THE RAT

Skills to be tested may include:

1. Carrying out instructions for dissection, displaying, drawing and labeling dissections.

THE RAT

Skills to be tested may include:

2. Performing simple physiological experiments, recording and interpreting the results. Examples include enzyme action from parts of the body such as liver, stomach and duodenum.

General requirements

1. Before attempting to answer any question ensure that you have understood the question.

General requirements

2. Even if you think you know the systems required in the question and you have theoretical diagrams, please carry out the instructions and draw an original diagram.

General requirements Cont….

3. Your drawings should be as original as possible and a representation of your dissection and NOT what you ought to have seen.

Drawings

Remember that examiners mark the drawings and not the dissection, thus ensure that your drawing is the correct representation of your dissection.

Drawings

Qualities of a good diagram

- Should have a title.
- Should have a magnification.
- Should be drawn in pencil and neat; avoid rubbing or use a white rubber.

Drawings

Qualities of a good diagram

- The drawing should have an outline.
- The drawing should be proportional, i.e. parts drawn to relative sizes.
- Avoid ambiguities. If a structure crosses or pass under one another, indicate this clearly or it may be assumed that they join.

Drawings

Qualities of a good diagram

Good diagrams can be achieved by continuous practice

Classification:

Note that;

1. When stating the "taxa" spellings are very important.
2. When giving reasons to justify the taxa; use only those that are observable external features.

Kingdom-Animalia

Characteristics

1. Has mouth for heterotrophic nutrition; this distinguishes it from plants that make their food
2. It's multicellular; this distinguishes it from protista that mostly unicellular such as amoeba

Kingdom-Animalia

Characteristics

3. Has limbs for locomotion; this distinguishes it fungi that are multi cellular and heterotrophic but not mobile.

Phylum: Chordata

- Characteristics

1. Has strong strengthening rod felt/back bone.
2. It is bilaterally symmetrical
3. Has a brain case/skull.

Phylum: Chordata

Other animals in phylum chordata include

fish, amphibian, reptile and birds.

Class- Mammalia

Characteristics

- Body covered by fur
- Possess external ear lobes/pinnae
- Presence of vaginal opening and teats in female or scrotum and prepuce in male

EXTERNAL FEATURES

- *Terms used to describe the topography of an animal include:*

- Dorsal – back side,
- Ventral –front side,
- Anterior – head side,
- Posterior – away from the head.

Identification of the sex of the rat

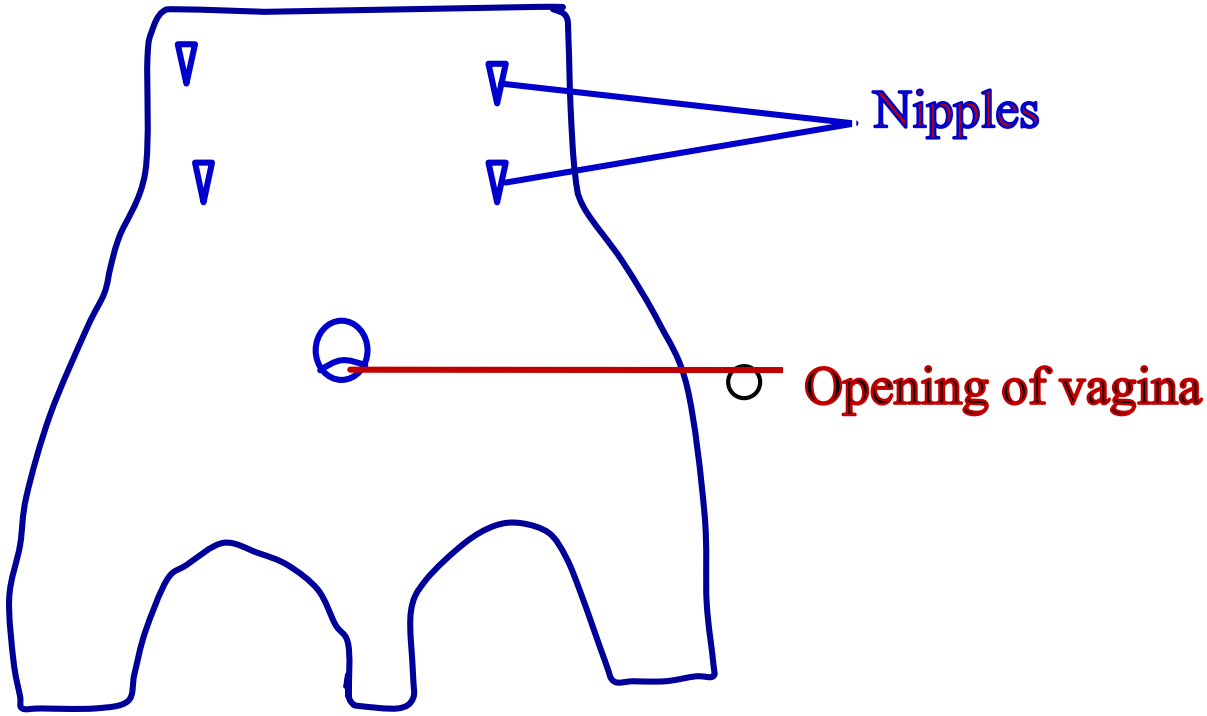
- This depends on whether you are dealing with a male or female rat.

  Lets start with female rat and then deal with the male rat later.

External features of a female rat

1. A female rat has teats or nipples leading to mammary glands.
2. A female rat has a vaginal opening.

A drawing of the structures used to identify a female rat



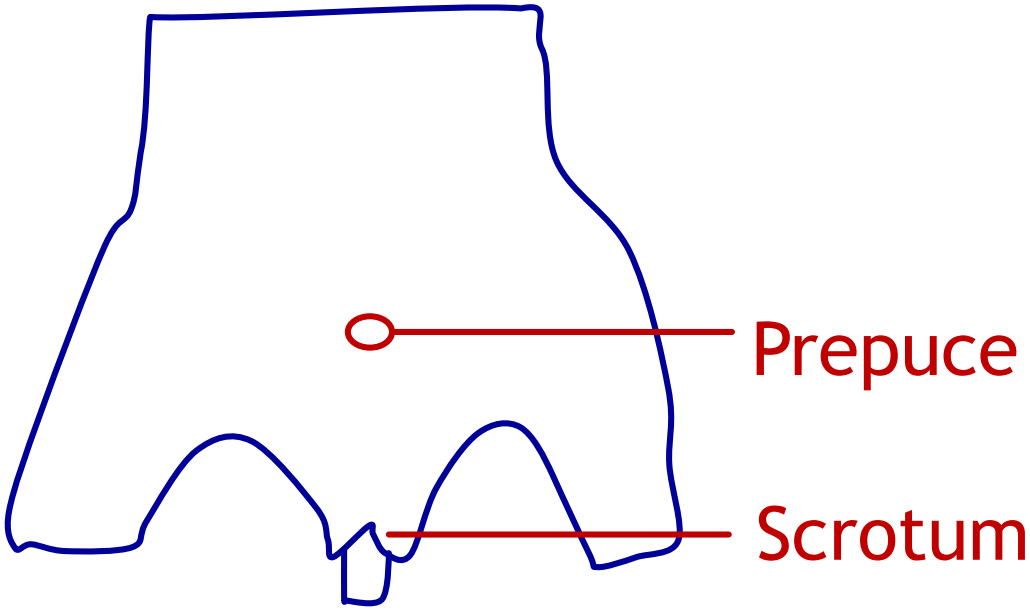
External features of a female rat

- * Terms like mammary glands, vagina and anus are not correct*
- We do not see mammary glands we see teats leading to mammary glands.
- We do not see vagina we see an opening to the vagina
- We do not label the anus because it is not used to identify the sex of a rat.

External features of a .male rat

- A male rat has prepuce covering the penis.
- And a scrotal sac or scrotum covering the testis.

A drawing of the structures used to identify a male rat



- Terms like sack, suc, suck, testes because they are wrong spellings.
- testis is also not correct because we don't testis but the scrotum.

The Head

- **Shape:** It is pear shaped

- *Adaptation of the shape*:

  It gives the animal a streamline body for easy movement.

The Head

- **Shape:** It is pear shaped

- *Adaptation of the shape*:

  It gives the animal a streamline body for easy movement.

Structures on the Head

- **Eyes with eyelids**
- **Whiskers**
- **Ears**
- **Nostril**
- **Mouth**

Ear

- **Location**: - The ear is dorso-laterally located on the head, i.e. it is at the junction between the dorsal and lateral side of the head.

Ear

- **Structure:-** **The ear is less hairy (to increase heat loss on a hot day)**

  - The Ear has a broad and funnel shaped pinna (to collect sound waves).

The whiskers

Structure : they are long stiff hairs

Location: on the lateral sides of the head

Function : sensitive to touch

The whiskers

Structure : they are long stiff hairs

Location: on the lateral sides of the head

Function : sensitive to touch

Adaptations to their function

- Long to sense far obstacles and estimate size of burrow.
- Stiff to prevent them from collapsing.

