are modified into wings that are supported by strong muscles for flying.

The hind limbs are covered with scales and carry claws for catching food.

Flight feather

Down feather


Primary feathers
Secondary feathers
(a)
(b)

4. Their upper and lower jaws extend to form the beak which is used for eating (different birds have different shapes of beaks because they feed on different types of food)

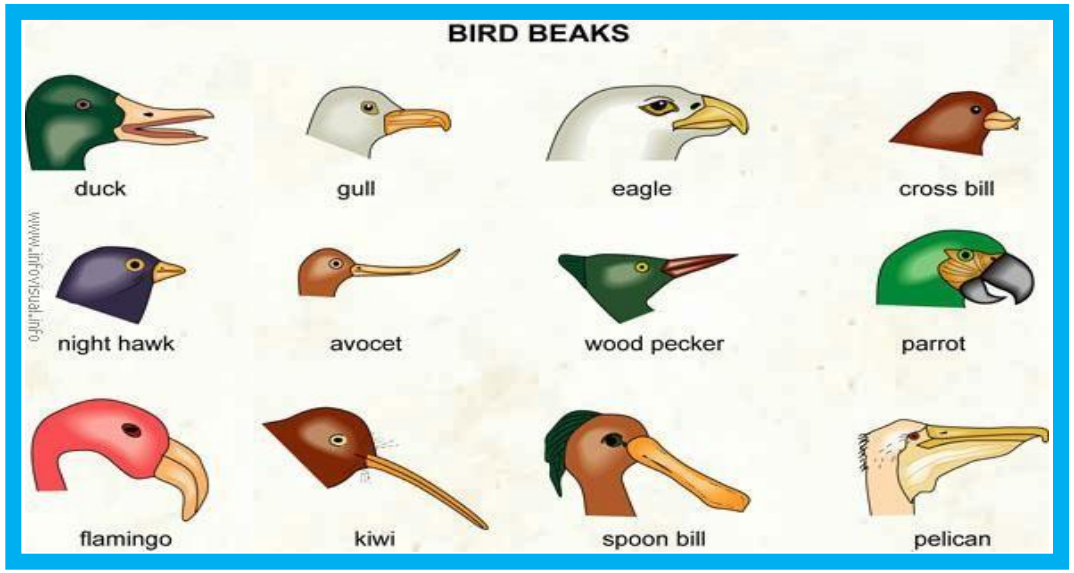
5. They have ears, their eardrums are found deep inside the head.

6. They reproduce sexually, fertilization occurs internally:

The female then lays hard shelled eggs to prevent dehydration and protect eggs from predators.

7. Bones are modified to be strong but light

8. A constant body temperature that is often much higher than that of the surrounding air.



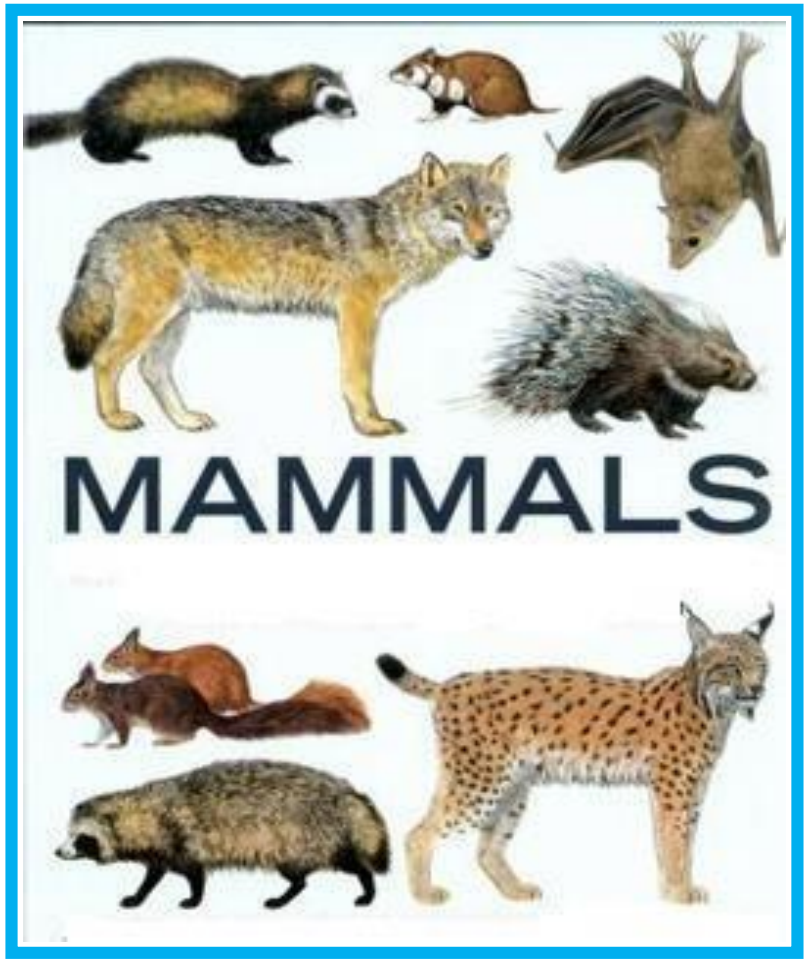
Class Mammals *They are homoeothermic vertebrates (warm –blooded).*

External features:

1. Their bodies are covered with hair, wool or fur.

2. They have 4 limbs used for walking and running except for bats which use their forelimbs for flying (whales use their limbs for swimming).

3. They have ear pinna, and the eardrums are found deep inside the head. The middle ear of mammals consists of three bones.



4. Most mammals have vibrissae (whiskers) near the mouth.

5. They have mammary glands to feed their young (produce milk for breast feeding).

6. They have 4 types of teeth:

a. Incisors

b. canine

c. premolars

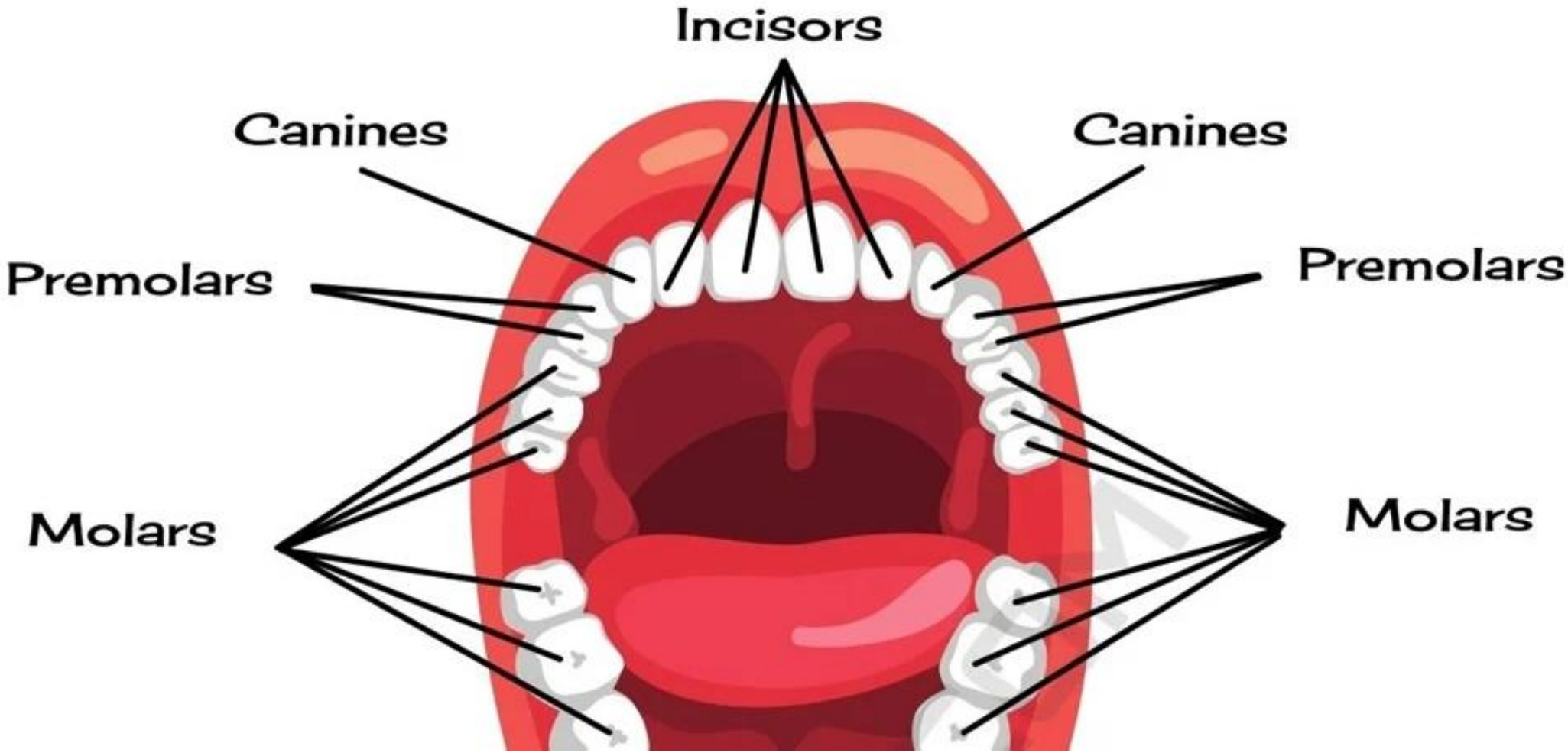
d. molars.

