

**SISFFIT004 Incorporate
anatomy and physiology
principles into fitness
programming**



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ASSESSMENT FOR SISFFIT004

Student name	
Date of assessment submission	Click here to enter a date.
Trainer/Assessor's name	
Date of assessment marking	Click here to enter a date.
Outcome for units	☐ Competent ☐ Not Yet Competent

TASK INSTRUCTIONS

- The assessment for these units of competency consists of the following:
 - **Quiz:** You are required to complete a series of multiple choice questions to demonstrate your knowledge and skills.
 - **Short answer activities:** You are required to provide short written responses to a series of activities to demonstrate your knowledge and skills.
 - **Case studies:** You are required to provide written responses to a series of case study scenarios to demonstrate your knowledge and skills.
 - **Practical task:** You will be required to put your knowledge and skills into practice, through observed tasks and work experience.
- At times, you will be provided with a specific context to which you must respond, otherwise it is anticipated that you will use a scenario of your choosing to provide context to the task.

QUIZ

QUESTIONS	CORRECT
1. What are the planes of body motion? ☐ Sagittal, Frontal, Reverse ☐ Sagittarius, Frontal, Transverse ☒ Transverse, Sagittal, Frontal ☐ Back, Front, Side	☐
2. What is the term associated with moving towards the midline of the body? ☐ Superior ☐ Inferior ☐ Plantar ☒ Medial	☐
3. What is the focussed movement in the movement of a shrug? ☐ Superior and then Inferior ☐ Anterior and then Medial ☒ Elevation and Depression ☐ Protraction and Retraction	☐
4. Which of the following are examples of connective tissue? ☐ Muscle, Bone, Cartilage, and Skin ☒ Ligaments, Tendons, Fascia, and Cartilage ☐ Tendons, Bones, Ligaments, and Muscle ☐ Muscle, Fascia, Cartilage, and Tendons	☐
5. What are the major muscles required for the flexion and extension of the elbow? ☐ Quadriceps and Hamstring ☐ Pectoral and Latissimus Dorsi ☐ Biceps Femoris and Triceps ☒ Biceps and Triceps	☐
6. What two (2) sections can the skeleton be divided into? ☒ Axial and Appendicular ☐ Axial and Appendages ☐ Torso and Limbs ☐ Long bones and Short bones	☐

7. What three (3) sections can joints be classified into? ☐ Fibrous, Cartilage, Synovial ☐ Fibre, Cartilaginous, Synovial ☒ Fibrous, Cartilaginous, Synovial ☐ Fibro, Hyaline, Symphysis	☐
8. What are fast twitch fibres known as? ☐ Type I ☒ Type II ☐ Type IA and Type IB ☐ Type III	☐
9. What does the mechanics of breathing involve? ☐ Breathing in and breathing out ☐ Inspire and exhale ☒ Inspiration and expiration ☐ Respiration and expiration	☐
10. What does ATP stand for? ☐ Adenosine Two Phosphate ☒ Adenosine Tri Phosphate ☐ Adenosine Three Phosphates ☐ Adrenaline Tri Phosphate	☐
11. True or False: In multicellular organisms, including humans, all cells, tissues, organs, and organ systems of the body work together to maintain the life and health of the organism. ☒ True ☐ False	☐
12. What are the four (4) tissue types? ☐ Isokinetic, Isometric, Concentric, Eccentric ☒ Connective, Muscle, Nervous, Epithelial ☐ Superficial, Inferior, Deep, Anterior ☐ Muscle, Nervous, Connective, Organism	☐
13. Which of the following methods will keep you aware of emerging knowledge of anatomy and physiology relevant to the development of your own professional practice? Select all that apply. ☒ Reading journal articles ☒ Newsletters from health professional associations ☒ Networking within your industry	☐

14. Fill in the blanks for the statements below, selecting the correct option.

☐

Statement	Option 1	Option 2
The pectoralis major is _____ to the rhomboids.	☒ Anterior	☐ Posterior
The soleus is _____ to the gastrocnemius.	☒ Deep	☐ Superficial
The pectoralis major is _____ to the rhomboids.	☐ Deep	☒ Superficial
The rhomboids are _____ to the trapezius.	☒ Anterior	☐ Posterior
The bicep femoris is _____ to the semimembranosus.	☒ Lateral	☐ Medial
Anterior deltoid is _____ to rectus abdominus.	☒ Superior	☐ Inferior
Rectus abdominus is _____ to the obliques.	☐ Lateral	☒ Medial
The elbow joint is _____ to the shoulder joint.	☐ Superior	☒ Inferior
The wrist joint is _____ to the elbow joint.	☒ Distal	☐ Proximal
The knee joint is _____ to the ankle joint.	☐ Distal	☒ Proximal

15. Match the terms below with the appropriate movement, placing the corresponding movement letter label next to each term.

☐

Letter	Term
H	Flexion
D	Extension
A	Adduction
K	Abduction
G	Pronation
J	Supination
I	Dorsiflexion
B	Plantarflexion
C	Circumduction
F	Inversion
E	Eversion

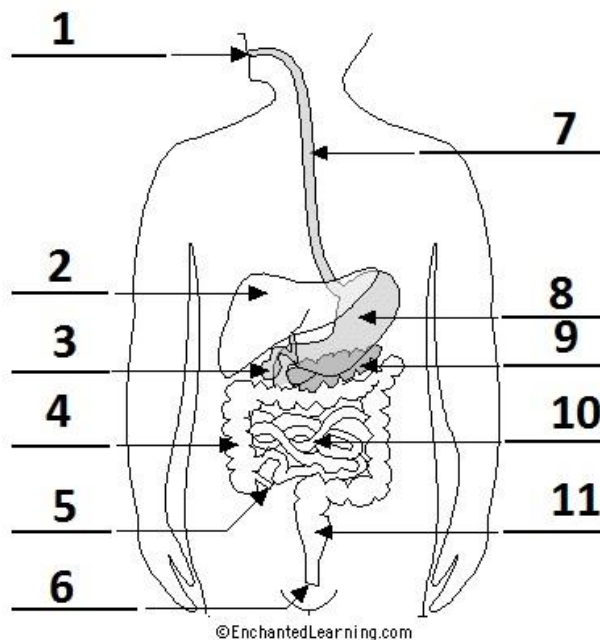
Movements
A. The movement of a limb sideways direction towards the midline of the body
B. Extension at the ankle
C. To allow a joint to perform movement through all possible axes
D. The straightening of a joint. It occurs when the angle at a joint increases and the two opposing surfaces move apart
E. To turn the sole of the foot laterally
F. To turn the sole of the foot medially
G. To turn the palm posterior
H. The bending of a joint. It occurs when the angle of the joint becomes smaller and the two opposing surfaces move together
I. Flexion at the ankle
J. To turn the palm anterior
K. The movement of a limb in a sideways direction away from the midline of the body

16. Identify the type of muscle tension for each listed exercise.

☐

Exercise	Isokinetic	Isometric	Isotonic
Pushing against a wall	☐	☒	☐
Performing a bicep curl	☐	☐	☒
Holding a push up position at the bottom of the movement	☐	☒	☐
Swimming	☒	☐	☐
Holding a shopping bag	☐	☒	☐
Performing a squat	☐	☐	☒
Cycling on a stationary bike	☒	☐	☐

17. Match the terms below with the appropriate diagram label, placing the corresponding number label next to each term.

☐


Number	Term
6	Anus
5	Appendix
7	Esophagus
3	Gall bladder
4	Large intestine
2	Liver
1	Mouth
9	Pancreas
11	Rectum
10	Small intestine
8	Stomach

18. What effect does regular cardiovascular exercise have on the following respiratory volumes? Select the correct option.

☐

Respiratory volume	Increase in size	Decrease in size
Vital capacity	☒	☐
Residual volume	☐	☒
Total lung capacity	☒	☐

Outcome for Quiz

- ☐ Satisfactory
☐ Not satisfactory

Trainer/Assessor comments

SHORT ANSWER ACTIVITIES

ACTIVITY 1

Consider the relevance of the anatomical position.

- a) Provide a definition of the anatomical position.
- b) Explain the reason for this body position in relation to health screening.

Definition

All movement is assumed to occur from an anatomical position. This is a reference position where the upright body faces anterior, with the arms straight and the palms facing towards the body.

Relation of health screening

The anatomical position is of importance in anatomy because it is the position of reference for health screening, for example to establishing poor posture.

Outcome for Activity 1

- ☐ Satisfactory
☐ Not satisfactory

Trainer/Assessor comments

ACTIVITY 2

Explain the path of an oxygen molecule from the initial phase of inspiration, starting at the nasal cavity.

Path of oxygen molecule

The oxygen molecule floating through the air is breathed in through the mouth and nose during inhalation. It travels from the mouth and nose into the pharynx (oropharynx and nasopharynx). The epiglottis closes to prevent foreign objects from entering the trachea (windpipe). From the pharynx, oxygen passes by larynx (voice box) through the trachea. The trachea splits into two mainstream branches called bronchi that go into each lung. The oxygen once in each bronchi, travels through smaller branches called bronchioles and then to the Alveoli. The oxygen molecule passes through or filters through the alveoli. Small pulmonary capillaries pass by the alveoli. When oxygen travels through the alveoli, the oxygen molecule transfers to or jump onto the hemoglobin molecule in the red blood cells of the blood through the thin walls in the alveoli and through the pulmonary and alveolar capillaries thus creating oxygen-rich blood. At the same time, carbon dioxide, a waste product of the body cells, transfers from or jumps off the hemoglobin molecule and is expelled during exhalation. This is commonly known as the gas exchange that takes place in the lungs.

Outcome for Activity 2

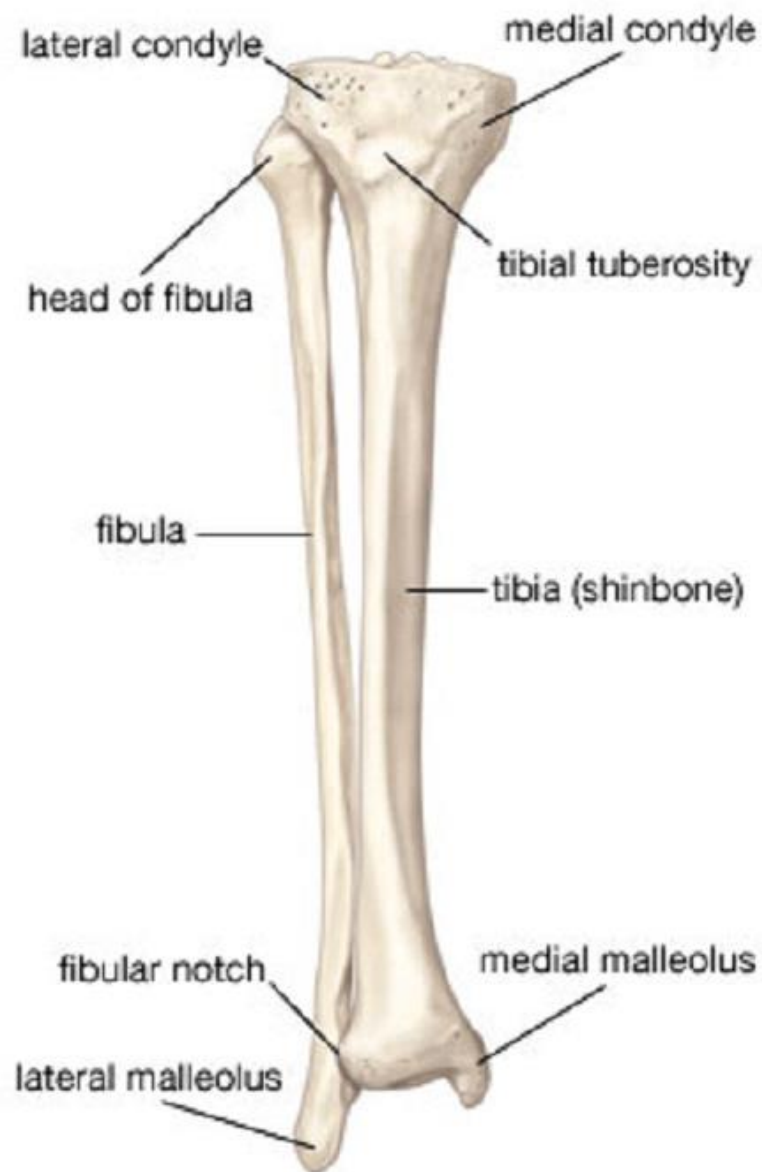
- ☐ Satisfactory
☐ Not satisfactory

Trainer/Assessor comments

ACTIVITY 3

Draw and label a sketch of a long bone.

Labelled sketch



Outcome for Activity 3	☐ Satisfactory ☐ Not satisfactory
Trainer/Assessor comments	

ACTIVITY 4

Identify three (3) types of muscle. Describe these muscles and explain where they are found in the body.

Muscle 1

Name of muscle	Quadrates Muscles
Description and location	Location: Rhomboids Description: It has four sides and is a flat muscle. Quadrates muscles have muscle fibres that run parallel to each other

Muscle 2

Name of muscle	Longitudinal Muscles
Description and location	Location: The rectus abdominis (abdominals) and Sartorius muscles (thigh) are classified as longitudinal muscles. Description: They are strap like muscles with fibres that lie parallel to each other. They give the impression of long and straight muscles.

Muscle 3

Name of muscle	Bipennate Muscle
Description and location	Location: Rectus femoris (of the quadriceps muscle group). Description: It has muscle fibres extending diagonally in pairs from either side of a long tendon, resembling a tail feather.

Additional answers may include:

Muscle 4

Name of muscle	Triangular Muscles
Description and location	Location: Pectoralis major Description: The triangular muscles generally protrude from a small narrow attachment to a broad and wide attachment at the other end. For example the pectoralis major inserts into a narrow insertion on the humerus.

Muscle 5

Name of muscle	Fusiform Muscles
Description and location	Location: Biceps, Brachialis and Brachioradialis Description: Rounded muscle that taper at both their origin at insertion and they give the impression of a cylinder shape.

Muscle 6

Name of muscle	Unipennate Muscles
Description and location	Location: Tibialis posterior muscle (calf region). Description: Half feather shaped muscle; it has a series of short parallel fibres that extend diagonally into one side of a long tendon.

Muscle 7	
Name of muscle	Multipennate Muscle
Description and location	Location: Deltoid Description: The deltoid is broken up into three sections with each section performing a different action at the shoulder joint. This is due to its ability to perform as a multipennate structure. The deltoid consists of muscle fibres grouped together which runs diagonally in different directions.

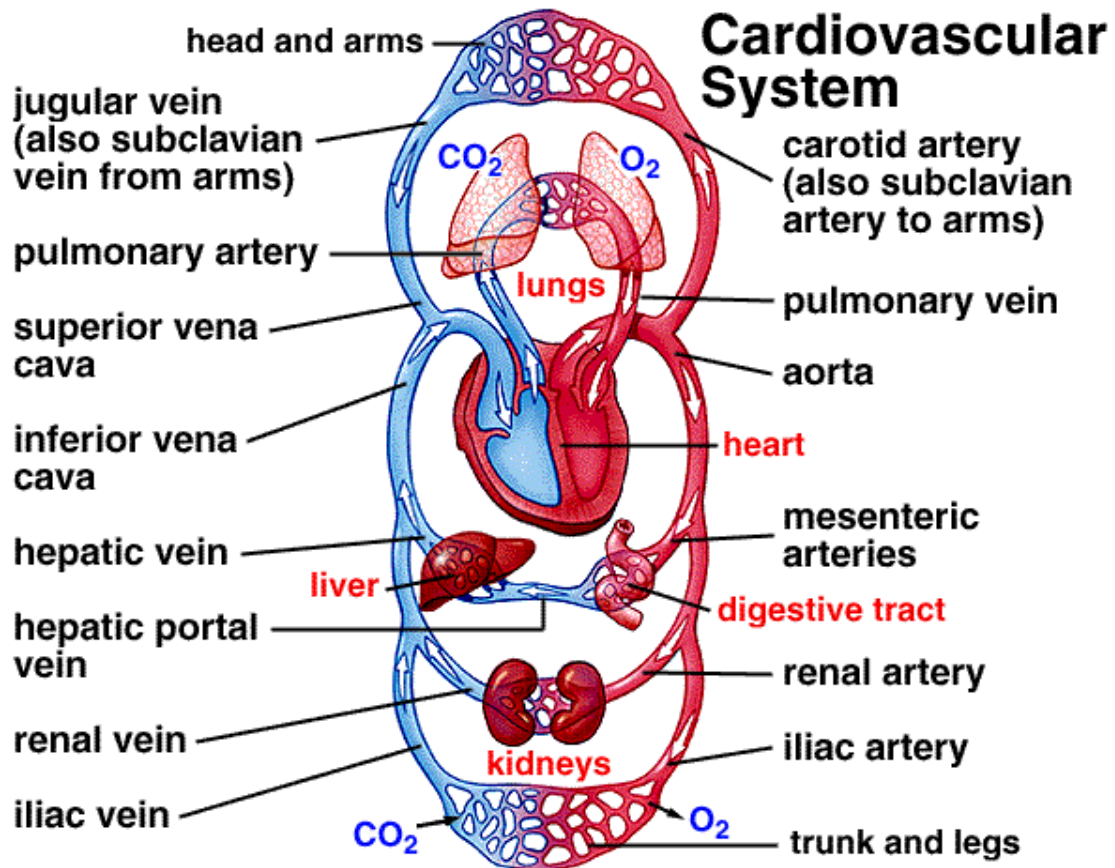
Outcome for Activity 4	☐ Satisfactory ☐ Not satisfactory
Trainer/Assessor comments	

ACTIVITY 5

Draw and label a sketch of the cardiovascular system.

Labelled sketch

Sylvia S. Mader, Inquiry into Life, 8th edition. Copyright © 1997 The McGraw-Hill Companies, Inc. All rights reserved.



Outcome for Activity 5

- ☐ Satisfactory
- ☐ Not satisfactory

Trainer/Assessor comments

ACTIVITY 6

Consider the movements in a push up.

- Describe the agonists and antagonists responsible for movement.
- Describe the role synergists play in this movement.
- Describe the role connective tissue plays in this movement.
- Describe the role of a Fixator or Stabilizer during an exercise movement, such as a push up.
- Describe the role of a Prime Mover in muscle movement.

Agonists and antagonists

Agonist is directly responsible for the action. Chest muscles pectoralis major, clavicle; triceps and anterior deltoid are the agonist muscles in the push up.

Antagonist are the opposite muscles to the agonist muscles- they relax and lengthen within the movement. In a push up the antagonist muscles are latissimus dorsi, erector spinae muscles, teres major and minor, biceps and rear deltoid.

Synergists

Synergists in a movement is the muscle that stabilises a joint around which the movement is occurring, which in turn helps the agonist function effectively. Synergists muscles also help to create the movement.

Connective tissue

Every muscles has connective tissue that attaches the muscles fibres together. It gives the ability to withstand pulling or longitudinal strains and stretches while holding the muscles together. Without you would lose strength and the ability to move your bones or support your frame.

Fixator or Stabilizer

In push up the abdominal muscles act as the fixator or stabilizers to prevent the back from arching and to perform the movement correctly. The group of muscle contract statically to support the body part or the action to occur.

Prime Mover

The prime mover is helped by other muscles called synergist, these muscles act in opposition to the movement generated by the agonists and are responsible for returning a limb to its initial position. synergists. These muscles perform, or assist in performing, the same set of joint motion as the agonists.

Outcome for Activity 6

- ☐ Satisfactory
☐ Not satisfactory

Trainer/Assessor comments

ACTIVITY 7

Write a description of cross bridging. Include references to the following:

- All or none theory
- Motor units
- CNS
- Structure of a muscle

Description

A single cross-bridge cycle consists of four basic stages. First, myosin binds actin, forming the high-energy/attached state. The power stroke occurs when myosin changes its shape, pulling the thin filaments towards the middle of the sarcomere - that's what causes sarcomere shortening in muscular contraction.

The central nervous system (CNS) is made up of the brain, the spinal cord, and the optic nerves. The central nervous system controls thought processes, guides movement, and registers sensations throughout the body.

The all-or-none law is the principle that the strength by which a nerve or muscle fibre responds to a stimulus is independent of the strength of the stimulus. If that stimulus exceeds the threshold potential, the nerve or muscle fibre will give a complete response; otherwise, there is no response.

A motor unit is essentially a single motor nerve or neuron. Each motor neuron can control muscle cells that are collectively called a motor unit. These motor neurons receive signals from the brain and all the muscle fibres in that particular motor unit are stimulated at the same time.

A whole skeletal muscle is considered an organ of the muscular system. The structure of each muscle consists of skeletal muscle tissue, connective tissue, nerve tissue, and blood or vascular tissue. Skeletal muscles vary considerably in size, shape, and arrangement of fibres. They range from extremely tiny strands such as the stapedium muscle of the middle ear to large masses such as the muscles of the thigh. Some skeletal muscles are broad in shape and some narrow. In some muscles the fibres are parallel to the long axis of the muscle; in some they converge to a narrow attachment; and in some they are oblique.

Outcome for Activity 7

- ☐ Satisfactory
☐ Not satisfactory

Trainer/Assessor comments

ACTIVITY 8

Muscle fibres can be classified as either fast twitch or slow twitch.

- a) Describe each twitch type.
- b) Provide an example of a specific sport where they are most used.

Description

Fast twitch (type II) fatigue faster but are used in powerful bursts of movements.

Slow twitch (type I) help enable long endurance.

Sports where most used

Fast Twitch = Sprinting- soccer, netball, basketball and football.

Slow Twitch = Distance running- marathons, swimming

Outcome for Activity 8

- ☐ Satisfactory
☐ Not satisfactory

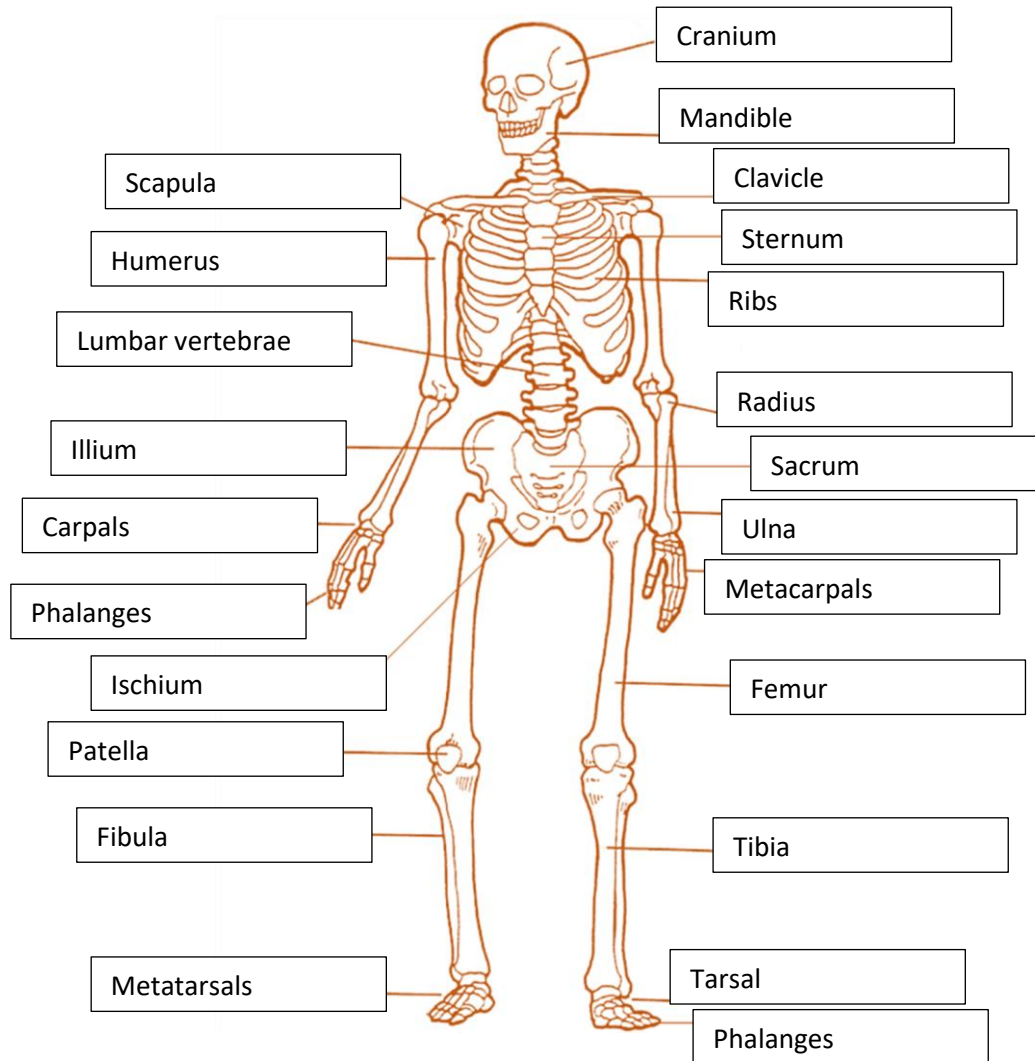
Trainer/Assessor comments

ACTIVITY 9

It is important to have a detailed knowledge of the human skeleton as part of fitness programming.

- Name the labelled parts of the skeleton shown below.
- Give three (3) examples of bony landmarks from the diagram.

Labelled sketch



Bony landmarks

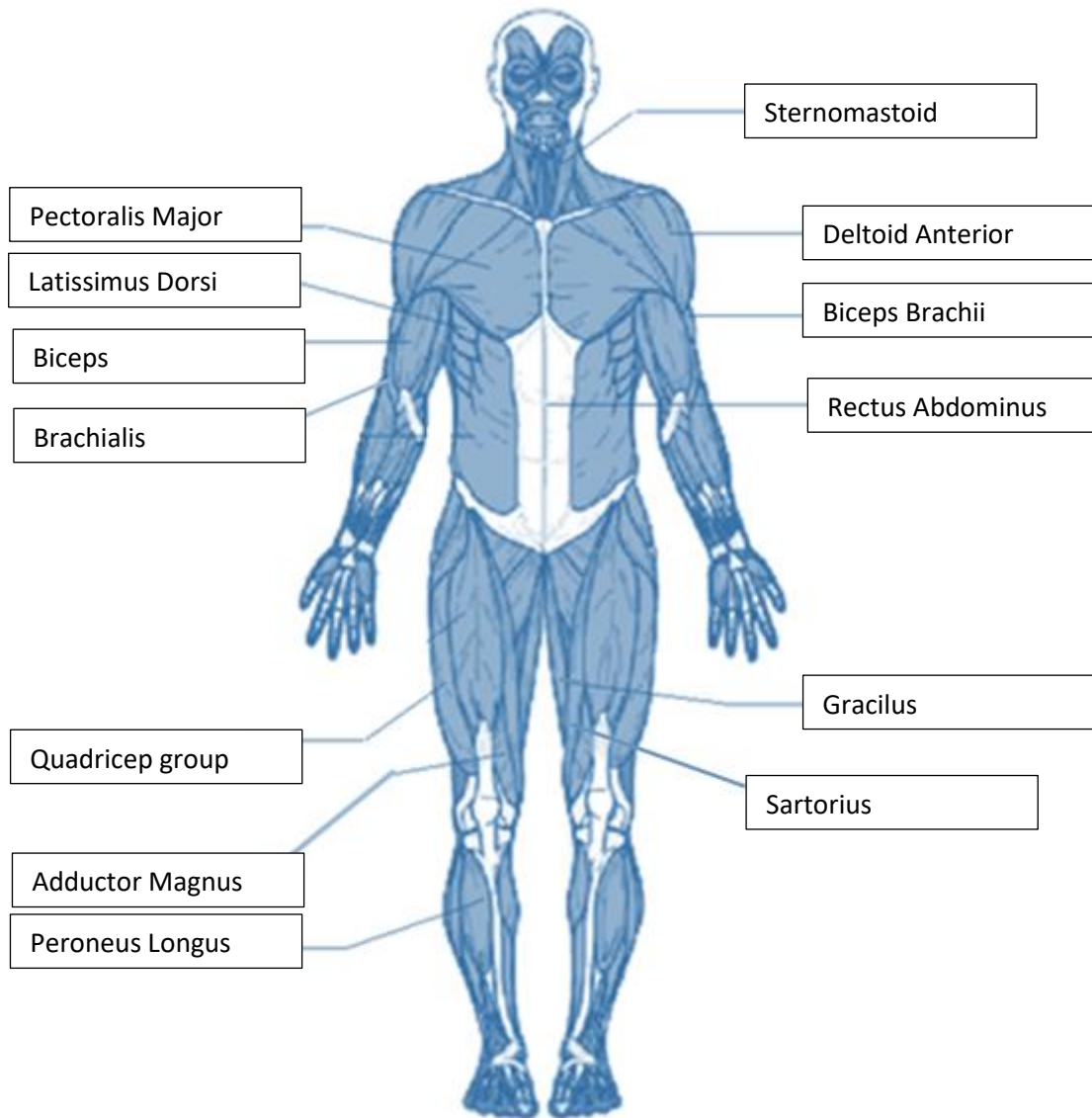
Clavicle, Ulna, Carpals, Patella, Tibia, Tarsals, Femur (distal to hip joint)

Outcome for Activity 9	☐ Satisfactory ☐ Not satisfactory
Trainer/Assessor comments	

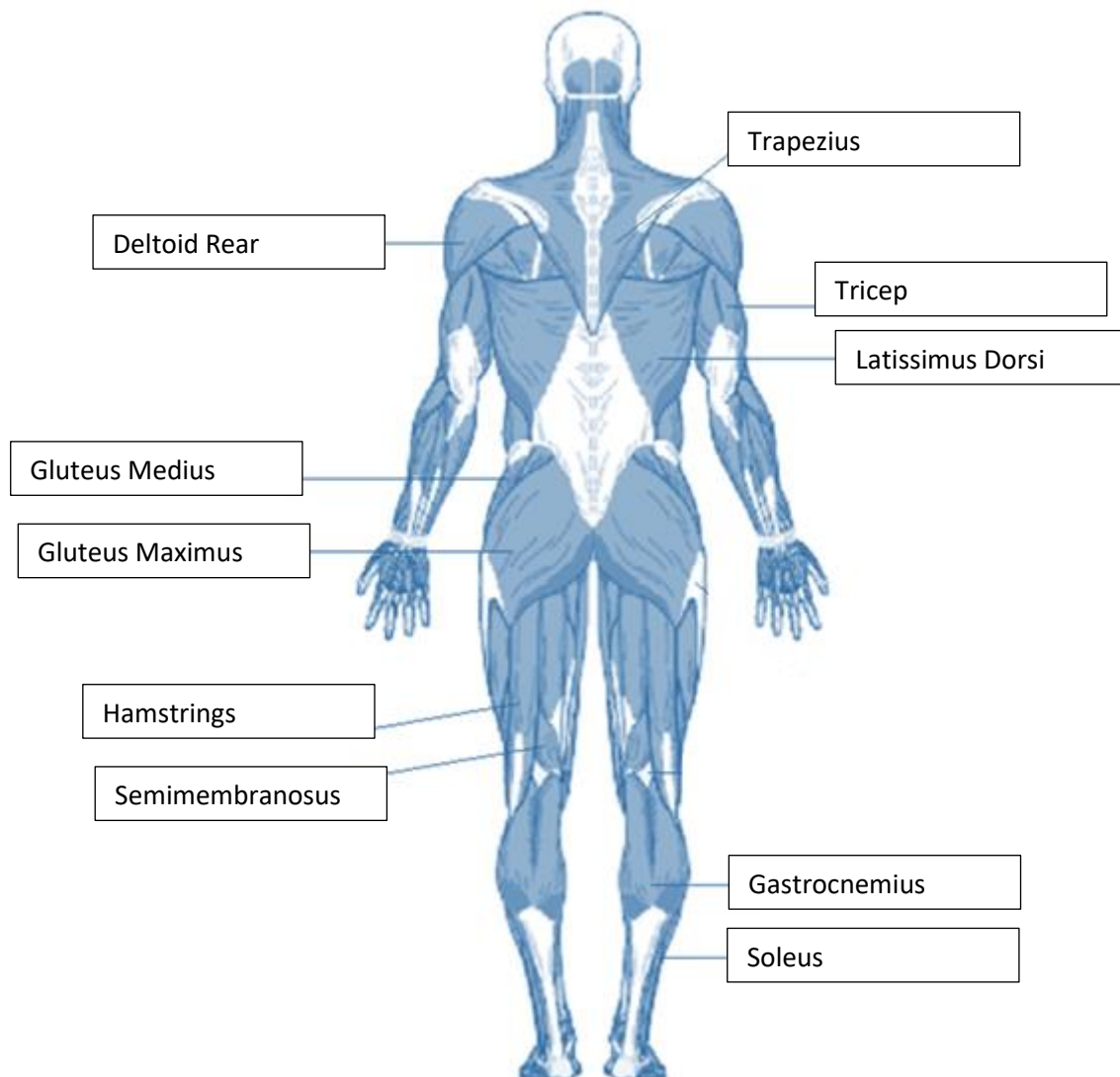
ACTIVITY 10

Name the labelled muscles shown in the sketches below.

Labelled sketch 1



Labelled sketch 2



Outcome for Activity 10

- ☐ Satisfactory
☐ Not satisfactory

Trainer/Assessor comments

ACTIVITY 11

Consider the role of thermoregulation.

- Provide a description of this term.
- Outline the role it plays in exercise.
- Describe what a person can do to ensure their body is prepared to undertake the stresses of exercise in relation to body temperature, as well as accounting for environmental conditions.

Description

Thermoregulation is a process that allows your body to maintain its core internal temperature. A healthy internal body temperature falls within a narrow window, with the average person having a baseline temperature between 37°C and 37.8°C. Your body has some flexibility with temperature. If the body temperature falls to 35°C or lower causes hypothermia. This condition can potentially lead to cardiac arrest, brain damage, or even death. If the body temperature rises as high as 42 °C brain damage or even death can result.

Role in exercise

When exercising sweat glands release sweat, which cools the skin as it evaporates. This helps lower your internal temperature.

Another form is Vasodilatation where the blood vessels under your skin get wider. This increases blood flow to the skin where it is cooler — away from the warm inner body. This allows the body release heat through heat radiation.

Preparing the body for exercise

Your hypothalamus is a section of your brain that controls thermoregulation. When it senses your internal temperature becoming too low or high, it sends signals to the muscles, organs, glands, and nervous system. They respond in a variety of ways to help return the body temperature to normal. When preparing to undertake exercise ensure you warm up properly, gradually increasing the body's core temperature, keep hydrated especially in hot conditions. In cool environments it is essential to wear appropriate training attire to keep body warm and cool down post exercise to enable the body to return to its natural temperature.

Outcome for Activity 11

- ☐ Satisfactory
☐ Not satisfactory

Trainer/Assessor comments

ACTIVITY 12

Explain the difference between motor and sensory neurons. Be sure to refer to afferent and efferent nerves.

Motor and sensory neurons

Efferent neurons, otherwise known as motor neurons, carry nerve impulses away from the central nervous system to effectors such as muscles or glands

Afferent neurons (otherwise known as sensory neurons), carry nerve impulses from receptors or sense organs towards the central nervous system.

Outcome for Activity 12

- ☐ Satisfactory
☐ Not satisfactory

Trainer/Assessor comments

ACTIVITY 13

Why does oxygen demand increase when you are physically active?

Oxygen demand

When doing physical activity, there is an increase in the energy output in the active muscle tissue. Increased energy output means that more oxygen is required to create more energy to meet the demands of the active tissue

Outcome for Activity 13

- ☐ Satisfactory
☐ Not satisfactory

Trainer/Assessor comments

CASE STUDIES

CASE STUDY 1

A 39 year old female client, Janice, has shown indications of scoliosis during her exercise pre-screening. The postural problem is causing problems with her work and has been slowly getting worse since she started playing social tennis three (3) nights a week.

Janice has come to you looking for advice on how to relieve these symptoms and improve her overall strength. She has concerns that lifting weights will make her bulky and put her at risk of further injury.

Respond to the following points:

- a) Write a 200 word response to Janice allaying her concerns and giving suitable advice. Be sure to consider the following:
 - What anatomical positioning would indicate these symptoms
 - Why the factors indicated would make her muscles imbalanced
 - Where to access further information to help you prior to writing Janice's program
 - Any Allied Health Professionals (AHPs) you would recommend Janice visit prior to commencing her training program with you
- b) Using the template below, write a program from Janice to commence her training with you. Be mindful of the following points:
 - Janice has never been to the gym before and intends to come to you three (3) times a week initially
 - Janice's doctor has recommended that she improve her lower back and abdominal strength, as well as improve the balance of strength in her upper back
 - Currently, Janice's right side is much stronger than her left
 - Ensure you provide exercises to prevent the development of pathological postures and provide correction of joint alignment
- c) Explain how both the *Golgi tendon reflex* and the *Stretch reflex* will potentially assist Janice. Include a description of how the reflex arc works and the response it will have.

Advice to Janice

Assessor's discretion

In relation to c)

The Golgi tendon reflex:

- Protects the musculoskeletal system from damage caused by excessively heavy loads
- Golgi tendon organ measures force production
- When force production exceeds 'safe' level, sensory neuron sends information to spinal level of central nervous system
- Sensory neuron attaches directly to motor neuron which activates opposing muscle group
- Muscle is forced to relax because of reciprocal inhibition when the opposing muscle is activated, thus stopping the potentially damaging force production

The stretch reflex:

- Measures the rate of stretch in a muscle
- Activates when muscle spindle senses that muscle is stretching too quickly and sensory neuron sends information to spinal level of central nervous system
- Sensory neuron attaches directly to motor neuron which activates the muscle that is stretching
- Muscle starts to contract to prevent further damage from excessive stretch

FIT TO LEARN PROGRAM CARD				
Name	Assessor's discretion			
Trainer				
Date				
Goals/Aims				
Contraindications				
Session length				
Exercise	Sets	Reps	%1RM/Weight	Rest
<i>Squat</i>	3	8-10	70%	60 sec
Cardiovascular training method	Time/Distance		Level/Resistance/Intensity	
Cool down				
Stretches				

Outcome for Case Study 1	☐ Satisfactory ☐ Not satisfactory
Trainer/Assessor comments	

CASE STUDY 2

Steven is a 22 year old athlete who is trying to transition from a junior career as a 100m sprinter into playing state league Australian Rules football. While he is very lean and muscular, he says that he is feeling very tired after the first 10 minutes of each quarter. Also, as a result of moving from a short distance sport to an endurance sport, he is finding the DOMS he is experiencing seem to be lasting longer than the other members of his team.

Steven has always played sport but is wants to better understand how different energy systems and training styles can impact on his health, performance and recovery.

Respond to the following points:

- a) Using Steven's sports and symptoms, describe how understanding muscle types, energy systems and training methods can help to improve sport performance. Include definitions of key terms.
- b) What training advice would you give Steven to help make his transition to a new sport easier in the coming months?
- c) Explain the role the nervous system plays in Steven's training.

	Response
a)	Assessor's discretion
b)	Assessor's discretion
c)	When a muscle becomes stronger in response to training, the gain in strength is usually attributed to an improvement in the size or quality of the muscle. The truth, however, is that strength upgrades can occur without any change in the muscle at all. Many upswings in strength are actually the result of alterations in the way the muscle is controlled by the nervous system. Specifically, the nervous system can do a better job of recruiting muscle fibres and collections of muscle cells (motor units) within the muscle during an athlete's sporting activity, thus producing more forceful movements. The nervous system might also become more accomplished at stimulating 'synergists' (i.e. muscles which aid the primary muscle in carrying out its assigned function). Importantly, the nervous system can also enhance its ability to inhibit 'antagonists' (i.e. muscles which produce forces counter to the desired direction of movement); when this 'restraining order' is put in place, prime movers and synergists can create considerably stronger movements.

Outcome for Case Study 2	☐ Satisfactory ☐ Not satisfactory
Trainer/Assessor comments	

PRACTICAL TASK

You are required to have a suitable observer verify your ability to complete the following tasks. These tasks may be simulated or real.

TASKS	VERIFIED
A. You are to plan for and provide five (5) clients with instruction on the following body systems – cardiovascular, respiratory, musculoskeletal (with attention to bone strength, muscle endurance, muscle strength), nervous and digestive. Your clients will include beginners, intermediate and advanced participants, and will require instruction for low and high impact. During each client session, you are to complete the following: • Explain and demonstrate: ○ The major movements of the body, while identifying major muscles ○ Actions of major joints during exercise ○ Relevant information regarding structure and function of skeletal muscle, and process of muscle contraction during exercise ○ Muscle actions and functions during different types of contractions • Complete an evaluation of your work (including associated documentation) identifying improvements for your professional practice	☐

Outcome for Practical Task	☐ Satisfactory ☐ Not satisfactory
Trainer/Assessor comments	