Eyes

- **Location:- Dorso-laterally located on the head.**

  (to provide a large angle vision or a wide field of view)

Nostrils

- **Structure:** - the nostrils are open coma shaped holes for letting in and out air.

- **Location:** - the nostrils are anteriorly located on the head. (to detect smell and direction of food and predator).

Mouth

- **Location:-** on ventral and anterior side of the head.

Mouth

- **Adaptations:** - has teeth (to bite and chew food).
- has tongue (to taste food).

Mouth

Adaptations:

- has teeth (to bite and chew food).
- has tongue (to taste food).
- has saliva (i.e. moist for softening food).

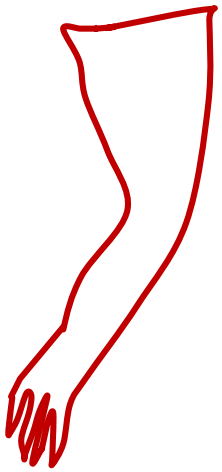
Limbs

Note that:

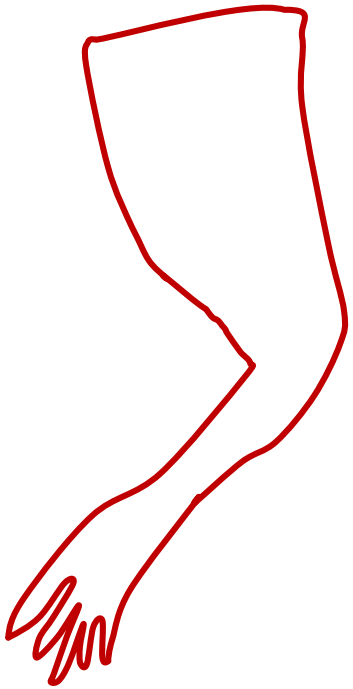
- the hind limbs are longer and more muscular than the fore limbs.
- The hind limb has five digits whereas the fore limb has four digits.

A drawing of the fore and hind limbs to the same magnification.

Fore limbs



Hind limbs



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Differences between the fore and hind limb.

Fore Limb

- **Short and stout (to absorb shock on landing and to reduce weight when the rat is standing on hind limbs).**

Hind Limb

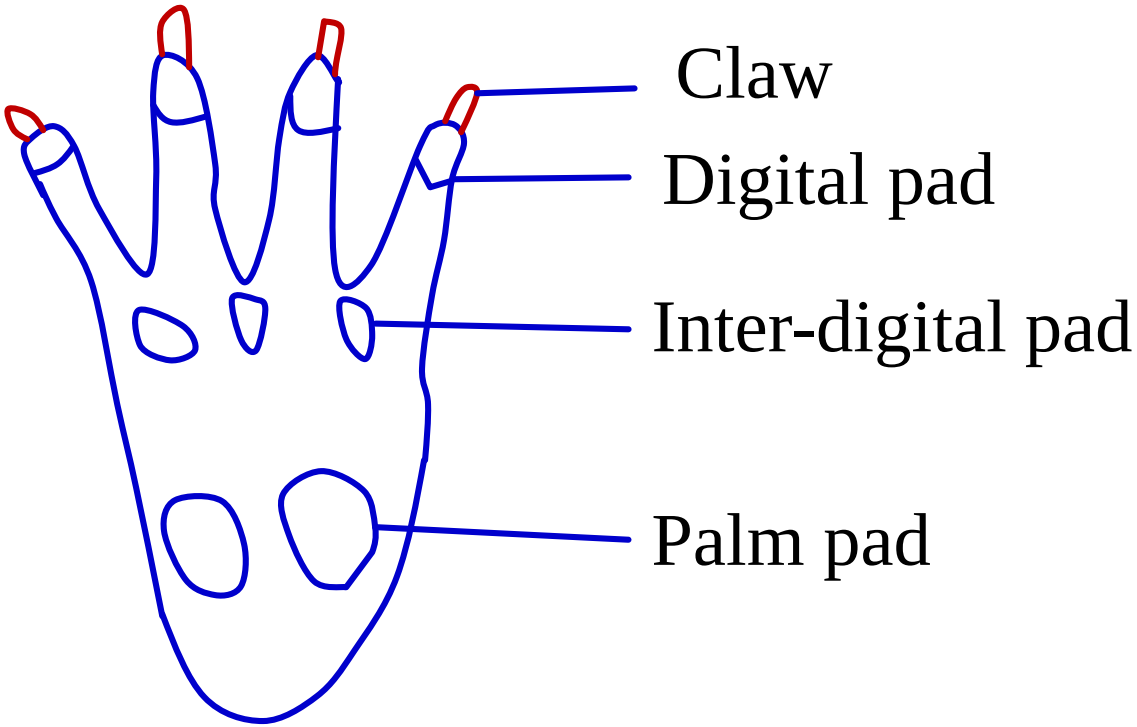
- **Long and muscular (to provide propulsion force).**

Differences between the fore and hind limb.

Fore Limb	Hind Limb
▶ **Has four digits**	▶ **Has five digits**

Limbs

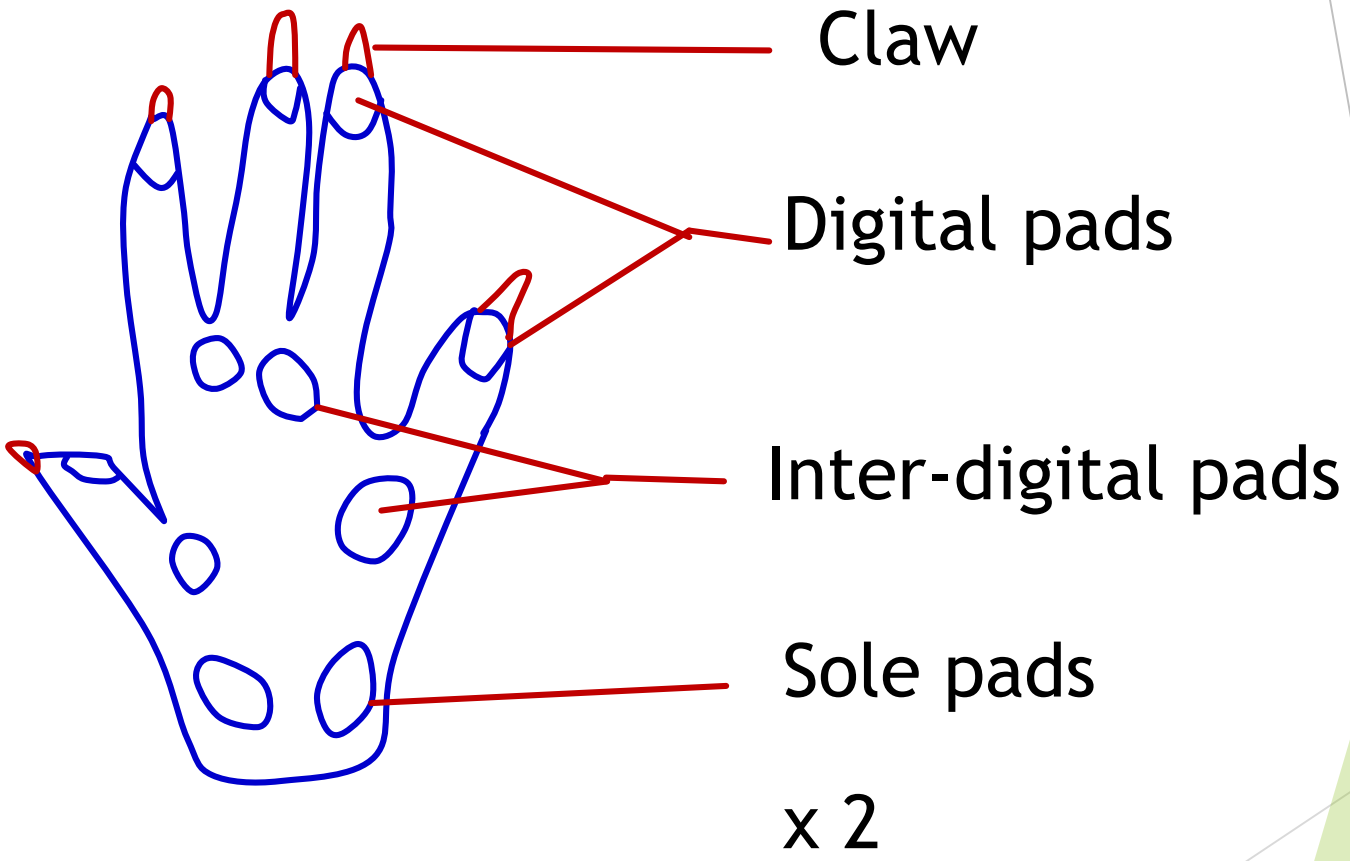
A drawing of the ventral side of the fore limb



Hind foot

The hind foot has five digits, each digit has a claw, and a digital pad. There are inter digital pad between the digits and two sole pads.

