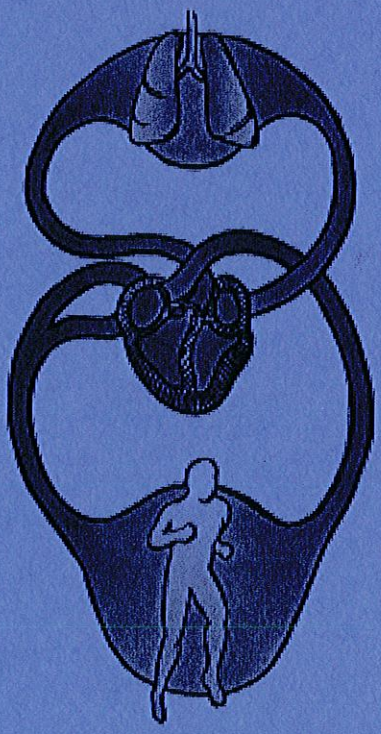
Year 10 – PASS

2014

BODY SYSTEMS & ENERGY FOR PHYSICAL ACTIVITY



Name: _____

Teacher: _____

THE SYSTEMS OF THE BODY

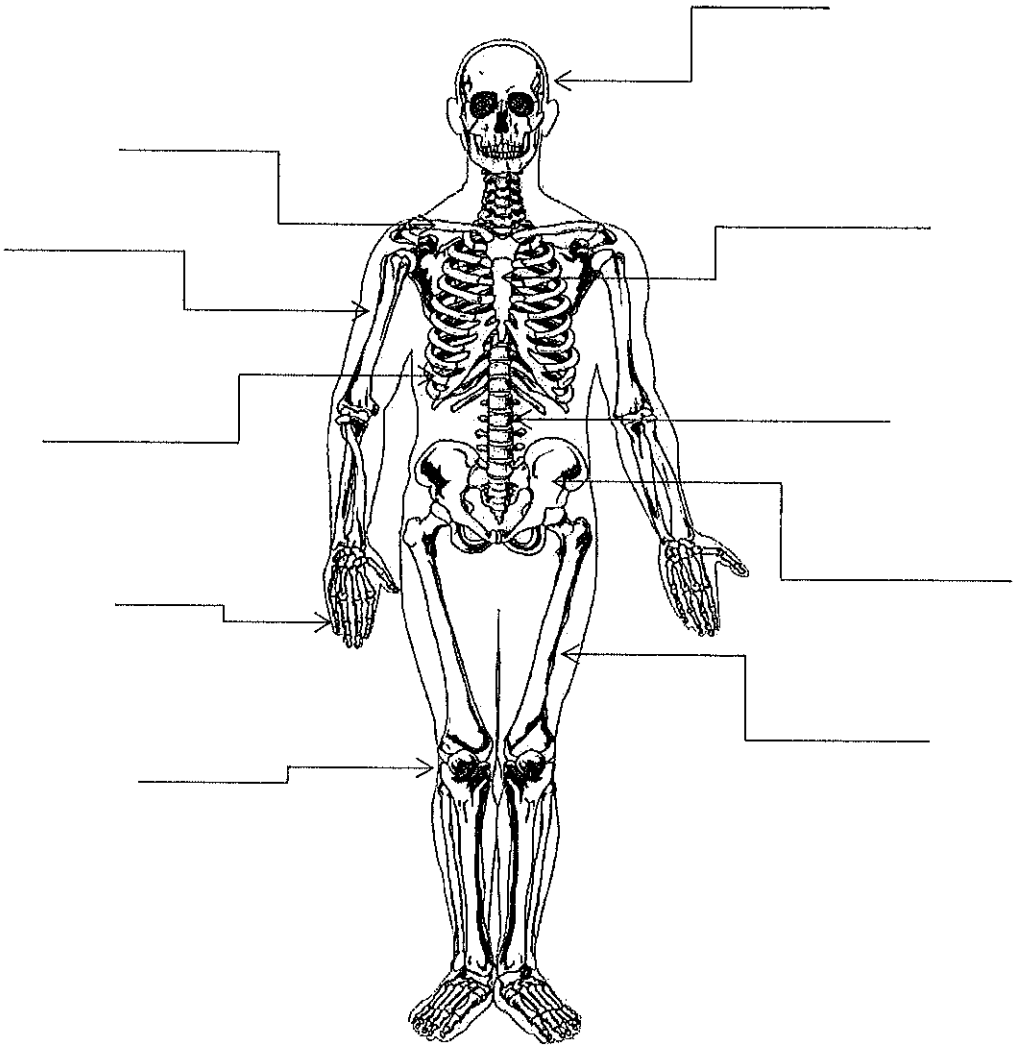
The body is made up of several systems that interact together to enable the body to function. Match the following body systems with their organs by drawing a line...

Circulatory:	Brain, spinal cord, nerves
Digestive:	Bones, joints, cartilages
Endocrine:	Glands, pancreas, testis, ovary
Integumentary:	Mouth, oesophagus, stomach, liver, intestine
Lymphatic:	Heart, quadriceps, bicep, pectoral, abdominal
Muscular:	Vagina, penis, testis, ovary
Nervous:	Skin, hair, nails
Reproductive:	Lymph nodes, lymphatic vessels
Respiratory:	Heart, veins, arteries
Skeletal:	Kidney, bladder, urethra
Urinary:	Nose, trachea, larynx, bronchioles, lungs

No one system works on its own. The systems work together so we can run, jump, catch and do everyday activities.

Structure and Function of the Skeletal System

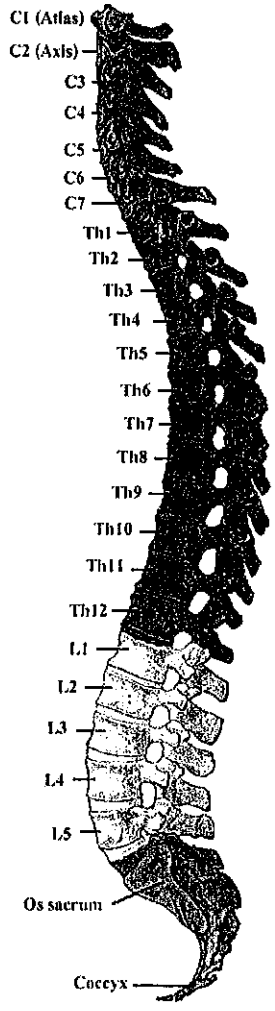
This activity is to see how well you know the bones of the body; do not be afraid to have a go, because by the end of the term, you will all be experts. Using your prior knowledge, **identify** and **label** the skeletal bones from the list of bones in the box.



