

3.1

Parts of the digestive system

Science understanding

Visual/Spatial

Your digestive system changes the food you eat into a form your body can use.

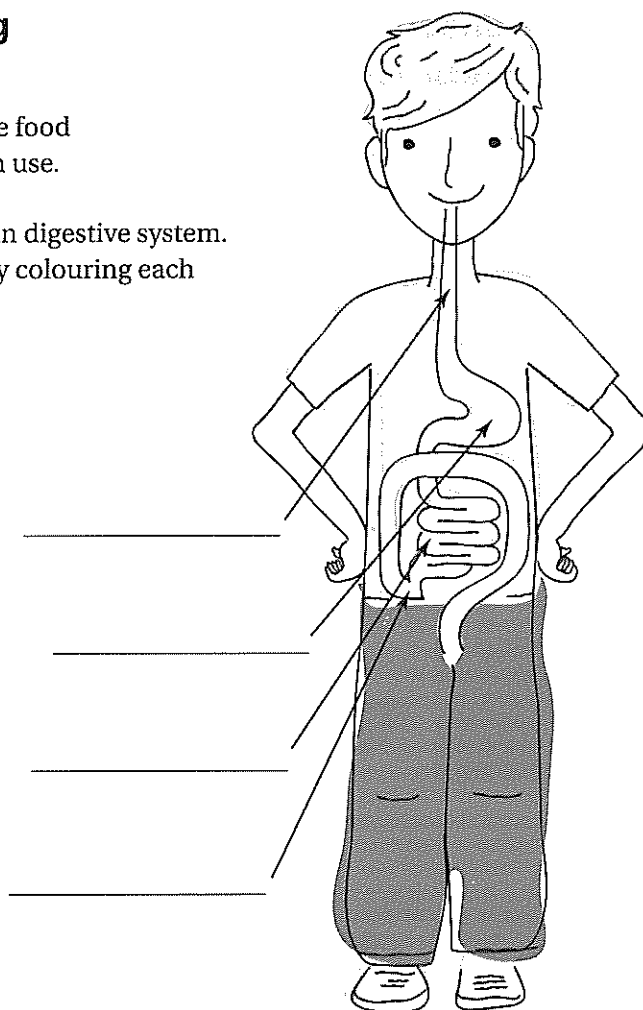
- The diagram shows the human digestive system. **Identify** the following parts by colouring each as follows and adding labels.

small intestine: red

oesophagus: blue

large intestine: green

stomach: yellow



- Draw a line to **identify** the part of the digestive system with its description.

Part of the digestive system	Description
Mouth	This is where water is taken back into the body and any wastes and unwanted food are passed out of the body through the anus. This structure is short but quite wide.
Oesophagus	Most of the digestion is finished here. Food is now very tiny particles that can be absorbed by the body. This structure is quite long, but is quite narrow. Useful nutrients pass through the wall into the body where they are taken by the blood to the cells.
Stomach	Mechanical digestion starts here when you chew your food. Chemical digestion of carbohydrates starts here using chemicals found in saliva.
Small intestine	This is the tube that carries the chewed food from the mouth to the stomach. A muscle wave known as peristalsis moves the food to the stomach.
Large intestine	This is where very strong acid helps to digest proteins and helps to kill any bacteria in the food.

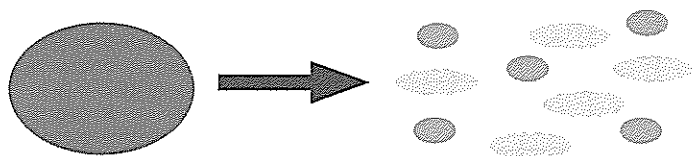
Science understanding, Science inquiry

 Visual/Spatial  Verbal/Linguistic

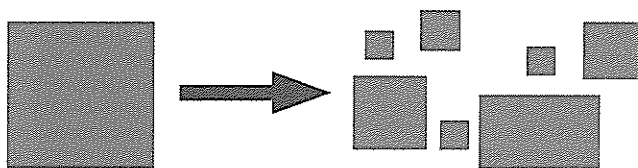
When you bite off a piece of apple and chew it into smaller pieces of apple, this is mechanical digestion. Chemical digestion occurs when the complex sugars in the apple are changed into simple sugars by chemicals in your mouth and small intestines.

The following five diagrams represent digestion. **Propose** which type of digestion each represents. **Explain** your decision in each case.