7. They have lungs with ribs and diaphragm.

8. Parental care.

9. They reproduce sexually, fertilization occurs internally, and give birth to fully developed young instead of laying eggs. The fertilized eggs undergo a period of development in the uterus of females.

10. They have sweat glands which secrete sweat.


Incisors
Canines
Canines
Premolars
Premolars
Molars
Molars

Vertebrates have a backbone

mammals
hair, four-chambered heart, placenta, mammary glands, different types of teeth

birds
feathers, four-chambered heart, wings, beak, lay eggs with hard shells

reptiles
scales, lay soft-shelled eggs on land

amphibians
smooth skin, lay eggs with no shells in water

fish
scales, lay eggs with no shells in water

VERTEBRATES

THESE ARE ANIMALS THAT HAVE A BACKBONE

REPTILES

HAVE DRY SCALY SKIN.
LAY EGGS ON DRY LAND.
ARE COLD BLOODED.
(SNAKE, CROCODILE)

FISH

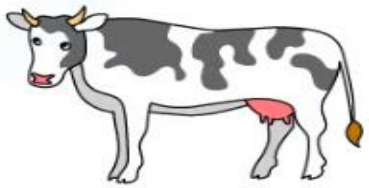
HAVE SCALES ON THEIR BODIES. HAVE GILLS FOR BREATHING. ARE COLD BLOODED.
(SHARK, TUNA)

AMPHIBIANS

HAVE MOIST SLIMY SKIN.
LAY EGGS IN WATER.
ARE COLD BLOODED.
(FROG, NEWT)

BIRDS

HAVE FEATHERS AND WINGS.
HAVE BEAKS AND LAY EGGS.
ARE WARM BLOODED.
(WREN, SWAN)



MAMMALS

HAVE FUR OR HAIR.
FEED YOUNG ON MILK.
ARE WARM BLOODED.
(COW, HUMAN)

Complete Table 1.1 to compare the five groups of vertebrates using a tick (✓) to indicate if the group shows the feature, or a cross (✖) if not.

The first row has been completed for you.

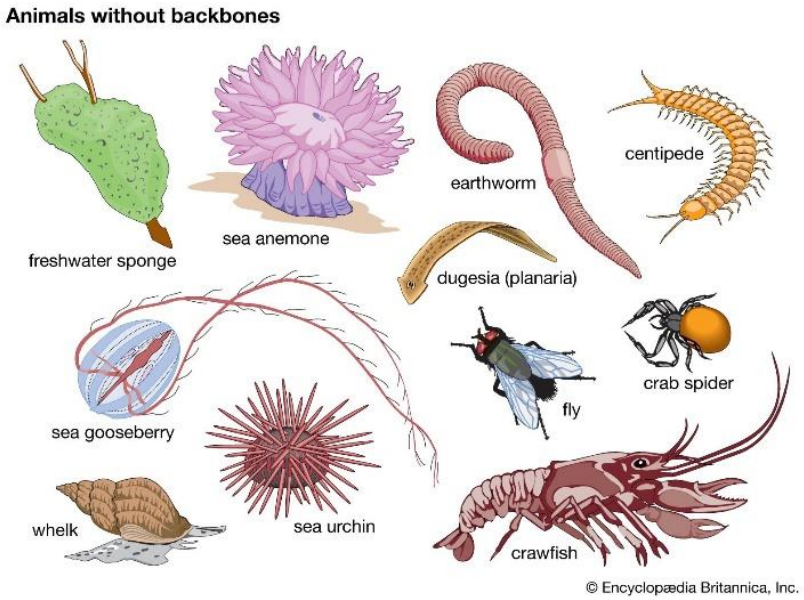
Table 1.1

group of vertebrates	scaly skin	external ear (pinna)	feathers	glands
birds	✓	✖	✓	✖
bony fish				
amphibians				
reptiles				
mammals				

	Answers	Marks
1 (a)		[4]

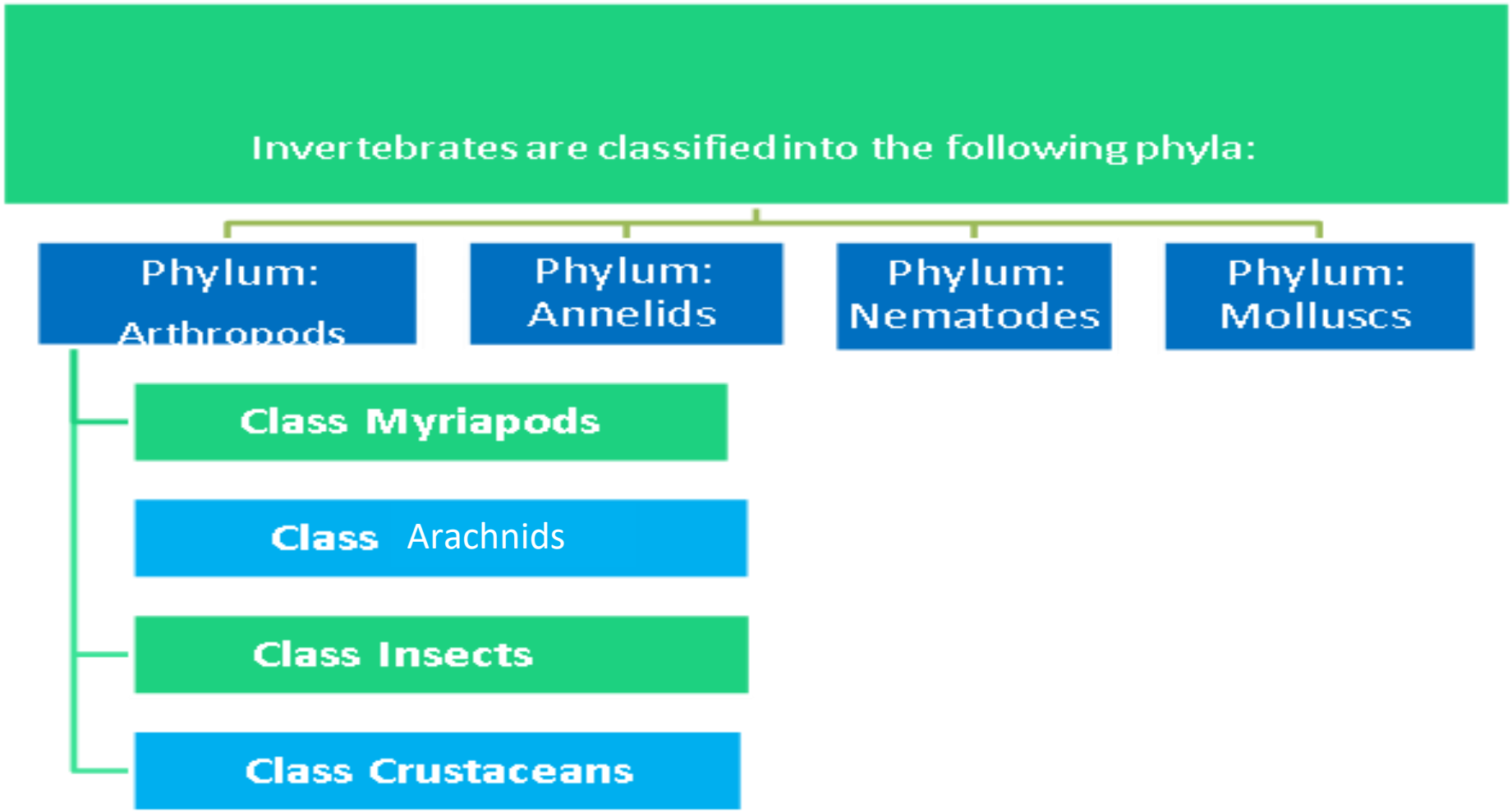
group of vertebrates	scaly skin	external ear (pinna)	feathers	mammary glands
birds	✓	×	✓	×
bony fish	✓	×	×	× ;
amphibians	×	×	×	× ;
reptiles	✓	×	×	× ;
mammals	×	✓	×	✓ ;

