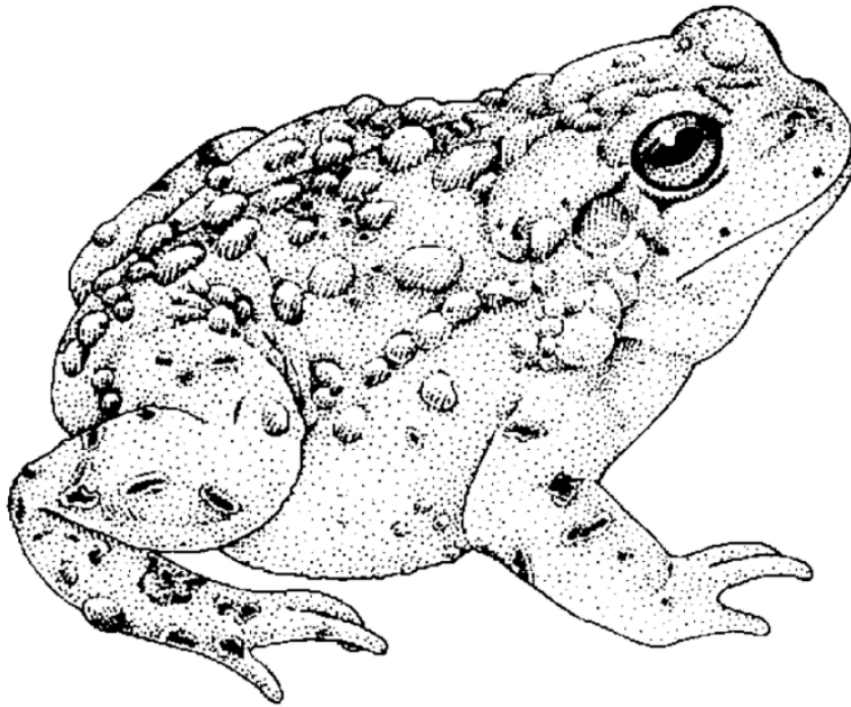


UNDERSTANDING DISSECTION OF THE AMPHIBIAN

John Bruce R.



A student guide

- *Hand drawn illustrations*
- *Short summarized notes*
- *Trial questions*
- *Provision for more drawings.*

“With dexterity science is easy”

The amphibians.

These are organisms that live both in water and land. Frogs and toads are the animals of interest here. (*salamanders, newts are other examples of amphibians*)

ECOLOGY OF THE ANIMAL

Differences between toad and frog

Frog	Toad
Skin smooth, shinny, moist	Skin rough, warty, moist
Very long, slender, flexible hind limbs highly folded onto the body	Hind limbs averagely long, muscular, folded onto the body.
Colour of the body green with black/dark brown/yellow spots	Colour of the body dark brown/ black

CLASSIFICATION

	FROG	TOAD
<i>Kingdom</i>	Animalia	Animalia
<i>Phylum</i>	Chordata	Chordata
<i>Class</i>	Amphibia	Amphibia
<i>Order</i>	anura	anura
<i>Family</i>	bufonidae	ranidae
<i>Genus</i>	Bufo	Rana
<i>species</i>	regularis	temporalis

Why is the animal classified in:

i) *Class Amphibia*

- *Thin moist glandular skin; warty skin;*
- *Wide gape*
- *Webs between digits of hind limbs.*

ii) *Order anura*

- *External ear drum/ tympanic membrane*
- *Long, hind limbs for leaping*
- *Webs between digits of hind limbs*

HABITAT

Frogs are found in damp environments; grass near water, swamps, ponds, slow flowing streams.

Toads are found in drier moist environments. Behind buildings, gardens, abandoned storage tanks.

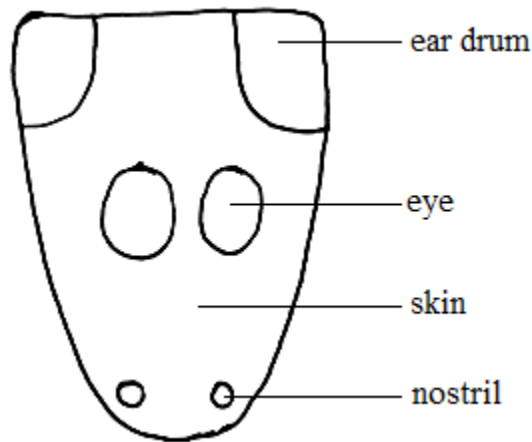
Why amphibians live near water?

- *Keep the skin moist for cutaneous respiration.*
- *Easily escape enemies*
- *They lay their eggs in water*

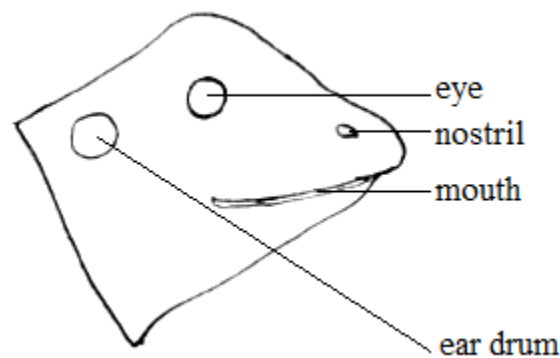
ADAPTATIONS FOR SURVIVAL

a) Head.

Component structures on the head (dorsal view)



- *Is triangular, apex anterior and base posterior, joined to the trunk directly. No neck.*
- *Dorso-ventrally flattened and tapers anteriorly.*
The shape above gives a well streamlined shape that reduces resistance to motion in water.



i) Nostrils

These are a pair of small, rounded openings anteriorly located on the head and above the mouth. This position allows gaseous exchange when the rest of the body is submerged in water. Their location allows detect smells of food, enemies in the environment and other stimuli.

ii) Eyes

Are large, round, protruding, lined dorsally, facing laterally. This gives the animal a wide field of view.

Eyes are covered by a translucent fold of skin- the nictating membrane that cleans and moistens the eye but also protects it.

iii) Ear drum/ tympanic membrane

The ear drum is a tough, prominent, circular patch of tough membrane. They are located dorsal laterally behind the eyes. Their structure suits reception of sound vibrations making the animal aware of its nearest environment. The tough nature allows resist pressure exerted by water and other obstacles without rupture.

iv) Mouth

Anteriorly located on the head, has a wide gape to ingest large size prey.

v) Tongue

Is long, muscular, flat, elastic/ stretchable, forked/bilobed anteriorly, sticky/slimy and has many small blood vessels. It is attached on the floor at the front.

- *It is long enough to and elastic to trap insects at relatively far distance for food.*
- *It is sticky to trap small insects for food.*
- *It is muscular to stretch out long to trap insects.*
- *It is flattened to increase surface area for trapping prey.*
- *It has numerous glands that secrete sticky mucus to trap prey.*
- *It has a wide base for firm attachment.*
- *It is attached to anterior end of the lower buccal floor to easily flick out and trap insects at a long distance.*

b) Skin

The skin is firmly attached on the head region, throat and legs. This is an adaptation for locomotion. It is also loosely attached on the rest of the body with fluid filled air spaces on the trunk. This allows distension of the body wall and movement of skin without rupture of internal organs.

The following are adaptations of the skin

- *It is tough and hard protecting the internal delicate organs from injury and damage.*
- *The skin has poison glands all over the body with much concentration on the head which secrete a milky mucus that protects the animal from predators.*
- *It is thin and moist to allow gaseous exchange when the animal is in water.*
- *It is warty and slimy making it slippery to allow the animal to escape predation.*
- *Colour (specify it) is suited for camouflage efficiently in their environments.*

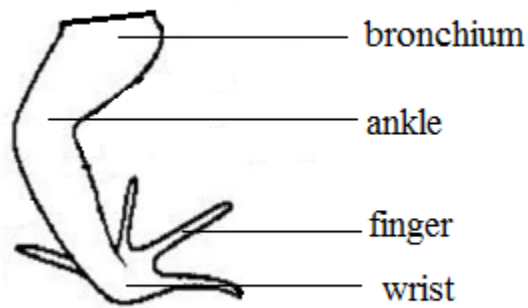
c) Limbs.

These are of unequal size reflecting their different functions. The limbs are both muscular, jointed with digits. The fore limbs hold the body and absorb shock during hopping. The hind limb generates strong propulsive thrust during movement.