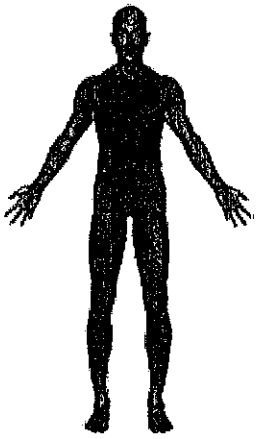
Rib Cage	Clavicle
Patella	Spine
Pelvis	Pelvis
Sternum	Skull
Phalanges	Humerus

Parts of the Vertebral Column

Copy from the board the different sections of the vertebral column:



THE ANATOMICAL POSITION



Stand up and assume the "Anatomical Position" (copy the image above)

Directional Terms Game - elimination

One of the following directional terms will be called out by the teacher. Your task is to point toward that direction ASAP. You are eliminated if:

- you are the last to perform the directional term
- you perform the incorrect directional term

- Superior- point UP
- Inferior- point DOWN
- Anterior- point to the FRONT
- Posterior- point to the BACK
- Medial- 2 hands pointing towards the CHEST
- Lateral- 2 hands pointing towards the SIDE
- Proximal- 1 arm on SHOULDER
- Distal- 1 arm on WRIST

THE STRUCTURE OF A BONE

read through the notes below as a class

Figure 1.1 Structure of a femur bone

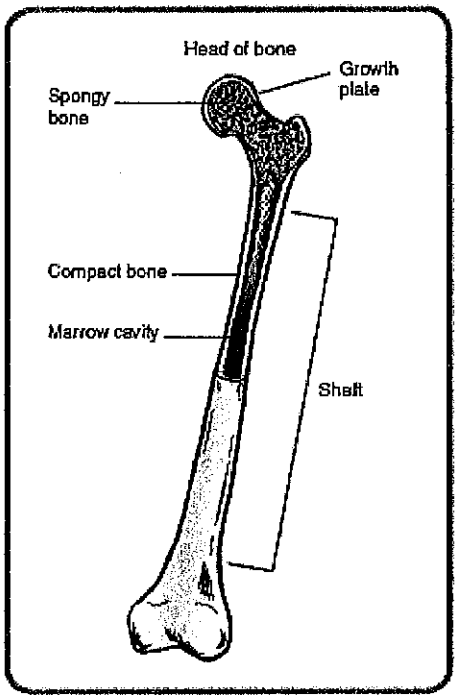


Figure 1.1 shows the structure of a bone—it is a very simple structure, yet a very important one. The bones in our body are all alive and the end of the bone shown in figure 1.1 has a growth plate that is very important to the growth of the bone. If the growth plate is damaged the growth of the bone may be stunted and physical problems can occur. For example, damage of the growth plate in one femur bone (upper leg) could cause reduced growth in one leg, resulting in one leg being shorter than the other.

Basic Contribution to Efficient Movement

The skeletal system is the inner core for stable movement of the body. Bones provide the internal frame for our muscles and joints to work together to perform voluntary movement. To enable our body to move efficiently, the skeletal system provides support and leverage so that well balanced movement can occur.

Types of Bones

The bones in the body are classified by their shape and are grouped into 6 types:

- _____ **bones** are long and slightly curved for strength, and can be found in the arms and legs.

  eg._____

- _____ **bones** are small and nearly equal in length and width. They can be found in the wrist and ankles.

  eg._____

- _____ **bones** are generally thin and flat, with the purpose of protecting vital organs.

  eg._____

- _____ **bones** are an unusual shape and are not like any other bones.

  eg._____

- _____ **bones** are small bones that are buried in tendons where pressure exists.

  eg._____

1 Match the following bones up with their type using the table opposite.

Type of bone	Name of bone
Long bone (L)	Tarsal
Short bone (Sh)	Patella
Flat bone (F)	Femur
Irregular bone (I)	Scapula
Sesamoid bone (SB)	Vertebra

JOINTS

Bones are held together by connective tissue that allows movement between the joints. Joints that are relied on for movement in physical activity contain connective tissue that allows muscles and bones to work together to move.

Joints are connections between the bones. The three basic types are:

- _____ - (immovable) eg. skull
- _____ - (slightly movable) eg. vertebrae
- _____ - (freely movable) eg. hip joint