The characteristics of invertebrates

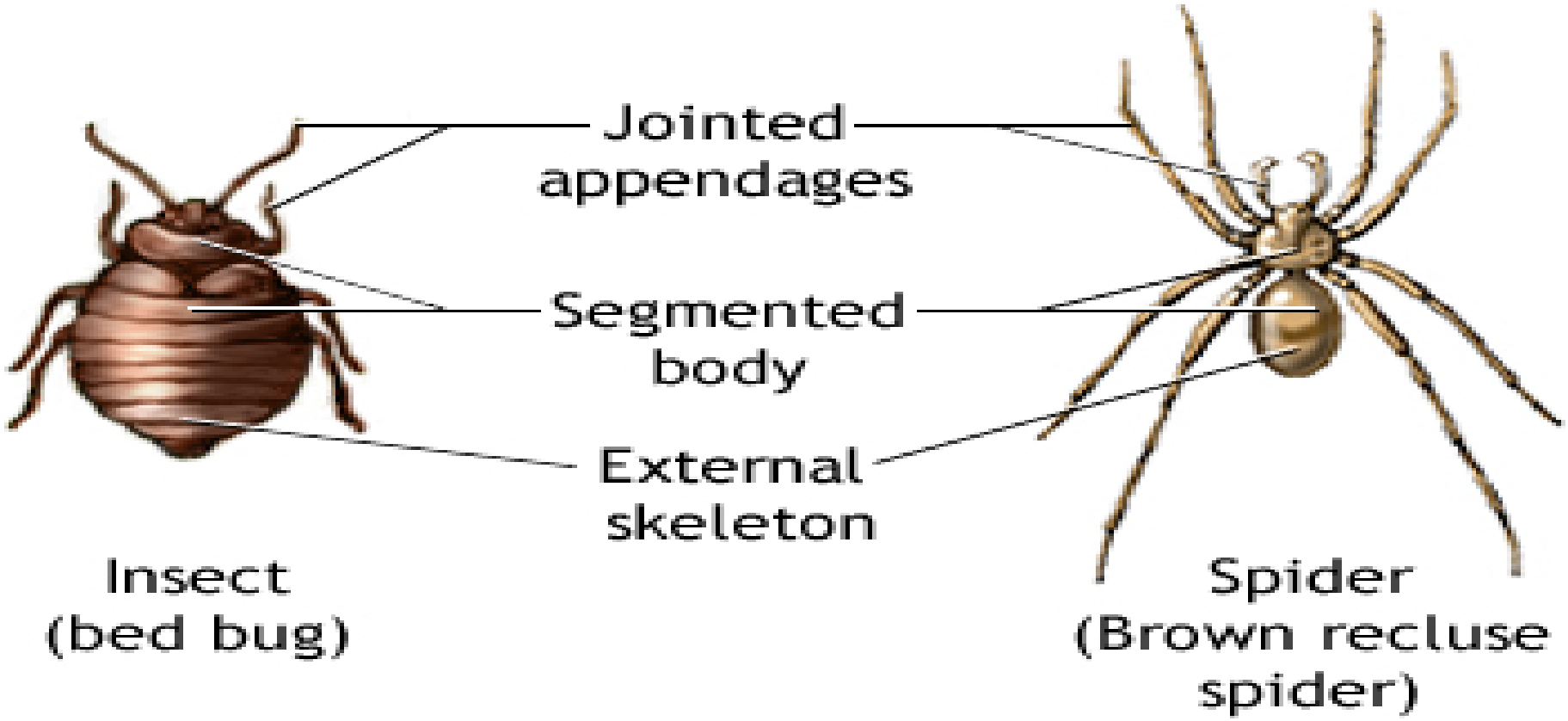


Invertebrates are animals that don't have a vertebral column (backbone).

Invertebrates account for almost 90% of all living things.


Invertebrates are classified into the following phyla:
Phylum: Arthropods
Phylum: Annelids
Phylum: Nematodes
Phylum: Molluscs
Class Myriapods
Class Arachnids
Class Insects
Class Crustaceans

Three Basic Characteristics of Arthropods (Insects and their Relatives)



Phylum Arthropods:

Arthropods means jointed limbs.

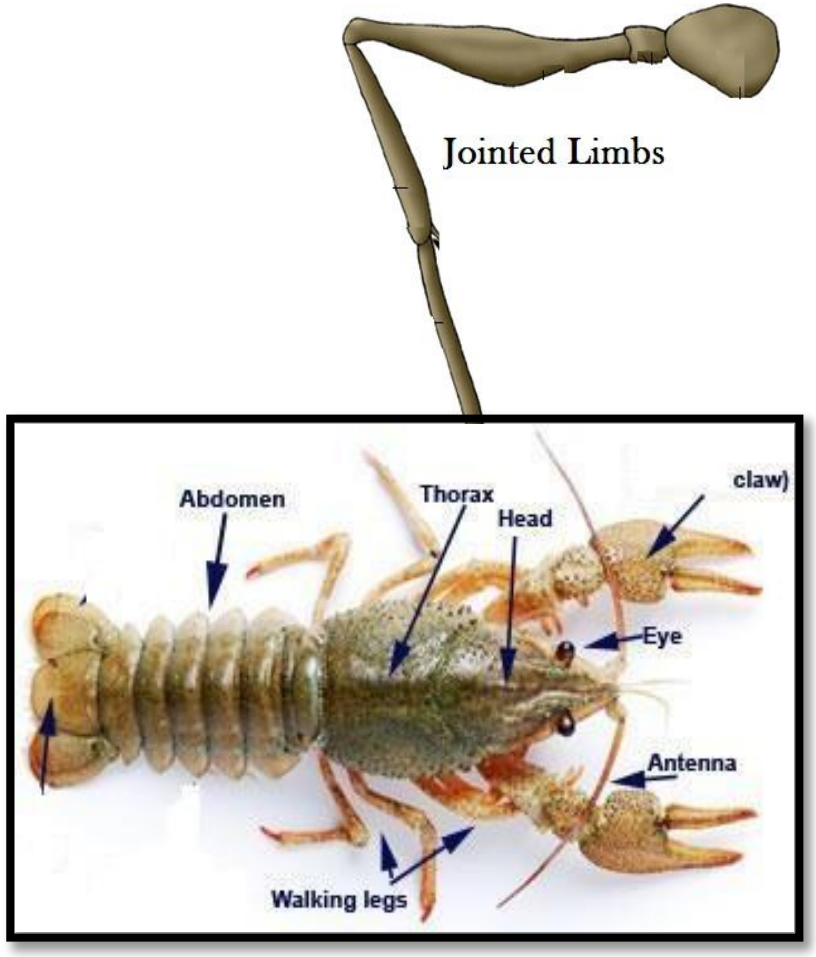
*** Common external features:**

1. They have jointed limbs.

2. The body is segmented (divided into segments). In most arthropods a number of segments are joined together and therefore the body becomes divided into 3 district parts (head, thorax, and abdomen).

3. Their body is covered with hard, rigid and firm cover called exoskeleton or cuticle.

* The cuticle is hard substance made up of chitin (a carbohydrate).



Importance of exoskeleton:

a. Protects, supports and gives shape.

a. Prevents dehydration (water loss)

a. Muscles are attached to cuticle to allow their movement.

4. They have sense organs to detect stimuli such as eyes and antennae.

5. They reproduce sexually internal fertilization, the female then lays eggs.

Class Crustaceans: *Example:Crabs,lobsters, shrimps,wood lice, water lice.

External features:

1. **Their body is divided into 2 parts:**

- ✓ Head and thorax are joined together to form a part called **Cephalothorax.**
- ✓ Abdomen.

2. limbs:

- ✓ In the head region: the limbs are modified to form antennae or specialized mouth parts for feeding.
- ✓ In the thoracic region: limbs are called walking limbs.
- ✓ In the abdominal region: limbs are used as swimming appendages.

  In the second segment, the pair of limbs is modified to form claws or pincer.