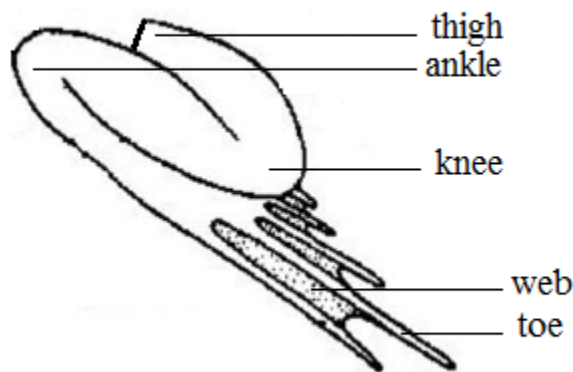
Differences between Fore and hind limbs

Fore limb	Hind limb
Has 4 digits	Has 5 digits
No webs between digits	Webs between digits
Divided into 2 regions	Divided into 3 regions
Less muscular	Muscular
L- shaped	Z- shaped
2 joints	3 joints
Short and stout	Elongated and folded

A DRAWING OF THE FORE LIMB



A DRAWING OF THE HIND LIMB.



Adaptations.

- Forelimbs are *short* and *stout*, *holding* the body clear off the ground during rest.
- Fore limbs are *short* and *stout* to *absorb shock* during hopping.
- Hind limbs have *webbed feet* providing a *large surface area* against which a *forward thrust* is generated during swimming.
- Hind limbs are *long*, *muscular* and *highly folded* into three regions. They provide a *forward thrust* to the body during jumping and swimming in water.
- Hind limbs have *long nailed toes* which dig deep into the ground to provide *stability* during jumping on land

assignment 1.

a) You are provided with specimen R (Toad) which is freshly killed. Classify the specimen as far as possible giving reasons for the class.

- b) Observe the structural features on the head from the left hand side. Draw and label the features concerned with sensitivity and feeding.
- c) Examine the head of the specimen. Describe the shape of the head and its significance.

SEX IDENTIFICATION

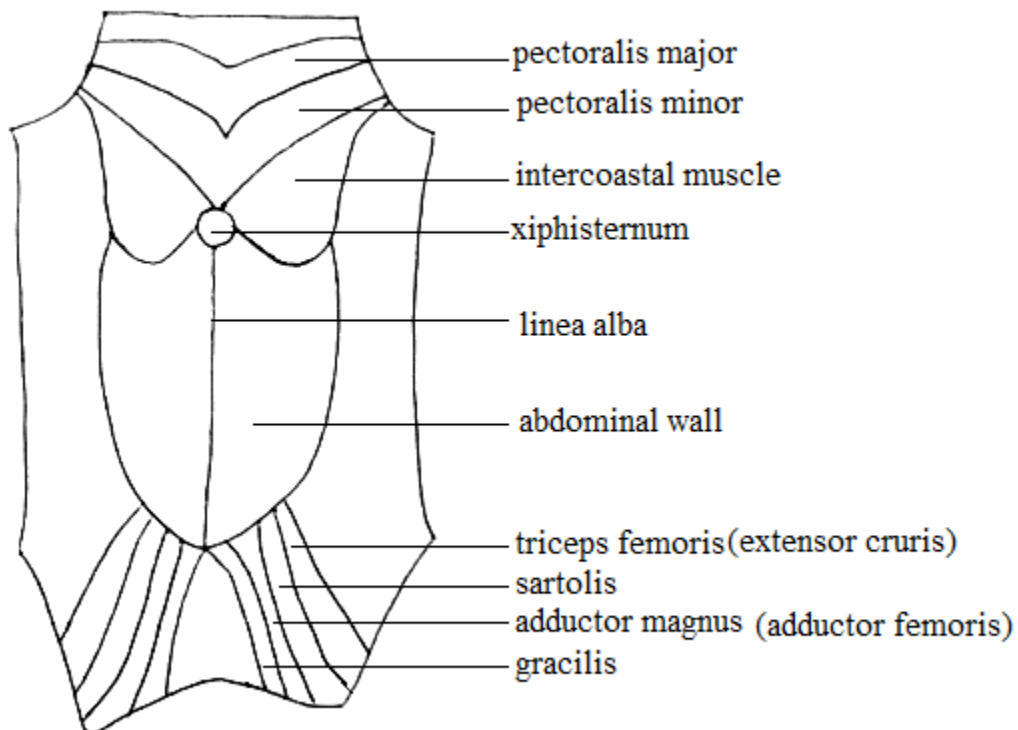
No external genitalia are present. However males and females have structures that allow identification.

<i>Males</i>	<i>Females</i>
Slender body	Broad abdomen with eggs especially during the breeding season.
Skin underlying throat is usually white	Skin underlying the throat is creamy/ grey
Rough black warty patch on ventral surface of first finger on the fore limb called nuptial pad	Broad body

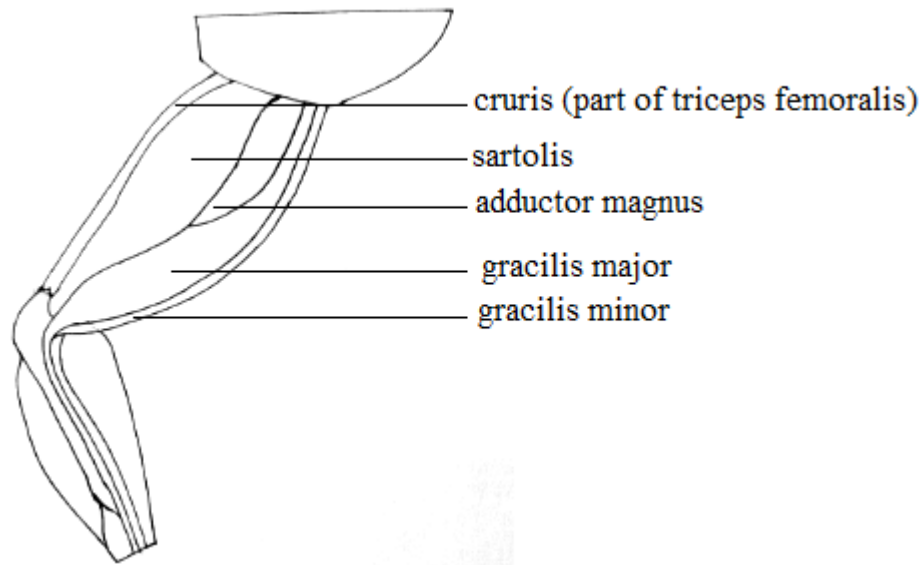
INTERNAL ANATOMY

MUSCULATURE OF THE TOAD.

With normal dissection procedures, (opening up body cavity-the frog, fig 4 HCQ Rowett, page 69), the arrangement of muscles underlying the skin can be seen as below;.



A drawing of ventral muscles of the lower limb



The musculo-cutaneous vein emerges from the arm pits and branches into smaller blood vessels distributed over the inner surface of the skin.

- There are four/ five muscle blocks arranged parallel to each other. The muscle blocks overlap.

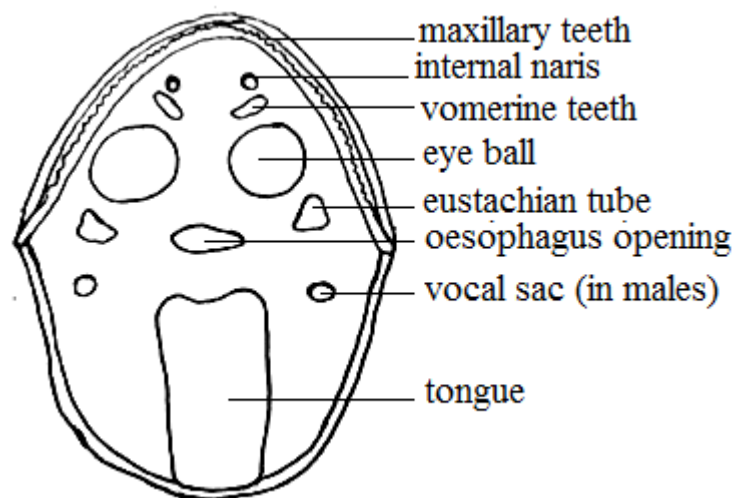
A drawing of the dorsal view of the hind limb.