A drawing of the ventral side of the hind foot



Adaptation of the foot to its functions

- Has claws (for burrowing, grabbing food, scratching enemy).
- Toes are joined and spread (for stability).

Adaptation of the foot to its functions

- Has soft pads (for firm grip on a slippery floor, and also to reduce sound during movement).

Structure for defense

- **Teeth** (for biting the enemy).

Adaptations

- They are sharp and strong

- **Claws** (for scratching the enemy)

Structure for defense

- **Teeth** (for biting the enemy).

Adaptations

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- **Claws** (for scratching the enemy)

Adaptation

- They are sharp and strong.

Structure for defense

- **Tail – (beating the enemy)**

Adaptations

- **It is long and muscular to inflict pain.**

Adaptation of the rat to its ecology

Anything that enable the rat to live a successful is given as an adaptation to its ecology

- **Has large dorso-ventral eyes for effective sight for food and enemy.**

Adaptation of the rat to its ecology

Anything that enable the rat to live a successful is given as an adaptation to its ecology

- **Has nostrils to detect smell of food and enemy.**

Adaptation of the rat to its ecology

Anything that enable the rat to live a successful is given as an adaptation to its ecology

- **Has hair to reduce water and heat loss**

Adaptation of the rat to its ecology

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- **Has legs for locomotion.**

Adaptation of the rat to its ecology

Anything that enable the rat to live a successful is given as an adaptation to its ecology

- **Has tail same size as the body for balancing and defense.**

Adaptation of the rat to its ecology

Anything that enable the rat to live a successful is given as an adaptation to its ecology

- **Has claws for digging burrow, grip and hold food**

Adaptation of the rat to its ecology

Anything that enable the rat to live a successful is given as an adaptation to its ecology

- **Has vibrissae/whiskers that are sensitive to touch.**

Adaptation of the rat to its ecology

Anything that enable the rat to live a successful is given as an adaptation to its ecology

- **Has ears for detecting sound waves.**

Adaptation of the rat to its ecology

Anything that enable the rat to live a successful is given as an adaptation to its ecology

- **Has thick long and strong hind limbs for propulsion.**

Adaptation of the rat to its ecology

Anything that enable the rat to live a successful is given as an adaptation to its ecology

- **Has nictating membrane to wash off foreign particles from eyes.**

Internal structures

Note that:

1. The rat is dissected upside down; .in this position your right is its left and vice- versa.

Internal structures

Note that:

1. The rat is dissected upside down; .in this position your right is its left and vice- versa.
2. During marking the teachers mark the drawing but not the dissection; therefore, endeavor to make the right drawing.

Question 1

- Remove the skin from the specimen to expose the glands and muscles on the ventral side of the neck and the chest region and draw.

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- Cut to remove the skin, pin it on the side.

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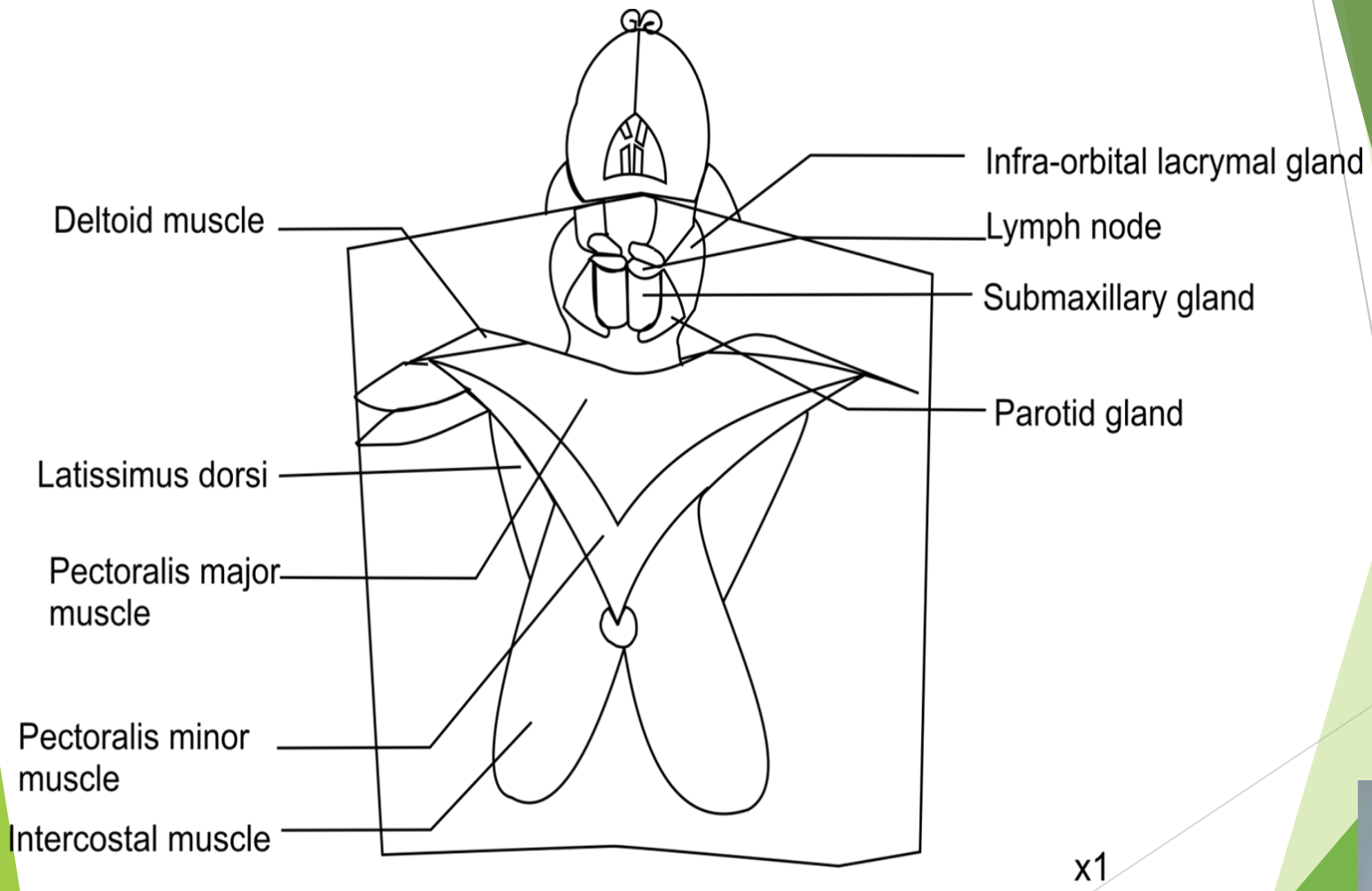
- Remove the skin from the specimen to expose the glands and muscles on the ventral side of the neck and the chest region and draw.
- Remove the tissue from the neck to expose the glands.

A drawing of the glands, muscles and structures in the neck and chest region



Question 2

- Open the abdomen, expose and draw the visceral structures in undisturbed form and draw.

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- Open the abdomen, expose and draw the visceral structures in undisturbed form and draw.
- Let us open the abdomen to observe the required parts.

Question 2

- Open the abdomen, expose and draw the visceral structures in undisturbed form and draw.
- We are expected to see,

  Liver lobes, stomach, spleen, duodenum, pancreas, small intestines, caecum, appendix, and urinary bladder.

Question 2

We are expected to see,
liver lobes, stomach, spleen, duodenum, pancreas, small intestines, caecum, appendix, and urinary bladder.

- In the male rat we may see in addition, seminal vesicle, coagulating gland and prostate gland.