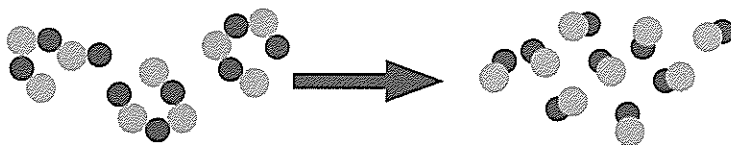
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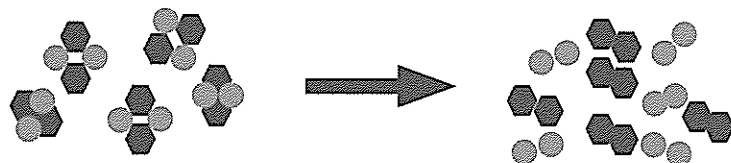
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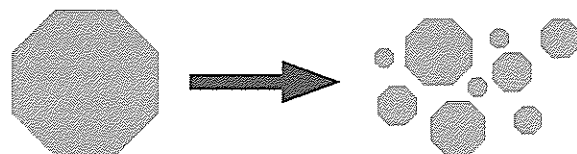
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Science inquiry

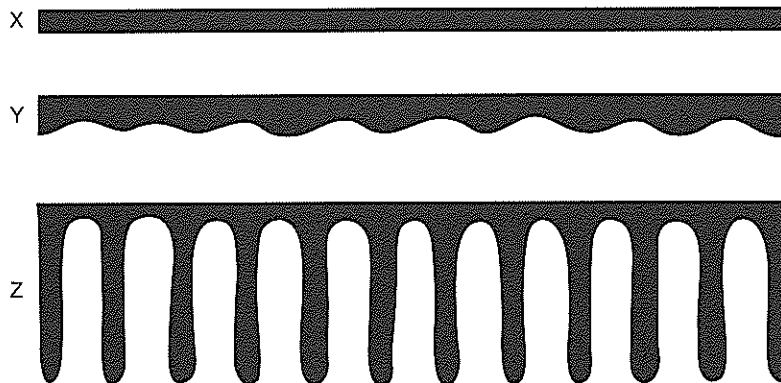


Bodily/Kinaesthetic

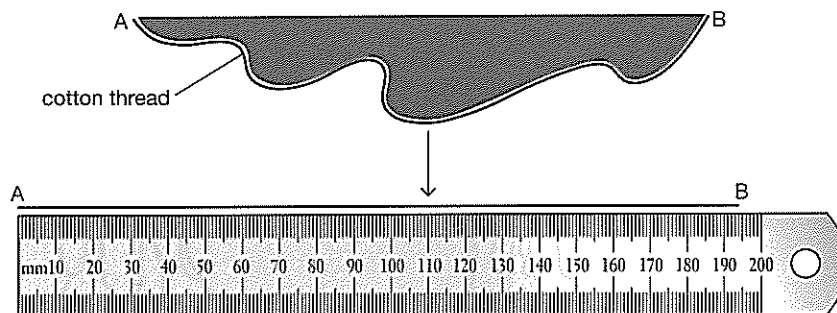


Verbal/Linguistic

The following diagram represents three different surfaces.



- 1 Use cotton thread or fine string and a ruler to measure the length of the lower side of each surface, as shown below.



Length of surface X _____ Y _____ Z _____

- 2 Assume that each centimetre of surface absorbs 5 mL of digested material every 10 minutes. **Calculate** the amount of digested material absorbed in one hour by each surface.

Y _____

Z _____

X _____

- 3 Compare the efficiency of surfaces X, Y and Z.

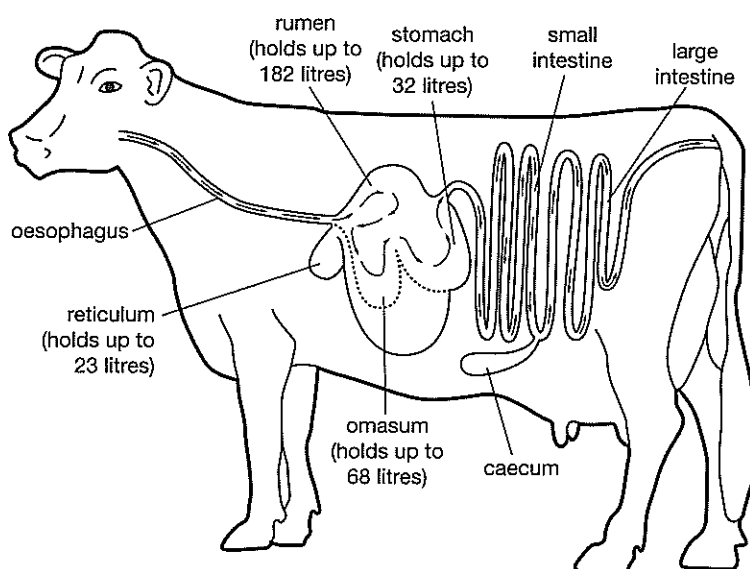
- 4 Explain why it is an advantage to have villi lining the small intestine.

Science inquiry



Digestive system of a cow

The stomach, small intestine and large intestine of cows are similar to those found in dogs and humans. Cows are herbivores, which means that they only eat plant material. Plant cell walls are very difficult to digest. To help the digestive process, cows have three extra parts to their digestive systems between the oesophagus and the stomach. These are the rumen, reticulum and omasum. The parts of the digestive system of a cow are shown in the diagram below.