DIGESTIVE SYSTEM

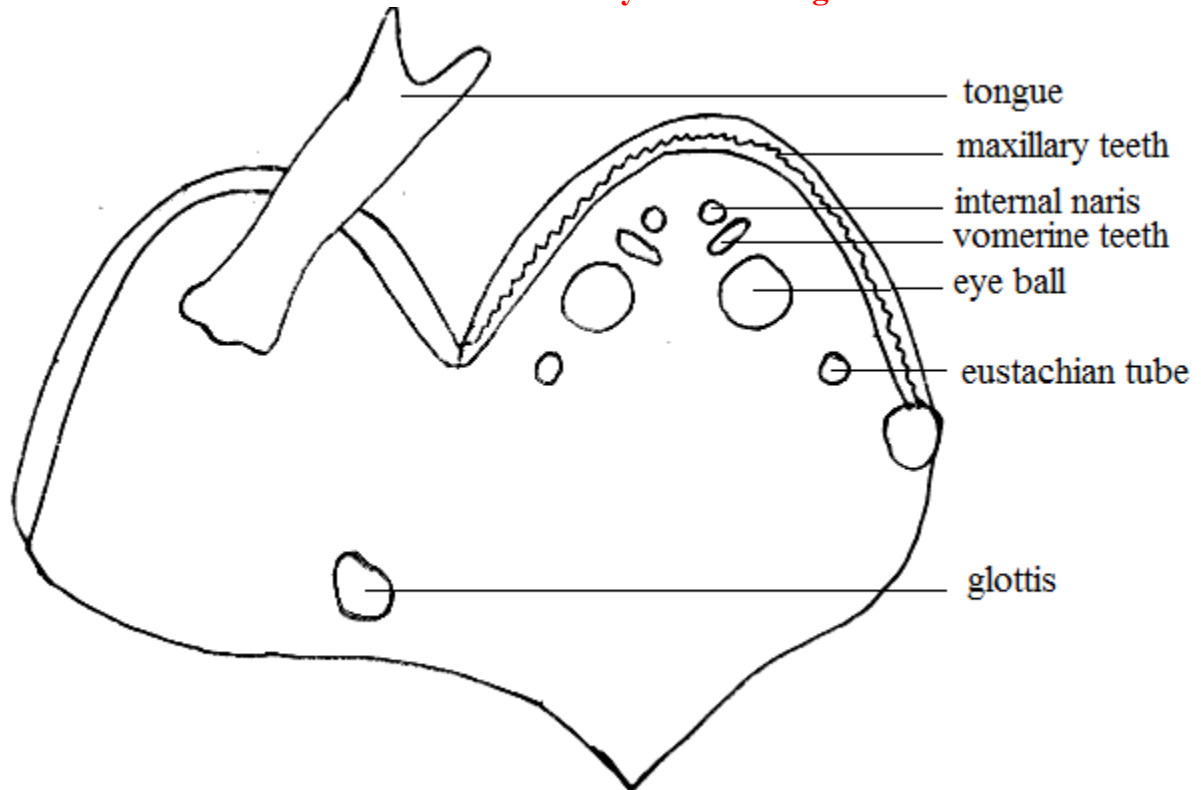
This is made up of the alimentary canal and associated organs. Alimentary canal consists of mouth, buccal cavity, pharynx, oesophagus, duodenum, ileum, rectum. Associated organs include pancreas, liver, gall bladder.

Mouth.

- Terminal, very large, extends to tympanic membrane. This provides wide gape for ingestion of large food and prey.
- Numerous maxillary teeth which are uniform, small, pointed, conical shaped and curving backwards.
- Internal roof has nares (singular-naris) through which air enters the buccal cavity. They are 2, small, rounded, with valves.
- Vomerine teeth protrude out of the roof of the mouth above the eye balls.



Structure of the buccal cavity after cutting to one side.



The **Oesophagus** is short, narrow, tubular within. It has longitudinal folds which close entry of air into the stomach.

The **stomach** is elongated and thick walled, internally it is folded longitudinally to allow distension and increase surface area for secretion of gastric juice.

There are 2 constrictions. One anterior is the cardiac sphincter controlling entry of food and the other cardiac sphincter controlling exit of food.

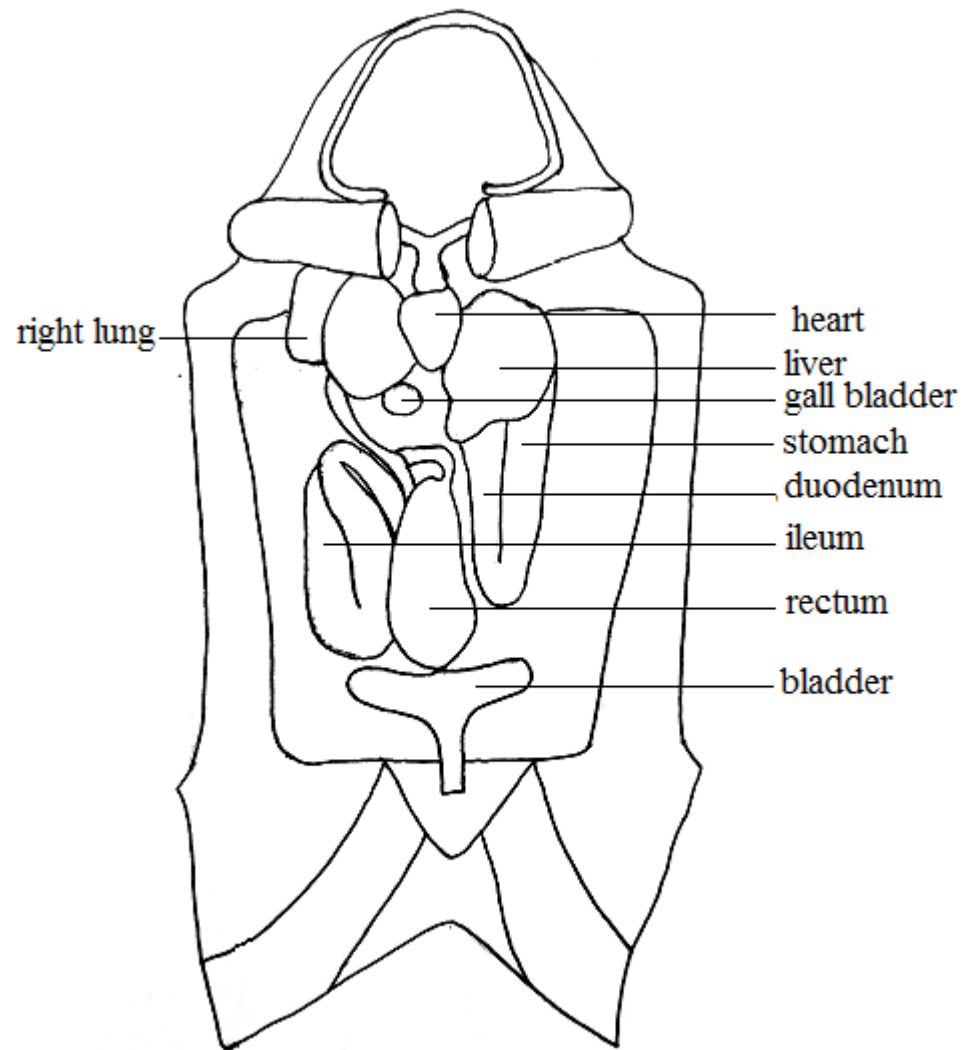
The **pancreas** is cream coloured and lives in the mesentery between the stomach and the duodenum.

The **gall bladder** is an oval shaped sac lying between the main lobes of the liver. It has the bile duct its outlet.

The **ileum** is very coiled, narrow, tubular with thin walls.

The **rectum** is short, thick walled, enlarged, wide between the colon and the cloaca. It is used for temporary storage of wastes before elimination

A drawing showing the abdominal organs in situ.



A drawing showing the abdominal structures when the alimentary canal is displaced to the left of the specimen.

The viscera is a word that collectively means the internal organs of the body in the abdominal and thoracic cavities.

URINOGENITAL SYSTEM

This system is clear only when the alimentary canal is removed.

The lungs, kidneys, ureter, urinary bladder and cloaca form the excretory system.

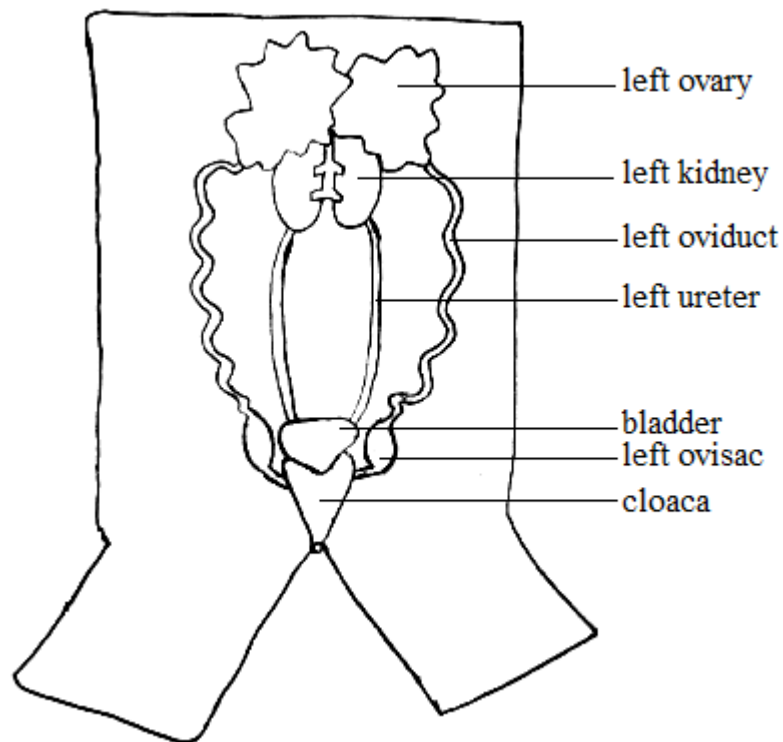
Part	Description and location
------	--------------------------