3. They have 2 pairs of antennae which are sensitive to touch and chemicals.

4. They have a pair of compound eyes which are made up of tens or hundreds of separate lenses à very sensitive to movements

5. They have specialized mouth parts for feeding

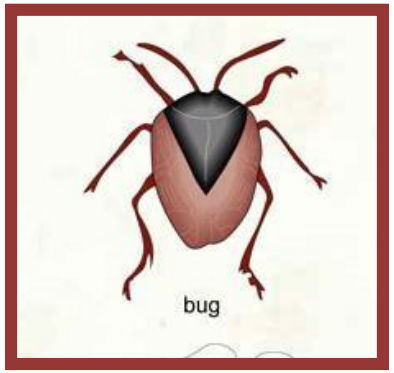
Class Insects: *Examples: bees, ants, butterfly, mosquitoes.*

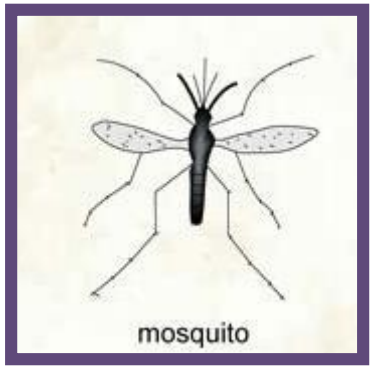
External Features:

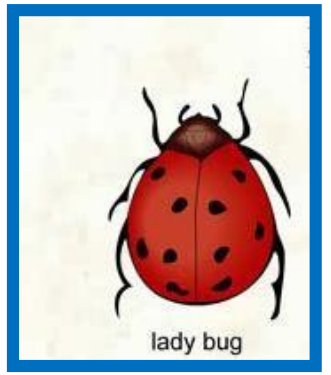
1. Their body is divided into 3 parts (head, thorax, and abdomen).

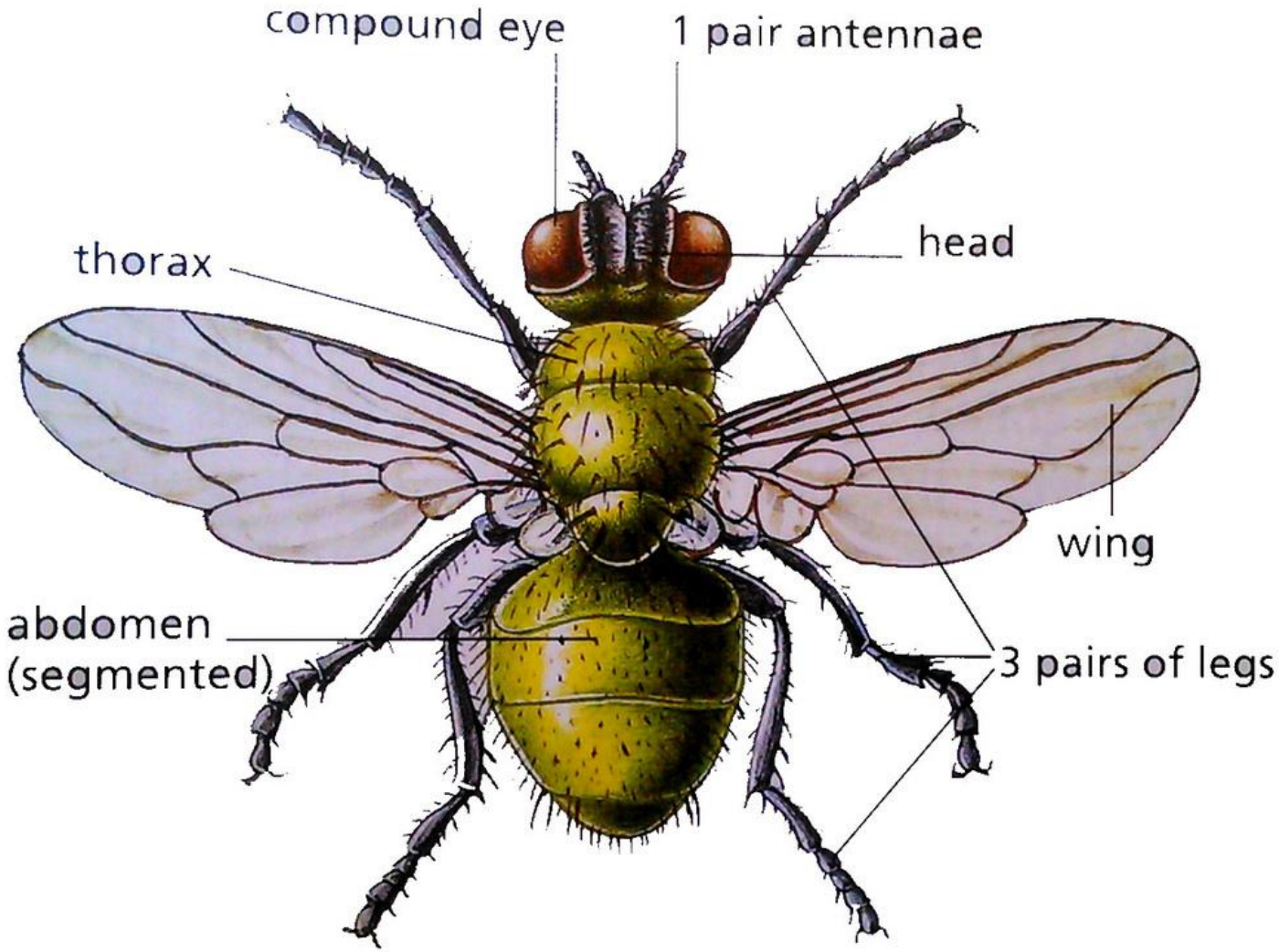
3. They have 3 pairs of limbs attached to the thoracic region (no limbs in the abdominal region)

3. They have 1 pair of antennae which detect vibrations








compound eye
1 pair antennae
thorax
head
wing
abdomen
(segmented)
3 pairs of legs

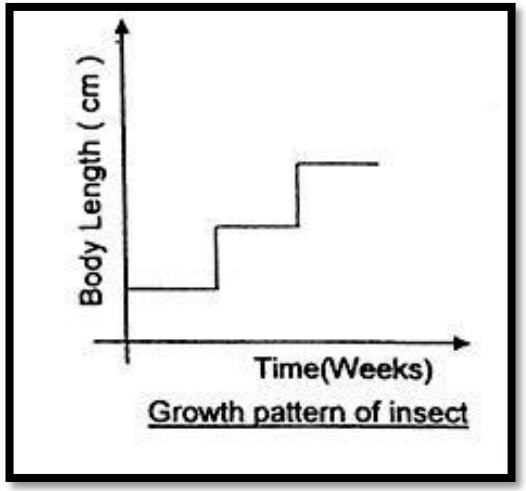
4. Some of them have 2 pairs of wings like butterflies. Some have 1 pair of wings like mosquitoes. Others are wingless (no wings) like ants.

5. They have one pair of compound eyes

6. They have specialized mouth parts for feeding.

Note: during the growth of insects, the exoskeleton covering the insects' body is shed; this is because the exoskeleton is hard and resists expansion in size.

**** To do this, the old exoskeleton is shed and the insect emerges with a new soft exoskeleton before it hardens at a larger size.***



Growth pattern of insect

Class Arachnids: Examples: spiders, scorpions, mites, ticks

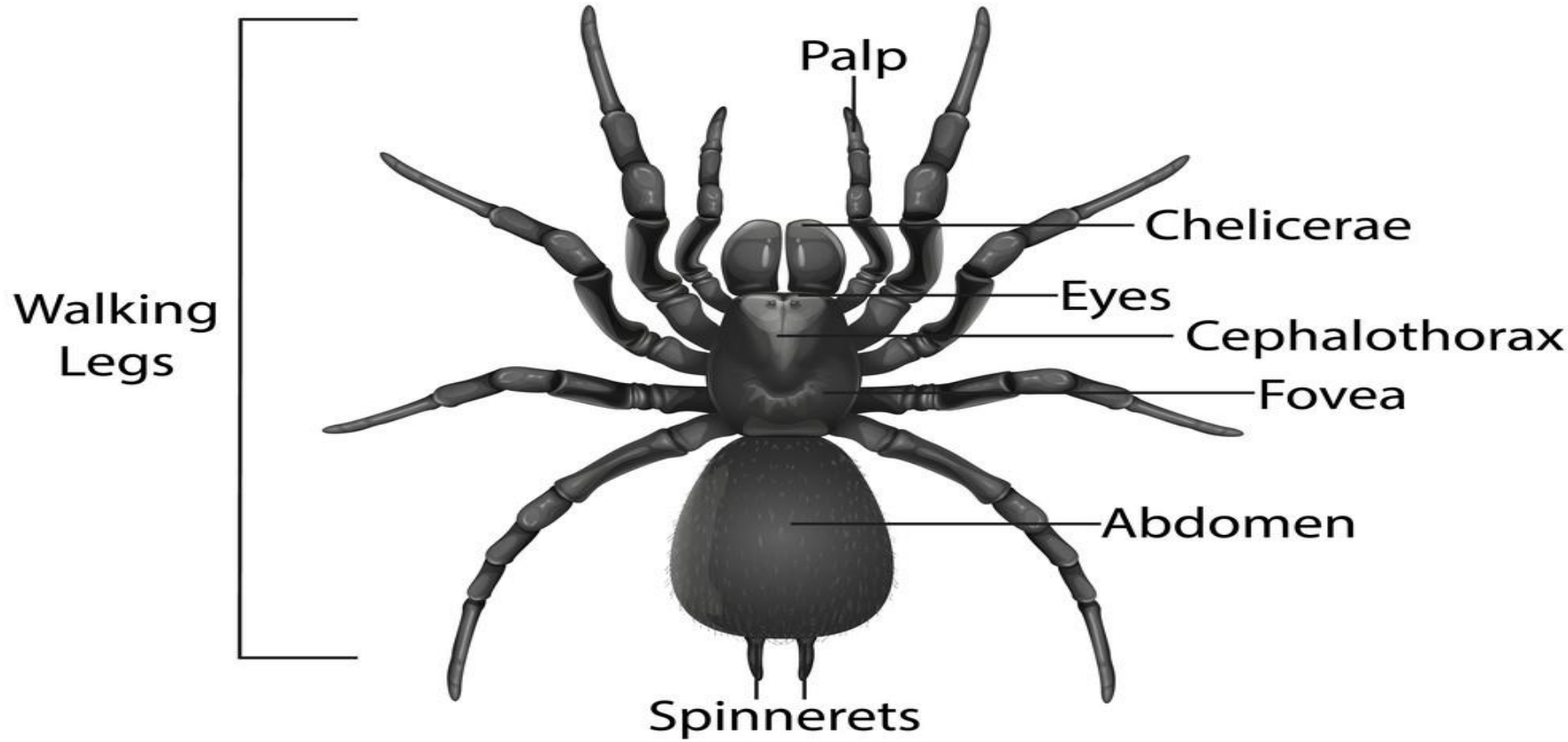
External Features:

1. Their body is divided into 2 parts:
   - Cephalothorax
   - Abdomen
2. They don't have antennae.
3. They have 4 pairs of jointed limbs attached to the thoracic region (no limbs on the abdomen).
4. They have many pairs of simple eyes.
5. They have specialized mouth parts called chelicerae which pierce the prey and paralyze it with a poison secreted from a gland at the base.
6. They have a pair of pedipalps that are used during breeding (reproduction).


male's pedipalp


© W.P. Armstrong 2007

External Anatomy of a Spider



Class Myriapods :

They are divided into 2 groups:

Centipedes 100 legs----- Carnivorous

Millipedes 1000 legs -----Herbivorous

External Features:

1. They have a segmented body that is not clearly divided into head, thorax and abdomen.

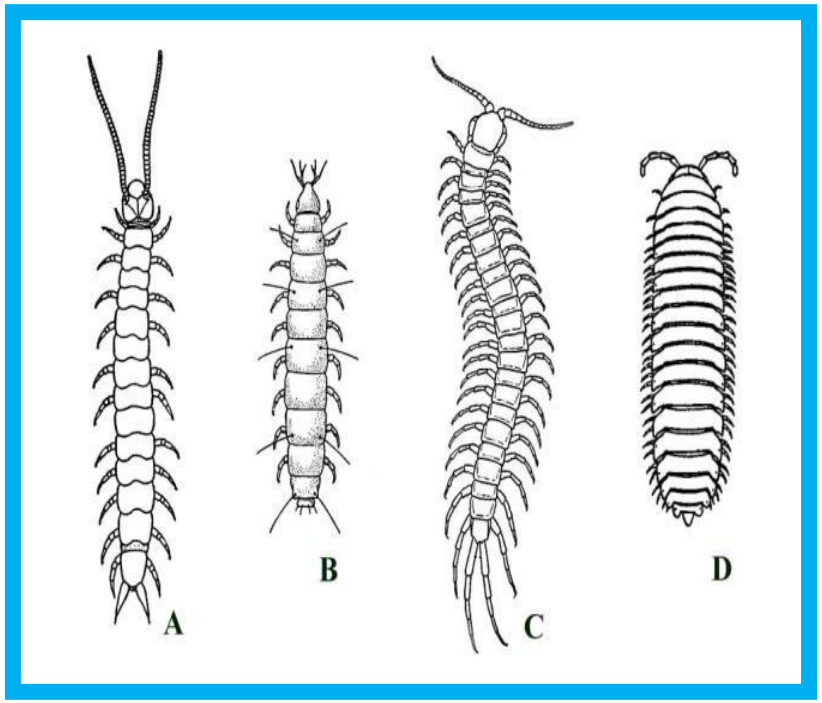
- ✓ The first segment is the head.
- ✓ The following 4 segments following the head is the thorax

2. Each segment carries a pair of jointed limbs. In millipedes, each 2 segments fuse together (every segment appears to have 2 pairs of limbs).

3. They have a pair of antennae.

4. They have one pair of simple eyes.

5. They have specialized mouth parts.



Arthropods have
- jointed legs
- segmented bodies

arachnids
body divided into head and cephalothorax, four pairs of jointed legs

insects
body divided into head, thorax and abdomen, six jointed legs attached to the thorax, four wings attached to the thorax

myriapods
many similar segments, each with at least one pair of jointed legs

crustaceans
more than four pairs of jointed legs, hard shell

CLASSIFICATION OF ARTHROPODS

ARACHNIDS

EIGHT LEGS, TWO BODY PARTS, NO ANTENNAE.

(SPIDER, SCORPION)

CRUSTACEANS

MOSTLY SEA CREATURES. MANY LEGS AND TWO SETS OF ANTENNAE.

(CRAB, LOBSTER)

INSECTS

WINGS, SIX LEGS, THREE BODY PARTS, ONE PAIR OF ANTENNAE

(BEE, LADYBIRD)

MYRIAPODS

MANY LEGS AND BODY SEGMENTS.

(CENTIPEDE, MILLIPEDE)

Summary:

Class	Crustaceans	Insects	Arachnids	Myriapods
Number of segments	The body is divided into 2 segments Cephalothorax and abdomen	The body is divided into 3 segments: Head , thorax and abdomen	The body is divided into two segments : Cephalothorax and abdomen	MANY SEGMENTS!
Number of jointed limbs	Each segment carries a pair of jointed limbs	3 pairs of jointed limbs	4 pairs of jointed limbs ATTACHED TO THORAX	MANY LEGS!
Extra features	Claws \ pincers	Usually one or 2 pairs of wings	Pedipalps and Specialized mouth parts called chelicera	Every segment carries a pair of jointed limbs in centipedes Each segment carried 2 pair of jointed limbs in millipedes

Crabs are classified, along with prawns, shrimps and lobsters, as crustaceans. Most crabs live in the sea, although some live in freshwater and there are a few land-dwelling crabs.

Fig. 1.1 shows the structure of a typical crab.