Rumen

Cows graze, taking the food into their rumen. They can store large amounts of food in the rumen. The rumen also contains micro-organisms that digest the fibre in the plant material.

After eating, the cow rests and ruminates. Rumination involves bringing back the chewed plant material from the rumen into the mouth. In the mouth, it is chewed again and mixed with saliva. We call this 'chewing the cud'. Cows can produce up to 100 litres of saliva every day.

Because they go through the process of rumination, cows and other animals that chew the cud are known as ruminants.

Gases such as carbon dioxide and methane are produced as the bacteria digest the food in the rumen. Cows belch frequently to get rid of the gas.

Reticulum and omasum

When the plant material is partly digested, it is pushed along into the reticulum. Like the rumen, the reticulum is a large muscular sack containing micro-organisms. The muscular walls continually contract and relax, churning the partly digested food.

The food is then pushed along further to the omasum and the stomach.

Stomach and beyond

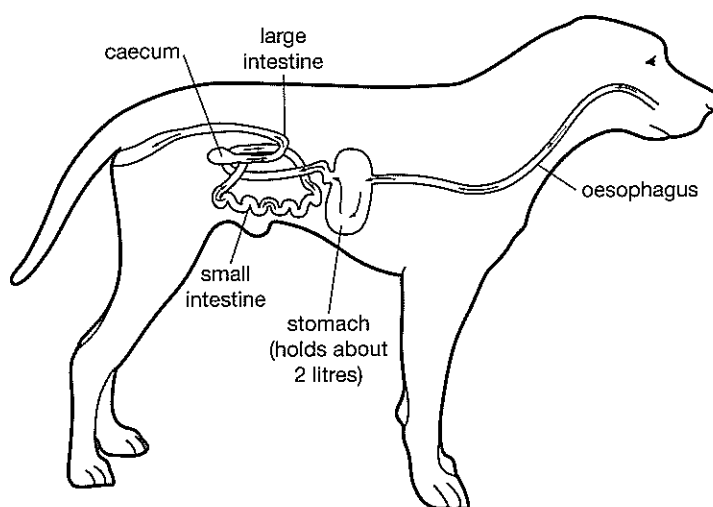
In the stomach, the micro-organisms from the rumen are digested before the stomach contents pass into the small intestine. In the small intestine, the nutrients are absorbed into the bloodstream just as in the human digestive system.

The remaining contents of the small intestine then pass into the caecum. In the caecum are bacteria that further digest any remaining plant material.

The large intestine is the last part of the digestive system. There, water is reabsorbed just as it is in the human digestive system.

Digestive system of a dog

Dogs are carnivores. They have a simple digestive system that is adapted to meals of meat. The digestive system of a carnivore is the shortest of all types of animals. It is basically a long tube with a single bulge (the stomach) near the beginning. The parts of the digestive system of a dog are shown in the diagram below.



In the mouth, the teeth tear and crush the food. Although saliva is produced, it is not involved in digestion. It just helps lubricate the food so that it can be swallowed easily.

The dog's stomach is very small. It can only hold about 2 litres of food, which is all the food that a dog can eat at one time. Carnivores do not need a lot of food because meat and fat have high concentrations of nutrients.

In the dog's stomach, concentrated hydrochloric acid dissolves the food. Any food that cannot be dissolved, such as raw plant material and bone, either passes through or is vomited out.

Up to this point, the food has been digested mechanically. Chemical digestion does not start until the food passes into the small intestine. In the small intestine, the food is digested and enters the bloodstream.

Carnivores cannot digest plant cell walls. Plant material joins other undigested material and passes from the small intestine into the large intestine past the caecum. The caecum in carnivores does not have a function. In the large intestine, water is reabsorbed from the wastes and solid faeces is produced.

1 **Name** in order the parts of the cow digestive system through which food passes.

2 **Explain** what happens to the cow's food in the rumen.

3 **Explain** why dogs and other carnivores are able to survive without a rumen.

4 (a) **Describe** what is happening when cows 'chew the cud'.

(b) **Explain** how chewing the cud is of benefit to the cow.

5 **Explain** why a dog only has a small stomach.

6 **Compare** the function of the stomach in a cow and a dog.

7 Miniature cows are a special breed of cows that may not be much larger than some large dogs. Yet their digestive system is longer and can hold a much larger volume of food.