6 Types of Synovial Joints of the Body

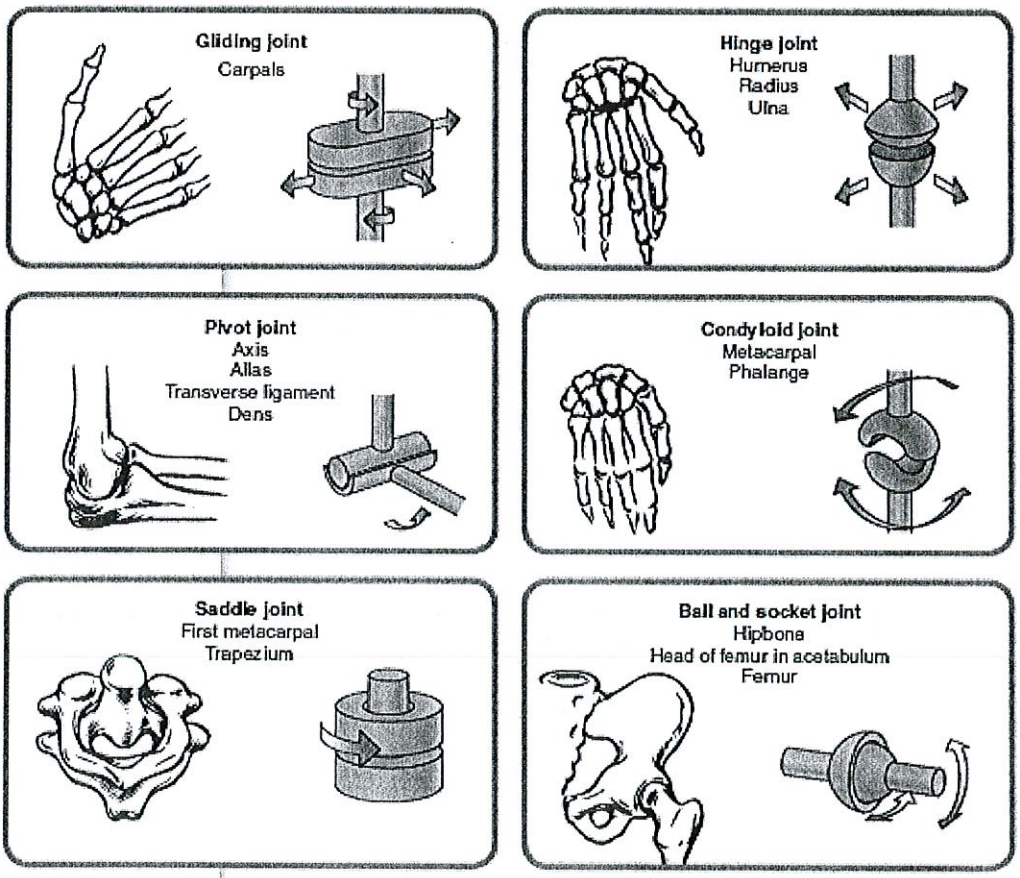


Figure 1.3
Six moveable joints of the body

from *Hole's human anatomy and physiology*, (1999), 8th edn, Shier, Butler and Lewis

On the diagram above**, label** the following joints as one of the 6 types of synovial joints:

shoulder elbow metacarples ankle knee carples proximal-radioulna hip

Important Structures in Synovial Joints

Synovial joints are the most "freely moveable" of all the joints in the body. Certain structures within these joints help the joint to move so freely. The most important structures in synovial joints are:

- _____

_____
_____
_____

- _____

_____
_____
_____

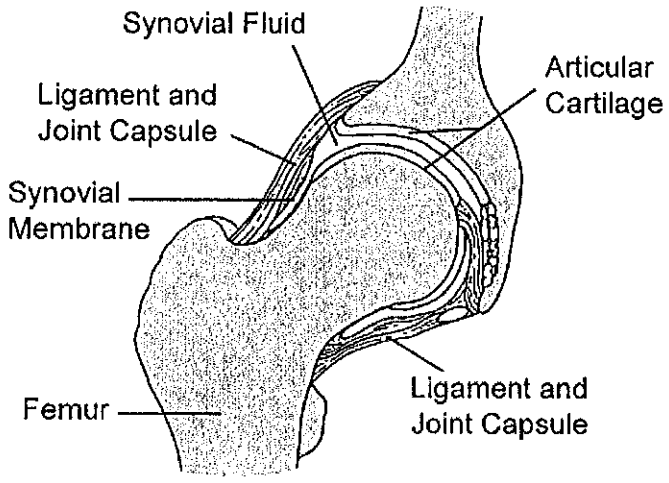
- _____

_____
_____
_____

- _____

_____
_____
_____

Hip Joint

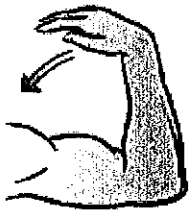
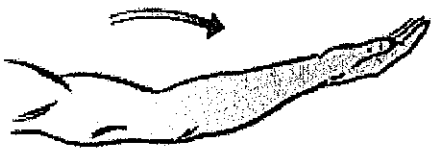
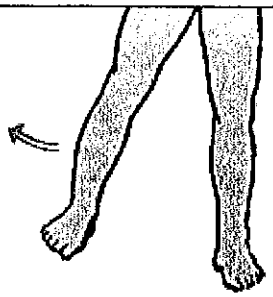
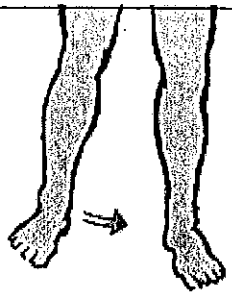
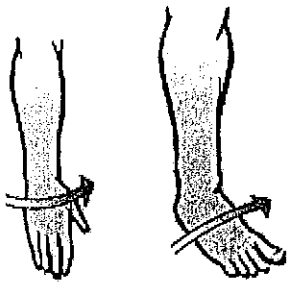


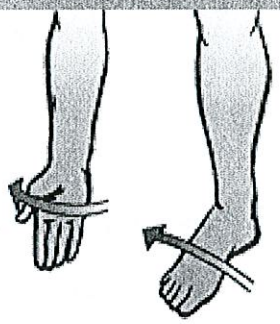
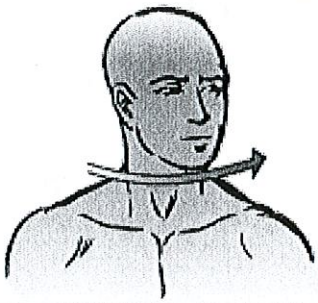
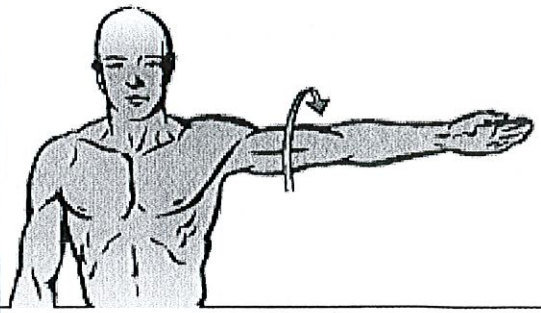
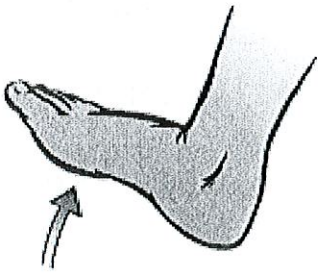
JOINT ACTIONS

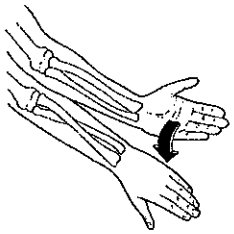
The numerous joints of the body, together with the muscles around these joints, allow us to perform a remarkable range of twisting, turning and rotating movements. We are able to identify these movements by becoming familiar with joint action terminology.

Explore the different types of joint actions possible by the body.