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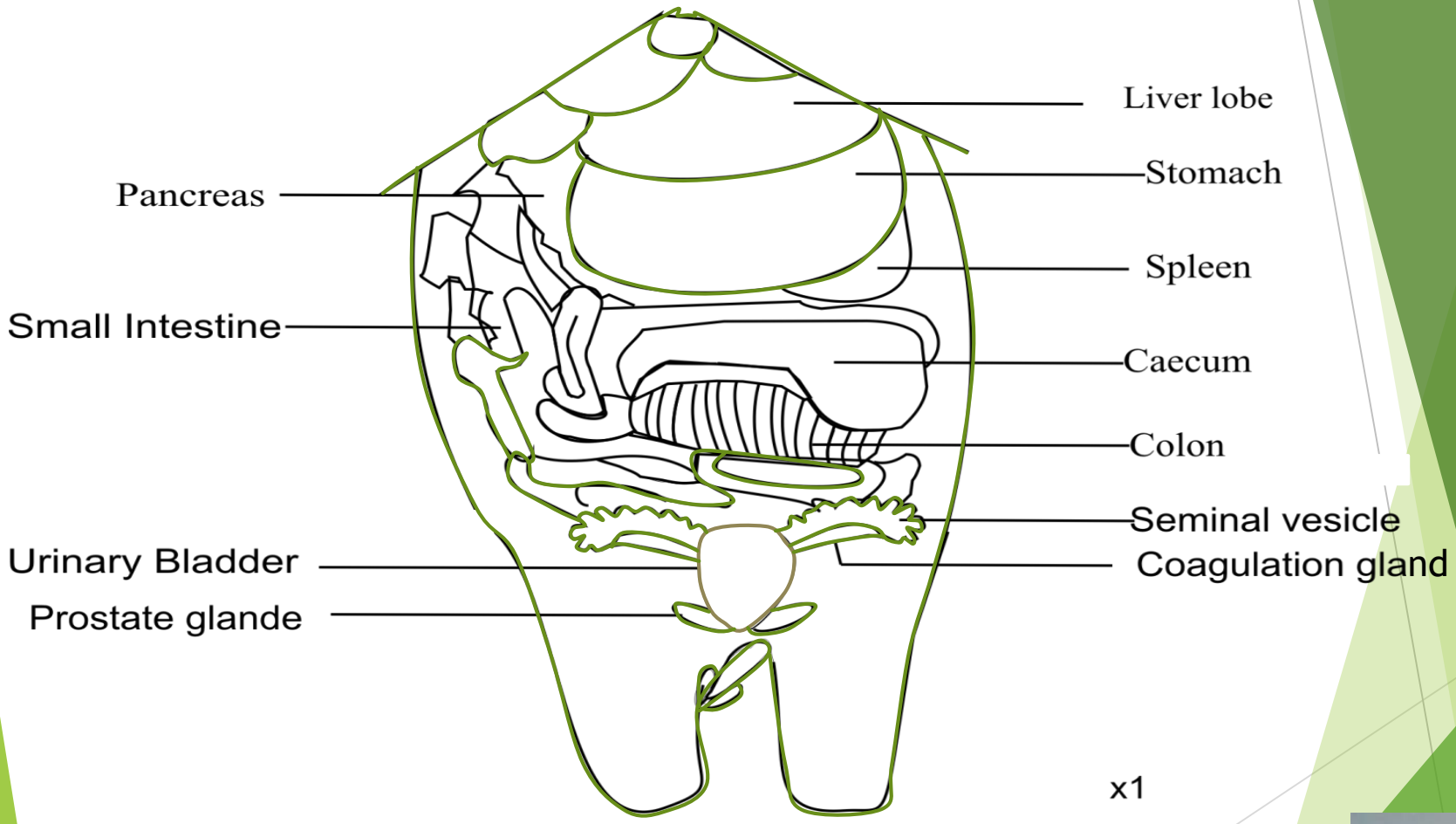
liver lobes, stomach, spleen, duodenum, pancreas, small intestines, caecum, appendix, and urinary bladder.

- In the female rat we may see:
  vagina and uterus lacking in the male rat.

A drawing of abdominal structures of male rat in undisturbed form.



Question 3:

Expose blood vessels that drain the digestive system and draw.

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To see these blood vessel we put the intestines to the right,

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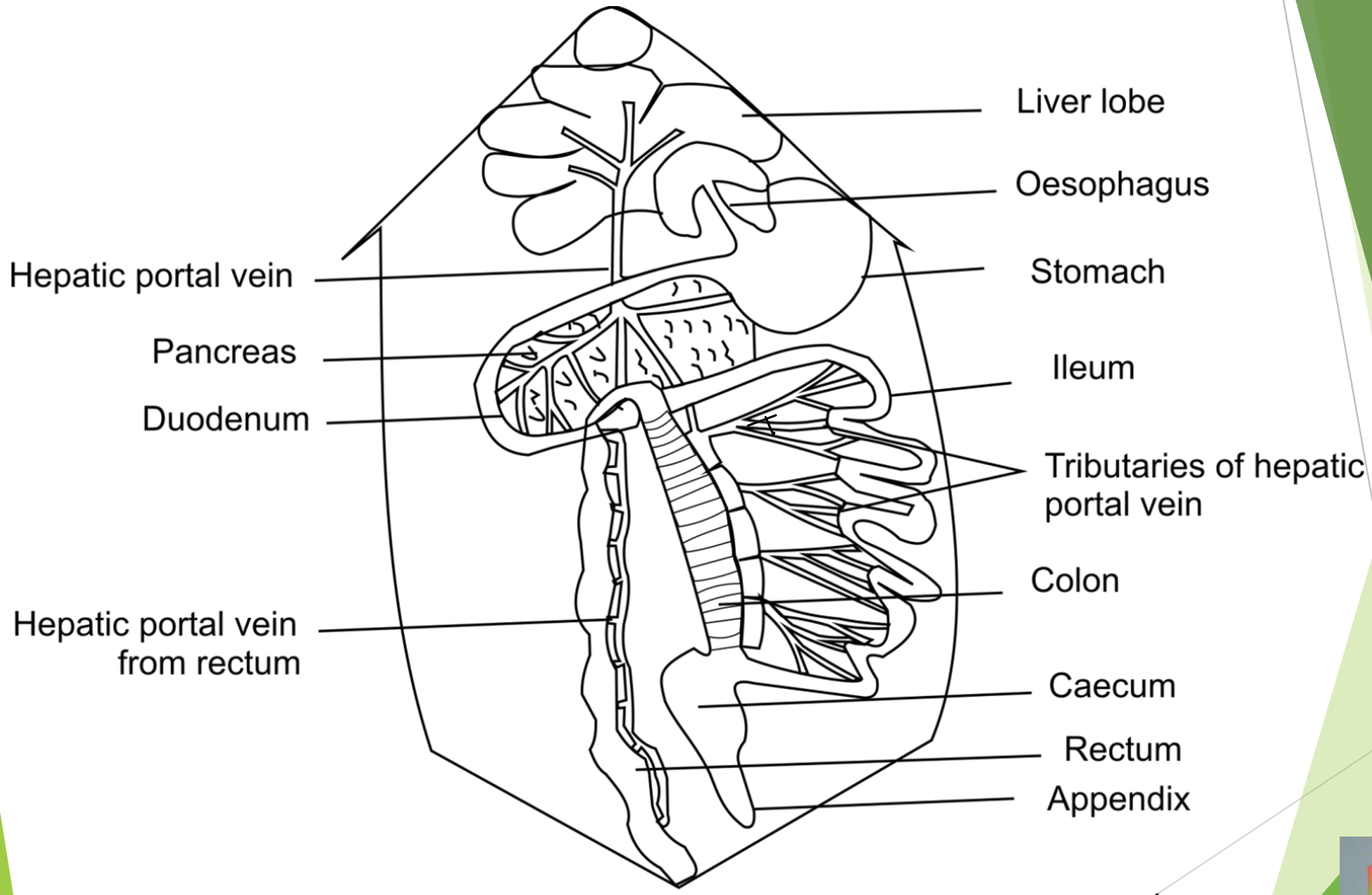
Expose blood vessels that drain the digestive system and draw.

To see these blood vessel we put the intestines to the right, the duodenum and rectum to the left.

A drawing of blood vessels that drain the digestive system.



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Question 4:

Expose blood vessels that supply the digestive system and draw.

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Blood vessel that supply the body are the arteries, the question may be rephrased as: expose the arteries that supply the digestive system.

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These are

- ***Coeliac artery***

Question 4:

Expose blood vessels that supply the digestive system and draw.

Blood vessel that supply the body are the arteries, the question may be rephrased as: expose the arteries that supply the digestive system.

These are

- ***Anterior mesenteric artery***

Question 4:

Expose blood vessels that supply the digestive system and draw.

Blood vessel that supply the body are the arteries, the question may be rephrased as: expose the arteries that supply the digestive system.

These are

- ***Posterior mesenteric artery***

Question 4:

Expose blood vessels that supply the digestive system and draw.

- To see blood vessels that supply the digestive system we place the intestines to the right of the animal. Just above left renal vein we find the coeliac artery that supplies the stomach, liver and the pancreas.

Question 4:

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- To see blood vessels that supply the digestive system we place the intestines to the right of the animal. Just above left renal vein we find the coeliac artery that supplies the stomach, liver and the pancreas.

Question 4:

Expose blood vessels that supply the digestive system and draw.