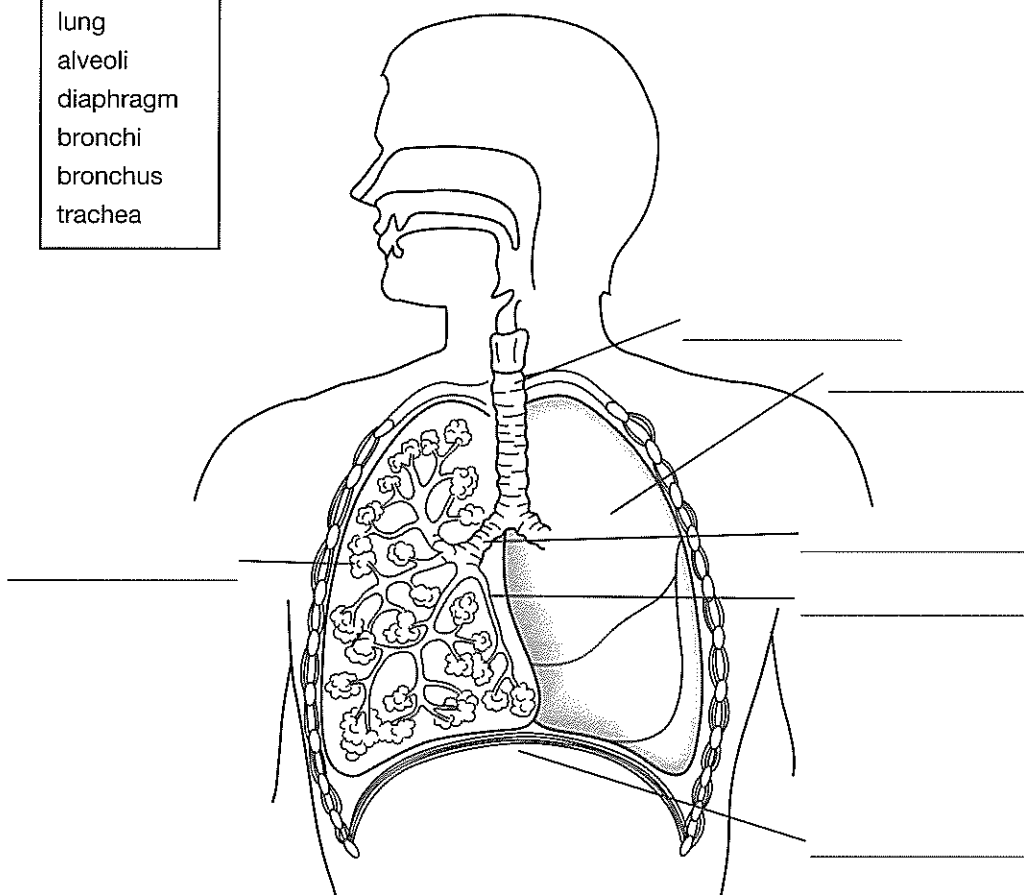
Propose why a dog and a miniature cow of the same size do not have digestive systems the same size.

Science understanding

 Verbal/Linguistic  Visual/Spatial

- 1 Select terms from the list below to **name** the parts of the respiratory system indicated.

lung
alveoli
diaphragm
bronchi
bronchus
trachea



- 2 Recall your knowledge of the respiratory system by drawing lines to match the parts of the respiratory system with their description.

Part of the respiratory system	Description
Trachea	A sheet of muscle that separates the chest from the abdomen. It contracts and flattens as you breathe in and arches up as you breathe out.
Bronchi	A cluster of sacs in which oxygen and carbon dioxide are exchanged.
Alveoli	Thin-walled tube reinforced with rings of cartilage. You can feel these rings as ridges on the front of your throat.
Diaphragm	One of these carries air into each lung.

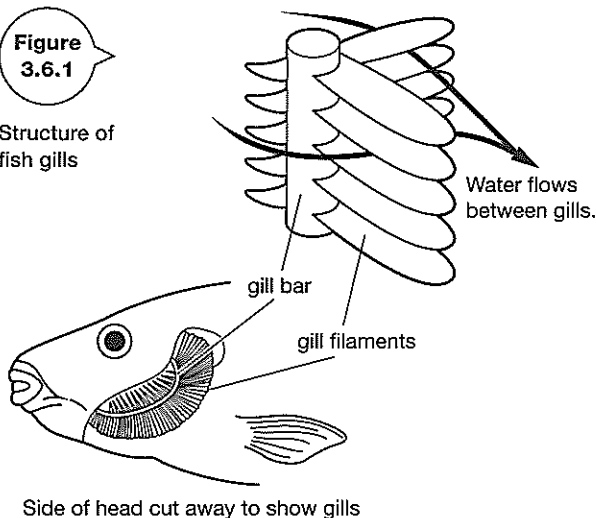
Science understanding, Science inquiry

 Verbal/Linguistic  Visual/Spatial

In humans, millions of tiny alveoli provide a large surface area through which the gases oxygen and carbon dioxide can be exchanged. Other animals have slightly different respiratory systems. Fish have gills, insects have structures called trachea and earthworms exchange gases through their skin. You are going to compare these respiratory surfaces.

Figure 3.6.1

Structure of fish gills



The gills of fish have a large surface area. Gills are made up of many fine filaments (thread-like structures), each of which has a very good blood supply.

Gills are always moist because they are surrounded by water.

