Name _____ Date _____

LABORATORY

Dissecting an Amphibian—the Frog

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BACKGROUND

Frogs are members of the class Amphibia. Biologists have appropriately named these organisms amphibians because they have adaptations that enable them to "live in two ways"—both on land and in water. In this laboratory you will examine a frog and observe how it is adapted to both environments.

OBJECTIVES

- Dissect and identify the external and internal structures of a frog.
- List three ways the frog is adapted to life on land and in water.

MATERIALS

Preserved frog	Hand lens
Dissecting tray	Compound microscope
Dissecting pins	Stereoscopic dissecting microscope
Dissecting scissors	Probe
Forceps	Dissecting needle

PROCEDURE A

THE EXTERNAL ANATOMY OF THE FROG

1. Place the preserved frog in your dissecting tray. Obtain all the dissecting equipment and place it at your work area.

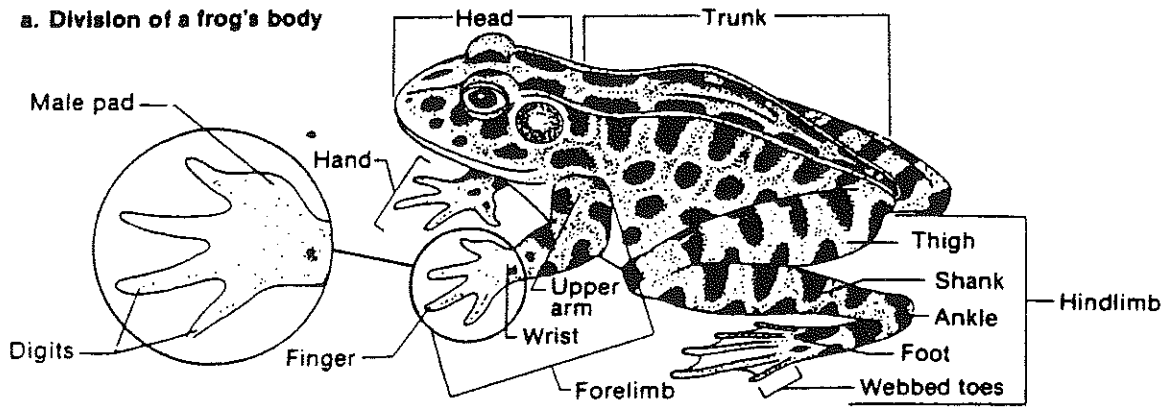
2. Observe the frog. Feel the smooth and pliable skin. Note the coloration on all parts of the body. Describe how the coloration on the dorsal surface and ventral surface differ.

   (a) _____

   _____

3. The division of a frog's body includes the *head*, *trunk*, and *limbs* or *legs* as shown in **a**. All frogs lack necks and tails. Examine the front and hind limbs of the frog. Find the *digits* which are fingerlike projections on the forelimbs and hindlimbs. Locate the *hindlimbs* which are the longer and more muscular limbs of the frog. A hindlimb consists of a *thigh*, *shank*, *ankle*, *foot*, and *webbed toes*. Locate the *forelimbs* which are shorter than the hindlimbs. A forelimb consists of an *upper arm*, *wrist*, *hand*, and *fingers*. Find on the male frog the *male pad* located on the innermost finger of the forelimb. The male pad is a dark swelling or enlargement used by a male to grasp a female during mating.

a. Division of a frog's body



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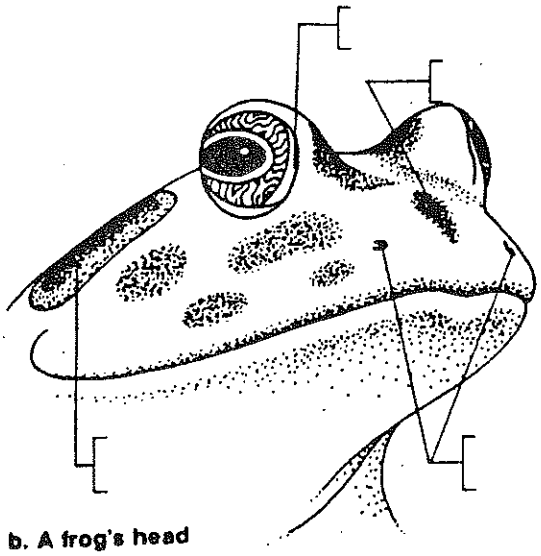
4. Examine the frog's head. Notice the size of the frog's *eyes* and how the eyes protrude. Find the nonmoveable *upper and lower eyelids*. Locate the *nictitating membrane* that is a transparent covering that sweeps upward over the eyes. Identify the *tympanic membrane* or the *eardrum* located on each side of the head. Observe the *frontal organ* or brow spot found between and anterior to the two eyes. The frontal organ is the remaining indication of a third or middle eye. Note the *external nares* or *nostrils* that are the openings on the anterior and dorsal part of the skull. Label each of these structures on **b**: *eyes, nictitating membrane, tympanic membrane, frontal organ, external nares.*