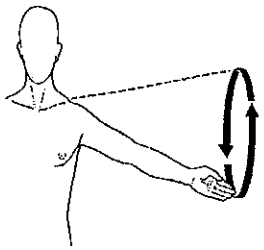
Table 1.1 Joint actions

Joint action	Description of the joint action	
Flexion	An action involving the angle between two bones decreasing with the movement	
Extension	An action involving the angle between two bones increasing with the movement (it is the opposite of flexion)	
Abduction	An action that involves movement away from the middle of the body	
Adduction	An action that involves movement towards the middle of the body	
Pronation (Inversion)	An action where the foot or hand is turned inward	

Joint action	Description of the joint action	
Supination (eversion)	An action where the foot or hand is turned outward (it is the opposite of pronation)	
Rotation	An action performed by turning the upper body or head to one side	
Circumduction	An action that is similar to rotation but involves the circular motion of a limb	
Plantar flexion	An action of the foot, where the toes are pointed forward (for example, pressing on an accelerator when driving)	
Dorsi flexion	An action of the foot, where the toes are lifted upward (for example, taking your foot off an accelerator when driving and pointing the toe toward the knee; it is the opposite of plantar flexion)	



JOINT ACTION Terms Game



One of the following joint action terms will be called out by the teacher. Your task is to perform that joint action ASAP. You are eliminated if:

- you are the last to perform the joint action
- you perform the incorrect joint action

- Flexion- of the ELBOW
- Extension- of the ELBOW
- Abduction- of the LEG
- Adduction- of the LEG
- Pronation- of the HAND
- Supination- of the HAND
- Rotation- of the TRUNK
- Circumduction- of the ARM
- Plantar flexion- of the ANKLE
- Dorsiflexion- of the ANKLE

MOVEMENT ANALYSIS

(1) Determine the joint action/s that are possible at the following joints-

- Shoulder- _____
- Wrist- _____
- Knee- _____
- Ankle- _____
- Phalanges- _____
- Elbow- _____
- Hip- _____
- Head- _____

(2) List an example of a sport that uses each joint action-

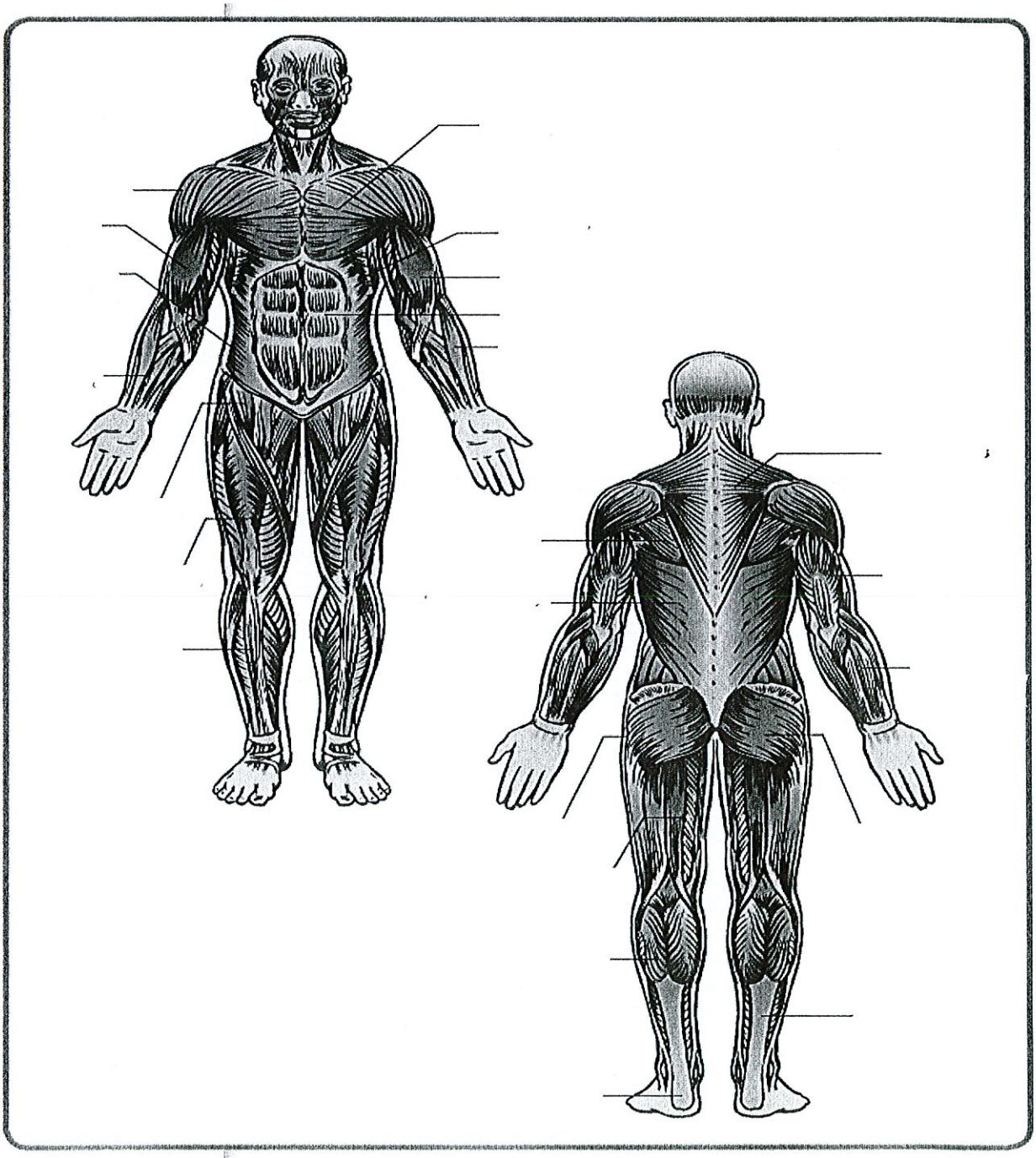
- Flexion- _____
- Extension- _____
- Abduction- _____
- Adduction- _____
- Pronation- _____
- Supination- _____
- Rotation- _____
- Circumduction- _____
- Plantar flexion- _____
- Dorsi flexion- _____

Structure and Function of the Muscular System

Using your prior knowledge, **label** the major muscles of the body.

(HINT: Make links to bone names, joints, joint actions and directional terms to help you.)

deltoid latissimus dorsi hamstrings tibialis anterior gluteus maximus rhomboid biceps abdominals soleus wrist extensors hip flexors latissimus dorsi triceps quadriceps trapezius external oblique gastrocnemius wrist flexors facial muscles pectorals sternocleido mastoid sartorius erector spinalis brachioradialis



Muscle Contractions
Notes

The Muscular System

Application Questions:

1. Many muscles work in groups eg. bicep/tricep, opposing each other to effectively perform a movement. **Identify** 5 muscle groupings in the body.

   - _____
   - _____
   - _____
   - _____
   - _____

2. **Identify** the following muscles as either the "AGONIST" or "ANTAGONIST".