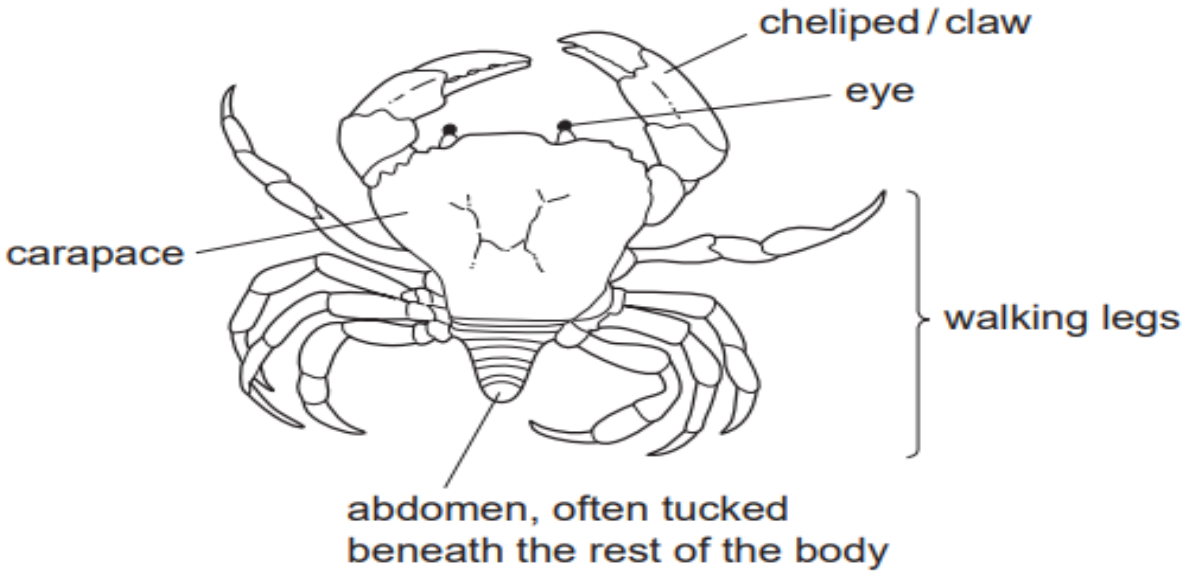


Fig. 1.1

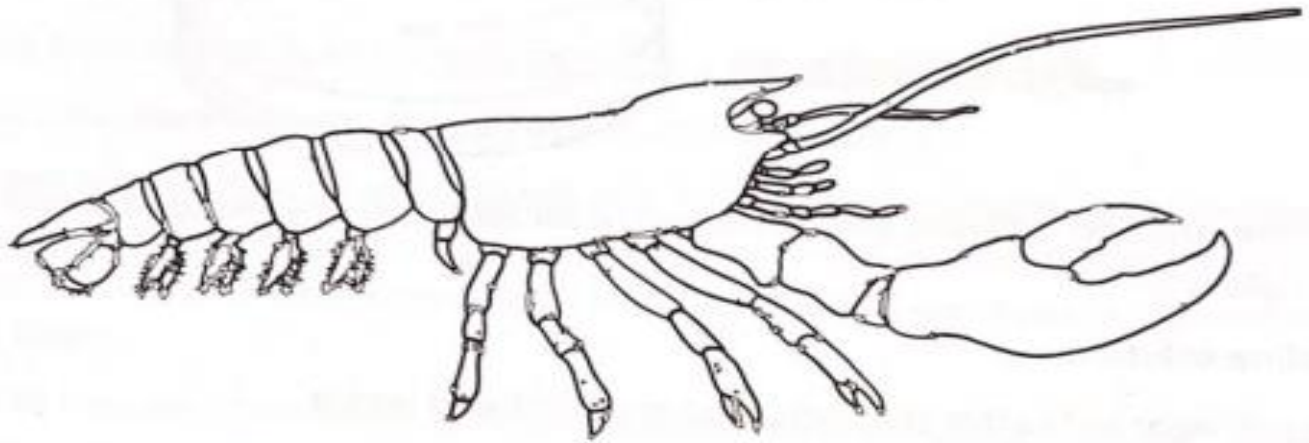
(a) State the group of animals that includes crustaceans, insects, arachnids and myriapods.

Arthropods

..... [1]

Animals and plants belong to different kingdoms.

(a) The diagram shows a lobster, which belongs to the animal kingdom. The binomial of this organism is *Homarus americanus*.



(i) State **one** feature, visible in the diagram, which shows that the organism is:

- an arthropod **Jointed legs**
- a crustacean **The body is divided into 2 parts cephalothorax and abdomen** [1]

(ii) Name the genus to which this organism belongs. [1]

(b) There are several different species of lobsters. [1]

Explain how a biologist could decide whether two types of lobster belong to the same species, or to different species.

If they belong to the same species so they can reproduce and have a fertile offspring

https://wordwall.net/resource/59441449/biology/igcse-vertebrate-and-invertebrate-animals game

Name one characteristic visible in the picture that explains why a shark is a fish.

Name one characteristic visible in the picture that explains why a frog is an amphibian.

Name one characteristic visible in the picture that explains why an egret is a bird.

What are the characteristics of birds?

	skin covered in feathers	maintain a constant body temperature	jelly-covered eggs	external ears present
A	✓	X	✓	X
B	X	X	X	✓
C	✓	✓	X	X
D	X	✓	✓	✓

Use the key to identify which group is fish.

1. Fur absent	go to 2
Fur present	mammals
2. Beak absent	go to 3
Beak present	group **A**
3. Moist skin.....	go to 4
Dry, scaly skin	group **B**
4. No limbs	group **C**
Four limbs	group **D**

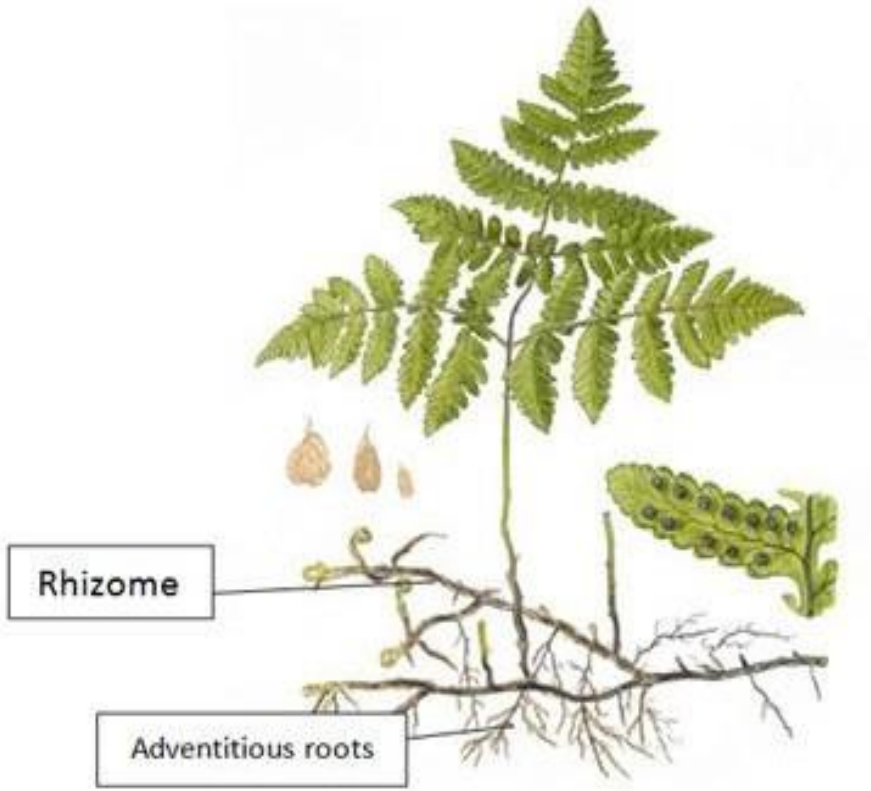
Plant kingdom

Features of the plant kingdom:

- Plants are autotrophic living organisms that can synthesize their own food by the process of photosynthesis.
- All plants contain the light absorbing pigment chlorophyll.
- All plants have a cell wall made up of cellulose.
- The plant kingdom is divided into 4 phyla but we will only consider two:
  - ✓ **Ferns**
  - ✓ **Flowering Plants**

The Phylum of Ferns:

- The stem of ferns is almost entirely found underground, and takes the form of a rhizome.
- The roots which grow from the rhizome are called adventitious roots.
- The stems and leaves of ferns have sieve tubes and vessels that carry water similar to phloem and xylem of flowering plants à that's why they are referred to as vascular plants because they all have vascular bundles.
- Most of fern leaves have an upper and lower epidermis and a layer of mesophyll cells similar to the leaves of flowering plants. Leaves of ferns are called **fronds** have the same appearance of bird feathers.
- They reproduce by spores. Spores are stored in a capsule structure called **sporangium.** Sporangia are formed on the lower side of the leaves. When spores fuse together the zygote gives rise to a new fern plant.


Rhizome
Adventitious roots

https://www.youtube.com/watch?v=0OlSGbtDKdw

Phylum of Flowering plants

https://www.youtube.com/watch?v=7DqsZbSdbrk

Class Monocotyledons

Class Dicotyledons

Monocotyledonous: The seeds contain only one cotyledon examples: corn, wheat.