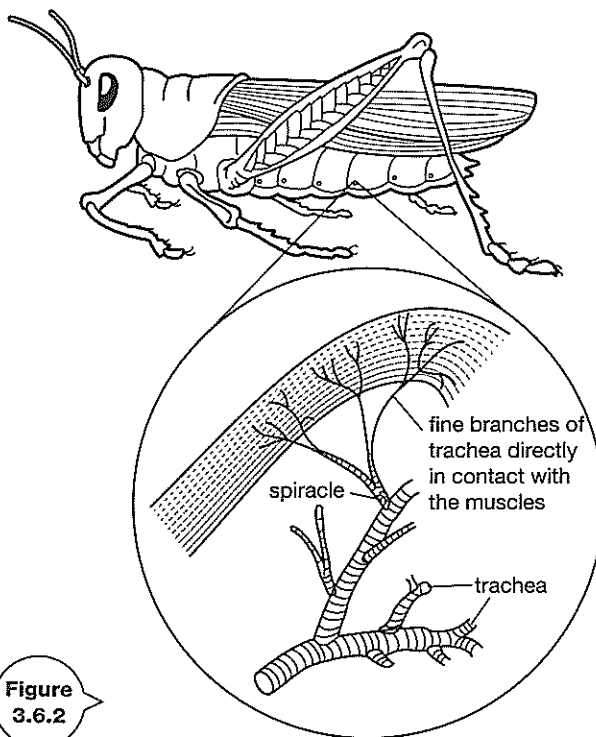


Figure 3.6.2

Structure of insect trachea

Insects have small tubes called trachea that carry air to every cell of the body. The ends of the small branches of the trachea are moist. Oxygen dissolves at the moist surface and then moves into the cells.

Small openings called spiracles on the outside of the insect's body close the trachea when the insect is not active. This prevents water being lost and makes sure that the ends of the trachea do not dry out.

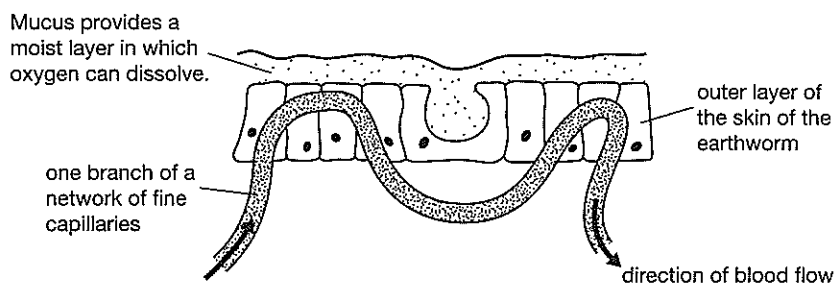


Figure 3.6.3

An earthworm's skin acts as a gas exchange surface.

Earthworms produce a layer of mucus over their skin. Mucus is a thin jelly that keeps the skin moist. Oxygen from the air dissolves at the moist surface. The earthworm has many blood capillaries close to the surface and its blood contains haemoglobin and is red, just like human blood. The haemoglobin collects the dissolved oxygen and the blood carries it to the cells.

- 1 List** the characteristics that make an efficient gas exchange surface.

- 2 Compare** the human, fish, insect and worm gas exchange surfaces in terms of the characteristics you have listed.

- 3** The maximum amounts of oxygen that can be supplied to each gram of muscle tissue in 1 hour are: earthworm 60 mm³, mouse running 20 000 mm³ and butterfly flying 100 000 mm³.

- (a) Explain** how a butterfly is able to supply oxygen to its muscles more quickly than a mouse can.

- (b) Explain** why the earthworm has such a limited supply of oxygen.

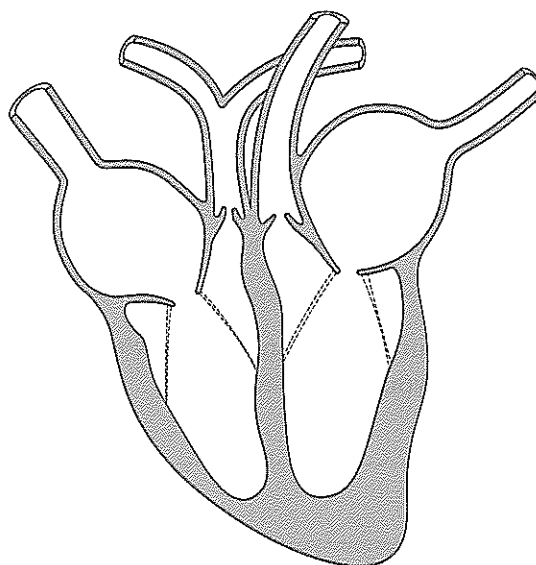
- (c)** Where do you think a human would fit in the list? **Justify** your response.