- Tricep- Flexion of elbows during tricep dip _____
- Tricep- Extension of elbows during tricep dip _____
- Gastrocnemius- Plantar flexion on a step _____
- Gastrocnumius- Dorsi flexion on a step _____
- Abdominals- Flexion of hips during up phase of sit-up _____
- Abdominals- Extension of hips during down phase of sit-up _____

3. **List** 2 examples of the following contractions:

   - Isotonic (concentric/eccentric)

     _____
     _____

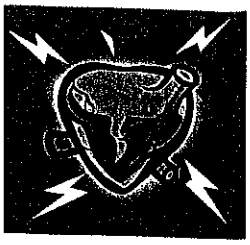
   - Isometric

     _____
     _____

   - Isokinetic

     _____
     _____

Structure and Function of the Circulatory System



The **circulatory system** is a very complex system that relies on the heart and lungs to circulate blood, oxygen and waste products around and out of the body. During exercise this system works very efficiently to circulate oxygen to the working muscles by pumping blood through the heart muscle.

The heart is the centre of the circulatory system. It is a smooth muscle that is positioned in the centre of our chest and is on 'automatic pilot'. This means that without instruction from the brain the heart will keep pumping blood around our body twenty-four hours a day, seven days a week, non-stop.

Role of the Circulatory System

The role of the circulatory system is to:

- _____
  _____
- _____
  _____
- _____
  _____
- _____
  _____

Major Components of the Circulatory System

Activity - Highlight the following on the info sheet: "Principal Arteries and Veins of the Circulatory System"

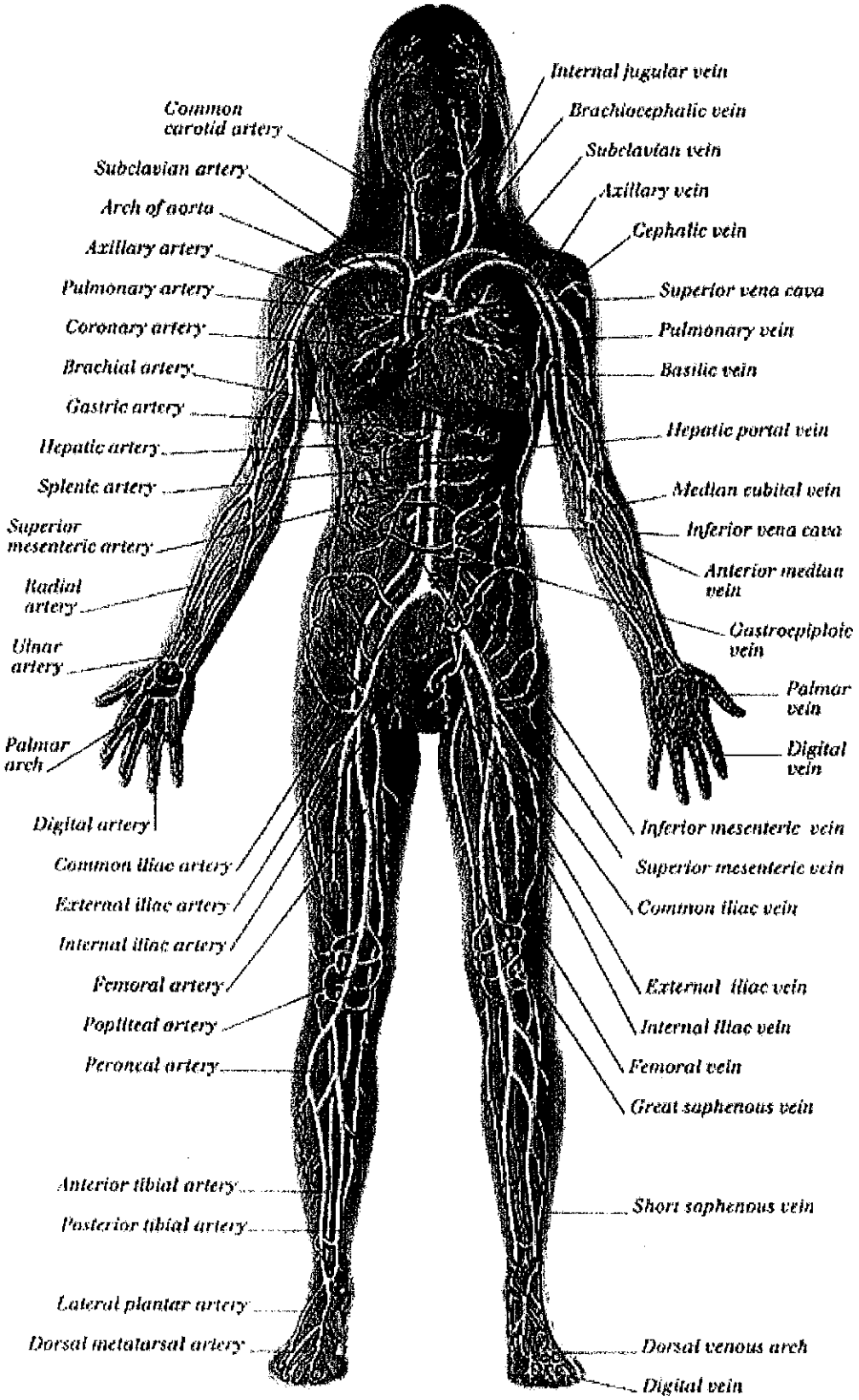
Highlight in RED the following main arteries:

- Carotid
- Aorta
- Pulmonary
- Coronary
- Brachial
- Radial
- Femoral

Highlight in BLUE the following main arteries:

- Jugular
- Axillary
- Superior vena cava
- Pulmonary
- Inferior vena cava

Principal Arteries and Veins of the Circulatory System



Basic contribution to efficient movement

In order to participate in physical activity and sports we need an efficient circulatory system. The heart and lungs work together to efficiently pump oxygen-rich blood around the body and filter the waste products from deoxygenated blood. The circulatory system is very important to our aerobic energy system and the way in which we use energy. During exercise the heart will work much harder than at rest and a trained athlete will have a strong, fit heart to support their body during physical activity. If an athlete is physically fit they will have an efficient target heart rate for exercise and a relatively low resting heart rate (pulse). The average pulse rate for a fit teenager ranges between 60 and 70 beats per minute.

