

NASM-CPT™ - Quiz Questions with Answers

Domain 1: Basic and Applied Sciences and Nutritional Concepts

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1.

Which of the following are the two hormones responsible for the "fight-or-flight" response?

Epinephrine and norepinephrine

Testosterone and estrogen

Growth hormone and testosterone

Epinephrine and testosterone

Correct answer: Epinephrine and norepinephrine

Epinephrine and norepinephrine are hormones categorized as catecholamines, which are produced by the adrenal glands. These hormones are part of the stress response referred to as the "fight or flight" response.

During any activity, exercise, or stress, the adrenal glands secrete more epinephrine, which increases heart rate, elevates blood sugar, sends blood to working muscles, and dilates airways.

2.

Which of the following is the best place to manually monitor heart rate?

Wrist

Carotid artery

Antecubital space

Temple

Correct answer: Wrist

With the palm facing up, place the index and middle finger about one inch below the thumb. This will give a safe, accurate reading of an individual's heart rate.

Although the carotid artery has a strong pulse, this location is not recommended because pressure on this artery disrupts blood flow to the brain, which can lead to dizziness as well as an inaccurate measurement.

The antecubital space is a location for a stethoscope during a blood pressure reading. The temple can be used to check pulse, but it is less reliable than the wrist.

3.

Which of the following is not a characteristic of Type II (fast-twitch) muscle fibers?

Slow to fatigue

Decreased oxygen delivery

Short-term contractions

Larger in size

Correct answer: Slow to fatigue

Type II muscle fibers (fast-twitch) are able to produce more speed and power in a contraction, but the intensity of that contraction is much shorter in duration because Type II muscle fibers fatigue more quickly than Type I muscle fibers (slow-twitch).

This is mainly because Type II muscle fibers have fewer capillaries, mitochondria, and myoglobin than Type I muscle fibers. Because Type II muscle fibers have fewer capillaries, they have less oxygen delivery. Type II muscle fibers are larger in size than Type I muscle fibers.

4.

After exercising for over 90 minutes, which fuel source is an individual most likely to run out of?

Glycogen

Acetyl-CoA

Fat

Amino acids

Correct answer: Glycogen

Once enough carbohydrates have been consumed to meet the body's immediate energy needs, the body stores the remaining glucose by converting it to glycogen for storage. However, these stores are limited and can become depleted quickly.

If carbohydrates are not consumed at a rate fast enough to replace the depleted stores, then the body will experience "hitting the wall." When this happens, activity has to slow down or stop altogether.

The body contains enough fat and amino acids to last for days of exercise, and acetyl-CoA is made from carbohydrates and fats.

5.

Which connective tissue is responsible for attaching muscle to bone?

Tendons

Ligaments

Synergists

Stabilizers

Correct answer: Tendons

Tendons are the tissues that connect muscle to bone. They serve as an anchor for muscles, allowing force production. Tendons are flexible but inelastic cords of strong, fibrous collagen tissue.

Ligaments are the connective tissue that connects bone to bone.

Because muscles are recruited as groups, many muscles will transmit force onto their respective bones, creating movement at the joints. This synergistic action of multiple muscles to produce movement around a joint is known as a force-couple relationship.

Synergists are the muscles responsible for assisting the prime mover during a joint action. Stabilizers are the muscles responsible for minimizing unwanted movement while the prime mover and synergist work.

6.

During a stretch, which of the following is happening to sarcomeres within the muscle?

The sarcomeres lengthen

The sarcomeres shorten

The sarcomeres stay the same length

The sarcomeres contract and lengthen simultaneously

Correct answer: The sarcomeres lengthen

When a muscle is stretched, the overlap within the sarcomeres of the thick and thin filaments decreases, allowing the muscle fibers to elongate.

When a muscle is contracted (shortened), the overlap within the sarcomeres of the thick and thin filaments increases.

7.

Which of the following is a potential effect of excessive intake of magnesium?

Diarrhea

Nerve damage

Kidney stones

Loss of appetite

Correct answer: Diarrhea

Dietary reference intake (DRI) values for nutrients provide good guidelines for what constitutes an adequate intake of a nutrient. However, excess intake of mineral elements can also cause health problems. For example, excess intake of magnesium can lead to diarrhea.

8.

All of the following are considered very low carbohydrate diets, except:

South Beach diet

Atkins diet

Protein power plan

Ketogenic diet

Correct answer: South Beach diet

Weight gain is a result of repeatedly eating more calories than are used. An excess of any nutrient, carbohydrate, fat, protein, or alcohol over daily calorie needs will cause weight gain. There are many diets individuals have used to achieve their weight-loss goals, some of which emphasize very-low carbohydrate consumption (<21% carbohydrates daily). These include the Atkins diet, the protein power plan, and the ketogenic diet.

The South Beach diet is considered a low-carbohydrate diet (21-42% carbohydrates daily).

9.

The patella is considered to be which type of bone?

Sesamoid bone

Flat bone

Irregular bone

Short bone

Correct answer: Sesamoid bone

Sesamoid bones are small bones that are installed in a joint capsule. They can also exist where a tendon crosses over a joint. They can act like a pulley system to provide leverage through a tendon's range of motion to help generate force. The patella is an example of this within the quadriceps tendon.

Short bones are cube-like bones, whose width is almost equal to their length. They maximize shock absorption because of their spongy bone tissue. Examples of short bones include the carpals of the hands and tarsals of the feet.

Flat bones are made of a thin layer of spongy bone tissue enclosed by two thin layers of compact bone tissue. They protect internal organs such as the brain and heart and are also attachment sites for muscles. Examples of flat bones include the sternum, cranial bones, ribs, ilium, and scapulae.

Irregular bones are bones that serve unique purposes and have unique shapes, thus not falling into any other category. Examples of irregular bones include the vertebrae, pelvic bones, and certain facial bones.

10.

How many calories does an individual following a very low calorie diet (VLCD) typically consume?

800 calories

900 calories

1,200 calories

1,000 calories

Correct answer: 800 calories

A very low calorie diet (VLCD) should be medically supervised and typically uses commercially prepared formulas for weight loss in obese patients. People on a VLCD consume about 800 calories per day or fewer. Fitness professionals should discourage clients from eating less than 1,200 calories per day and instead promote healthy eating, nutrition awareness, and increased activity.

11.

What percentage of an individual's total calorie count should come from carbohydrates?

45-65% of their total calories

10-35% of their total calories

25-55% of their total calories

30-65% of their total calories

Correct answer: 45-65% of their total calories

It is recommended that adults get 45-65% of their total calories from carbohydrates, primarily from complex carbohydrates such as starches and fiber as well as whole grains. However, every individual is different, and their carbohydrate consumption will vary depending on their activity level. For example, the more active an individual is, the more carbohydrates they should consume.

12.

Which of the following structures is commonly referred to as the thick myofilament?

Myosin

Elastin

Tropomyosin

Nebulin

Correct answer: Myosin

Myosin is correctly identified as the thick myofilament within muscle cells. In the structure of a sarcomere—the basic unit of muscle tissue—myosin filaments are the thicker filaments that interact with thinner actin filaments to facilitate muscle contraction. Myosin has a larger diameter compared to actin and is central to the muscle contraction mechanism through its interactions with actin, where it forms cross-bridges and slides along the actin filaments during contraction using energy from ATP hydrolysis.

Elastin is a protein found in connective tissues and is key to their elasticity, allowing tissues like skin, lungs, and arteries to resume their shape after stretching or contracting. Elastin is not involved in the contraction of muscles and does not form part of the sarcomere structure. It is neither classified as a thick nor a thin myofilament but is instead part of the extracellular matrix that helps tissues return to their original shape.

Tropomyosin is a regulatory protein that runs along the length of the actin filament in muscle cells. It plays a crucial role in muscle contraction by blocking and unblocking the binding sites on the actin filaments, regulating the interaction between actin and myosin. While tropomyosin is integral to muscle function, it is part of the thin filament structure, not the thick filament. It works alongside troponin to control the access of myosin heads to their binding sites on actin, thus it's incorrect to refer to it as a thick myofilament.

Nebulin is another protein associated with thin filaments in muscle cells and is primarily involved in maintaining the structural integrity and length of the actin filaments. It acts as a molecular ruler that specifies the length of actin filaments and is essential for the proper assembly and alignment of actin in the sarcomere. Like tropomyosin, nebulin is associated with thin filaments and does not qualify as a thick myofilament.

Myosin is the only thick myofilament involved directly in muscle contraction mechanisms, whereas elastin, tropomyosin, and nebulin serve different functions in muscle and connective tissue structures and are not part of the thick filament category.

13.

What type of fatty acids are omega-3?

Polyunsaturated fatty acids

Saturated fatty acids

Monounsaturated fatty acids

Trans-fatty acids

Correct answer: Polyunsaturated fatty acids

Fats are classified based on their level of saturation of hydrogen, which is why some fatty acids are classified as either saturated or unsaturated. Polyunsaturated fatty acids have multiple areas that are not saturated with hydrogen, unlike a saturated fat, which is a chain of carbons that is completely saturated with all of the hydrogen it can hold. Omega-3 fatty acids are a type of polyunsaturated fatty acid.

Specifically, omega-3 fatty acids have anti-inflammatory effects and help decrease blood clotting, and omega-6 fatty acids promote blood clotting and cell membrane formation.

14.

All of the following nutrients have a great potential for an excess dosage in dietary supplements, except:

Vitamin C

Vitamin D

Zinc

Iron

Correct answer: Vitamin C

The Dietary Reference Intakes (DRIs) are reference values used to help plan and assess the nutrient intake of healthy individuals. There are four nutrient-based values that are considered DRIs:

- *Recommended Dietary Allowance (RDA)*
- *Adequate Intake (AI)*
- *Estimated Average Requirement (EAR)*
- *Tolerable Upper Intake Level (UL)*

The UL is the highest average daily nutrient intake level likely to pose no risk of adverse health effects to almost all individuals in a particular life stage and gender group. Vitamin A, vitamin D, iron, and zinc are common nutrients with the greatest potential for excess dosage in dietary supplements.

15.

Which type of sensory receptors does the human body depend on to effectively regulate its internal temperature?

Thermoreceptors

Mechanoreceptors

Baroreceptors

Osmoreceptors

Correct answer: Thermoreceptors

Thermoreceptors are specialized sensory receptors that the human body utilizes to monitor and regulate its internal temperature. These receptors are located in the skin, as well as in the hypothalamus of the brain, which is a critical center for controlling thermoregulation.

Thermoreceptors can detect changes in external and internal temperatures and send signals to the central nervous system. When a deviation from the body's optimal temperature range is detected, these receptors initiate responses to adjust the body's temperature back to its normal state. This could include triggering mechanisms such as sweating, shivering, altering blood flow to the skin, and adjusting metabolic processes, all aimed at maintaining thermal homeostasis.

Mechanoreceptors receptors detect mechanical stimuli such as pressure, touch, vibrations, and stretch. They are essential for sensations like touch and proprioception, which is the body's ability to sense its position in space. However, mechanoreceptors do not play a role in detecting temperature changes or regulating body temperature, making them irrelevant to thermal regulation.

Baroreceptors are sensitive to changes in blood pressure. They are primarily located in the carotid arteries and the aorta. When they detect a change in the blood pressure, they send signals to the brain to adjust the cardiovascular system, such as heart rate and blood vessel dilation or constriction. Although these adjustments can indirectly influence body temperature, baroreceptors themselves do not detect temperature and thus are not involved directly in thermoregulation.

Osmoreceptors are sensitive to the osmotic pressure of body fluids, which is related to the concentration of solutes such as sodium. They play a crucial role in maintaining the body's fluid balance by influencing thirst and the release of hormones like AntiDiuretic Hormone (ADH). While fluid balance can affect overall thermoregulation, osmoreceptors do not directly detect or respond to temperature changes. Hence, they

are not the sensory receptors that regulate body temperature in response to thermal stimuli.

While mechanoreceptors, baroreceptors, and osmoreceptors each play distinct and crucial roles in the body's function, they do not contribute directly to the sensory detection and regulation of temperature. This task is specifically carried out by thermoreceptors, making them the correct answer to the question regarding the regulation of body temperature.

16.

Which of the following does not classify as a macronutrient?

Fiber

Carbohydrates

Lipids

Proteins

Correct answer: Fiber

Fiber does not classify as a macronutrient, primarily because it is not used by the body as a primary source of energy, which is a defining characteristic of macronutrients. Fiber is a type of carbohydrate that the human body cannot digest. While it is crucial for digestive health, helping to regulate sugar absorption and maintain bowel health, it does not provide energy in the same way that other macronutrients do. Instead, fiber passes through the digestive system relatively intact, aiding in various digestive processes and providing health benefits, such as reducing the risk of certain diseases, but without contributing significant caloric content.

Carbohydrates are a classic macronutrient, essential for providing energy to the body. They are the body's preferred energy source, and they break down into glucose, which is used to fuel cellular activities. Including complex carbohydrates (like whole grains) and simple carbohydrates (like sugars), they play a fundamental role in the nutritional balance.

Lipids, commonly referred to as fats, are another major macronutrient. They are crucial for long-term energy storage, insulating and protecting vital organs and aiding in the absorption of fat-soluble vitamins (vitamins A, D, E, and K). Fats provide more than twice the energy per gram as carbohydrates or proteins, making them a dense energy source.

Proteins are macronutrients made up of amino acids, which are essential for building and repairing tissues, making enzymes and hormones, and supporting immune function. Like carbohydrates, they provide energy, but their primary role is not energy supply; instead, they are critical for growth and maintenance of body tissues.

While carbohydrates, lipids, and proteins all serve as essential macronutrients providing energy and supporting various bodily functions, fiber, although important for

digestive health, does not provide energy and thus does not meet the criteria to be classified as a macronutrient.

17.

Golfer's elbow is categorized as which type of injury?

Pattern overload injury

Acute traumatic injury

Chronic wear-and-tear injury

Compression-related injury

Correct answer: Pattern overload injury

Golfer's elbow, medically known as medial epicondylitis, is categorized as a pattern overload injury. This type of injury occurs due to repetitive motions that overload certain muscles and tendons, leading to strain and inflammation over time.

Specifically, golfer's elbow results from the excessive use of the muscles in the forearm that enable wrist and finger flexion as well as wrist pronation. It often arises from the repetitive motion of swinging a golf club, which places consistent stress on the tendons attaching to the medial epicondyle of the elbow, but it can also occur from similar actions in other sports or activities.

Below are explanations for the incorrect answer options:

- **Acute traumatic injury:** *This description is incorrect for golfer's elbow because the condition does not typically result from a single, sudden event, which characterizes acute traumatic injuries. Instead, golfer's elbow develops gradually due to the repetitive stress and micro-trauma to the tendons, rather than from an acute or sudden trauma like a fall or collision.*
- **Chronic wear-and-tear injury:** *While golfer's elbow does involve wear and degradation of the tendon over time, classifying it strictly as a wear-and-tear injury might imply a degenerative process associated more commonly with aging or long-term deterioration, such as seen in osteoarthritis. Golfer's elbow, on the other hand, is specifically related to the repetitive mechanical overload of certain movements, distinguishing it from general wear-and-tear conditions.*
- **Compression-related injury:** *This type of injury typically results from direct pressure on structures, causing damage or dysfunction. Golfer's elbow, however, arises from tension and overuse of the tendons, not from compression. The injury mechanism involves strain from repetitive pulling forces, not from compressive forces.*

Golfer's elbow is best described as a pattern overload injury due to its development from repetitive stress and overuse specific to certain muscle movements rather than

from acute trauma, generalized wear and tear, or compressive forces. This distinction is important for accurate diagnosis and appropriate treatment planning.

18.

How do mechanoreceptors function?

Mechanoreceptors respond to alterations of touch, pressure, sound, or motion in body tissue

Mechanoreceptors respond to pain stimulus by altering neuron sensitivity

Mechanoreceptors respond to chemical interactions, including smell and taste

Mechanoreceptors respond to light stimulus by transmitting data to the central nervous system

Correct answer: Mechanoreceptors respond to alterations of touch, pressure, sound, or motion in body tissue

Mechanoreceptors are specifically designed to respond to physical pressure within tissues and then communicate via the peripheral nervous system. They respond to outside forces such as touch, pressure, stretching, sound waves, and motion and conduct data through sensory nerves. Mechanoreceptors include muscle spindles, Golgi tendon organs, and joint receptors.

Nociceptors respond to pain stimulus by altering neuron sensitivity. Chemoreceptors respond to chemical interactions, including smell and taste. Photoreceptors respond to light stimulus by transmitting data to the central nervous system.

19.

Which of the following statements accurately reflects the characteristics and functions of tendons?

Tendons connect muscle to bone, facilitating the transfer of force to produce movement

Tendons are highly elastic tissues that can stretch to twice their length

Tendons are avascular structures, meaning they lack blood vessels

Tendons serve as the primary shock absorbers in the body, protecting bones from impact during physical activity

Correct answer: Tendons connect muscle to bone, facilitating the transfer of force to produce movement

Tendons play a crucial role in the musculoskeletal system, connecting muscles to bones and facilitating movement by transmitting force from muscle contractions to bone. The correct answer underscores this fundamental function of tendons in enabling bodily motion.

While tendons possess some degree of elasticity to allow for movement, they are not as elastic as other connective tissues like ligaments or elastic cartilage. Tendons are designed to withstand tension and transmit force efficiently, but excessive stretching can lead to damage or injury rather than enhanced flexibility.

Tendons are indeed vascular structures, meaning they have a blood supply. While tendons have a relatively low metabolic rate compared to other tissues, they still require blood vessels to deliver nutrients and oxygen and remove waste products to support their function and repair processes.

While tendons do contribute to the body's overall shock-absorbing capacity to some extent, their primary role is not as shock absorbers. This function is more closely associated with other structures such as cartilage, synovial fluid, and certain specialized ligaments. Tendons are primarily responsible for transmitting muscular forces to bone, providing stability and facilitating movement rather than directly absorbing shock.

While tendons are integral to the biomechanics of movement and contribute to the body's overall resilience, their primary function is to connect muscles to bones and transmit force.

20.

What type of muscle pairing is seen in a force-couple relationship?

Synergist pairing

Inverse pairing

Contralateral pairing

Agonist pairing

Correct answer: Synergist pairing

In a force-couple relationship, synergists work together to create the same joint action from different angles.

For example: In a posterior pelvic tilt, the hamstrings and gluteus maximus pull down on the posterior of the pelvis while the rectus abdominis pulls up on the anterior of the pelvis.

21.

What percentage of total calories should come from fat sources?

20-35% of total daily calories

15-20% of total daily calories

35-45% of total daily calories

10-15% of total daily calories

Correct answer: 20-35% of total daily calories

It is recommended that an individual get 20-35% of their total daily calories from healthy sources of fat. While fats are the major source of energy in the body, they are also responsible for functions such as supplying essential fatty acids and protecting and insulating vital organs. Healthy sources of fats include avocados, peanuts, almonds, salmon, and flax seeds.

22.

Reciprocal inhibition can best be described as:

When a muscle relaxes to allow another muscle to contract

The resting length of a muscle and the tension that muscle can produce at that resting length

Muscle groups producing movement around a joint by moving simultaneously

Response to stimuli that activates movement in muscles

Correct answer: When a muscle relaxes to allow another muscle to contract

Reciprocal inhibition is a neuromuscular reflex that inhibits opposing muscles during movement. The concurrent contraction of one muscle (agonist) and the relaxation of another muscle (antagonist) allows movement to take place. It would be impossible to move if both an agonist and an antagonist contracted at the same time.

Length–tension relationship is defined as the amount of force that a muscle can produce at its existing length.

Neural activation is the response to stimuli that activates muscle movement.

The force–couple relationship is defined as muscle groups producing movement around a joint by moving simultaneously.

23.

What is the unique characteristic that sets essential amino acids apart from the other types of amino acids?

They cannot be produced by the body and must be acquired by food

They are the building blocks of proteins

They are produced by the body and do not need to be consumed in dietary sources

They cannot be produced by the body in some disease conditions

Correct answer: They cannot be produced by the body and must be acquired by food

Amino acids are the building blocks of proteins and can be divided into two main groups: essential amino acids and nonessential amino acids. Essential amino acids are those that cannot be made by the body and must be acquired by food; nonessential amino acids are sufficiently produced by the body and do not need to be consumed in dietary sources.

24.

All the following are causes of restrictive lung disease, except:

Asthma

Obesity

Fractured ribs

A neuromuscular disease

Correct answer: Asthma

Asthma is not a cause of restrictive lung disease but rather an example of an obstructive lung disease.

Obstructive lung diseases are characterized by a difficulty in expelling air from the lungs, leading to an obstruction of airflow. Asthma involves inflammation and narrowing of the airways, which restricts airflow during exhalation but does not necessarily affect the lung's ability to expand, which is a hallmark of restrictive lung diseases.

Restrictive lung diseases, on the other hand, are primarily characterized by a reduced lung volume or limited lung expansion, often due to changes in the lung tissue itself or due to external pressure or restrictions.

Here's why the other listed options are indeed causes of restrictive lung disease:

- **Obesity:** Obesity can cause restrictive lung disease through a mechanical compression of the lungs and chest cavity. Excessive body fat, especially around the abdomen and chest, can limit the expansion of the lungs and diaphragm, thereby reducing lung capacity. This external restriction makes it difficult for individuals to fully inflate their lungs, fitting the definition of restrictive lung disease.
- **Fractured ribs:** Fractured ribs can severely impact lung function by causing pain during breathing, which often leads individuals to take shallow breaths to avoid discomfort. The limitation in lung expansion due to pain and mechanical restriction from the broken bones directly contributes to a restrictive lung pattern.
- **A neuromuscular disease:** Neuromuscular diseases, such as Amyotrophic Lateral Sclerosis (ALS) or muscular dystrophy, can lead to restrictive lung disease because they weaken the muscles involved in breathing. This muscle weakness impairs the ability of the respiratory system to expand and contract normally, thereby reducing lung capacity and restricting lung function.

Asthma is incorrectly grouped with causes of restrictive lung disease because its primary effect is obstructive, not restrictive. The other conditions listed—obesity, fractured ribs, and neuromuscular disease—directly impact the lung's ability to expand, making them accurate examples of factors that can lead to restrictive lung disease.

25.

What amount of caffeine has been shown to increase performance?

3-6 milligrams per kilogram of body weight

2-10 milligrams per kilogram of body weight

4-8 milligrams per kilogram of body weight

15-18 milligrams per kilogram of body weight

Correct answer: 3-6 milligrams per kilogram of body weight

It has been shown that taking moderate doses (3-6 milligrams per kilogram of body weight) of caffeine approximately one hour before and during exercise can increase performance. Natural sources of caffeine include coffee, tea, and chocolate.

26.

In regard to anatomical location, where is the femur in relation to the tibia?

Superior

Inferior

Anterior

Posterior

Correct answer: Superior

"Superior" is the term used when a body part is located above a landmark or closest to the head. From an anatomical point of view, the femur is superior to the tibia. The femur is the thigh bone and the tibia is the shin bone.

27.

During a biceps curl, the triceps brachii would be considered which type of mover?

Antagonist

Agonist

Stabilizer

Synergist

Correct answer: Antagonist

An antagonist is the muscle that opposes the prime mover, or agonist, during a specific joint movement.

During a biceps curl, the biceps brachii is the agonist for elbow flexion; the brachialis and brachioradialis are the synergists, or the muscles responsible for assisting the prime mover. The posterior deltoid and lower trapezius are the stabilizers that minimize any unwanted movement, which during a biceps curl would be the shoulders shrugging. And the triceps brachii would be the antagonist.

Biceps Curl

- **Agonist:** biceps brachii
 - **Antagonist:** triceps brachii
 - **Synergist:** brachialis and brachioradialis
 - **Stabilizers:** posterior deltoid and lower trapezius
-

28.

What might upper extremity exercise result in for an individual with lung disease?

Onset of dyspnea earlier than usual

Decreased muscular performance

Hypertrophied neck muscles

Muscle wasting

Correct answer: Onset of dyspnea earlier than usual

Chronic lung disease is divided into two basic categories, obstructive and restrictive:

- **Chronic obstructive lung disease** results in normal lung tissue with restricted airflow.
- **Restrictive lung disease** results in fibrotic, dysfunctional lung tissue.

The constraints during exercise are similar in both of these types of lung diseases. A physiologic consideration for individuals with lung disease is that upper extremity exercise may result in earlier onset of dyspnea (shortness of breath) and fatigue.

Lower extremity cardio and resistance training exercises are more tolerated, and sufficient rest intervals should be planned into the workout.

29.

Which of the following is not a primary muscle of the global stabilization system?

Tibialis anterior

External obliques

Gluteus medius

Rectus abdominis

Correct answer: Tibialis anterior

The global stabilization system is comprised of muscles that attach from the pelvis to the spine. These muscles provide stability by transporting stress from a load between the upper and lower extremities. During functional movements, these muscles contribute to stabilization.

The global stabilization system includes the psoas major, external obliques, portions of the internal oblique, rectus abdominis, gluteus medius, latissimus dorsi, and adductor complex.

30.

Which type of energy is contained in food?

Chemical energy

Aerobic energy

Anaerobic energy

Metabolic energy

Correct answer: Chemical energy

Chemical energy describes the energy found in a molecule that has not yet been released in carbohydrates, fats, and proteins. For this chemical energy to become a usable form of energy (ATP), metabolism takes place.

The body's metabolism is the sum of all the chemical reactions that are required for life, and it is responsible for acquiring, transporting, using, and disposing of nutrients.

31.

Which hormone is typically elevated in the bloodstream as a result of overtraining?

Cortisol

Insulin

Leptin

Epinephrine

Correct answer: Cortisol

Cortisol, often referred to as the stress hormone, is typically elevated in the bloodstream as a result of overtraining. This hormone is produced by the adrenal cortex and plays a crucial role in various body functions, including metabolism regulation and the immune response. Cortisol levels increase in response to physical and mental stress, and prolonged high intensity or high volume training without adequate recovery can lead to sustained elevated cortisol levels. This chronic elevation can have detrimental effects, such as impaired immune function, increased muscle breakdown, and disrupted sleep, all common symptoms of overtraining syndrome.

Insulin is a hormone produced by the pancreas that primarily regulates glucose levels in the blood. It facilitates the uptake of glucose into cells from the bloodstream, used for energy or stored as fat. While exercise can affect insulin sensitivity and its action, insulin is not typically elevated due to overtraining. Insulin levels are more directly influenced by food intake and metabolic health rather than the stress response associated with overtraining.

Leptin is a hormone associated with regulating energy balance by inhibiting hunger, which in turn helps to regulate body weight. It is produced by fat cells and signals the brain to reduce appetite. Unlike cortisol, leptin levels are not directly linked to stress or overtraining. In fact, intense training and reduced body fat (often seen in highly active individuals) might lead to lower leptin levels, not higher, which would contradict the premise of being a marker for overtraining.

Epinephrine, also known as adrenaline, is a hormone and neurotransmitter involved in the body's acute stress response. It is rapidly released in response to short-term stressors, preparing the body for a fight or flight reaction. While epinephrine levels can spike during intense physical activities, they typically return to baseline fairly quickly and do not remain elevated as a chronic response to overtraining like cortisol. Epinephrine spikes are transient and not a reliable indicator of overtraining, which involves prolonged physiological stress and recovery imbalance.

While insulin, leptin, and epinephrine play significant roles in various physiological processes, they do not typically exhibit sustained elevated levels in response to overtraining as cortisol does. Cortisol's role as a stress indicator makes it particularly relevant in scenarios of overtraining, where the body is under chronic physical stress without adequate recovery.

32.

Which of the following best describes altered reciprocal inhibition?

A tight agonist muscle impedes its antagonist muscle, causing muscular inhibition

A synergist muscle takes over function for a weak or restricted prime mover muscle(s)

Repetitive stress injuries caused by frequent immobility

Pattern overload caused by repetitive physical activity

Correct answer: A tight agonist muscle impedes its antagonist muscle, causing muscular inhibition

Reciprocal inhibition occurs when one muscle simultaneously contracts while its antagonist relaxes, resulting in normal movement. On the other hand, altered reciprocal inhibition occurs when the agonist muscle is overly tight. This causes inhibition of the antagonist muscle and results in altered movement patterns.

Synergist dominance occurs when incorrect muscles take over the function of a weak or restricted prime mover.

Pattern overload can be caused by frequent immobility or repetitive physical activity.

33.

Which organization is responsible for ensuring a supplement is safe before it is marketed?

The supplement manufacturer

The Food and Drug Administration (FDA)

The Drug Enforcement Agency (DEA)

Both the supplement manufacturer and the FDA

Correct answer: The supplement manufacturer

The supplement manufacturer, not the FDA, is responsible for ensuring that a dietary supplement is safe before it goes on the market.

Furthermore, the FDA does not need to approve dietary supplements before they are sold.

Therefore, it is important as a fitness professional to educate your clients that just because a supplement is out on the market does not mean that it has been approved by the FDA.

34.

Which of the following is classified as a sesamoid bone?

Patella

Vertebra

Humerus

Carpals of the hand

Correct answer: Patella

Sesamoid bones are small bones that are installed in a joint capsule. They can also exist where a tendon crosses over a joint. They can act like a pulley system to provide leverage through a tendon's range of motion to help generate force.

- *The patella is an example of a sesamoid bone within the quadriceps tendon*
 - *Carpals of the hand are considered to be short bones*
 - *Vertebrae are irregular bones*
 - *The humerus is a long bone*
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35.

Which of the following is not classified as an essential amino acid?

Glutamine

Leucine

Valine

Tryptophan

Correct answer: Glutamine

Glutamine is not classified as an essential amino acid. Essential amino acids are those that the human body cannot synthesize on its own and therefore must be obtained through the diet. Glutamine, however, is classified as a conditionally essential amino acid, which means under normal circumstances, the body can produce adequate amounts of glutamine. However, during times of extreme stress or illness, the body's requirement for glutamine may exceed its ability to produce it, and it becomes conditionally essential.

The following are classified as essential amino acids:

- **Leucine:** *Leucine is one of the nine essential amino acids. It is crucial for protein synthesis and muscle repair, and it plays a significant role in regulating blood sugar levels, stimulating wound healing, and producing growth hormones. As an essential amino acid, leucine must be obtained from dietary sources because the body cannot synthesize it.*
- **Valine:** *Valine is another essential amino acid that belongs to the Branched-Chain Amino Acid (BCAA) group, along with leucine and isoleucine. It is vital for muscle growth and tissue repair, and energy production. Valine helps stimulate muscle regeneration and is involved in the metabolism and regulation of the immune system. Like other essential amino acids, valine cannot be produced by the body and must be acquired from food.*
- **Tryptophan:** *Tryptophan is also an essential amino acid and is well-known for being a precursor to the neurotransmitter serotonin, which plays a role in mood, sleep, and appetite regulation. It is also necessary for the production of niacin (Vitamin B3), which is vital for energy production and metabolism. The body cannot synthesize tryptophan, necessitating its presence in the diet.*

The difference between essential and non-essential amino acids hinges on whether the body can produce them on its own. Glutamine, although conditionally essential under specific conditions, is generally not considered essential because the body can produce it under normal physiological conditions. In contrast, leucine, valine, and

tryptophan are classic examples of essential amino acids, which must be obtained through the diet to meet the body's needs.

36.

Which of the following refers to a sensory pathway within the nervous system?

Afferent pathway

Efferent pathway

Descending pathway

Peripheral pathway

Correct answer: Afferent pathway

An afferent, or ascending pathway, conveys sensory information from a peripheral structure to the central nervous system. Efferent, or descending pathways, convey motor information from the central nervous system to peripheral structures.

Peripheral pathway is not a recognized term in this context.

37.

The axial skeleton is comprised of bones in all of the following areas, except:

Hand

Skull

Rib cage

Vertebral column

Correct answer: Hand

The axial skeleton is comprised of 80 bones, all of which are located in the skull, rib cage, and vertebral column.

The appendicular skeleton is comprised of approximately 126 bones, divided into the upper and lower extremities.

38.

Which of the following fatty acids has the longest shelf life?

Trans-fatty acids

Monounsaturated fatty acids

Triglycerides

Polyunsaturated fatty acids

Correct answer: Trans-fatty acids

Fats are classified based on their level of saturation of hydrogen, which is why some fatty acids are classified as either saturated or unsaturated. For example, polyunsaturated fatty acids have multiple areas that are not saturated with hydrogen, unlike a saturated fat, which is a chain of carbons that is completely saturated with all the hydrogen it can hold. On the other hand, trans-fatty acids are unsaturated fatty acids that have been hydrogenated—saturated with hydrogen—to make them harder at room temperature and increase their shelf life.

39.

All of the following foods are sources of trans-fatty acids, except:

Whole milk

Doughnuts

Margarine

Fried chicken

Correct answer: Whole milk

Fats are classified based on their level of saturation of hydrogen, which is why some fatty acids are classified as either saturated or unsaturated. Trans-fatty acids are unsaturated fatty acids that have been hydrogenated—saturated with hydrogen—to make them harder at room temperature and increase their shelf life.

Foods such as fried chicken, stick margarine, and doughnuts are all sources of trans-fatty acids, whereas whole milk is a source of saturated fat.

40.

A motor neuron and the muscle fibers it innervates is known as a(n):

Motor unit

Action potential

Synapse

Neurotransmitter

Correct answer: Motor unit

A motor unit is made up of one motor neuron and the muscle fibers with which it connects. The number of muscle fibers within a motor unit varies, and therefore some motor units are larger than others. The size of a motor unit is inversely related to the precision of movement for a certain muscle.

For example, the thigh muscles, which produce large, powerful movements, can have up to a thousand fibers per motor unit. Contrastingly, the muscles of the eye, which require small, precise movements, have far fewer fibers per motor unit.

41.

Which of the following initiates the electrical impulses that determine an individual's heart rate?

Sinoatrial (SA) node

Atrioventricular (AV) node

Atrioventricular bundle

Purkinje fibers

Correct answer: Sinoatrial (SA) node

The sinoatrial (SA) node is located in the right atrium of the heart. The SA node is the initiation point of the electrical signal responsible for stimulating the mechanical contraction of the myocardial cells of the heart. This signal is responsible for determining an individual's heart rate. It is often termed the "pacemaker of the heart."

The atrioventricular (AV) node receives impulses from the SA node and directs them to the walls of the ventricles, delaying the signal long enough to allow the right atrium time to fill and contract before the ventricles follow suit.

The atrioventricular bundle is responsible for making sure proper blood flow occurs from the atria to the ventricles without any blockage or backflow.

The Purkinje fibers can be found within the walls of the ventricles, and they are responsible for sending nerve impulses that allow the ventricles to contract and pump blood either to the lungs or to the rest of the body.

42.

Which of the following are not classified as mechanoreceptors?

Rods and cones

Pacinian corpuscles

Golgi tendon organs

Merkel cells

Correct answer: Rods and cones

Mechanoreceptors are sensory receptors responsible for sensing mechanical pressure or distortion. They are typically found in the skin, joints, and various internal organs, where they detect stimuli such as touch, pressure, stretch, and vibration. Understanding their role helps identify what types of cells or structures do not function as mechanoreceptors.

Rods and cones are photoreceptors, not mechanoreceptors. They are located in the retina of the eye and are crucial for visual perception. Rods are responsible for vision at low light levels (scotopic vision), while cones are active at higher light levels (photopic vision) and enable the perception of color. These cells convert light into electrical signals, which are processed by the brain as visual images, entirely different from the mechanical stimulus detection performed by mechanoreceptors.

Pacinian corpuscles are a type of mechanoreceptor that is found deep in the dermis and in various viscera. They are especially sensitive to rapid changes in pressure and vibrations. When these corpuscles are deformed by mechanical pressure or vibration, they generate a nerve impulse by mechanically gated ion channels. This makes them true mechanoreceptors, hence making the statement incorrect.

Golgi tendon organs are mechanoreceptors located in the tendons near the junction between tendon and muscle. They are sensitive to changes in muscle tension and are involved in the reflex regulation of muscle contraction. They help prevent muscle damage during excessive force generation by sending information to the nervous system to relax the muscle, demonstrating their role as mechanoreceptors.

Merkel cells are found in the skin's epidermal layer and are associated with nerve endings, forming Merkel cell-neurite complexes that are sensitive to light touch. They respond to sustained pressure and texture, transmitting signals that contribute to the body's ability to detect fine details through touch. This functionality clearly classifies them as mechanoreceptors.

While rods and cones are involved in vision by processing light, Pacinian corpuscles, Golgi tendon organs, and Merkel cells are all mechanoreceptors that respond to mechanical pressures or distortions, which is why they are incorrectly listed as non-mechanoreceptors in this context.

43.

How is the sliding filament theory best defined?

Sliding of thick and thin filaments within the sarcomere, producing force

Conversion of chemical energy into mechanical energy within muscle cells

Process by which muscle fibers lengthen during relaxation phases

Theory describing how muscles store energy for future use

Correct answer: Sliding of thick and thin filaments within the sarcomere, producing force

The sliding filament theory is defined as the process where thick (myosin) and thin (actin) filaments slide past each other within the sarcomere, the basic unit of a muscle fiber. This sliding action is what causes the muscle to contract and produce force. When a muscle is stimulated, cross-bridges form between myosin heads and actin filaments, and through a series of actions facilitated by the hydrolysis of ATP, the filaments move relative to one another, shortening the overall length of the sarcomere and thus contracting the muscle.

Conversion of chemical energy into mechanical energy within muscle cells: *While it's true that muscle contraction involves the conversion of chemical energy (from ATP) into mechanical energy, this description does not specifically address the mechanism of how muscle contraction occurs according to the sliding filament theory. The theory specifically details the interaction and movement of myosin and actin filaments, which is the direct cause of the mechanical movement, rather than broadly discussing energy conversion.*

Process by which muscle fibers lengthen during relaxation phases: *This answer inaccurately represents the sliding filament theory, which does not describe muscle fiber lengthening. Instead, the theory specifically explains muscle contraction. The lengthening of muscle fibers, or relaxation, occurs when the actin and myosin filaments slide back to their original position as the muscle ceases to contract and the cross-bridges detach, a process not covered by the theory's focus on contraction mechanics.*

Theory describing how muscles store energy for future use: *The sliding filament theory does not deal with how muscles store energy. It explains the mechanical process of muscle contraction. Muscle energy storage, typically in the form of creatine phosphate and ATP, is a separate biochemical issue related to cellular metabolism and energy management within muscle cells rather than the physical mechanism of contraction described by the sliding filament theory.*

The sliding filament theory centrally involves the biomechanical actions that result in muscle contraction. The other answer options encompass the broader biochemical processes of energy conversion, storage, and muscle fiber lengthening during relaxation.

44.

All of the following are signs of dehydration, except:

Slow heartbeat

Water retention

Low blood pressure

Decreased sweat rate

Correct answer: Slow heartbeat

Dehydration can severely alter an individual's performance and even threaten their overall health. It affects the body's ability to cool itself with sweat, which can lead to overheating and loss of electrolytes. A few signs of dehydration include rapid heartbeat, water retention, low blood pressure, and decreased sweat rate. As a fitness professional, know these signs well and encourage your clients to drink water often.

45.

If a fracture is proximal to the head of the humerus, where on the humerus is it located?

It is located at the top of the humerus

It is located at the bottom of the humerus

It is located at the midline of the humerus

It is located on the left side of the humerus

Correct answer: It is located at the top of the humerus

The term "proximal" is used when a body part is located closest to the center of the body or reference point. Distal refers to when a body part is located farthest from the center of the body or reference point.

The top of the humerus is also called the head, so a fracture that is proximal to the head will be near the top.

46.

What are the two mechanoreceptors involved in flexibility?

Muscle spindles and Golgi tendon organs (GTOs)

Muscle spindles and connective tissues

Golgi tendon organs (GTOs) and efferent neurons

Golgi tendon organs (GTOs) and connective tissues

Correct answer: Muscle spindles and Golgi tendon organs (GTOs)

Sensory receptors exist throughout the body to translate outside stimuli into sensory data so that the brain can produce a response. These receptors are divided into mechanoreceptors, nociceptors, chemoreceptors, and photoreceptors.

Mechanoreceptors allow individuals to detect touch and similar sensations, such as pressure on their shoulders from a heavy backpack. These receptors are also responsible for monitoring limb and muscle movement through proprioception.

Within the muscle, muscle spindles are sensitive to changes in length, and the Golgi tendon organs (GTOs) are sensitive to changes in tension.

47.

How many calories per gram does protein provide?

4 calories per gram

9 calories per gram

7 calories per gram

5 calories per gram

Correct answer: 4 calories per gram

Macronutrients are nutrients that provide calories to the body for energy and include carbohydrates, fats, and protein.

- **Protein:** 4 calories per gram
 - **Carbohydrates:** 4 calories per gram
 - **Fats (Lipids):** 9 calories per gram
-

48.

Trunk rotation is the force-coupling of which two muscles?

Internal and external obliques

Iliopsoas and quadratus lumborum

Rectus abdominis and internal obliques

Rectus abdominis and external obliques

Correct answer: Internal and external obliques

Force-couple relationships are the result of muscle groups moving together to produce movement around a joint. Muscles in a force-couple pull in contrasting directions on the bones with which they are connected. Due to these different directional pulls at various attachment sites and at various angles, each muscle creates a different force on the joint. The joint structure and cumulative pull from each muscle dictates that resulting movement.

For example, the insertion and attachment sites of the internal and external obliques create a force-couple to allow for trunk rotation. However, this only happens when both muscles have the right length–tension relationship and joint motion.

49.

Which of the following is a potential effect of ingesting too much iron?

Gastrointestinal irritation

Fatigue

Impaired immune function

Kidney stones

Correct answer: Gastrointestinal irritation

Dietary reference intake (DRI) values for nutrients provide good guidelines for what constitutes an adequate intake of a nutrient. However, excess intake of mineral elements can also cause health problems. For example, excess intake of iron can interfere with the absorption of other minerals, such as zinc, and can cause gastrointestinal distress and increase the risk of heart disease.

50.

Which of the following is considered a micronutrient?

Magnesium

Omega-6

Fructose

Lactose

Correct answer: Magnesium

Vitamins and minerals are considered micronutrients because they are required in smaller amounts than the macronutrients (carbohydrates, fats, and proteins). Vitamins and minerals are as vital as macronutrients because they play important roles in every function of the body. Magnesium is a mineral involved in energy metabolism.

Fructose and lactose are both disaccharides, which are a form of simple carbohydrate.

Omega-6 fatty acids are a type of polyunsaturated fatty acid.

51.

The sagittal plane divides the body into which sides?

Right and left

Front and back

Top and bottom

Upper and lower

Correct answer: Right and left

The sagittal plane includes movements such as flexion and extension of many joints. The frontal plane divides the body into front and back, and the transverse plane divides the body into upper/top and lower/bottom halves.

52.

All of the following are potential adverse side effects of androgenic-anabolic steroid use in adult males, except:

Decreased appetite

Sleeplessness

Loss of head hair

Acne

Correct answer: Decreased appetite

Androgenic-anabolic steroids mimic the effects of testosterone in the body, which can increase strength and growth of muscle mass. These drugs are often abused by athletes, and their use is banned by all major athletic organizations. The potential benefits associated with steroid use are accomplished at the risk of serious adverse health effects. Steroid use differs slightly between adult females and adult males; however, typical side effects associated with steroid use are acne, loss of head hair, and sleeplessness.

53.

An individual should consume at least how many calories per day to ensure that they are receiving proper and adequate nutrition?

1,200 calories per day

800 calories per day

1,500 calories per day

1,000 calories per day

Correct answer: 1,200 calories per day

Eating less than 1,200 calories per day can have adverse health effects. That is why as a fitness professional you should encourage your clients to eat small, frequent meals and to consume at least 1,200 calories per day to ensure that they are receiving proper and adequate nutrition.

54.

Within the muscle, which type of mechanoreceptors are sensitive to changes in length?

Muscle spindles

Golgi tendon organs (GTOs)

Afferent neurons

Efferent neurons

Correct answer: Muscle spindles

Muscle spindles are one type of mechanoreceptor. Mechanoreceptors allow individuals to detect touch and similar sensations. Within the muscle, muscle spindles are sensitive to changes in length, and the Golgi tendon organs (GTOs) are sensitive to changes in tension.

When a muscle is stretched, the spindles within that muscle are also stretched, which in turn conveys information about its length to the central nervous system (CNS) through sensory neurons. Once information from muscle spindles reaches the brain, it can then determine the position of various body parts.

Afferent and efferent neurons are not mechanoreceptors.

55.

All of the following are monounsaturated fats, except:

Flaxseeds

Avocados

Peanuts

Almonds

Correct answer: Flaxseeds

Fatty acids may be categorized as saturated or unsaturated, with unsaturated fats being categorized further into monounsaturated and polyunsaturated. Saturated fats are implicated as a risk factor for heart disease because they raise LDL levels, whereas unsaturated fats are associated with increases in good cholesterol and decreased risk of heart disease. Avocados, almonds, and peanuts are all made up of primarily monounsaturated fats, and flaxseeds are a source of primarily polyunsaturated fats.

56.

Which of the following is the first step in the oxidation of fat?

Beta-oxidation

The Krebs cycle

Gluconeogenesis

Aerobic glycolysis

Correct answer: Beta-oxidation

Fat can be metabolized aerobically, and to use fat substrates for aerobic energy production, the fat must first be converted into free fatty acids and then further broken down into acetyl CoA.

The first step in the oxidation of fat is a process of beta-oxidation (β -oxidation). This is the breakdown of triglycerides (fat) into smaller subunits called free fatty acids (FFAs) to convert FFAs into acetyl CoA molecules, which then are available to enter the Krebs cycle and ultimately lead to the production of additional adenosine triphosphate (ATP).

57.

What is the typical oxygen consumption of an individual at rest?

3.5 mL of oxygen per kilogram of body weight per minute, or 1 MET

1.75 mL of oxygen per kilogram of body weight per minute, or .5 MET

7 mL of oxygen per kilogram of body weight per minute, or 2 MET

0.875 mL of oxygen per kilogram of body weight per minute, or .25 MET

Correct answer: 3.5 mL of oxygen per kilogram of body weight per minute, or 1 MET

Simply put, oxygen consumption is the amount of oxygen the body uses. At rest, it is approximately 3.5 mL of oxygen per kilogram of body weight per minute, or 1 metabolic equivalent (MET). The more vigorous an activity is, the more oxygen consumption an individual will have, thus resulting in a higher MET value.

58.