Science understanding

 Visual/Spatial  Verbal/Linguistic

- 1 A basic diagram of the heart is provided below.
 - (a) Add labels from the box to **identify** the parts of the diagram.
 - (b) Colour the heart and blood vessels to **identify** where there is oxygenated blood (red) and deoxygenated blood (blue).
 - (c) Add arrows to **identify** the direction of blood flow through the heart.
 - (d) At the end of the blood vessels, **name** the part of the body the blood is flowing to or from.

right atrium
left atrium
right ventricle
left ventricle
aorta
vena cava
pulmonary artery
pulmonary vein
valves



- 2 (a) **Identify** whether the right or left ventricle is larger and has thicker walls.

- (b) **Propose** a reason for having the thicker walls.

- 3 **Construct** a flow diagram for the passage of the blood through the body and heart. Start and end with the right ventricle.

Science inquiry



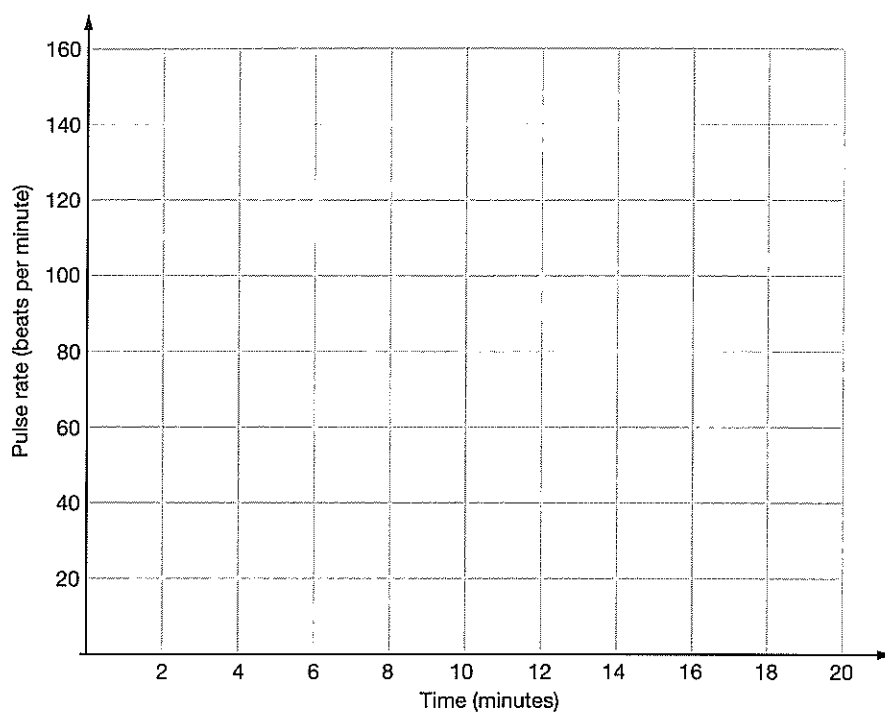
Logical/Mathematical

Two people had the change in their heart rate recorded during exercise. Mary trained on a regular basis and was reasonably fit. Ella did not train at all. The results are shown below.

Table 3.8.1 Pulse rate during exercise

	Time (minutes)	Pulse rate (beats per minute)	
		Mary (fit)	Ella (unfit)
Before exercise	1	55	62
	2	56	61
	3	55	62
	4	55	62
	5	56	61
During exercise	6	60	70
	7	70	80
	8	75	90
	9	97	120
	10	106	130
	11	120	140
	12	130	142
	13	132	148
	14	131	150
	15	131	150
After exercise	16	115	140
	17	98	118
	18	75	100
	19	60	90
	20	55	80

1 Construct line graphs of these data using the set of axes provided.



2 Describe how the pulse rates for Mary and Ella changed during exercise.

3 Propose why these changes occurred.

4 Compare the changes in pulse rate and account for the differences:

(a) before exercise

(b) in the first 5 minutes of exercise

(c) in the second 5 minutes of exercise

(d) after exercise was completed.