Kidney	<i>Dark, one on each side of the dorsal aorta or posterior venacava</i>
Ureter	<i>Slender duct from the kidney</i>
Bladder	<i>Thin-walled transparent bi-lobed structure. Opens into the cloaca.</i>
Cloaca	<i>Small median chamber and opens to the outside through an aperture.</i>

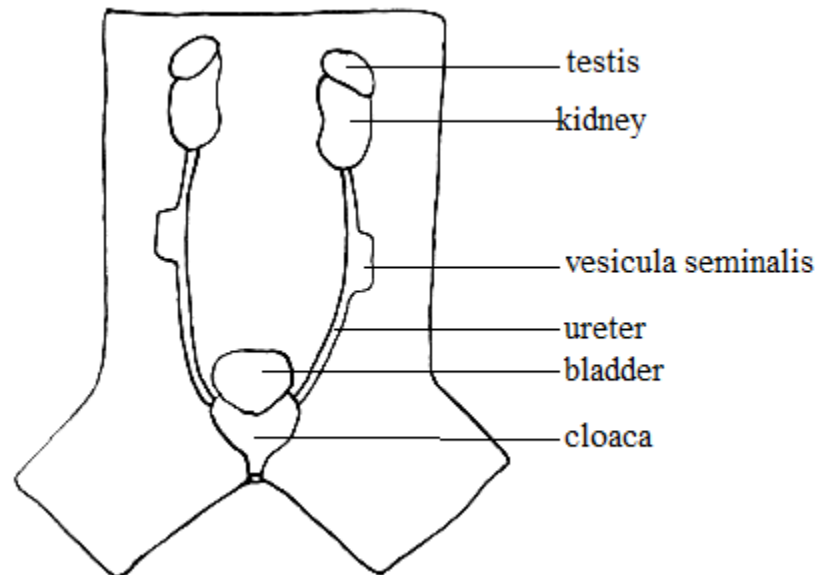
Reproductive system.

Male	Description
Testis	<i>Paired, yellow oval bodies, attached onto ventral side of the kidney.</i>
Vasa efferentia	<i>Convey sperm.</i>
Female	
Ovaries	<i>Pair of large irregularly folded structures.</i>
Oviducts	<i>Long, white above the ovaries. Posteriorly each widens to form large thin walled chamber the ovisac/ uterus.</i>
Cloaca	<i>Median sac. Opens to the outside via an aperture.</i>

The female Urinogenital system.



The male urinogenital system.



CIRCULATORY SYSTEM

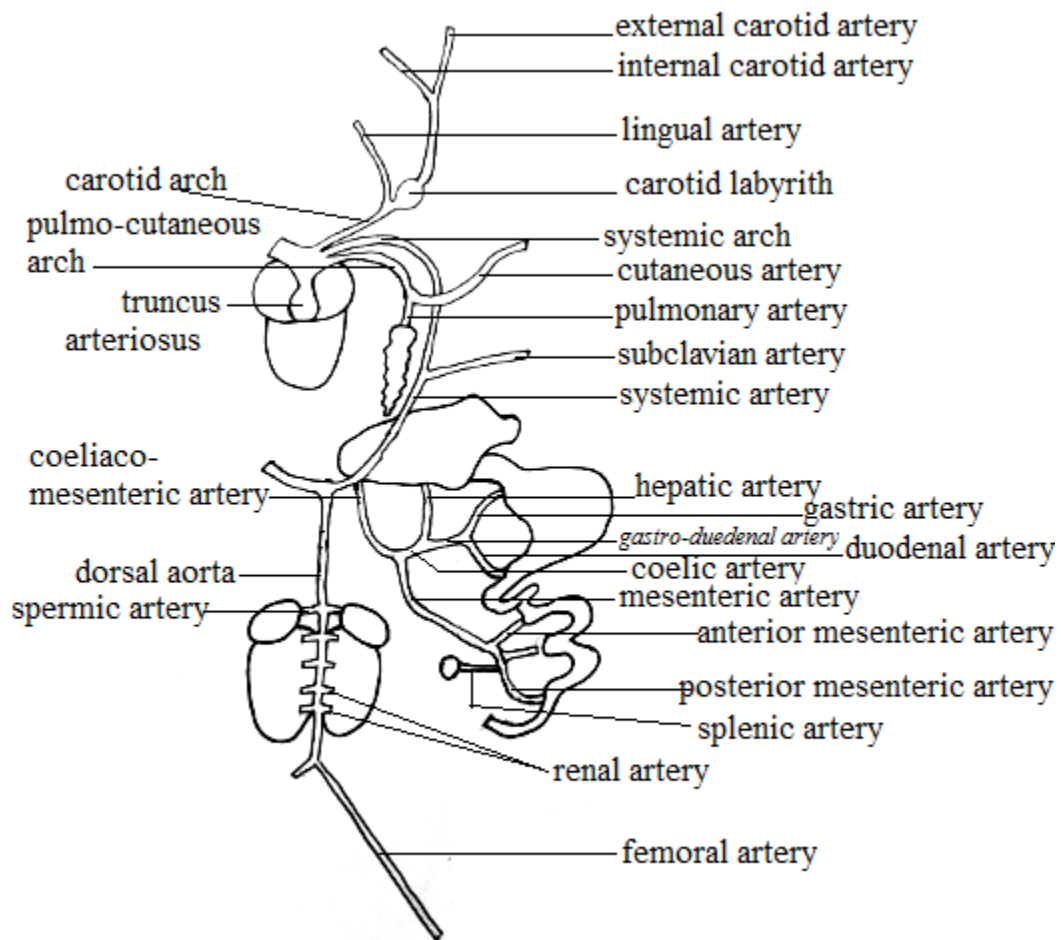
a) Arterial system.

Arteries are much paler than veins. To study the arterial system, the veins must be removed.

Carotid arch	Lingual/external carotid	Tongue, lower jaw
	Internal carotid	Eye, pharynx, palate
Systemic arch	Subclavian artery	Fore limbs
	Systemic artery	Posterior circulation
P u l m o cutaneous arch	Cutaneous artery	Skin
	Pulmonary artery	Lungs