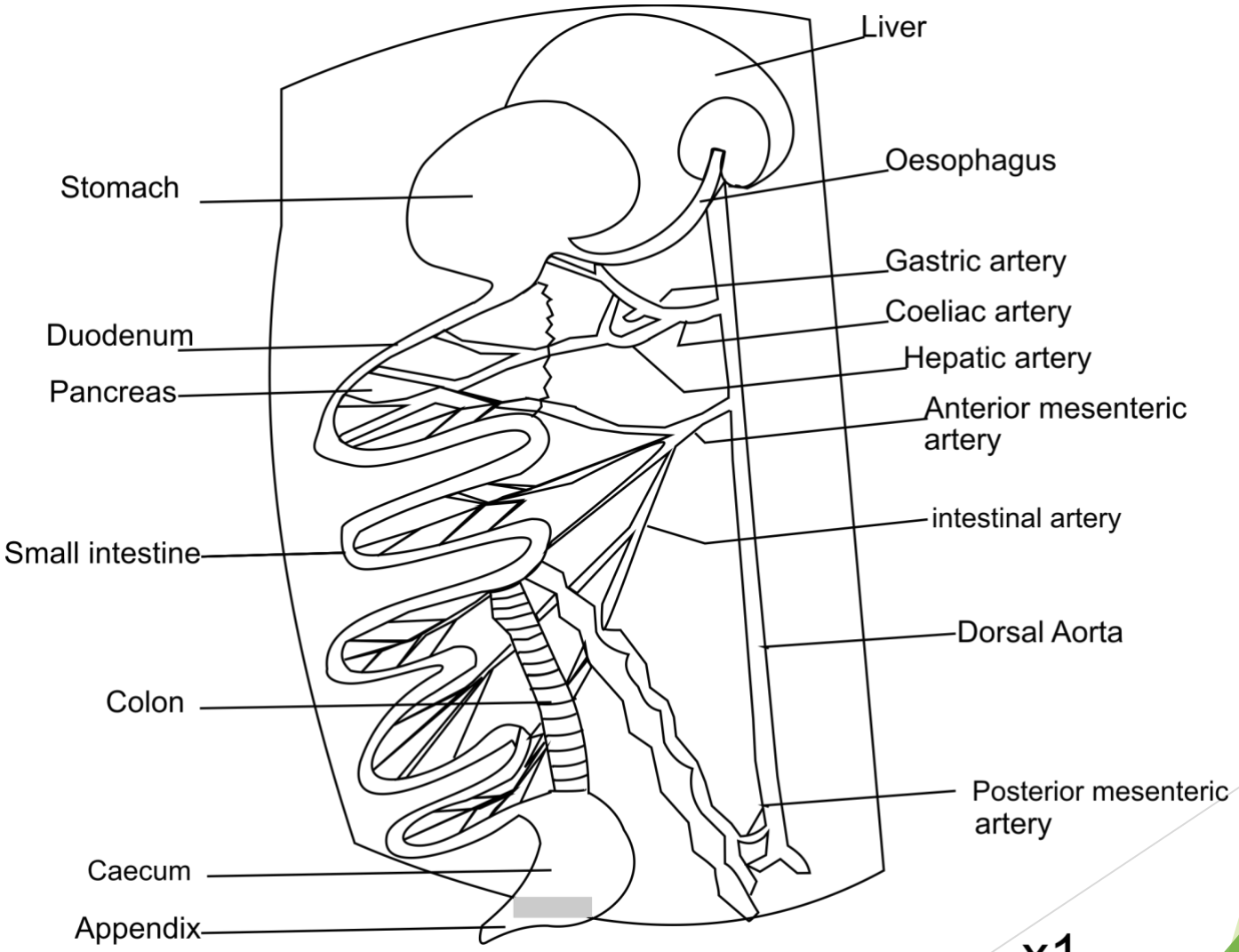
- Then the anterior mesenteric artery supplies the intestine.

Question 4:

Expose blood vessels that supply the digestive system and draw.

- The posterior mesenteric artery is found at the junction between the dorsal aorta and common iliac arteries

A drawing of blood vessels that supply the digestive system



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Question 4:

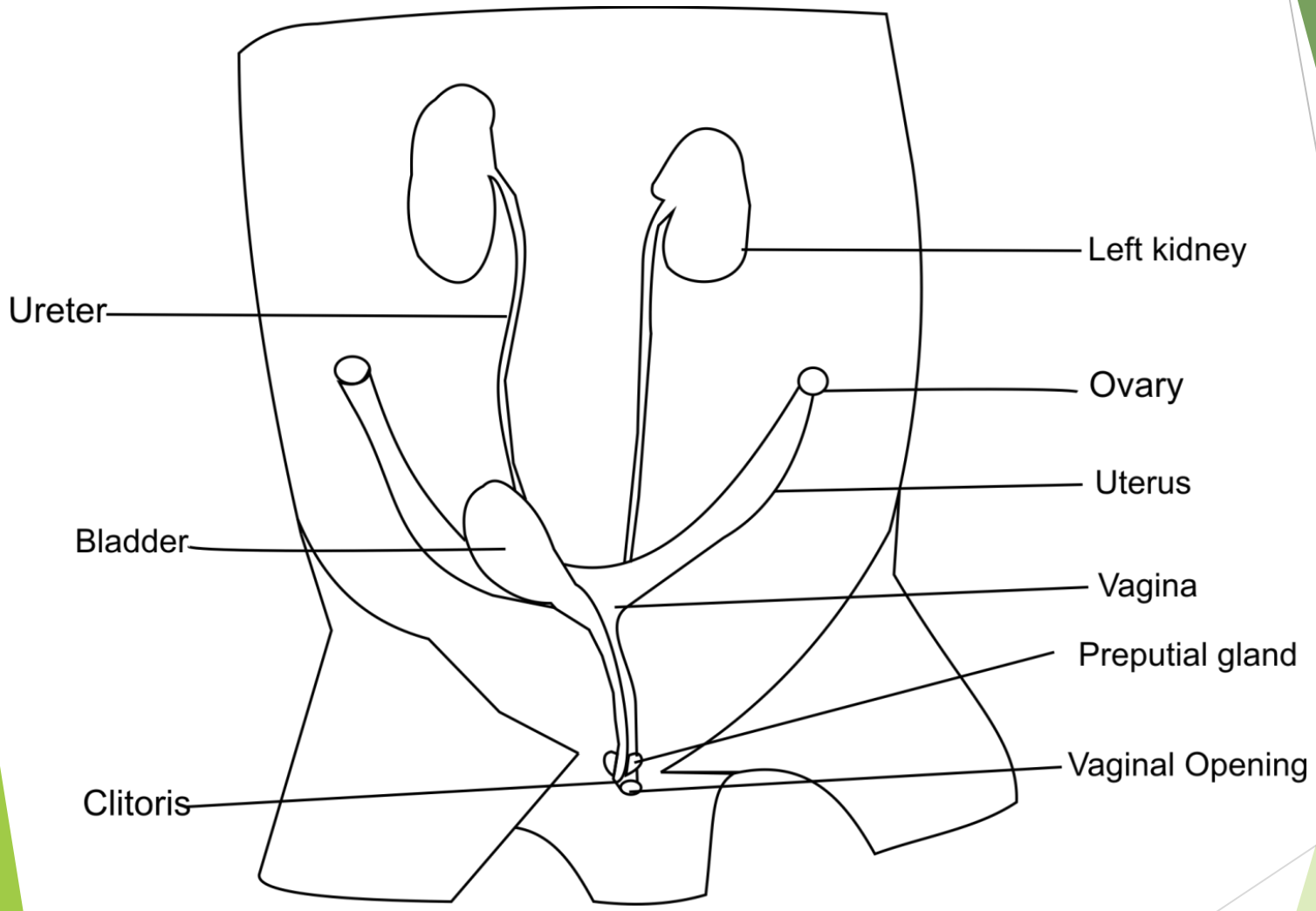
Expose blood vessels that supply the digestive system and draw.

- Labeling parts of the digestive system is necessary in order to show the relationship between the blood vessels and parts of the digestive system.

Question 5:

- Remove the structures responsible for digestion and strip off any unnecessary tissue to expose the urinogenital system. Carefully; observe the system and make a large clearly labelled drawing.