Science understanding

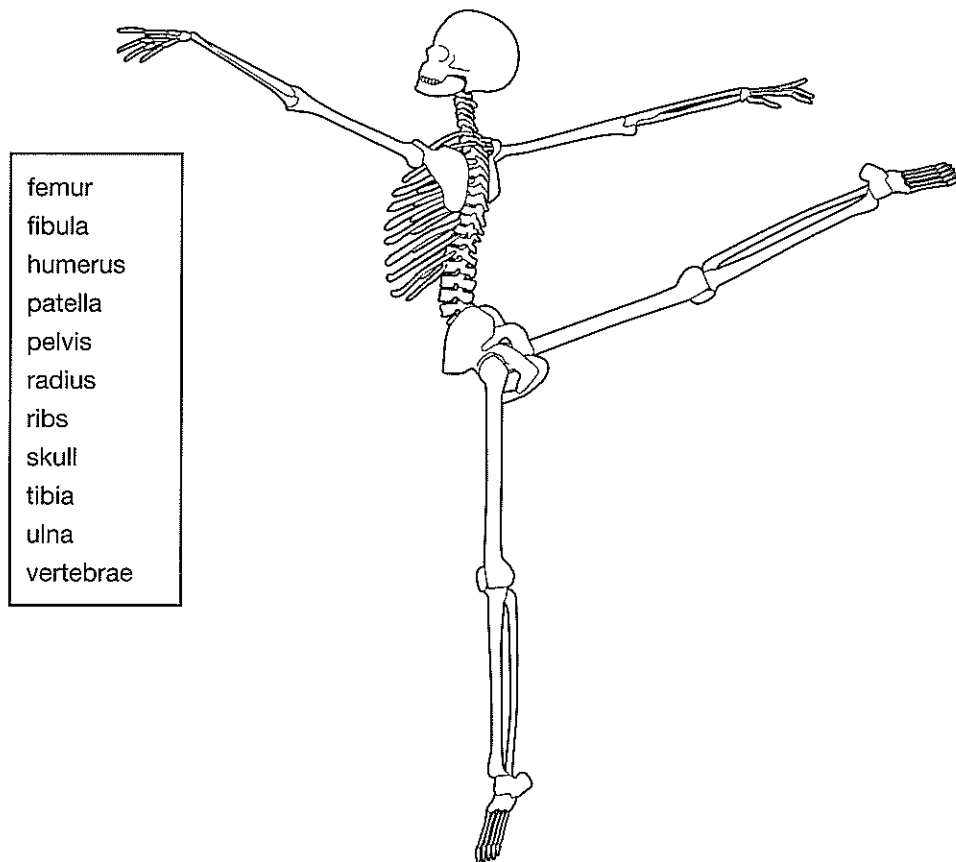


Verbal/Linguistic



Visual/Spatial

- 1 Use the list of words in the box to label the different parts of the human skeleton.
- 2 Colour in the axial skeleton red.



- 3 Circle in green and label a:
 - (a) hinge joint
 - (b) pivot joint.
- 4 Explain how the joints of the skeleton allow the dancer to hold her right leg in the position shown in the diagram.

Science as a human endeavour

Verbal/Linguistic

The spine is made of 33 small bones called vertebrae, each separated by a gel-filled cushion called a disc. Having a large number of small bones gives your spine flexibility. The spine gets compacted, stretched and twisted as you move and the discs act as shock absorbers between the bones.

Sometimes a disc may split, allowing the gel inside to escape into the surrounding tissue. The leaking gel can put pressure on the spinal cord and cause pain. The common name for this injury is a 'slipped disc'. However, the disc has not slipped or moved position; it has actually split.

Badly split discs require injections and sometimes an operation. To protect your back and prevent ruptured discs, it is important to learn to lift heavy objects correctly.

There are two rules to remember.

- Do not try to lift things that are too heavy for you.
- Do not bend over at the waist to lift. Keep your back straight.

Lifting correctly

- If the item is on the floor, bend at the knees and come to a squat position. You will then be using your leg muscles rather than the muscles of your back and shoulders to lift the item.
- Hug the item close to your body.
- Use the strength of your legs to push straight up. Don't bend or twist your back.
- Plan where you are going to put the item and then reverse the moves. First bend the knees and gently lower the object.

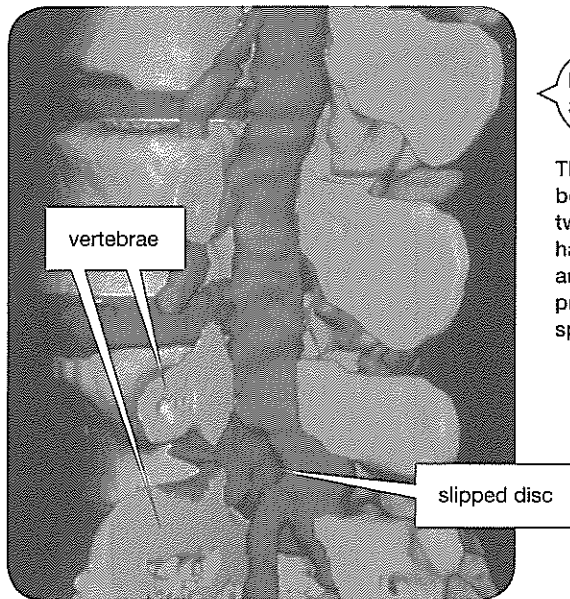


Figure 3.10.1

The disc between the two vertebrae has ruptured and is causing pressure on the spinal cord.

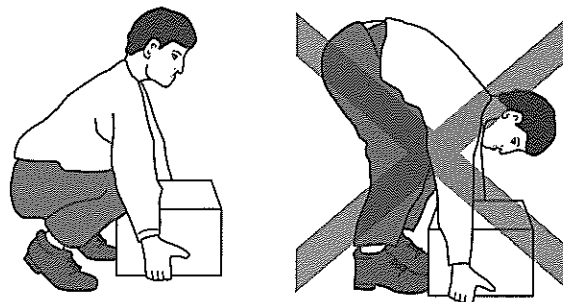


Figure 3.10.2

Lifting heavy objects the correct way protects your back.