Pulse facts

A pulse is a measure of the beats your heart takes to pump blood around the body. It is usually measured at the radial (wrist) or carotid (neck) sites on the body. Your true resting pulse should be taken before you get up, after a good night's sleep.

Factors that can affect pulse rates include digestion (processing food after eating), stress, sickness and fatigue, as they can all increase the pulse rate because the body is working harder to recover from these situations.

Learning experience

Perform an adequate warm-up and then complete the following steps for sections A and B to see how well your body copes with the demands of exercise. Record your results in your workbook.

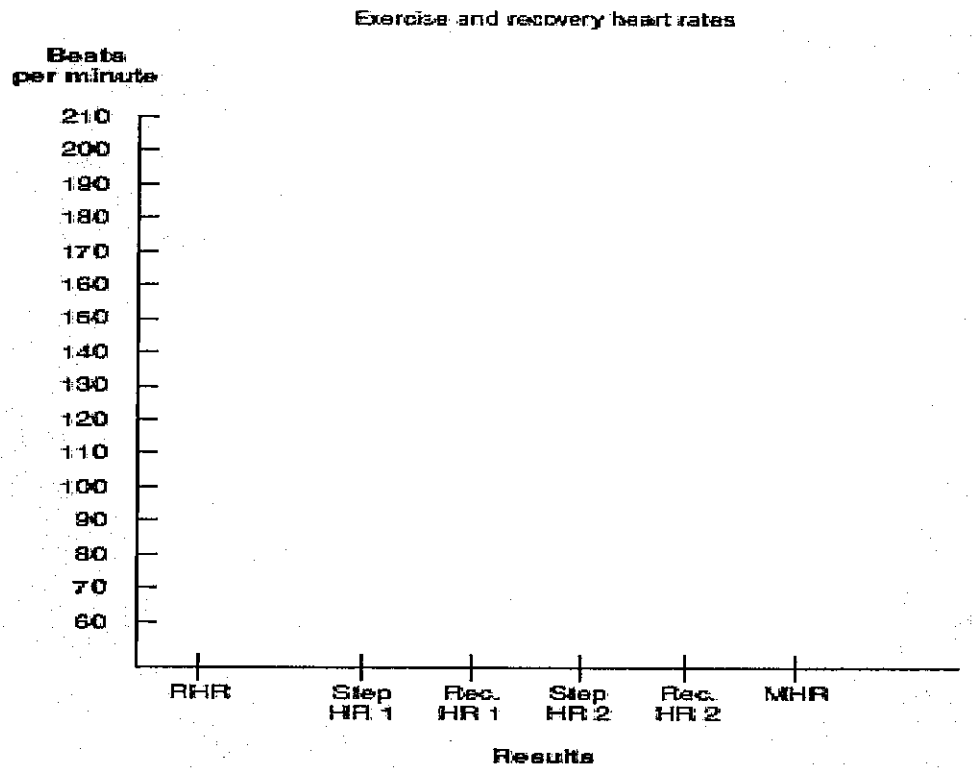
Section A

Complete the following tasks to determine your heart rate efficiency and estimate your fitness level.

1. Take your resting heart rate (pulse) and record the number of beats per minute. (This is RHR on the graph.)
2. Raise your heart rate by stepping onto and back off a step as fast as possible for 2 minutes. Take your heart rate immediately after stopping and record the number of beats per minute. (This is Step HR 1 on the graph.)
3. Walk slowly for 1 minute and then rest for 5 minutes. Take your recovery heart rate at the end of this rest and record the number of beats per minute. (This is Rec. HR 1 on the graph.)
4. Raise your heart rate by stepping as fast as possible for 2 minutes. Take your heart rate immediately after stopping and record the number of beats per minute. (This is Step HR 2 on the graph.)
5. Walk slowly for 1 minute and then rest for 5 minutes. Take your recovery heart rate at the end of this rest and record the number of beats per minute. (This is Rec. HR 2 on the graph.)
6. Calculate your maximum heart rate using the following formula:
   220 – your age = beats per minute.
   (This is MHR on the graph.) Using the details you recorded in steps 1–5, work out how far off your maximum heart rate you were for each activity.

Section B

Using a line graph like the one on page 15, plot your results from section A and discuss this activity with your class.



ICT: Web Connect

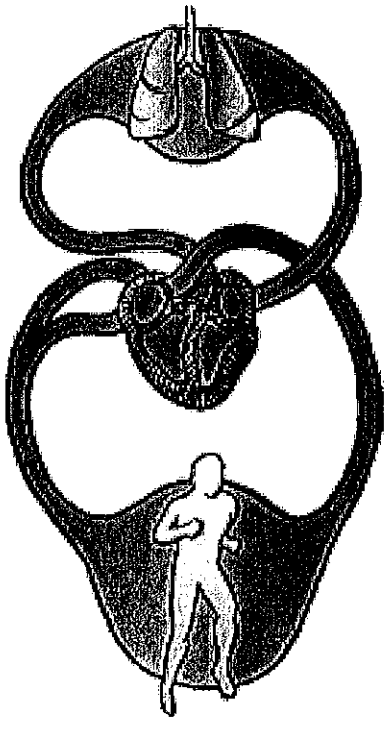
1. Visit the following site to observe the circulatory system in motion:

<http://library.thinkquest.org/11965/html/cyber-anatomy_car691.html>.

2. Visit the following site and observe an animated heart at work:

<www.ehc.com/vbody.asp>.

3. After visiting the sites listed above, draw arrows on the diagram below to indicate the flow of blood and oxygen in the circulatory system.



The Circulatory System

Application Questions:

1. **Draw** your own picture/diagram of the heart to show how oxygenated blood is reoxygenated and delivered around the body. **Draw** arrows to show the direction of blood flow and **label** all parts of the circulatory system.

2. **Write** a paragraph describing the path (to match your picture/diagram) that deoxygenated blood takes to become oxygenated and pumped around the body.

3. **Explain** why the blood flowing to the surface of the skin will help the body cool down.

4. **Name** the 4 chambers of the heart.

- ♦ _____
- ♦ _____
- ♦ _____
- ♦ _____

5. **Name** the 2 vessels that supply blood to the heart. What type of vessels are they?

- ♦ _____
- ♦ _____

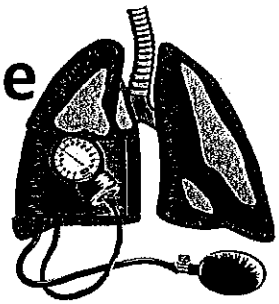
6. **Name** the 2 vessels that remove blood from the heart. What type of vessels are they?