A drawing of urinogenital system of a female rat



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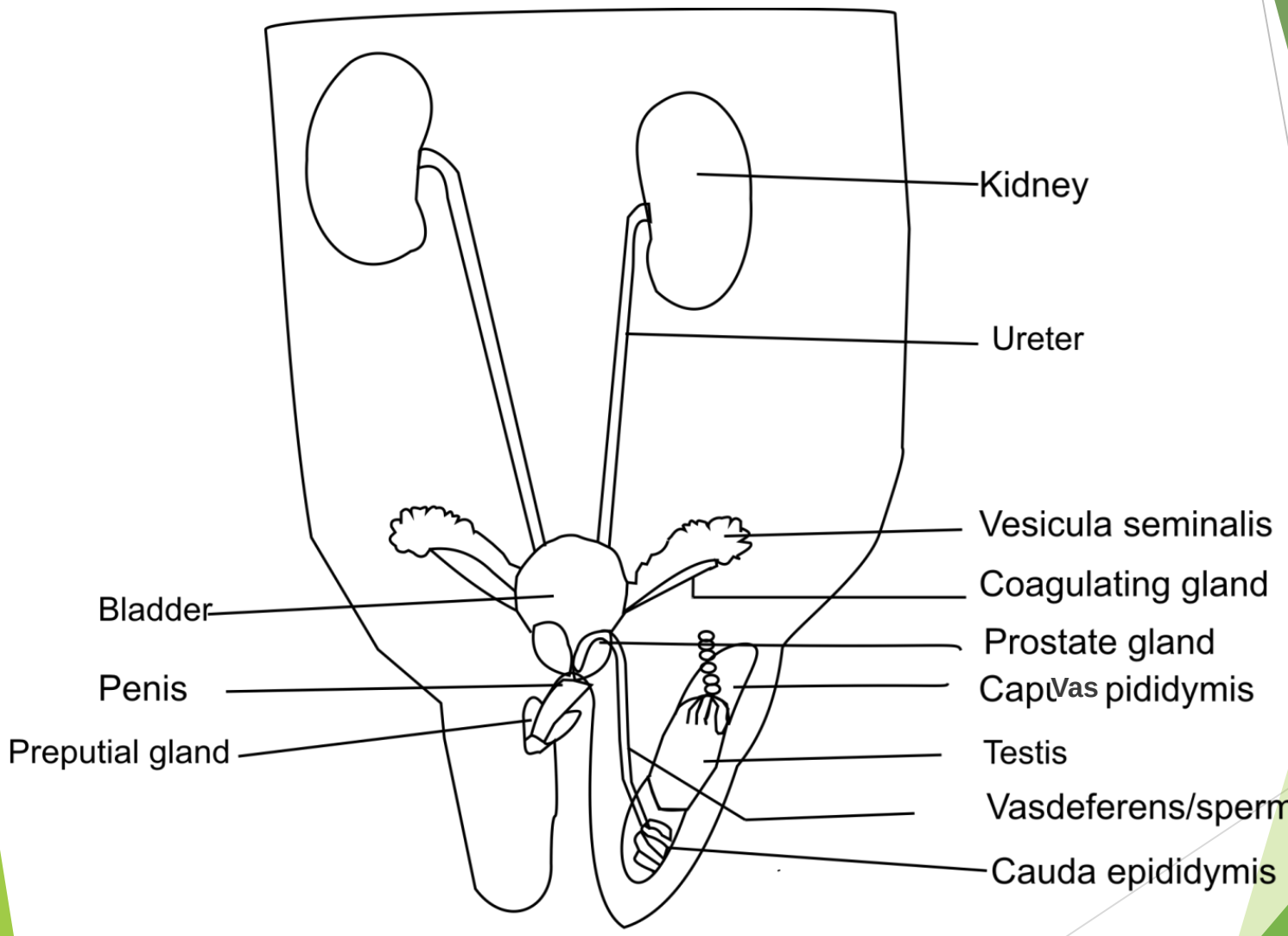
A drawing of urinogenital system of male rat



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Question 5: Urinogenital system

Structures exclusively for excretion include:

- Kidney, ureter and bladder.

Question 5: Urinogenital system

- **Structures exclusively for reproduction include:**

- **Male: Testes, vas deferens and prostate gland.**
- **Female: Ovary, Oviduct, uterus and vagina.**

Question 6:

Expose blood vessels that drain the left kidney and left limb and draw.

Question 6:

Expose blood vessels that drain the left kidney and left limb and draw.

We are expected to see

Left kidney

left renal vein

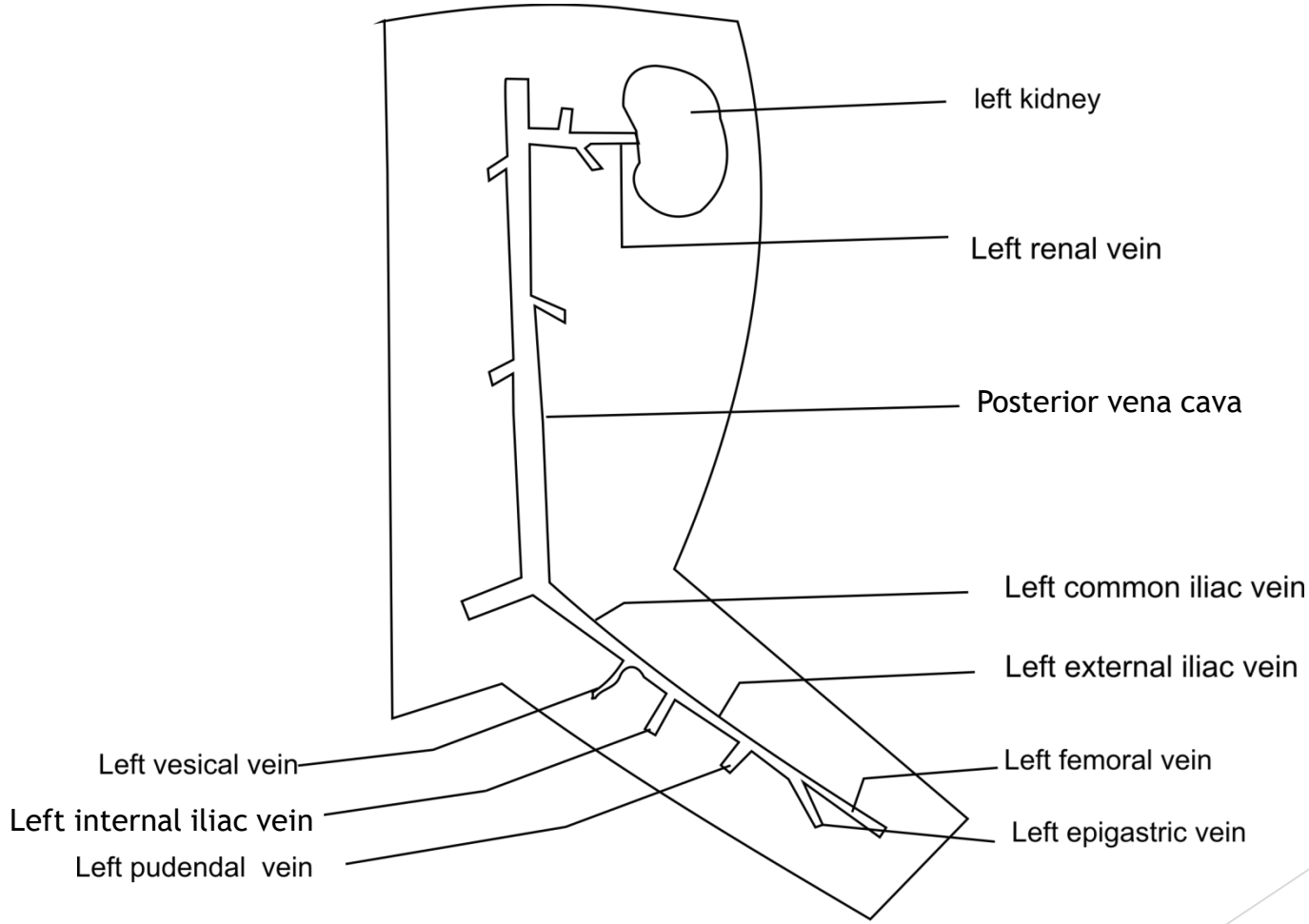
posterior vena cava

left common iliac vein

left vesical vein

left internal iliac vein

A drawing of blood vessels that drain the left kidney and left hind limb



Note that prefix 'left' is necessary on each vein because there are corresponding veins in the *right side* of the rat

The rib cage

Structure: The rib cage is tubular and rigid.

The rib cage

Structure: The rib cage is tubular and rigid.

Adaptation of the rib cage to its functions

- The rib cage is tubular to provide room for the heart and lungs.

The rib cage

Structure: The rib cage is tubular and rigid.

Adaptation of the rib cage to its functions

- The rib cage is tubular to provide room for the heart and lungs.
- The rib cage has rigid ribs to protect the heart and lungs.

The diaphragm

Structure: circular and dome shaped with a central tendon and peripheral muscular portion.

.

The diaphragm

Adaptation of the diaphragm to its functions

- **The diaphragm is muscular to prevent the liver and intestines from entering the rib cage;**

The diaphragm

Adaptation of the diaphragm to its functions

- **Contraction of the diaphragm muscles flattens the dome increasing volume of the thorax (decreasing pressure) to allow air into the lungs.**

The diaphragm

Adaptation of the diaphragm to its functions

- **Relaxation of the muscles create a dome shape that reduces the volume of the thorax, pushing the air out of the lungs.**

Question 7

- Lift the xiphoid cartilage and cut along the lower edge of the rib cage. Tie the xiphoid cartilage, pull it back and pin it down, cut a long the side wall of the thorax on both sides to remove the rib cage.