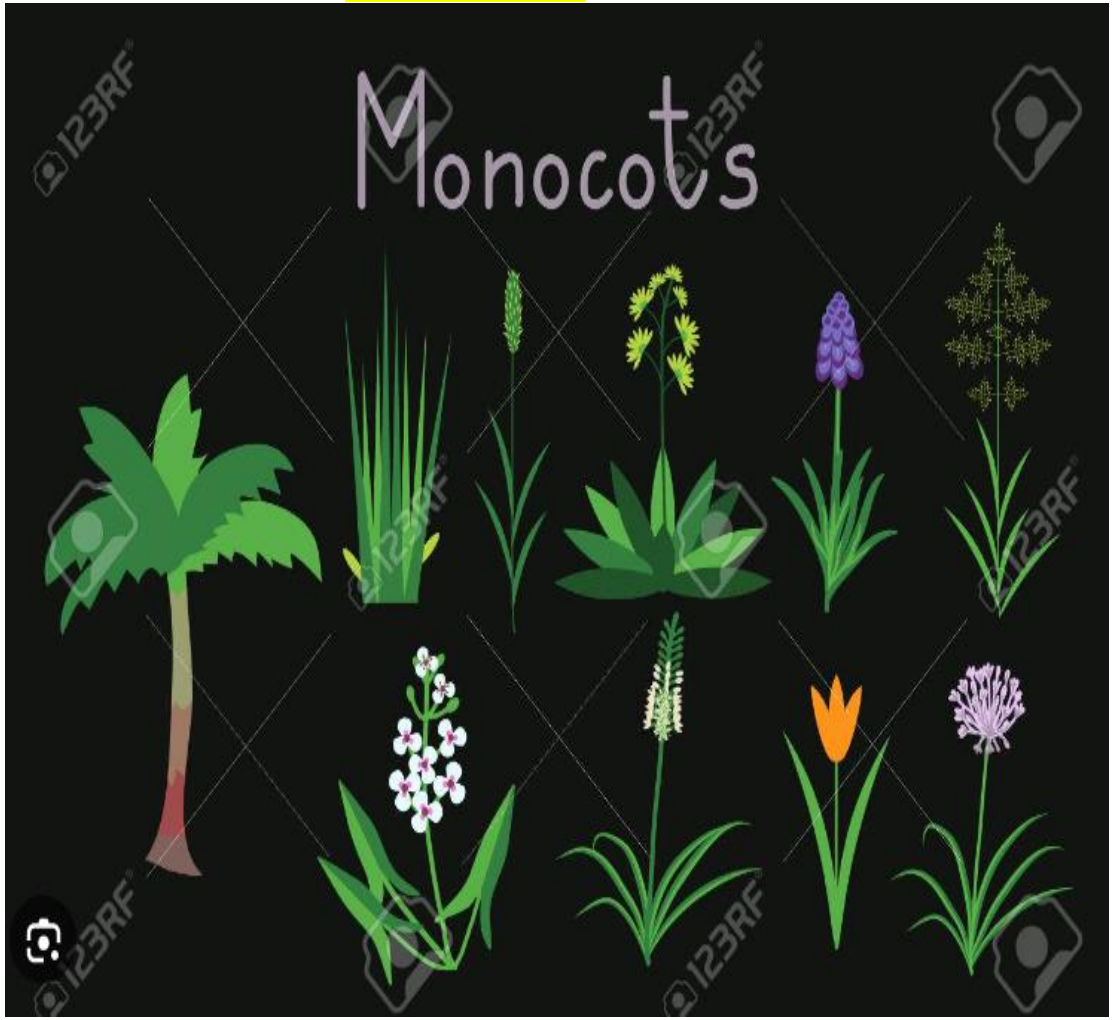
Dicotyledonous: The seeds contain 2 cotyledons enclosed within a coat, such as beans (broad beans, french beans)

Main Features:

- They have a stem, leaves and roots.
- They contain chloroplasts (chlorophyll) which is a green pigment used during the process of photosynthesis.
- They have a cell wall made up of cellulose.

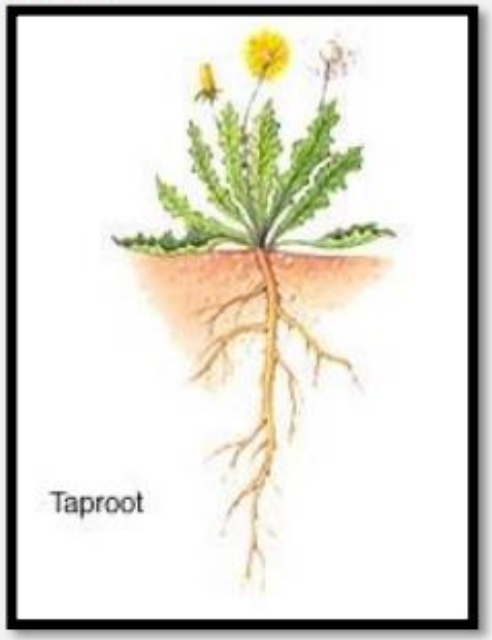
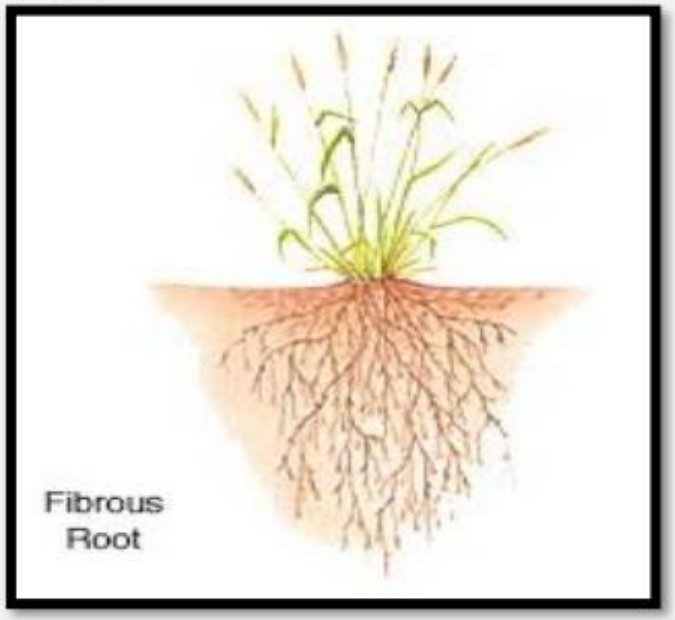
Dicots

Monocots

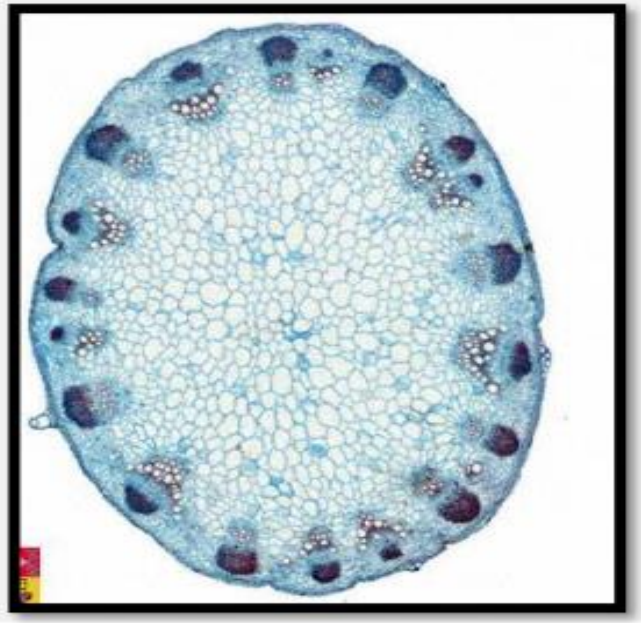


Comparison between monocots and dicots :

Dicots	Monocots
Two cotyledons (seeds give two leaves)	One cotyledon (seeds give one leaf)
Short and broad leaves	Long and narrow leaves
Veins are branched out of the midrib 	Veins are found a parallel pattern 
Have a petiole (leaf stalk)	No petiole (leaf stalk)
Stomata are mainly found in the **lower epidermis** of the leaf	Stomata (pores in the epidermis of the leaf) are **distributed evenly** on the upper and lower epidermis

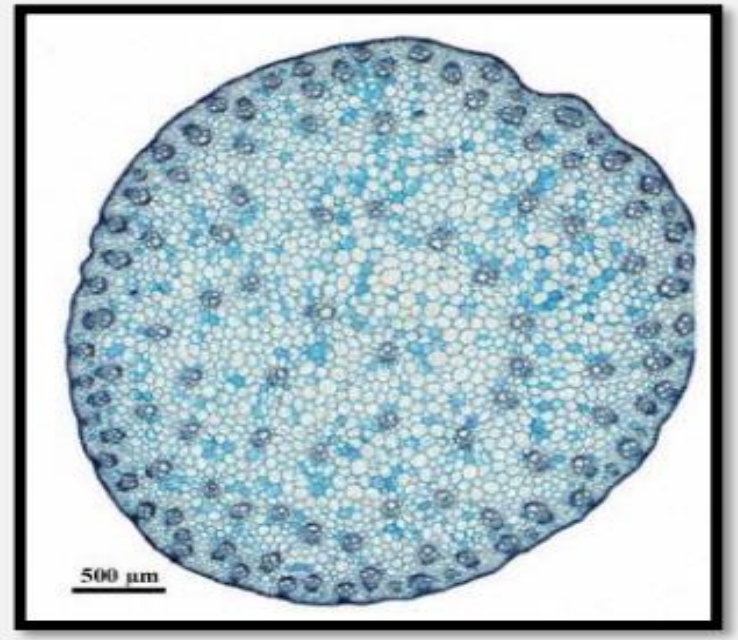
Have main root from which lateral roots grow.  	The roots are branched and shallow (no main root) 
The petals (colored parts of the flower) are found in multiples of 4 or 5	The petals are found in multiples of 3

The vascular bundles (made up of xylem and phloem which make the transport system) are arranged in a circular pattern in the stem.