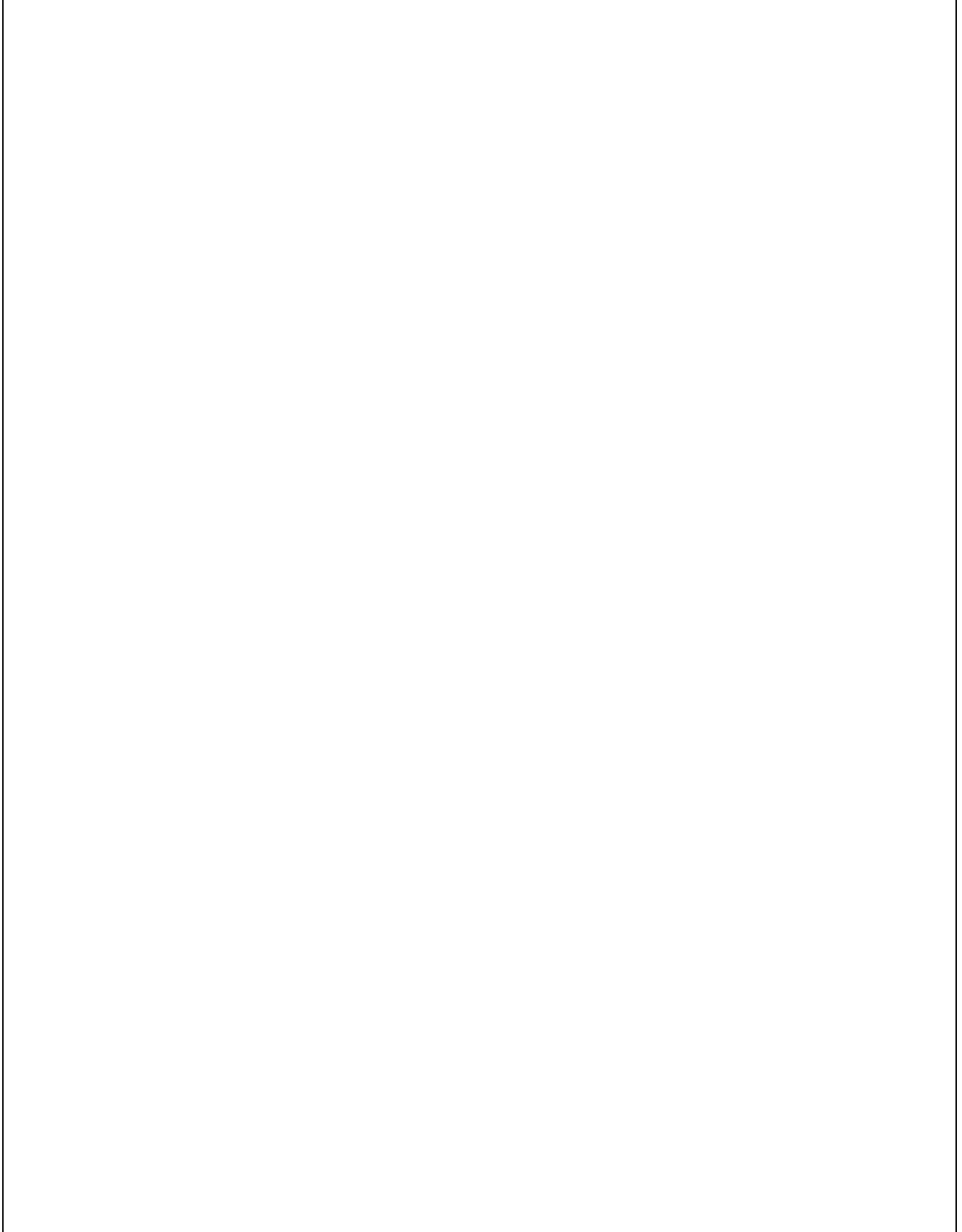
- The coeliaco-mesenteric artery branches off the left systemic artery before forming the dorsal aorta. It divides into coelic artery and mesenteric artery.
- The coelic artery divides into;
 - a) Gastro-duodenal artery divides into gastric artery(supplying the stomach) and duodenal artery (supplying the duodenum)
 - b) Hepatic artery that supplies the liver.
- The mesenteric artery divides into;
 - a) Anterior mesenteric artery to the intestines
 - b) Posterior mesenteric artery to the lower intestines and rectum.
 - c) Splenic artery supplying the spleen.
- Dorsal aorta branches into;
 - a) Renal arteries (usually 5) supplying left and right kidneys
 - b) Lumbar arteries to the dorsal muscles
 - c) Genital arteries
 - d) Iliac artery which also branches into femoral artery and sciatic artery.

A DRAWING OF THE SPECIMEN SHOWING THE MAIN ARTERIES OF THE BODY



A drawing of the vessels supplying the head region.

A drawing showing the blood vessels supplying the alimentary canal displaced to the right with its associated organs in the abdominal cavity of the toad.



A drawing showing the blood vessels that supply urinogenital system and the hind limbs of the toad.

THE VENOUS SYSTEM.

Turn the heart upwards and locate the anterior venacava and posterior venacava.

The anterior venacava originates from;

- a) External jugular vein made by joining of mandibular (draining lower jaw) and the lingual vein (draining the tongue).
- b) Innominate vein the middle of the three veins. It is formed by union of internal jugular vein (draining the jaw) and subscapular vein (draining the shoulder).
- c) Subclavian vein is the largest of the three. It comes from the arm. It is formed by joining of brachial vein (draining the arm) and musculo-cutaneous vein draining the skin and body wall.

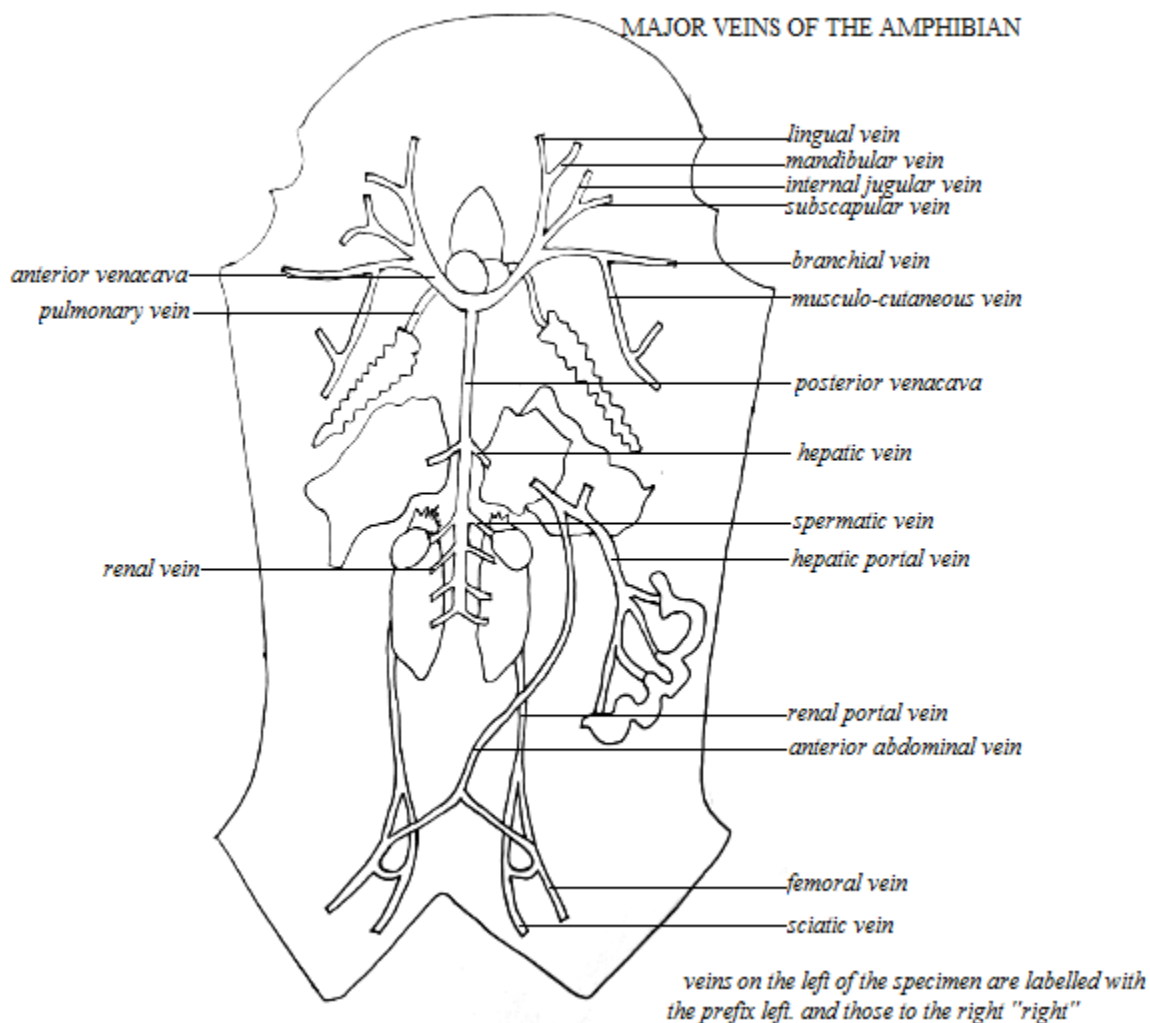
The posterior venacava originates from;

- a) Hepatic veins draining the liver
- b) Renal veins (4 in number) draining the kidneys

- c) Spermatic (draining the testis) or ovarian (draining the ovaries). *though sometimes they join one of the renal veins*)

Other vessels.

<i>Vein</i>	<i>Part it drains</i>
Pulmonary	Lungs to the left auricle. It is obscured by posterior venacava and the liver. <i>These have to be removed first</i>
Renal portal	Hind limbs. It drains blood from the femoral vein(hind limb) and sciatic vein(inside of thigh) to the kidney
Pelvic	From the femoral vein to the ventral abdominal
Ventral abdominal	From union of the right and left pelvic veins
Hepatic portal vein	Formed from a fusion of; Gastric vein draining the stomach Duodenal vein draining the duodenum Intestinal vein draining the ileum Splenic vein draining the spleen Rectal vein draining the rectum.



A drawing showing blood vessels that return blood from the head and fore limbs back to the heart.