1 **Name** the bones that make up your spine.

2 **Name** the parts of the spine that protect the bones.

3 **Propose** ways in which your life would be different if your spine was made of one strong bone like the femur instead of many small vertebrae.

4 **Describe** what happens when a person has a slipped disc.

5 **Explain** why the term *slipped disc* is not an accurate name for the problem.

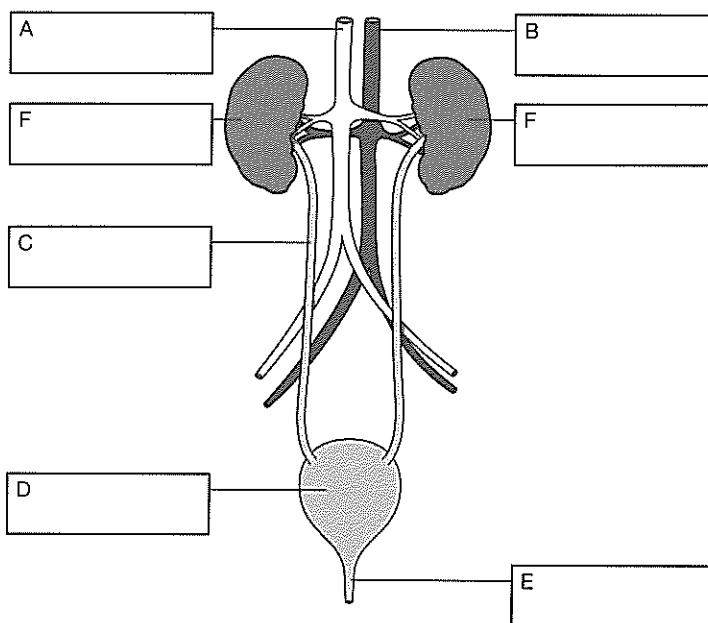
6 **Explain** why it is important to learn how to lift heavy objects correctly.

Science understanding

Verbal/Linguistic

- 1 Select terms from the list below to **name** each part of the excretory system indicated.

bladder
ureter
urethra
kidney
kidney artery
kidney vein



The respiratory system

Air is breathed in by the respiratory system. Within the lungs exchange of gases takes place and the air that is breathed out has a different composition.

Table 3.11.1 Comparison of inhaled and exhaled air

Gas	Percentage (%)	
	Inhaled air	Exhaled air
Nitrogen	78	78
Oxygen	21	17
Inert gases such as argon	1	1
Carbon dioxide	0.04	4
Water vapour	little	saturated

- 2 (a) List the gases that are present in the same quantities in inhaled and exhaled air.

(b) Explain why the quantities of these gases do not change.

- 3 The respiratory system functions as part of the excretory system. Identify what is being excreted by the lungs.

- 4 Explain where these excretory products have come from and how they were produced.

Science understanding, Science as a human endeavour**Verbal/Linguistic**

Refer to the Science as a Human Endeavour on page 122 of your student book.

- 1 Name** the form of energy used to create ultrasound images.

- 2 Identify** differences between parts of the object being examined that enable the ultrasound image to be created.

- 3 Explain** why grey-scaling was a significant breakthrough in ultrasound imaging.

- 4 Describe** a situation where ultrasound images are useful.

- 5 Propose** a potential use of ultrasound technology in dentistry.

- 6 Describe** the benefits this innovation could provide for dental patients.

Science understanding

Verbal/Linguistic

Recall your knowledge of human body systems by matching the key words on the left with their definitions on the right. Using a ruler, draw a line between the dots next to the matching terms or definitions. The line you draw should pass through one of the letters in the middle column. Reading down, the letters should spell out a key term relevant to this chapter.

Antagonistic	E	A	Reactions that change food chemically
Urine	S	X	Describes a pair of muscles that work in opposition to each other
Excretion	C	R	The tube that carries air from the nose and mouth into the chest cavity
Chemical digestion	R		Bony structure that holds body upright and protects organs
Trachea	E	T	The material that has been filtered out of the blood by the kidneys
Villi	O	T	Cluster of sacs where gas exchange takes place
Skeleton	N	O	Getting rid of the wastes the body has produced
Aorta	S		The artery that carries blood from the heart to the lungs
Atrium	T	M	Microscopic 'fingers' that greatly increase the surface area of the wall of the small intestine
Alveoli	Y	Y	The main artery leaving the left ventricle of the heart
Circulatory system	T	S	The system of the body that carries materials around the body. It comprises the heart, blood vessels and blood
Diaphragm	X	S	One of the chambers at the top of the heart that receives blood into the heart
Tendons	T	O	The lower chambers of the heart that contract, pushing blood out of the heart
Pulmonary artery	M	E	A sheet of muscle that separates the chest from the abdomen
Ventricles	N	Y	Elastic tissue that attaches muscle to bone

Key term: _____