PROCEDURE B OBSERVING THE FROG'S MOUTH CAVITY



b. A frog's head

1. Pry open the mouth. Use the scissors to cut the corners of the mouth where the *maxilla* (upper jaw) and *mandible* (lower jaw) join together. Examine the frog's mouth. Locate the *tongue* which is a muscular, sticky flap on a living frog. The frog flicks out the tongue from the floor of the mouth to catch flying insects. Flip out the tongue. Describe how the tongue is attached to the mouth.

(b) _____

_____

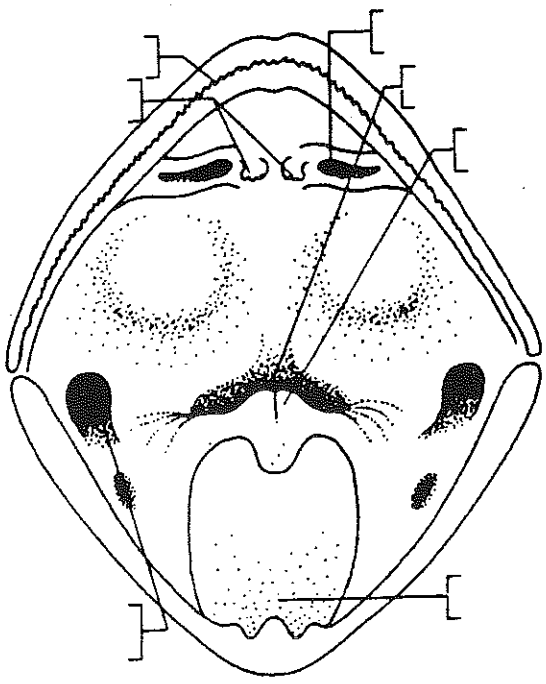
Feel the *maxillary teeth* that are found along the rim of the upper jaw or *maxilla*. Describe how the maxillary teeth would be useful to the frog.

(c) _____

Find the *vomerine teeth* attached to the skull bones of the roof of the mouth. Notice that only the upper jaw has small teeth. Locate the *internal nares* or *nostrils* found in the roof of the mouth. How is the location of the nares an adaptation to living in water?

(d) _____

_____



c. The frog's mouth cavity

Locate the *glottis* which is a slitlike opening on the swollen voice box found on the floor of the mouth. Air passes through the glottis going to and from the lungs. Find the *esophagus* at the rear of the mouth. The wide opening of the esophagus allows the frog to swallow food whole. The esophagus is the first tube of the alimentary canal leading to the stomach. Notice each *eustachian tube opening* found lateral to the esophagus near the hinge of the upper jaw. The eustachian tube openings lead to each ear and ensure equal air pressure on both sides of the tympanic membrane. Label each of these structures on **c**: *tongue, maxillary teeth, vomerine teeth, internal nare, glottis, esophagus,* and *eustachian tube opening.*

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Dissecting an Amphibian— The Frog (Continued)

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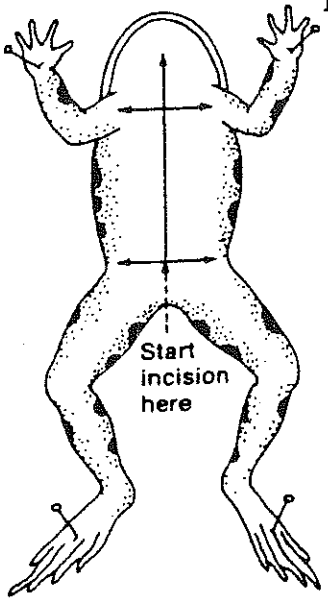
PROCEDURE C



d. How to dissect the frog

THE INTERNAL ANATOMY OF THE FROG

1. Place the frog in the dissection tray ventral side up and pin down both jaws. Use the forceps and scissors to lift a piece of skin where the hind legs meet. Insert the scissors and cut just the skin along the midline to the level of the lower jaw as shown in **d.** Clip the skin at a right angle to the incision as shown. Observe the layers of muscles now exposed. Repeat the incision procedure for the muscle tissue. Make this incision a little to the right of center to avoid cutting a major vein.