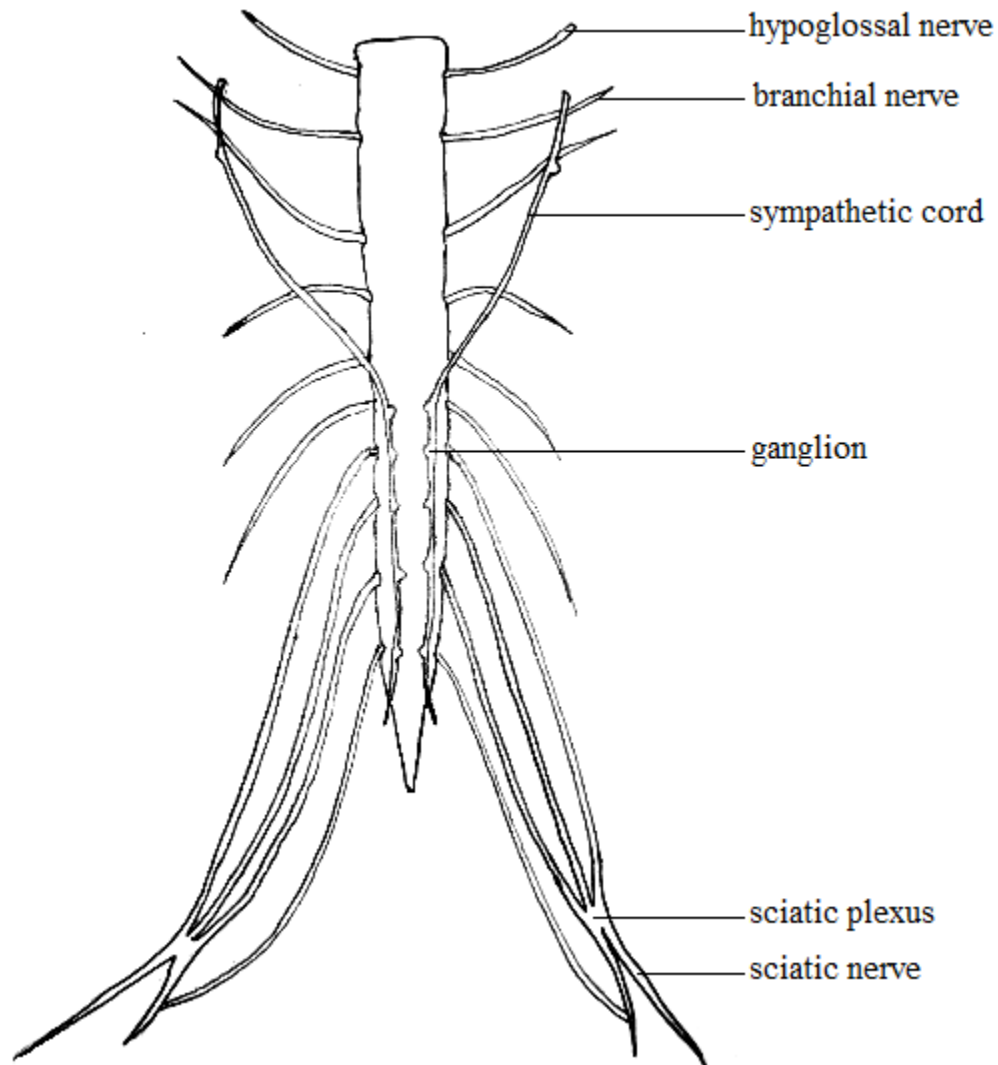
NERVOUS SYSTEM

Remove the heart, lungs, liver, kidney, testes or ovaries, the alimentary canal (while keeping the aorta intact).

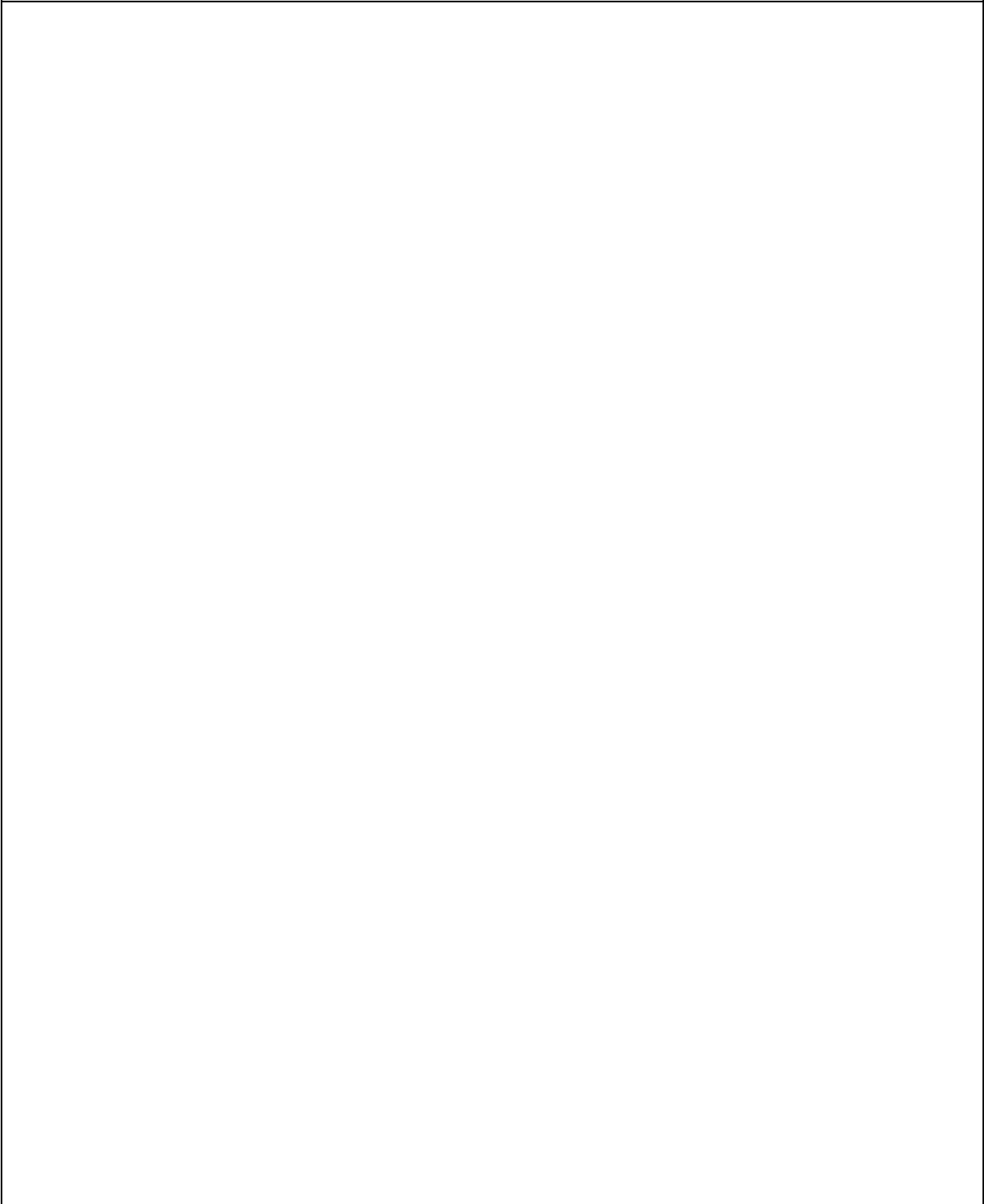
The bony vertebral column and ten pairs of spinal nerves are seen. The sympathetic cords are also seen.

(the nerves are distinct as thread like, white – features that make them easy to identify.)

A drawing showing the ventral branches of spinal nerves and sympathetic nervous system.



A DRAWING SHOWING ABDOMINAL STRUCTURES WHEN THE ALIMENTARY CANAL IS DISPLACED TO THE LEFT OF THE SPECIMEN.



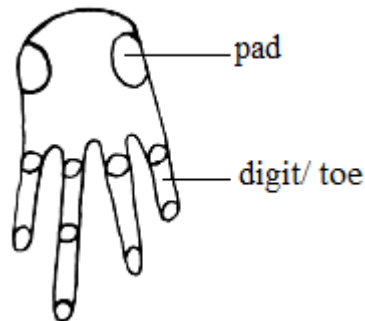
TRIAL QUESTIONS.