Question 7

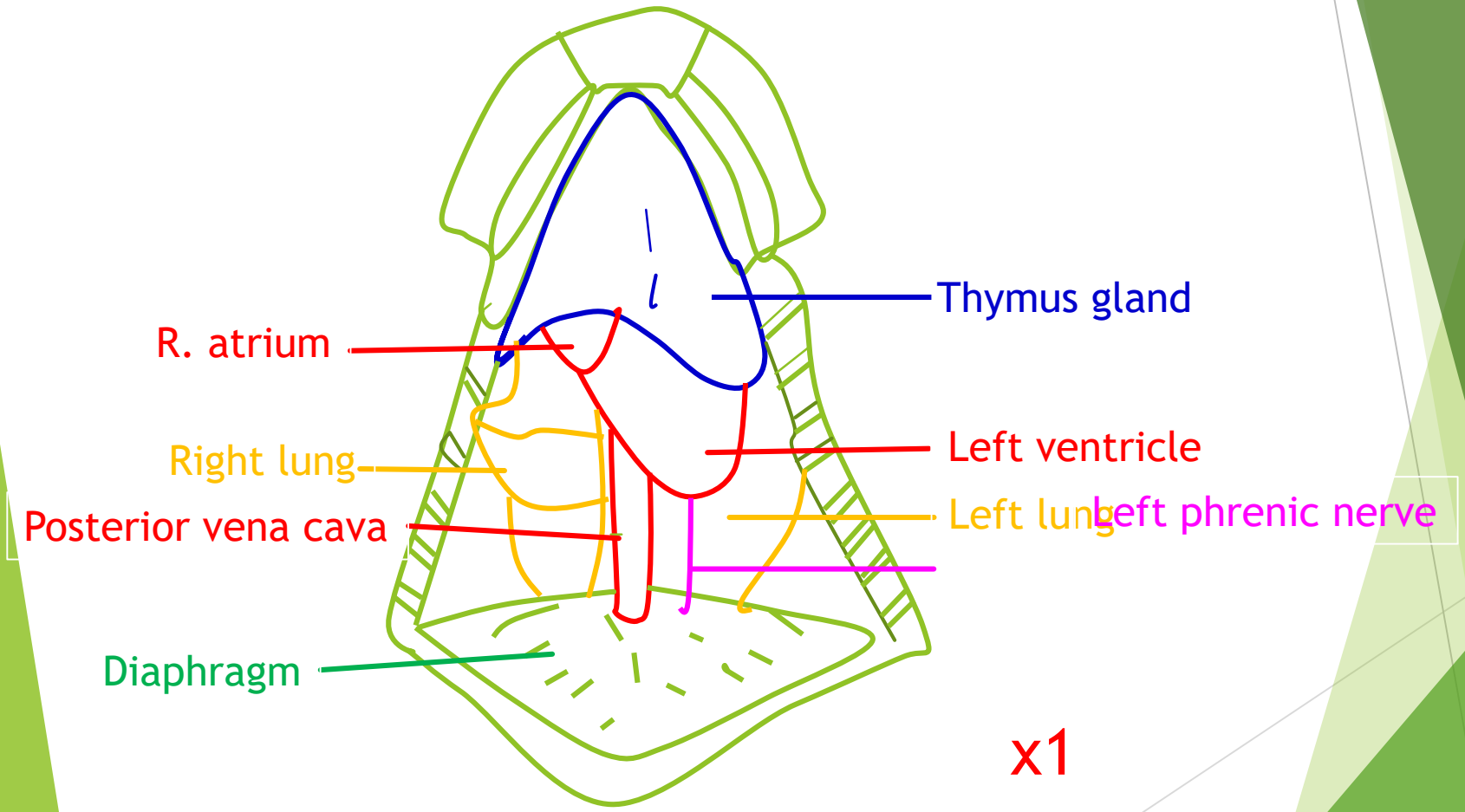
- This should expose the main blood vessels, nerves, and glands in this region. Draw the structures in chest cavity undisturbed form.

Question 7 Structures in chest cavity

These structures include:

- Thymus
- Ventricles of the heart
- Left lung
- Post-caval lobe of right lung
- Left phrenic nerve
- Lobes of left lung
- and inferior vena cava

A drawing of visceral structure of the chest region in undisturbed form



Question 8

Expose blood vessels, and structures in the neck and chest regions, remove the thymus gland but leave the heart undisplaced and draw.

Question 8: structures in neck region

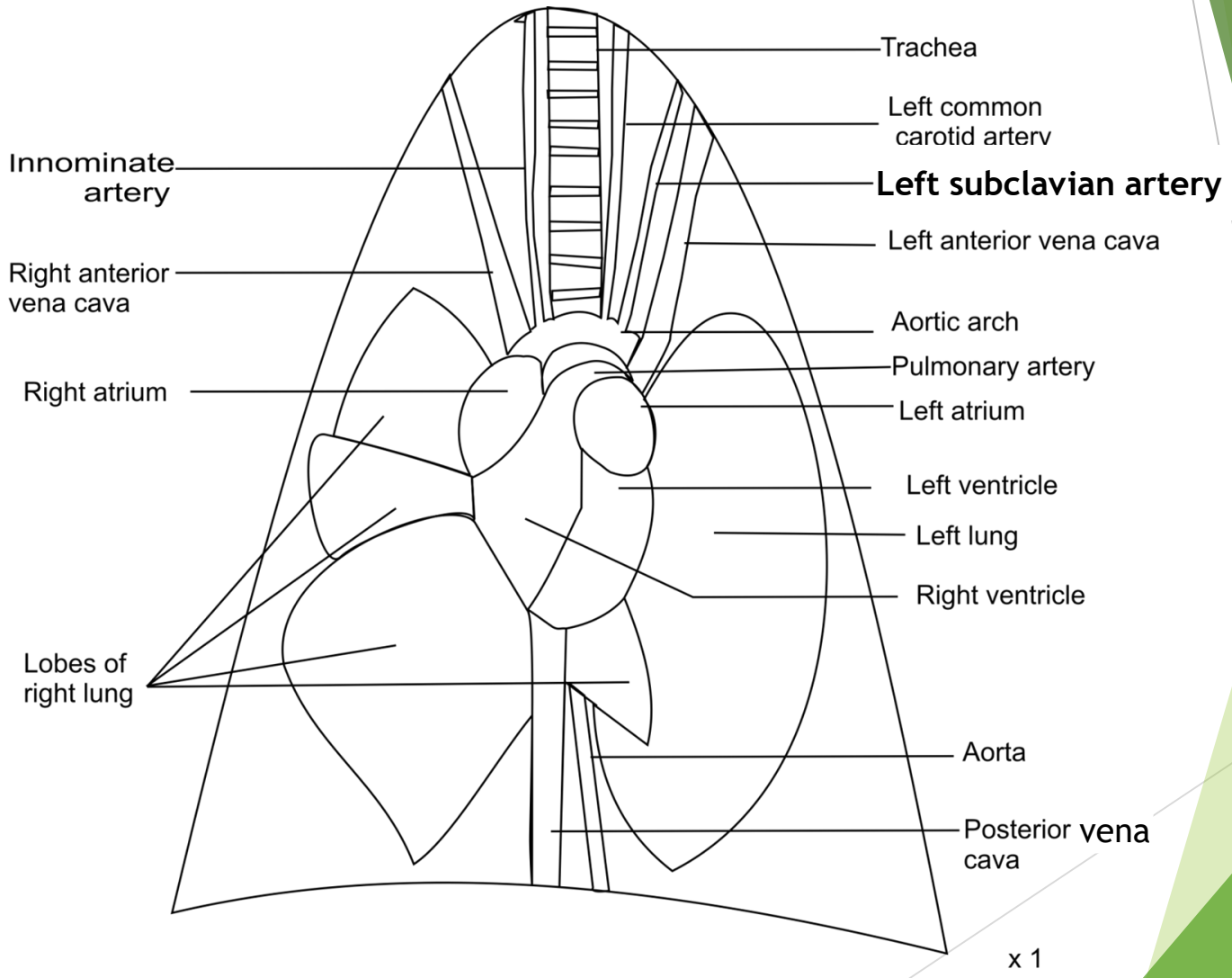
- Remove the thymus gland to expose the structures.

Question 8: structures in neck region

These include

Trachea, Left subclavian artery, Left anterior vena cava, Aortic arch Pulmonary artery Left ventricle Left lung, Aorta, Posterior vena cava, Innominate artery, Right anterior vena cava, Right atrium, Lobes of right lung

A drawing of structures in the neck and chest the heart undisplaced and, the thymus gland removed



Question 9

Expose blood vessels, and structures in the neck and chest regions, remove the thymus gland and displace the heart to the right of the animal and draw.

This is similar to question 8 except that the heart is displaced to right of the animal.