- ♦ _____
- ♦ _____

7. **Explain** why you think there are valves present in the heart?

8. **List** the factors that you think can affect a person's pulse rate, and **suggest** possible reasons for this.

Structure and Function of the Respiratory System



Role of the Respiratory System-Notes

The Respiratory System

Application Questions:

1. **Discuss** 3 reasons why the respiratory system might not work as well as it should during exercise.

2. **Predict** what will occur to the rate and depth of breathing during exercise.

3. **Explain** what happens when dust is breathed in the nasal passage.

Learning experience

This activity will indicate how well your lungs perform while participating in physical activity. Perform an adequate warm-up and then complete the following steps for sections A and B to see how well your body copes with the demands of exercise. Record your results in your workbook.

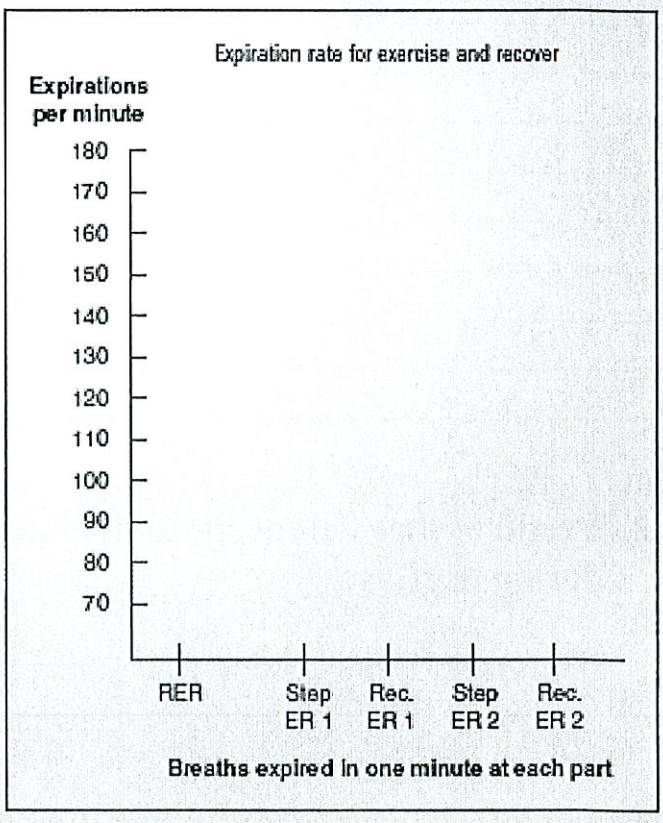
Section A

Complete the following tasks to determine your breathing rate efficiency and estimate your fitness level.

1. Count the number of breaths that you expire (breath out) in one minute to determine your resting expiry rate and record the number of expirations per minute. (This is RER on the graph.)
2. Raise your heart rate by stepping onto and back off a bench as fast as possible for 2 minutes. Take your expiration rate immediately after stopping and record the number of expirations per minute. (This is Step ER 1 on the graph.)
3. Walk slowly for 1 minute and then rest for 5 minutes. Take your expiration rate at the end of this rest and record your recovery breathing rate as expirations per minute. (This is Rec. ER 1 on the graph.)
4. Raise your heart rate by stepping as fast as possible for 2 minutes. Take your expiration rate immediately after stopping and record the number of expirations per minute. (This is Step ER 2 on the graph.)
5. Walk slowly for 1 minute and then rest for 5 minutes. Take your expiration rate at the end of this rest and record the number of expirations per minute. (This is Rec. ER 2 on the graph.)

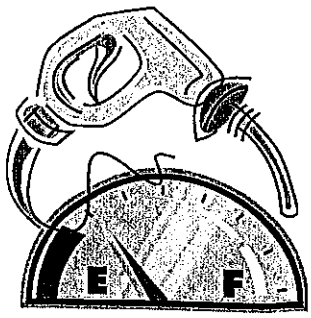
Section B

Using a line graph like the one below, plot your results from section A and discuss this activity with your class.



Energy and Physical Activity

The Role of Food as Fuel Sources



We get our energy to move from food. This energy is measured in _____ or _____.

Some foods contribute more energy than others:

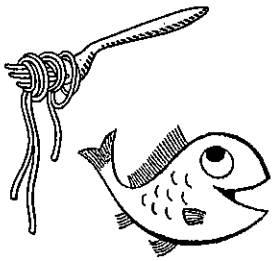
- 1gm of carbohydrate contributes _____ kJ's of energy
- 1gm of protein contributes _____ kJ's of energy
- 1gm of fat contributes _____ kJ's of energy

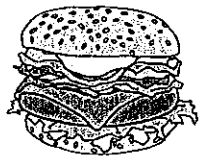
For the body to function effectively, your diet should consist of:

Carbohydrates→ _____ of diet

Protein→ _____ of diet

Fat→ _____ of diet





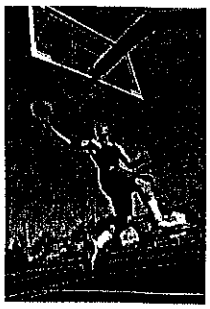
ENERGY SYSTEMS-CAR COMPARISON
TEACHER RESOURCE NOTES

CAR	BODY
CAR BODY	**HUMAN BODY**
Car body (metal shell)	Skin
Car frame	Bones
Engine	Heart
Leads & wires	Veins & capillaries
FUEL SOURCE	**FUEL SOURCE**
Petrol is fuel source	Food is fuel source
Ignition of fuel releases energy & enables fuel to be used	ATP (spark plug) releases energy & enables human movement
Fuel tank carries & stores fuel (petrol)	Chemical bonds carry & store fuel (ATP)
Measurement of petrol = Litres	Measurement of food = kJ's
CAR'S USE	**BODY'S USE**
Gears accommodate changes in speed	3 energy systems accommodate changes in intensity and time length of movement
Type of petrol determines performance and running of car eg. leaded→unleaded→premium super	Type of food determines performance of athlete eg. fatty foods (burger)→high carbs (pasta)
Type of car used depends on function needed eg. Drag racer, Datsun 180B or Daewoo Lanos	Energy system used depends on intensity and time of movement needed eg. ATP/PC, lactic acid or aerobic

***<u>Lesson Notes</u>**

1. Car's Body →Point out features
   →Open hood (student interaction)
2. Fuel Source →Discuss fuel source and energy release
   →Look under car for petrol tank (student interaction)
   →Petrol docket (student interaction)
   →Point out similarities
3. Car's Use →Go through 1st-5th gear (student interaction)
   →Open petrol cap (student interaction)

ENERGY INPUT
VS
ENERGY OUTPUT



When an athlete is participating in a sport or physical activity, they need to balance their **energy intake** (the amount of food and drink consumed) with their **energy expenditure** (exercise completed) to maintain a good level of energy. This is often a fine balance for athletes who have an intense training program. The basic principle to energy balance is outlined in table 1.2.