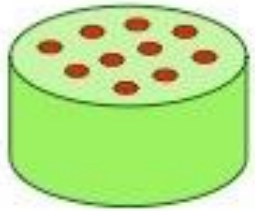
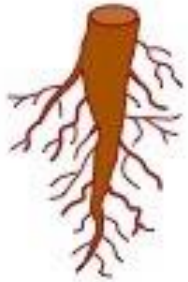
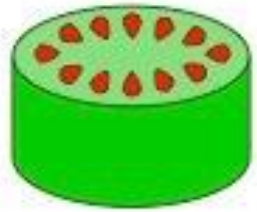


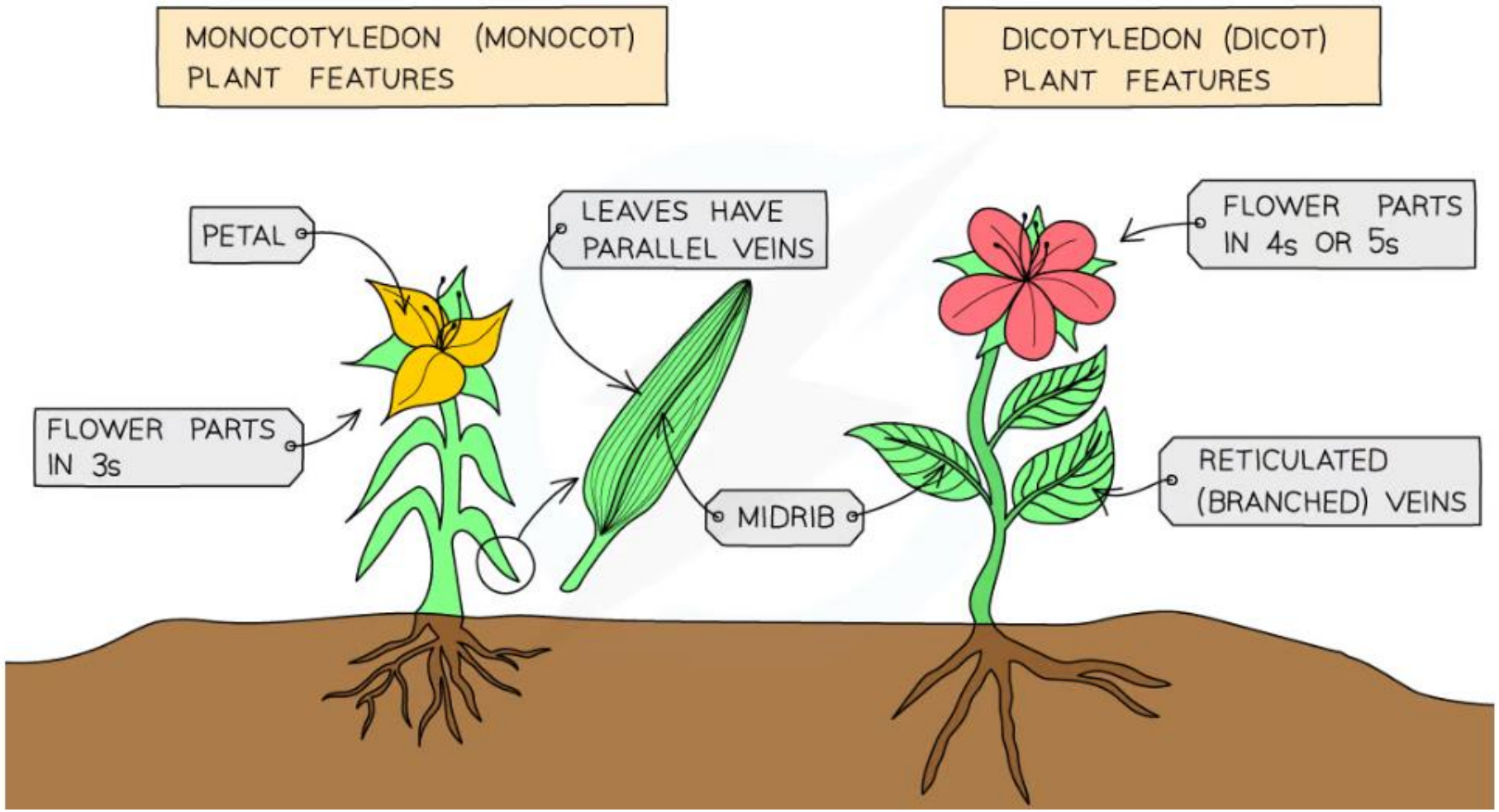
Vascular Bundles of dicots

The vascular bundles of the stem (made up of xylem and phloem which make the transport system) are scattered randomly



Vascular Bundles of Monocots

	Seed	Root	Vascular	Leaf	Flower
Monocot					
	One cotyledon	Fibrous roots	Scattered	Parallel veins	Multiples of 3
Dicot					
	Two cotyledon	Tap roots	Ringed	Net-like veins	4 or 5


MONOCOTYLEDON (MONOCOT) PLANT FEATURES
DICOTYLEDON (DICOT) PLANT FEATURES
PETAL
LEAVES HAVE PARALLEL VEINS
FLOWER PARTS IN 4s OR 5s
FLOWER PARTS IN 3s
MIDRIB
RETICULATED (BRANCHED) VEINS

Four different descriptions about plants are given below.

Which statement would apply to a plant that is a dicotyledon?

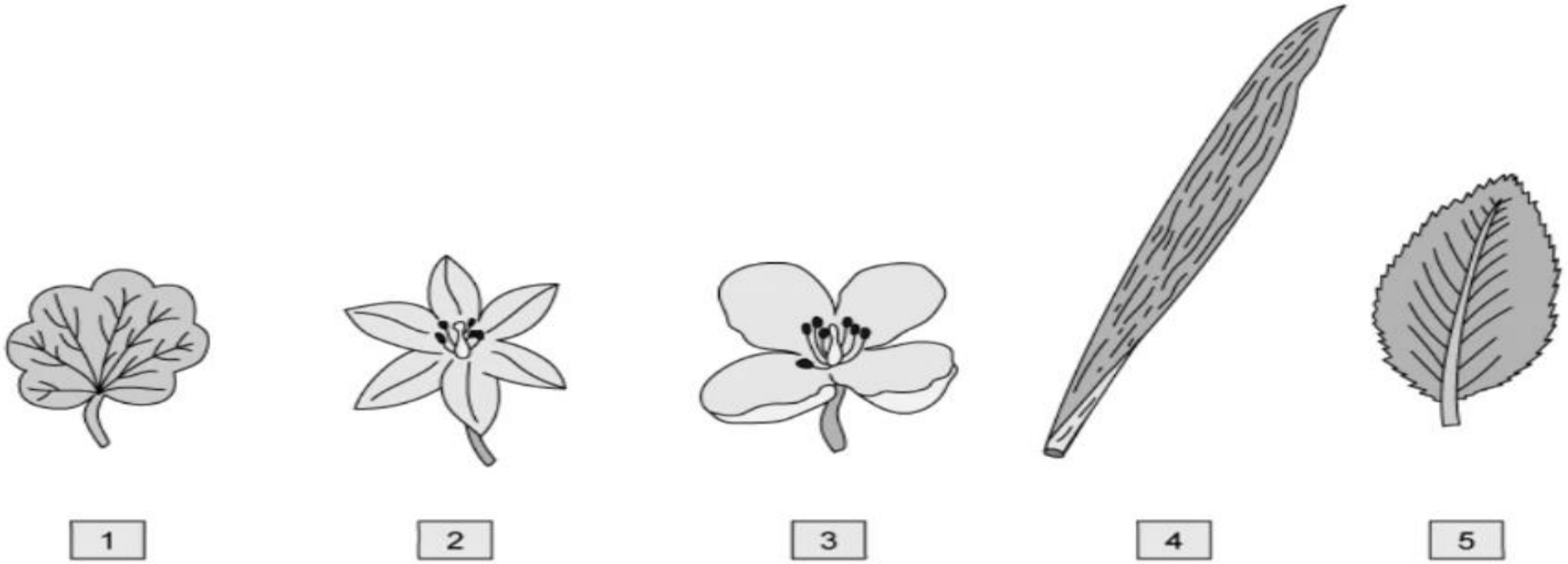
A The veins in the leaf are reticulated.

B Each flower has six petals.

C The flowers are all wind-pollinated.

D The leaves have parallel veins.

The image below shows some leaves and flowers from a variety of green plants.



Which of the leaves and flowers above would come from a monocotyledonous plant?

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

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Thank you

NOS