A drawing of blood vessels in the neck and chest regions, the heart displaced to the right and the thymus gland removed

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Question 10

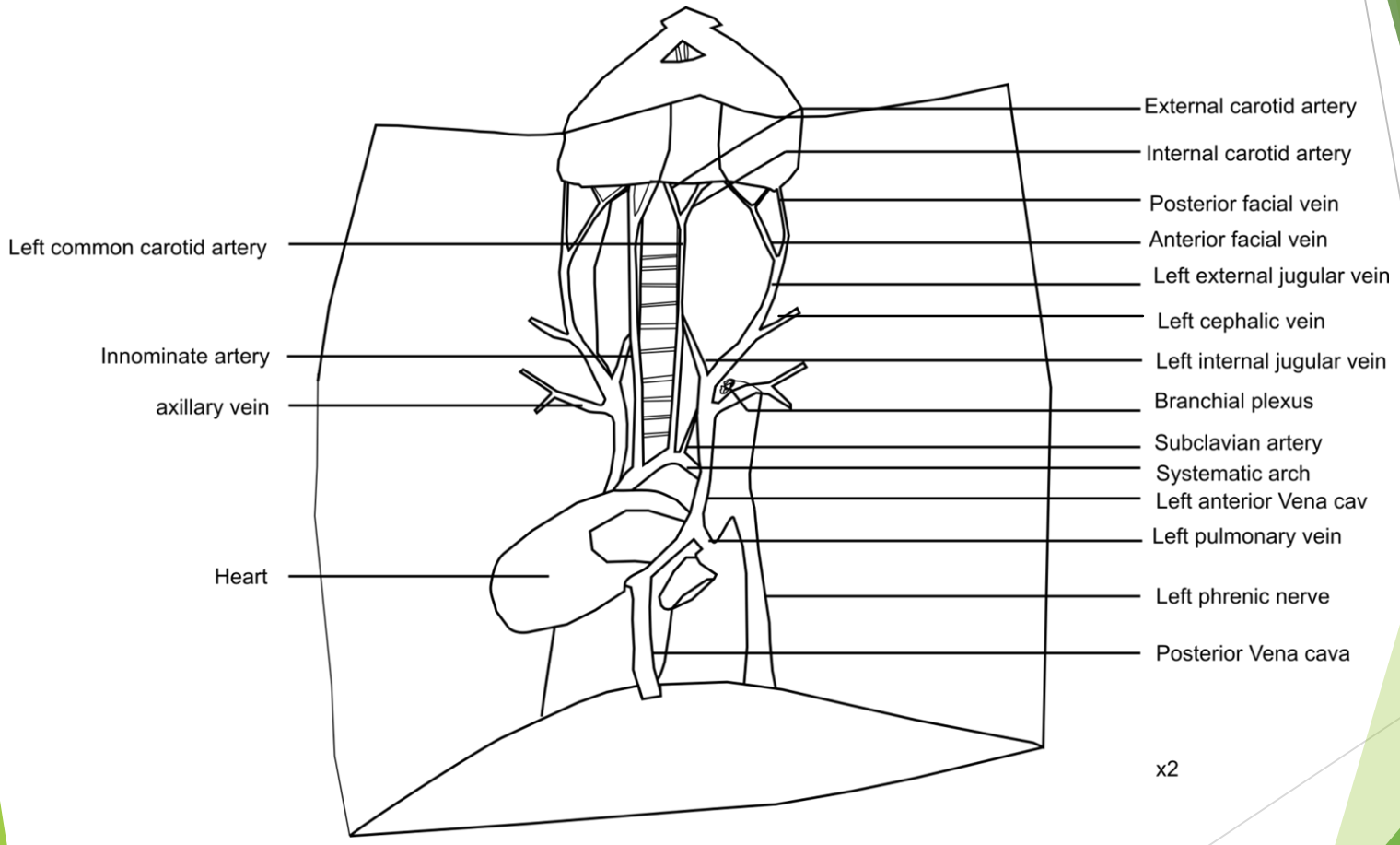
Lift the xiphoid cartilage and cut along the lower edge of the rib cage. Tie the xiphoid cartilage, pull it back and pin it down, cut a long the side wall of the thorax on both sides to remove the rib cage.

This should expose the main blood vessels, nerves, respiratory tract and glands in this region. Draw the neck region and label clearly.

Question 10

This is similar to question 9 but include veins and arteries in the neck region.

A drawing of the heart, blood vessels and nerves in the chest and neck region



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The Lungs

Colour: **Red/pink**

Structure: **sponge-like**

The Lungs

Relating the colour and structure of the lungs their function

- **The lungs are sponge-like because it contains numerous air sacs that increase the surface area for gaseous exchange**

The Lungs

Relating the colour and structure of the lungs their function

- **The lungs are red because they contain numerous blood capillaries that bring deoxygenated blood and carry away oxygenated blood maintaining diffusion gradient.**

The Trachea

Structure: Cylindrical tube with rigid cartilaginous rings with interval of non-cartilaginous rings

The Trachea

Adaptations:

It is rigid such that it remains open when the pressure in the thorax cavity falls.

The Trachea

Adaptations:

It is tubular to allow passage of air.

The Trachea

Adaptations:

The trachea is rigid with interval of non cartilaginous rings for flexibility.

Question 11

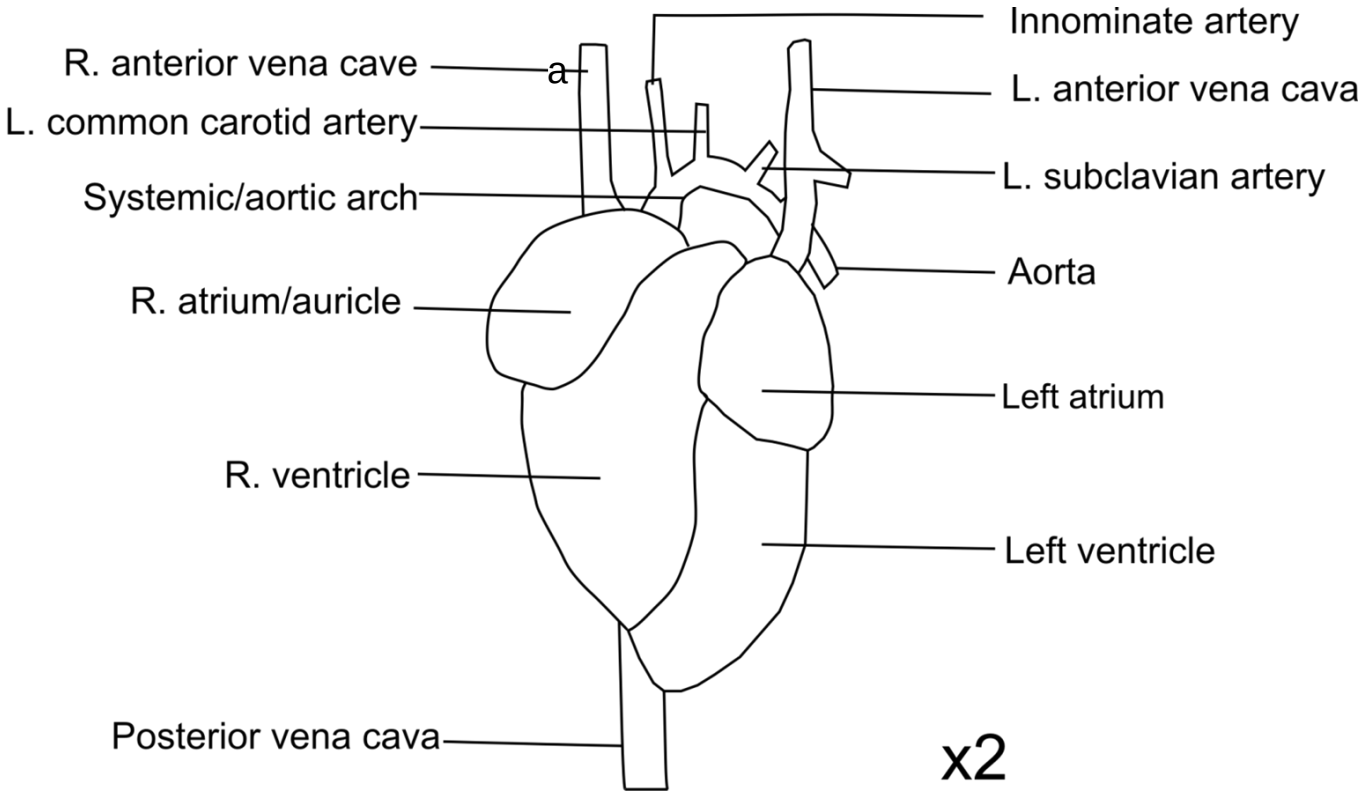
Carefully remove the heart from the chest cavity, by first ligaturing the major blood vessel to and from the heart.

Question 11

Carefully remove the heart from the chest cavity, by first ligaturing the major blood vessel to and from the heart.

Draw and label the ventral view of the heart.

A drawing of the ventral view of the heart with the major blood vessels



The Heart

The Heart

Structure:

- It is muscular with four chambers i.e. Two atriums or auricles and two ventricles.
- The wall of left ventricle is thicker than that of right ventricle.

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The Heart

Significance of the differences between the left and right ventricles

The walls of the left ventricle are thicker because they pump blood a long distance around the body while the right ventricles pumps blood a short distance to the lungs

Carrier guidance

- **To pass biology you have to develop the right attitude towards the subject and then work hard towards success. It is actually easier to study hard for a short while and get a job of your dreams than doing a disinteresting job for the rest of your life.**