1. UNEB 2016 QN 1. You are provided with specimen R which is freshly killed. Examine the fore and hind feet of the specimens.

a) Draw and label the ventral side of the left fore foot and the left hind foot of the specimen. Both drawings should be at the same magnification. (7 marks)

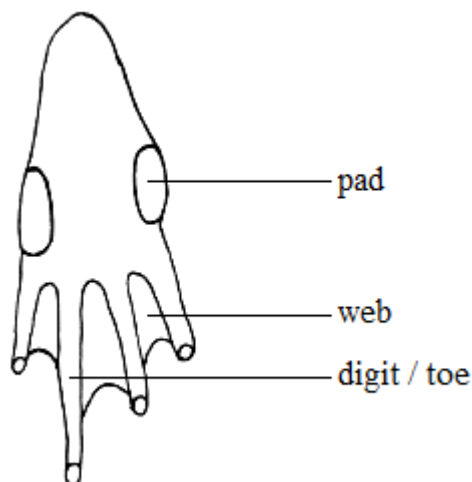
(i) Fore foot

A DRAWING OF THE VENTRAL SIDE OF THE LEFT FORE FOOT OF SPECIMEN R



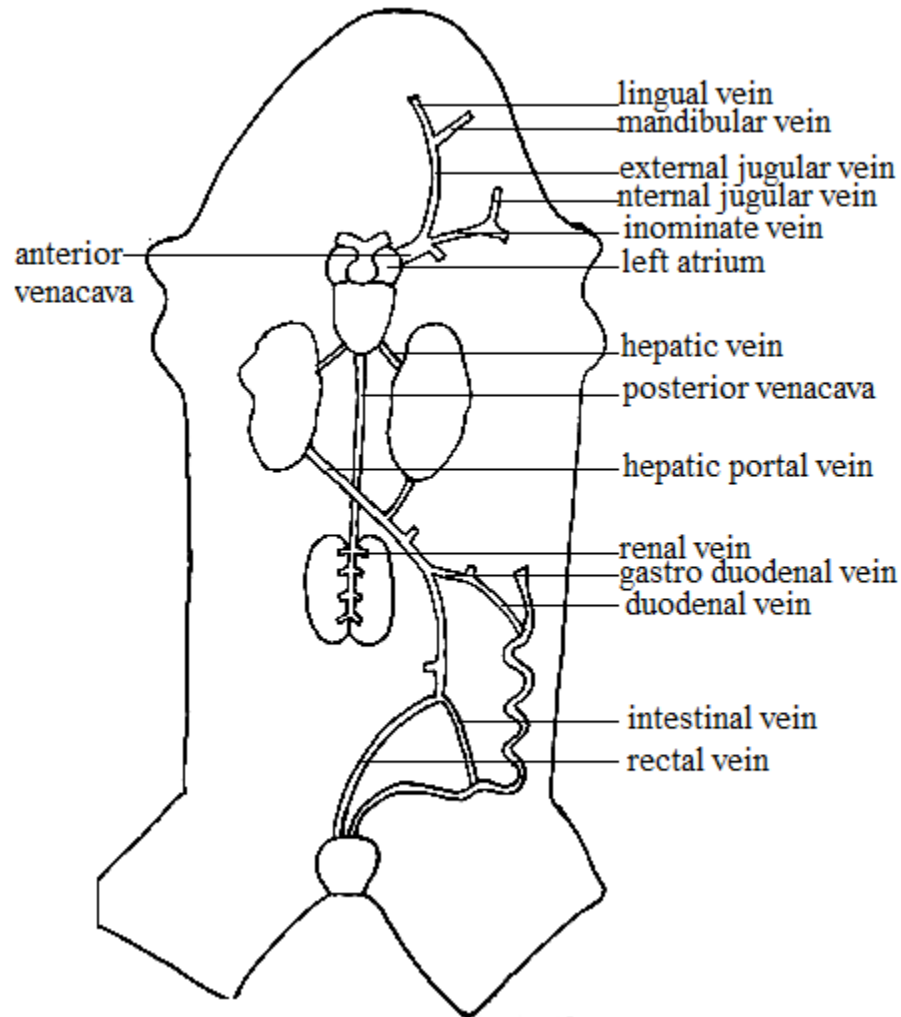
(ii) Hind foot

A DRAWING SHOWING THE VENTRAL SIDE OF THE LEFT HIND FOOT OF SPECIMEN R.



b) Dissect the specimen to display the heart and the blood vessels that carry blood from the head region, intestines and kidneys and back to the heart. Without displacing the heart, draw and label your dissection. (36 marks)

A DRAWING SHOWING THE BLOOD VESSELS THAT CARRY BLOOD FROM THE HEAD REGION, INTESTINES AND KIDNEYS OF SPECIMEN R WITH THE HEART UNDISPLACED.



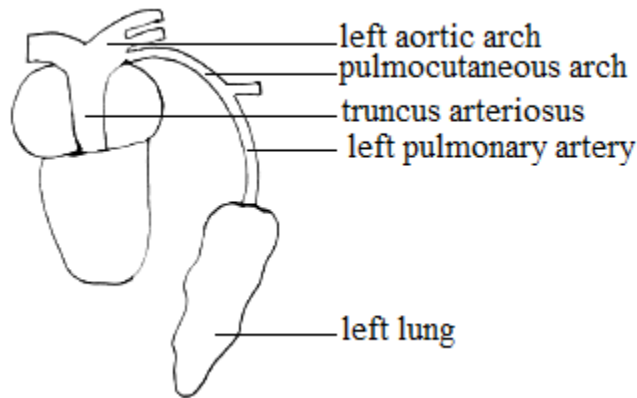
2. You are provided specimen P which is freshly killed.
 - (a) Examine the specimen and give five observable adaptive features that enable the specimen to survive in its habitat. (5 marks)
 - *Dorso-laterally positioned, large protruding eyes for a wide vision*
 - *Wide gape of the buccal cavity for consuming prey of large size.*
 - *Nostrils for passage of gases.*
 - *Streamlined head/ triangular head reducing water resistance while swimming.*
 - *Short , stout fore limbs act as shock absorbers when landing while jumping.*

- *Webbed hind feet/ digits provide large surface area to generate propulsive force in water.*
- *Dark skin for camouflage*
- *Jointed limbs for flexibility during movement/ locomotion.*
- *Numerous poison glands for defense.*
- *Nictating membrane to protect and moisten the eye.*
- *Any other adaptation accepted.*

(b) Dissect the specimen to display the;

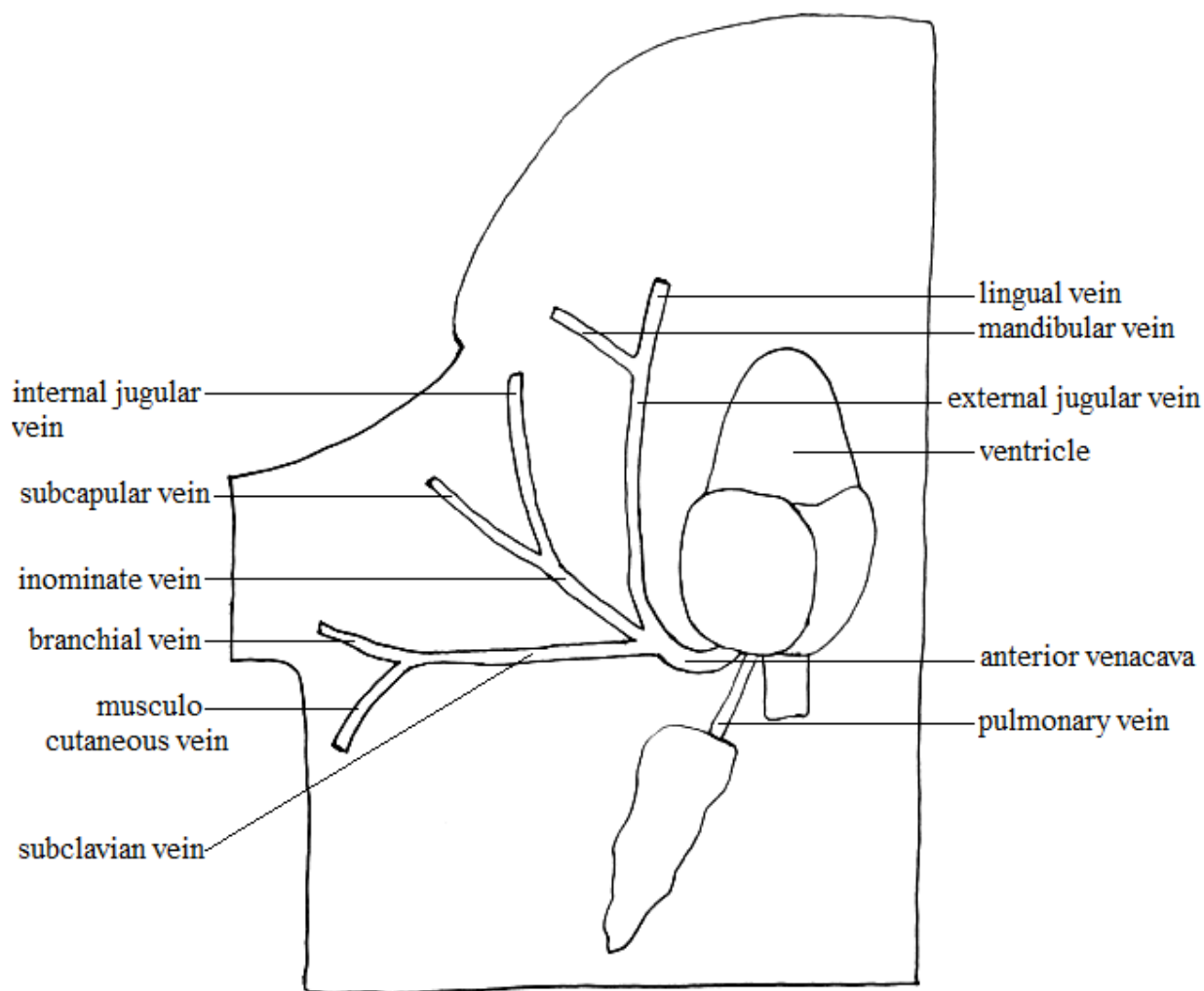
- i) Blood vessels taking blood to the left lung of the animal. Draw and label.
(16 marks)

A DRAWING OF SPECIMEN P SHOWING BLOOD VESSELS TAKING BLOOD TO THE LEFT LUNG.



- ii) Blood vessels returning blood from the right side of the head and chest region of the animal to the heart. (22 marks)

A DRAWING OF SPECIMEN P SHOWING BLOOD VESSELS RETURNING BLOOD FROM THE RIGHT SIDE OF THE HEAD AND CHEST REGION TO THE HEART



3. UNEB 2015 QN 1. You are provided with specimen K which is freshly killed.
- (a) (i) Measure the length of the fore and hind limbs and record the result in table 1. Express the results as a ratio of the length of fore limb: length of the hind limb. (2 marks)

Table 1.

Length	Fore limb	Hind limb
Ratio		

- (ii) State the significance of the ratio. (1 mark)
- (b) Examine the hind limb and state three ways it is adapted for the survival of the specimen in its habitat. (3 marks)
- (c) Examine the head of the specimen and draw and label the dorsal view of the anterior part of the head to show the structures for sensitivity. (5 marks)
- (d) Dissect the specimen to expose the heart. Turn the heart to display the main blood vessels;
- Returning blood from the trunk to the heart.
 - Supplying the structures for absorption of nutrients and excretory organs. Draw and label. (27 marks)

4. (a) You are provided with specimen R. classify it into the following groups. (1 marks)
- (i) Kingdom
 - (ii) Phylum
 - (iii) Class
- (b) Observe the head of the specimen and state how it is adapted to its habitat. (3 marks)
- (c) Dissect the specimen R to display the main superficial muscles of the left thigh of the specimen. Draw and label the muscles. (9 marks)
- (d) Continue to dissect the specimen to display,
- (i) The blood vessels that drain from the alimentary canal and its associated organs back to the heart, with the alimentary canal displaced to your right and the heart turned upwards and pinned through the ventricle.
 - (ii) the blood vessel that take blood from the heart to the thoracic region of the animal.
- Draw and label your dissection showing (i) and (ii) (26 marks)
5. UNEB 2007 QN 1. You are provided with specimen T which is freshly killed.
- (a) Pin the specimen with the ventral side uppermost. Dissect and remove the skin, taking note of how it is attached to the underlying body wall.
- (i) Describe the attachment of the skin to the body wall. (3 marks)
 - (ii) Suggest the significance of the way the skin is attached to the body wall as described in (a)(i) above. (3 marks)
- (b) Observe the main blood circulation on the skin.
- (i) Describe the pattern of blood circulation on the skin. (4 marks)
 - (ii) Give the significance of the pattern of blood circulation described in (b)(i) (3 marks)
- (c) Dissect the specimen further to display;
- (i) Blood vessels carrying blood from organs located on the left half of the abdominal cavity back to the heart.
 - (ii) Structures used for the elimination of unwanted materials from the body.
- With the heart displaced anteriorly, draw and label the blood vessels and structures displayed in (c)(i) and (ii) on one diagram. (27 marks)
6. You are provided with specimen K which is freshly killed. Open up the buccal cavity of the specimen and proceed with your dissection to display the rest of the internal structures. Carefully displace the alimentary canal to the left of the specimen without damaging any mesentery. Draw and label all the structures seen lying wholly anterior to the bladder. (25 marks)
7. a) Carefully examine the external features of the head and describe its structure. (10 marks)
- b) Using dissecting instruments open the buccal cavity and describe the structural features in this part of the body (10 marks)
- c) Explain three ways the structural features of the buccal cavity suit their function.

- d) Dissect the specimen to display the arterial circulation on the left side lying posterior to the heart plus the associated structures. Draw and label when the heart is displaced. (20 marks)
8. You are provided a freshly killed animal.
- Describe the following structural features of the head.
 - mouth (2 marks)
 - ear drum (2 marks)
 - eye (4 marks)
 - poison glands (3 marks)
 - Describe the structural features you used to identify the sex. (3 marks)
 - Dissect and remove the skin from the ventral sides of the animal's head, abdomen and limbs.
Search for the superficial structures, draw but DON'T label. (8 marks)
 - Dissect the animal to display the blood vessels draining the left side anterior to the heart, with the heart turned forward. Draw and label. (16 marks)
9. You are provided a freshly killed toad.
- Describe the structure of the foot of the posterior limbs. (3 marks)
 - Explain how the structure of the foot is related to its function (2 marks)
 - Dissect the animal to display the heart and the gut. Turn the heart forward and search for the vascular system draining the gut, spleen and associated structures. Draw and label. (18 marks)
 - By further dissection search for blood vessels that supply blood to the head, skin and stomach. Leave the heart undisplaced. Draw and label. (15 marks)
- 10 a) Explain five ways the animal is adapted to live in its habitat. (5 marks)
- b) Dissect the specimen to display the:
- The main routes of blood flow supplying the left anterior region of the specimen.
 - The main routes of blood flow draining the right hind limb of the animal to the heart, with the heart pinned forward through the ventricle. Draw and label your dissection. (30 marks)
- 11) You are provided with a freshly killed toad.
- Carefully observe the animal and explain five structural features that suit the animal to live on either land or water bodies. (5 marks)
 - Describe the position and structure of the following; Webbed toes, Cloaca, Head, Tongue: (8 marks)
 - Lay the specimen ventral side uppermost. Dissect it in the usual way, and remove the skin of the head, trunk and fore and hind limbs up to the elbow and knee respectively.

i) Draw and label the superficial structures.

(13marks)

ii) Describe the structural features of the skin and clearly indicate, how they relate to function.

(05marks)

c) Proceed to dissect and display the internal structures. Displace the stomach further to the right, the right lung to cover part of the heart. Search for blood vessels supplying the stomach, pancreas, and the right hand side of the animal anterior to the heart. Draw and label.

(16marks)

12. You are provided with a freshly killed frog.

a) Observe the fore and hind limbs and describe their structure. (04marks)

b)i) Outline three differences between the fore and hind feet. (03marks)

ii) Draw but don't label the hind foot. (03marks)

c) Lay the animal ventral side upper most. Dissect it in the usual way to display internal structures. Turn the dish side ways and cut through the right angle of the jaw, pharynx up to oesophagus. Pin a side the floor of the buccal cavity and pharynx. Search for structures used for feeding Search for blood vessels supplying the gut. Draw and label your dissection.

(22marks)

13. You are provided with a freshly killed frog.

a. i) Examine the head and describe how it is adapted to promoting the animal's survival. (05marks)

ii) Open the buccal cavity, using dissecting instruments search for a structure at the front of the floor of the buccal cavity, hold the structure, pull it and release it. State your observations and explain their significance in promoting the animal's nutrition. (03marks)

(b) Dissect the specimen and pull the skin off the body wall.

i) Describe its attachment on the body wall. (02marks)

ii) Examine the skin and explain three ways it is adapted to the process of gaseous exchange. (3marks)

c) Dissect the specimen further to display the routes of blood flow:

(i) Carrying blood from the head region on the right hand side of the specimen back to the heart.

- (ii) Carrying blood to the alimentary canal, displaced to the right and to the kidneys, the right turned to appear on top of the left. Without displacing the heart, draw and label your dissection. (25marks)

14) You are provided with a freshly killed toad.

a) With the mouth opened, pull out the tongue and pin it. Draw and label the head as observed in lateral view.(05marks)

b) Dissect the animal to display:

i) Blood vessels supplying the left hand lung, fore limbs, skin and head.

ii) Blood vessels draining blood from the right hand side of the animal EXCEPT the inner part of the hind limb. Turn the heart forward. Draw and label.

(28marks)

15. You are provided with a freshly killed animal labelled T.

a)i) State the sex of the animal. Give a reason for your answer.

ii) Outline 3 differences between the fore and hind limbs.

(b) Lay specimen T- ventral side upper most. Pin it and proceed to dissect, display:

i) Routes of blood flow draining blood from the left hand side of the head and lung to the heart.

ii) Routes of blood flow supplying the right forelimb, part of digestive system anterior to ileum and the urinogenital system. Displace the heart forward. Draw and label.

“with dexterity science is easy”.....john bruce.