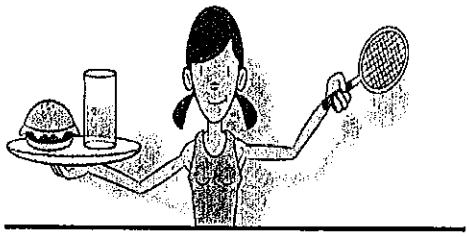
Table 1.2
Energy balance

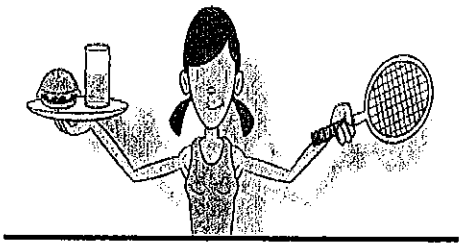
Description of energy balance	Result
Energy expenditure = energy intake	Stable, no change in weight
More energy expenditure + less energy intake	Weight loss
Less energy expenditure + more energy intake	Weight gain

ACTIVITY-

Maintaining energy balance can be difficult. It takes a lot of organisation and exercise to keep a healthy body shape that allows an athlete to participate in the sport of their choice. Referring to the illustration below, complete the following.

1. Give each diagram a title to represent the energy balance or imbalance that is illustrated.
2. **Write** one sentence to explain the balance or imbalance that each diagram represents.





Hydration and Physical Activity

Hydration is _____

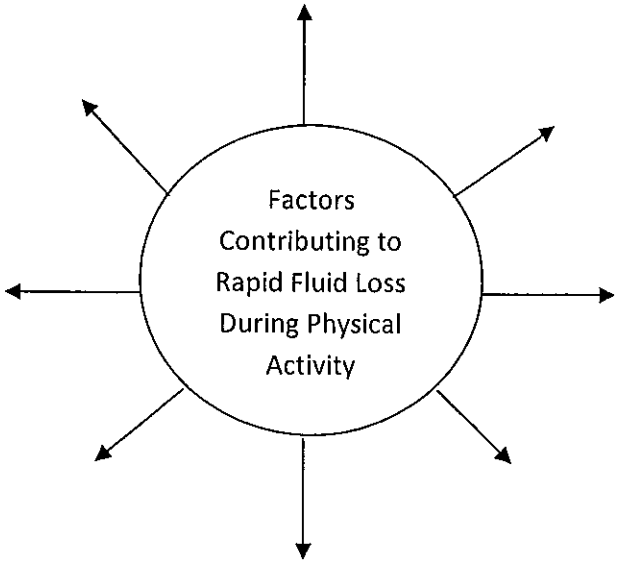
_____

Our body is made up of approximately _____% water and is vitally important to maintain performance during physical activity.

The role of water in the body includes:

- _____
- _____
- _____

Activity- Brainstorm factors that contribute to rapid fluid loss during physical activity



It is vitally important to keep a stable level of water in our body during physical activity so that an athlete performs at their best and prevents health problems.

Define each consequence and **list** its effects on the body.

- DEHYDRATION-

- HYPOTHERMIA-

- HEAT STROKE-

- HYPONATREMIA-

MANAGING FLUID LOSS & REPLACEMENT

Activity- **Suggest** 10 different ways that you could manage fluid loss and replacement.

(1) _____

(2) _____

(3) _____

(4) _____

(5) _____

(6) _____

(7) _____

(8) _____

(9) _____

(10) _____

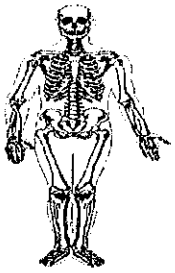
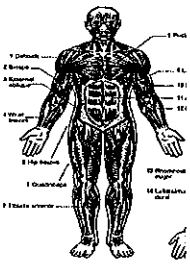
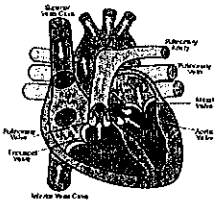
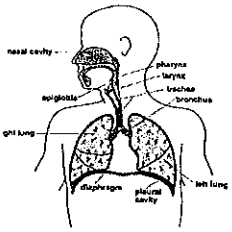
Sources of Hydration

Water is the best source of hydration for the body. However, many sports drinks are available and the market for these drinks is growing, with some targeting hydration through flavoured waters and electrolyte drinks. Drinks such as these need to be chosen carefully and factors such as content, cost and whether the drink supplies what the body needs following the specific demands placed on it by particular sports should be considered.

There are three main types of sports drinks and each one has a different purpose, depending on the type of training or competition in which an athlete is participating:

- _____
- _____
- _____

Interrelationships Between the Body Systems

Each of the body systems relate to each other and need to function together for our bodies to perform successfully. It is vital that our body systems work together to efficiently perform a series of movements.

The human body has an amazing capacity to adapt to the demand of exercise. When a person chooses to exercise, whether this exercise is mild or extremely active, the human body will activate the circulatory system (the cardiovascular and respiratory systems), together with the skeletal and muscular systems, to perform the voluntary movements that create the actions of an exercise pattern.

The human body and mind work together to allow a person to actively participate in many activities of choice. Our body systems rely on each other to work in harmony to move efficiently. The type of sport in which a person participates will also affect the demand that is placed on each system; for example, an athlete who is a long-distance runner will place much more demand on their circulatory system than an athlete who is a javelin thrower.

Group Task Activity

The class will be divided up into groups of 3-4. Each group will be allocated one of the following 4 body systems:

- Skeletal
- Muscular
- Circulatory
- Respiratory

On butchers paper, each group must:

(1) **Design** a flow chart to display the interrelationship between your allocated body system and the other 3 body systems.
eg. How does the skeletal system work in conjunction with the muscular system? circulatory system? respiratory system? to function effectively?

(2) **Discuss** the contribution and importance of your allocated body system during physical activity.

(3) **Present** your work to the class for discussion.

Notes:

Notes: