CHAPTER 02

Knowledge Review

Q1*:* What is meant by the following terms: a] medial b] proximal c] flexion d] contra-lateral e] sagittal plane f] endangerment site

A1:

a] medial: towards the midline

b] proximal: near to

c] flexion: bending of a joint, reducing its angle

d] contra-lateral: opposite side of body

e] sagittal plane: flat surface, dividing the body into left and right portions

f] endangerment site: specific area on the body where there is potential for harm to be caused by inappropriate pressure, movement or other technique

Q2: List ten facts about the skeletal system.

A2:

1. Comprised of: bones; cartilage; joints
2. Supports and protects the body
3. Bones provide sites of attachment for muscles
4. Structure and shape of components facilitates body posture and movement
5. There are generally considered to be around 206 bones in the body
6. 2 types of bone: compact and cancellous
7. 5 classifications of bone: long; short; flat; irregular; sesamoid
8. Bone contains marrow cells, which form much of the body's blood cells
9. Bone stores minerals and fats
10. Bone and its outer membrane - the periosteum - is living tissue and has blood, lymphatic and nerve supply
11. Activity, exercise, lifestyle and accidents all have profound effects upon the development and strength of bone

12. 3 types of cartilage: hyaline; fibro; elastic
13. 3 types of joints: fibrous; cartilaginous; synovial
14. 6 types of synovial joints: ball and socket; hinge; gliding; pivot; condyloid; saddle

Q3: What are the typical features of a synovial joint?

A3:

A typical synovial joint comprises of: a joint capsule; capsular ligaments; synovial membrane; synovial fluid; articular cartilage. There are six main types of synovial joint: gliding; hinge; ball and socket; pivot; condyloid; saddle.

Q4: Provide one example from each of the following joints: a] fibrous b] cartilaginous c] ball and socket d] hinge e] gliding f] saddle

A4:

a] fibrous: sutures of the cranium

b] cartilaginous: intervertebral joints; public symphasis

c] ball and socket: shoulder; hip

d] hinge: elbow; knee

e] gliding: carpal joints; tarsal joints

f] saddle: thumb

Q5: What are the key differences between striated, smooth and cardiac muscle tissue?

A5:

Striated muscle is also known as voluntary or skeletal muscle; smooth muscle is also known as involuntary muscle; cardiac muscle is also known as heart muscle. Each category has a different structure and functional purpose. Striated muscles are responsible for the maintenance of posture and performance of co-ordinated body movements. Smooth muscle tissue is responsible for such involuntary actions as the movement of digestive products through the gastro-intestinal tract [via peristalsis], the regulation of organ volumes and the

vasoconstriction and vasodilation of blood vessels. Cardiac muscle is a specialized contractile tissue found only in the heart.

Q6: Describe the structural breakdown of skeletal muscle tissue from the superficial fascia inwards.

A6:

Inside of the superficial fascia [connective tissue] layer lie the deeper fascial layers, these separate the muscles into groups. The superficial fascia provides protection, reduces heat loss, stores water and fat and provides a framework for nerves and blood vessels to enter and leave. Three further layers extend from the deep fascia: the epimycium contains the muscle; the perimycium surrounds the bundles of muscle fibres [the fascicles]; the endomycium separates the individual muscle fibres. Muscle tissue is comprised of many muscle fibres [the muscle cells], and each muscle fibre is made up of many contractile units called myofibrils. The muscle's tendon, which attaches it to bone at its origin and insertion, is a continuation of the connective tissues that surround it.

The membrane of the muscle cell is the sarcolemma, and underneath this is its sarcoplasm [its cytoplasm]. The sarcoplasm houses the cell's proteins, organelles, and the threadlike myofibrils. The myofibrils, within the muscle fibres, are composed of many overlapping protein threads called myofilaments. The myofibrils are also divided along their length into a series of distinct sections called sarcomeres. The sarcomeres are the functional contractile [shortening] units of each myofibril. The overlapping myofilaments of the sarcomere are the thin actin and thick myosin. The alternating light and dark pattern formed by these myofilaments are what gives skeletal muscle fibres their characteristic striped or striated appearance when viewed microscopically.

Q7: Describe, in one paragraph, how muscles contract.

A7:

When a muscle fibre receives a message [via a motor nerve impulse] to contract, its myofilaments [actin and myosin] slide across each other. Stored calcium, within the sarcoplasmic reticulum, is released when the nerve impulse action potential reaches the sarcoplasm and causes the release and diffusion of calcium into the muscle. As released calcium binds with troponin, on the actin myofilament, a positional change immediately occurs in tropomyosin. The amount of functional force produced depends upon the number of cross-bridges created. The process described, whereby the sarcomere is seen to shorten, during a concentric contraction, is commonly known as the sliding-filament theory.

Q8: List the main components of the nervous system.

A8:

The nervous system is basically comprised of the Central, Peripheral and Autonomic Nervous Systems [CNS; PNS; ANS]. The main components are the brain, spinal cord, 12 pairs of cranial nerves, 31 pairs of spinal nerves, the special sense organs and the sympathetic and parasympathetic divisions of the ANS. The functional nerve cell is the neuron, which propagates the nerve impulses. Each impulse is conducted neuron to neuron via a chemical neurotransmitter substance, the most common being acetylecholine.

Q9: Describe the systemic, pulmonary and portal circulatory systems.

A9:

The systemic, or general, circulation is the oxygenated blood supply from the heart to the tissues, and the return from the tissues of deoxygenated blood back to the heart. The pulmonary circulation is the flow of deoxygenated blood from the heart to the lungs, and the return of oxygenated blood from the lungs to the heart. The portal circulation is the flow of nutrient-rich, deoxygenated blood from the digestive system to the liver.

Q10: What are the main components and functions of the lymphatic system?

A10:

The lymphatic system is basically comprised of lymphocytes, lymph [fluid], lymphatic capillaries and vessels, lymph nodes, thoracic duct, right lymphatic duct, spleen, thymus

gland, tonsils, adenoids, lacteals, peyer's patches. The basic functions of the lymphatic system are to drain away excess [interstitial] fluids, destroy bacteria and other foreign substances, help prevent and fight infection and transport dietary lipids.

Q11: What is lymphatic drainage?

A11:

The term lymphatic drainage refers to the drainage of excess tissue fluid and particulate matter into the lymphatic vessels and onwards. Lymphatic drainage can be summarized as follows: any excess tissue fluid and waste, not taken up into venules, is drained into lymphatic capillaries; tissue fluid in the lymph capillaries becomes lymph [lymphatic fluid]; lymph capillaries drain into lymphatic vessels; larger lymphatic vessels travel towards lymph nodes; lymph is filtered in the lymph nodes; lymphatic vessels take the lymph on to either the thoracic or right lymphatic duct; the accumulating lymph then drains into either the left or right subclavian vein.

Q12: List the main organs of respiration.

A12:

The main organs of respiration and gaseous exchange are: nose and mouth; pharynx; larynx; trachea; lungs; bronchi; bronchioles; alveoli

Q13: What is a] breathing b] external respiration c] internal respiration d] cellular respiration?

A13:

a] Breathing [pulmonary ventilation] is the act of breathing in and out [inspiration and expiration].

b] External respiration is the exchange of gases [oxygen and carbon dioxide] within the lungs.

c] Internal respiration is the exchange of gases between the blood and tissue cells.

d] Cellular respiration is the use of oxygen within the tissue cells - oxygen is used to release energy from glucose and this takes place in the mitochondria.

Q14: Which skeletal muscles, major and accessory, are involved in respiration?

A14:

The major muscles of respiration are the diaphragm and the intercostals. The main accessory muscles of respiration are the scalenes, sternocleidomastoid, pectoralis minor, internal and external obliques, rectus abdominus and transversus abdominus.

Q15: List the main and accessory organs of the digestive system.

A15:

The main organs of the digestive system are the mouth, salivary glands, pharynx, oesophagus, stomach, small intestine, large intestine, rectum and anus. The main accessory organs of the digestive system are the liver, gall bladder and pancreas.

Q16: List the main endocrine glands.

A16:

The main endocrine glands are the hypothalamus, pituitary gland, pineal gland, thyroid gland, parathyroid glands, adrenal glands, pancreas, ovaries and testes.

Q17: List five functions of the endocrine system.

A17:

1. The endocrine system secretes hormones [chemical messengers] which assist in regulating the internal environment, metabolic processes and the energy balance of the body.
2. Hormones help regulate muscular contractions, glandular secretions and immune responses.
3. The endocrine system is greatly involved in the processes of growth, development and reproduction.
4. Oxytocin stimulates uterine contraction during labour, and milk ejection during breast-feeding.
5. Anti-diuretic hormone [vasopressin] stimulates water reabsorption by the kidneys and arterial constriction.

6. Prolactin helps initiate milk production in the female.
7. Parathyroid hormone helps regulate blood calcium and phosphate levels.
8. Adrenal glands [cortex and medulla], help regulate sodium and water reabsorption, anti-inflammatory responses and the stress ["fight or flight"] response.
9. The pancreas secretes glucagon, which increases blood glucose levels, and insulin, which decreases blood glucose levels.
10. Ovaries regulate development and maintenance of feminine characteristics, reproductive cycles, pregnancy and lactation.
11. Testes help to regulate development and maintenance of masculine characteristics, and have integral reproductive functions.
12. The pineal gland secretes melatonin, which is involved in the regulation of circadian rhythms [the 24 hour day/night cycle].

Q18: List ten anatomical or physiological differences between males and females.

A18:

1. Males tend to be taller and heavier, females tend to be shorter and lighter.
2. Male bones tend to be heavier and thicker, female bones tend to be lighter and thinner.
3. The surfaces of male joints tend to be relatively larger than those of females.
4. Male muscle attachment sites tend to be more distinct than those of females.
5. Male shoulders tend to be broader than the narrower females'.
6. The female has a smaller thorax than the male.
7. The female has breasts.
8. Male hips tend to be narrower, and the females' wider.
9. The male pelvis is deeper and has a smaller, heart-shaped, pelvic brim.
10. The female pelvis is shallower and has a larger, oval-shaped pelvic brim.
11. Male legs tend to be proportionately longer than the females', with the neck of the femur at a lesser angle to its shaft.
12. There is a lesser slant of the thigh to the knee on the male.
13. The female is more likely to demonstrate genu valgus [knock-knee] posture.

14. The male arms tend to be proportionately longer than a female's, and have a lesser carrying angle.
15. The male tends to have a greater percentage of muscle tissue.
16. The female tends to have a greater percentage of body fat.
17. The male tends to be more mesomorphic, and the female more endomorphic.
18. The average percentage of male body fat is around 13%.
19. The female average body fat percentage is around 25%.
20. The female tends to demonstrate a lower lean body mass [fat free mass], which indicates the reduced muscle mass.
21. The male tends to accumulate his excess body fat around his waist and on the upper body, whilst on the female more fat is deposited on to the hips and thighs.
22. The male tends to carry a greater percentage of blood in body fluid, and a greater percentage of water.
23. The male tends to have a larger heart, with a greater stroke volume and lower resting heart rate.
24. In blood, the female tends to carry less erythrocytes [red blood cells] and also reduced levels of haemoglobin within the blood cells.
25. Male blood pressure tends to be higher than a female's.
26. Male lungs tend to be around 10% larger.
27. Males tend to have an increased respiratory rate and a greater vital capacity.
28. Males tend to be stronger, faster and more powerful than females.
29. Females tend to be more flexible.
30. Males also tend to have a greater aerobic capacity.
31. Females experience the menstrual cycle, the menopause and also possibly pregnancy.

Q19: Describe the aerobic energy system.

A19:

The aerobic energy system supplies the fuel for energy when the body is at rest, during relatively easy activities, and during endurance-based exercise [walking, jogging, distance

running, cycling, etc.]. During relatively low intensity activities, the aerobic energy system can usually effectively supply oxygen to the working muscles. The main fuel for the aerobic production of ATP is from glycogen and fatty acids, both of which are normally in sufficient supply. These fuels undergo a process of oxidation when they are combined with oxygen inside the mitochondria of the muscle cells, and this slowly and continually produces ATP, the body's energy currency. The predominant waste products of the aerobic system are carbon dioxide and water. The aerobic system is not always able to generate enough ATP during more intense activities, such as a short sprint or series of heavy lifts, and this is where anaerobic pathways are utilized.

Q20: List some of the common effects of ageing on the body.

A20:

1. General slowing down of physiological functioning
2. Gradual degeneration of tissues.
3. Increased vulnerability to disease processes.
4. Skin becomes thinner, less elastic and supple [lines and wrinkles develop] and less protective.
5. Weakening of superficial skin capillaries [bruise more easily].
6. Hair tends to dry, become brittle, thin out, turn grey and become lack-lustre.
7. Postural changes may occur.
8. Height may reduce.
9. Weight can be gained or lost.
10. Muscle mass and strength reduces.
11. Bone mass reduces.
12. General mobility and flexibility reduces.
13. Musculo-skeletal conditions such as arthritis, degenerative disc disease, osteoporosis are more common.
14. Progressively reducing number of nerve cells.
15. Sensory, integrative and motor activity becomes less efficient.
16. Gradual deterioration in vision, audition, olfaction and gustation.

17. Reactions become slower.
18. Co-ordination becomes more impaired.
19. Memory becomes less clear.
20. Circulatory and respiratory systems slowly develop a reduced efficiency.
21. Stroke volume [and cardiac output] reduces.
22. Maximal exercising heart rate reduces.
23. Blood pressure tends to rise.
24. Blood vessels tend to become less elastic, more brittle and congested.
25. Lung capacities reduce.
26. Oxygen supply to the cells reduces.
27. Venous and lymphatic return becomes less efficient.
28. Increased susceptibility to infection and disease due to impaired immune responses.
29. Enzyme production in the digestive system reduces.
30. The effective absorption of nutrients is compromised.
31. The liver and kidneys become less efficient.
32. Basal metabolic rate decreases.
33. Efficiency of temperature regulation is reduced.
34. Increased healing times of injuries.