   (NOTE: Always lift the parts to be cut so as to avoid damaging underlying tissues and organs.) In the chest region you will have to cut through the breastbone. Again make right angle cuts from each end of the long incision as shown in **d.** Fold open and pin down flaps of the skin and body wall. Make additional cuts in the breastbone, if necessary, to expose the organs in the upper body.

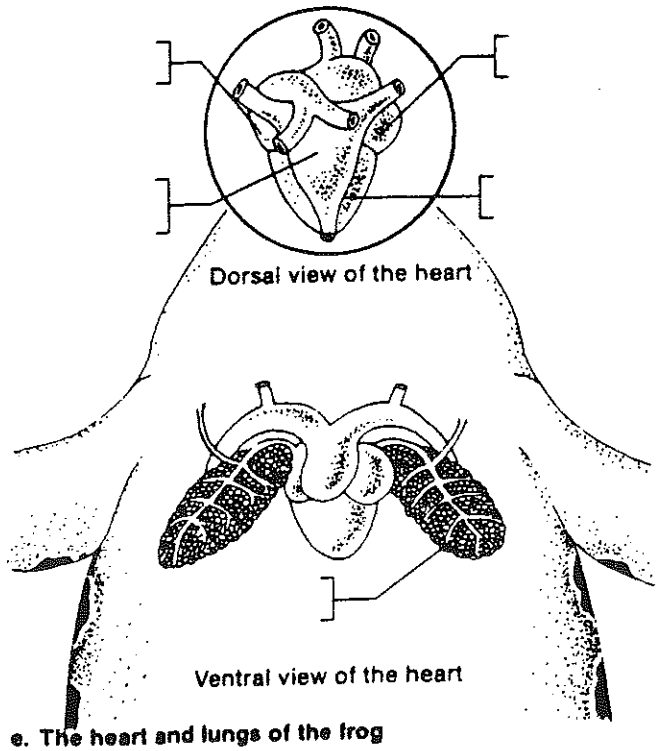
2. The sex of the frog is readily noticed once the internal organs are exposed. If there is a mass of black and yellow eggs in the transparent ovaries, the frog is a female. If the ovaries obscure the view of the other organs the ovaries may be cut out of the body at their point of attachment and removed from the body cavity.

Respiratory System

3. Locate the small pair of lungs and the bronchial tubes as shown in **e.** Describe the texture of the lungs.

   (e) _____

   Label the lung as shown in **e.**



e. The heart and lungs of the frog

Circulatory System

4. Find the *heart* in the center of the chest cavity between the lungs. Notice that the heart lies in a thin sac called the *pericardium*. Remove the pericardium to observe the three-chambered heart. The two, dark-walled chambers called *atria* receive blood. The *right atrium* receives deoxygenated blood from the *veins* of the frog's body. The *left atrium* receives oxygenated blood from the lungs. Each atrium empties into the *ventricle* which is the lighter-colored, thick-walled part of the heart. The large vessel forming a y-shape at the anterior end of the ventricle is the *conus arteriosus*. Blood is pumped out of the conus arteriosus through a system of *arteries* that you see around the heart. Label the *right atrium*, *left atrium*, *ventricle*, and *conus arteriosus* on **e.**

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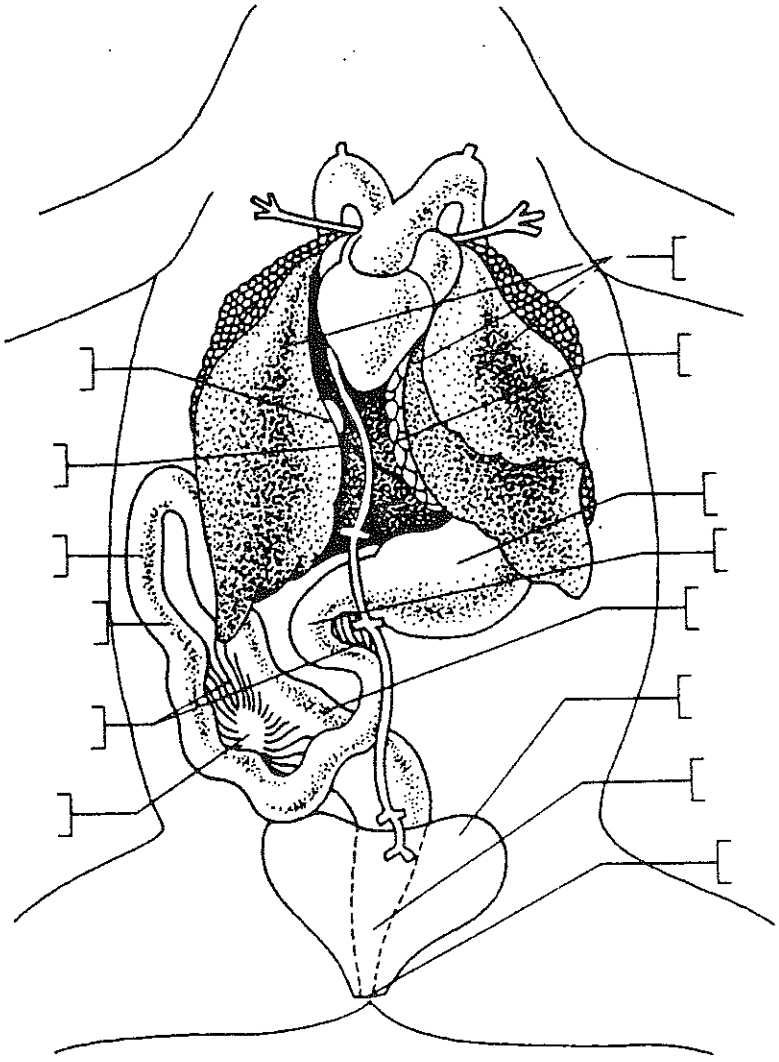
Digestive System

5. Find the dark brown *liver* composed of three to five lobes. Between the right lobe and the one next to it, is the transparent *gall bladder*, usually filled with the green *bile* that it stores. Locate the *bile duct* that brings bile from the gall bladder to the first part of the *small intestine* or *duodenum*. The duodenum and *stomach* form a loop that is held in place by sheets of membranous connecting *mesentery*. In the mesentery, between the stomach and duodenum, lies the *pancreas*, a glandular organ that produces digestive enzymes. The pancreas empties its enzymes through a duct that empties into the bile duct. The dark, spherical *spleen*, which is a circulatory and lymphatic system organ, lies in the mesentery posterior to the stomach. One of the spleen's functions is to store blood. The small intestine proceeds posteriorly to the coiled *ileum* that widens into the *large intestine*. Where the *urinary bladder* and reproductive ducts empty into the intestine, the section is called the *cloaca*. The wastes in the cloaca empty out at the *anus*. Label each of the following structures in **f**: *liver, gall bladder, bile duct, duodenum, ileum, small intestine, stomach, mesentery, pancreas, large intestine, cloaca, anus, spleen,* and *urinary bladder.*



f. The internal anatomy of the frog

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Dissecting an Amphibian— The Frog (Continued)

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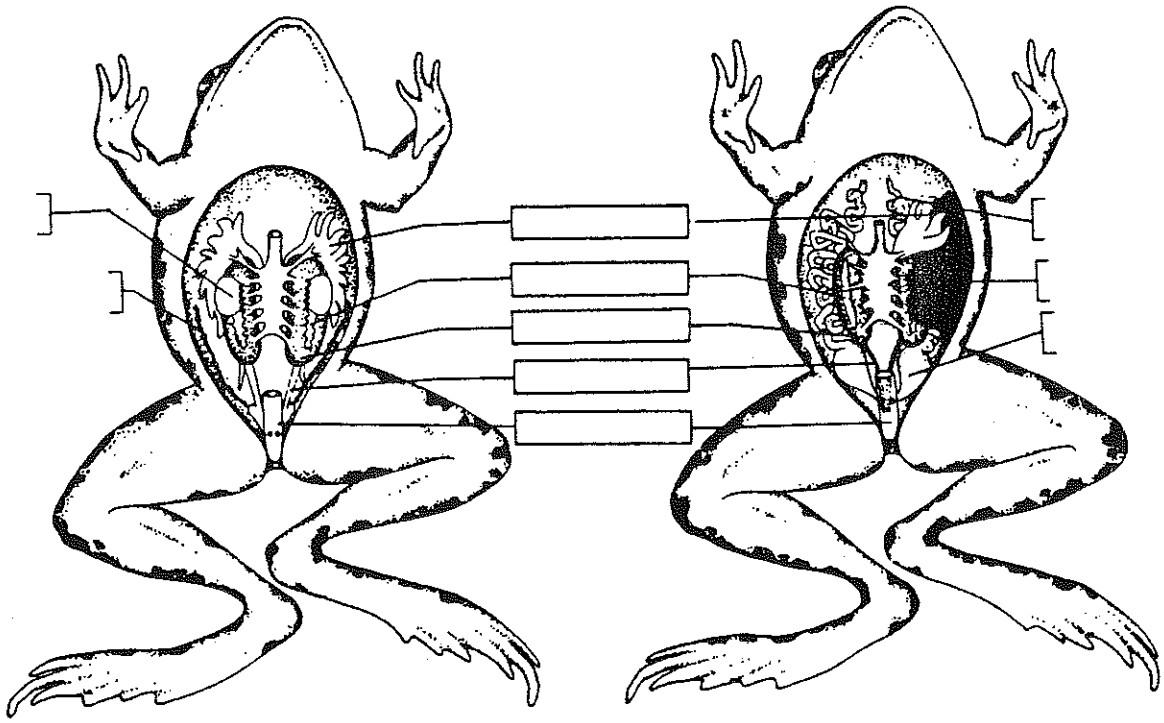
Excretory System

6. Push the intestines aside to see the two dark, oblong *kidneys* lying on the dorsal wall of the body cavity. Find the *ureter*, which is a tube leading out of each kidney. The ureters carry the chemical wastes from the blood that the kidneys have filtered out to the urinary bladder. The chemical wastes called urine are stored in the urinary bladder that empties into the cloaca. The *adrenal gland*, which is part of the endocrine system, can be seen as a yellow stripe on each kidney. *Fat bodies*, whose purpose is to store fat to be used during hibernation or when food is scarce, attach to the anterior end of each kidney. Usually fat bodies are bright yellow, finger-like projections. Label the *kidneys*, *ureters*, *cloaca*, *adrenal glands*, and *fat bodies* in g.



g. The reproductive and excretory systems of a male and a female frog

Reproductive System

7. In male frogs each yellowish, oval-shaped *testis* is attached by tubes to the kidney. During mating the sperm mixes with and follows the exit route of the urine. The males of many frog species have vestigial oviducts attached to the cloaca called *Mullerian tubes*. In female frogs the two ovaries appear as *egg sacs*. Eggs released from the ovaries enter a long, coiled *oviduct* at the anterior opening. Eggs pass down the cream-colored oviduct and are held in an *ovisac* or *uterus* before entering the cloaca. From the cloaca the eggs pass from the body to be fertilized outside the frog's body. Label the *Mullerian tube*, *egg sac*, *oviduct*, *ovisac*, and *testis* on g.

8. Dispose of your dissected frog where your teacher instructs. Clean up your work area and equipment. Return the cleaned dissecting equipment to the appropriate place.

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ANALYSIS

1. List the frog's features that are similar to features of animals that live in water.

2. How might the countershading of a frog help protect it from predators?

3. List the organs of the frog's digestive system through which swallowed food passes.

4. Which glands are part of the frog's digestive system?

5. Trace the path of urine through the frog's body beginning with the organ that filters waste from the blood.

6. List three ways the frog is adapted to life on land.

GOING FURTHER

1. Observe a living tadpole. Find out how the structures that a tadpole uses for locomotion, respiration, and ingestion of food differ from those of a frog.

2. Remove the brain of the frog and make a sketch of the dissected brain. Use a reference book to identify the parts of the brain.

Amphibians

NAME _____

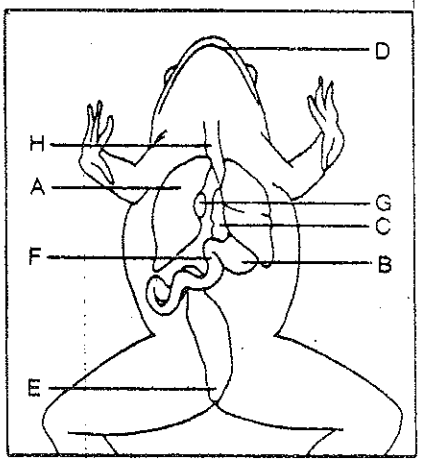
CLASS _____ DATE _____

A. DIGESTION IN A FROG

Textbook reference:

A frog's internal anatomy is typical of many vertebrates. The organ systems work together to enable the frog to carry out its functions. Study the diagram below. Place the letter and name of the lettered structure next to the phrase that most closely describes it.

___	_____	site of vomerine teeth
___	_____	beginning of esophagus
___	_____	produces digestive enzymes
___	_____	reduces food to a soupy mixture
___	_____	first part of small intestine
___	_____	final portion of large intestine
___	_____	stores bile
___	_____	produces bile

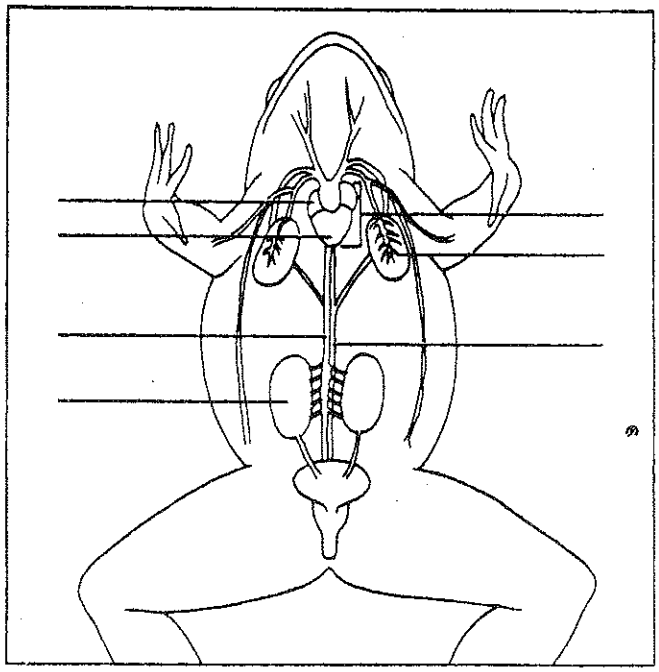


B. EXCRETION AND CIRCULATION IN A FROG

Textbook reference:

A separation of systemic and pulmonary circulation is first observed in amphibians. Complete the following paragraph and use the letters to label the diagram below.

Blood leaves the (A) _____, travels to the (B) _____ to get oxygen, and then returns to *A*. Oxygenated blood is pumped from the (C) _____ to the (D) _____ to bring fresh oxygen to the body's cells. Waste materials in the blood are filtered through the (E) _____. Deoxygenated blood returns to the *A* via the (F) _____. The blood enters the sinus venosus and then moves into the right (G) _____.

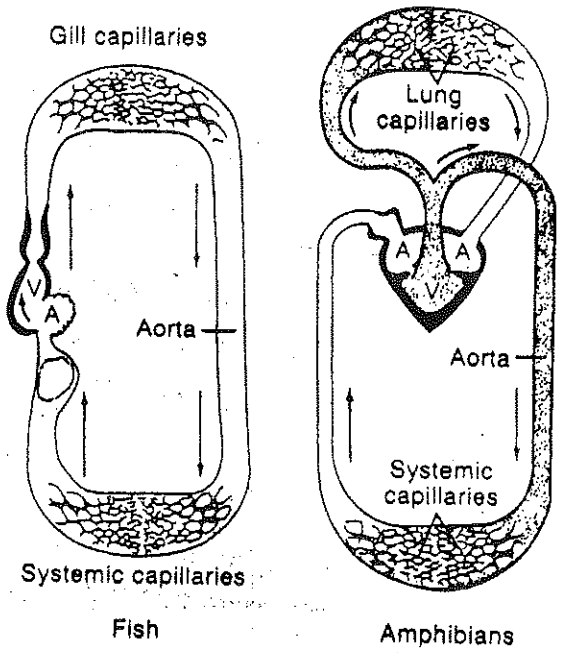


C. CRITICAL THINKING: COMPARING CIRCULATORY SYSTEMS

Textbook reference

A major evolutionary change can be observed in a comparison of the circulatory system of a fish with that of an amphibian. Compare the diagrams on the right and answer the questions below.

The blood that enters the lungs of an amphibian has relatively (more, less) _____ oxygen than the blood that enters the gills of a fish. The reason for this is that the blood that goes from an amphibian's heart to its lungs is a _____ _____. The blood that is carried to all the organs of a fish's body is _____. The blood that is carried to a fish's gills is _____. The blood that is carried to the organs of an amphibian's body is a _____ _____.



Which of these circulatory systems seems more efficient? Explain. _____

_____

_____

_____

_____

D. COMPARING AMPHIBIANS

Textbook reference.

Though frogs and toads are the most familiar, many other kinds of amphibians exist. The various types of amphibians seem to be intermediate between fish and land animals. The fossil record indicates that modern amphibians arose from fishlike animals that came onto the land about 350 million years ago. Study the three illustrations below. Then complete the chart on the next page.