All of the following are primarily made up of polyunsaturated fats, except:

Coconut oil

Corn oil

Soy oil

Sunflower oil

Correct answer: Coconut oil

Fatty acids may be categorized as saturated or unsaturated, with unsaturated fats being categorized further into monounsaturated and polyunsaturated.

Saturated fats are implicated as a risk factor for heart disease because they raise LDL levels, whereas unsaturated fats are associated with increases in good cholesterol and decreased risk of heart disease.

Tropical oils, such as coconut and palm oil, are examples of foods that are primarily made up of saturated fats.

59.

How does the central nervous system facilitate movement in the body?

Through integrative function, it processes sensory information and coordinates motor responses

Through sensory function, which is its ability to detect alterations in the body's internal or external environment

Through motor function, which is the neuromuscular response to sensory data

Through proprioception, which is its ability to sense the relative position of body parts

Correct answer: Through integrative function, it processes sensory information and coordinates motor responses

The Central Nervous System (CNS) facilitates movement in the body primarily through its integrative function. This function allows the CNS to process sensory information received from various parts of the body and the external environment, integrate this information, and then coordinate a suitable motor response. This process involves various components of the CNS, including the brain and spinal cord, which work together to evaluate the incoming data, decide on the best response, and then send signals to the appropriate muscles to execute movements. This integrative capability is essential for all voluntary movements and many involuntary movements, making it fundamental to how the CNS controls and facilitates bodily movements.

The other answer options are explained as follows:

- **Through sensory function, which is its ability to detect alterations in the body's internal or external environment:** *While the sensory function of the CNS is crucial for detecting changes and stimuli in both the internal and external environments, this function alone does not facilitate movement. Sensory functions involve the reception of sensory inputs (such as touch, pain, temperature, and proprioceptive information), but without the integrative function to process and respond to these inputs, no movement coordination or execution occurs.*
- **Through motor function, which is the neuromuscular response to sensory data:** *Motor function involves the activation and control of muscles and is a critical part of movement. However, stating that movement is facilitated through motor function alone is misleading because it overlooks the crucial role of the CNS's integrative function in interpreting sensory data and deciding the motor*

response. Motor function is the execution phase that follows the CNS's processing and decision-making.

- **Through proprioception, which is its ability to sense the relative position of body parts:** Proprioception is indeed a vital sensory input that informs the CNS about the position of different body parts in relation to each other and the environment, which is essential for coordinated movement. However, proprioception alone does not facilitate movement; it provides the information needed. The CNS must still integrate this proprioceptive information with other sensory data to produce a coordinated motor output. Proprioception feeds into the integrative function but is not itself a facilitator of movement.

The central nervous system facilitates movement through its integrative function, which processes and synthesizes sensory information to produce coordinated motor responses. While sensory inputs, motor outputs, and proprioceptive feedback are all critical to this process, they are components of the broader integrative function that enables the CNS to effectively control movement.

60.

If there is not enough oxygen when sprinting or when first beginning to exercise, which of the following is created?

Lactic acid

Pyruvate

Ketone bodies

Acetyl-CoA

Correct answer: Lactic acid

Once glucose has been broken down within the cell, it becomes a substance called pyruvate. This process does not require oxygen, and during this process ATP is produced.

If there is enough oxygen available, then the former glucose—now pyruvate—goes through aerobic metabolism to become acetyl-CoA. Once this occurs, the former pyruvate—now acetyl-CoA—can enter the Krebs cycle, and though the Krebs cycle can produce a lot of ATP, it requires oxygen.

If there is not oxygen available when sprinting or first beginning to exercise, this is when lactic acid is created from pyruvate.

61.

You know that this training session will be intense and you'll need your client to hydrate properly, especially following the workout. You have them weigh themselves before starting.

What is the recommended amount of post-training hydration?

1.25 times the amount of weight lost during a workout

1.5 times the amount of weight lost during a workout

1.75 times the amount of weight lost during a workout

2 times the amount of weight lost during a workout

Correct answer: 1.25 times the amount of weight lost during a workout

During exercise, the body produces a large amount of heat, which must be released to regulate body temperature. The way the body releases this heat is through sweating.

Factors such as the outside temperature, the intensity of training, and even the type of clothing worn determine the amount of water needed to be consumed during as well as after exercise.

To prevent dehydration and facilitate proper recovery, it is recommended that an individual consume water with electrolytes in the amount of 1.25 times the amount of weight lost during a workout.

62.

Proprioception uses information from which of the following to provide information about body position and movement?

Mechanoreceptors

Sensorimotor integration

Muscle synergies

Chemoreceptors

Correct answer: Mechanoreceptors

Mechanoreceptors create proprioception by sensing pressure within tissues from outside forces, including touch, pressure, stretching, motion, and sound. The mechanoreceptors transmit signals through sensory nerves.

These signals enable the brain to detect touch, sound, and motion of the body and to monitor the position of muscles, bones, and joints; this information is what is known as proprioception.

Proprioception is defined as the cumulation of sensory data that the mechanoreceptors have transmitted to the central nervous system.

63.

How much of an individual's total energy expenditure is a result of physical activity?

Approximately 20%

Approximately 10%

Approximately 50%

Approximately 70%

Correct answer: Approximately 20%

Estimated total energy expenditure (TEE) is defined as the amount of energy used in a typical day, on average. TEE can be determined by adding three energy components:

- **Resting metabolic rate (RMR):** The energy expended for basic body functions
- **Thermic effect of food (TEF):** The energy used to process and store food, which is expended above the RMR
- **Energy expended during physical activity:** The energy used in physical activity, which is expended above the RMR

Physical activity accounts for approximately 20% of TEE.

64.

Mechanoreceptors are located in all of the following, except:

Pacinian corpuscles

Skeletal muscle

Joint capsules

Tendons

Correct answer: Pacinian corpuscles

Mechanoreceptors sense pressure within tissues from outside forces, including touch, pressure, stretching, motion, and sound. The mechanoreceptors transmit signals through sensory nerves. They are found in skeletal muscle, joint capsules, ligaments, and tendons, providing information about how the body is positioned.

65.

Golfing and swinging a bat are both examples of movement that occurs in which plane of motion?

Tranverse

Sagittal

Frontal

Longitudinal

Correct answer: Transverse

The transverse plane is an imaginary plane that bisects the body into equal halves, producing a top and bottom half. All of the following occur in the transverse plane:

- *Pronation*
 - *Supination*
 - *Internal and external rotation*
 - *Horizontal adduction and abduction*
-

66.

Which of the following stimulants is a banned substance?

DHEA

Caffeine

Creatine

Ergogenic aid

Correct answer: DHEA

There are more than 50 types of stimulants prohibited by the World Anti-Doping Agency for competitive sports: amphetamines, ephedrine, and less commonly known drugs or substances with biologic effects that resemble drugs. Dehydroepiandrosterone (DHEA) is produced naturally in the body and is a precursor to testosterone. However, high levels of this prohormone are associated with various health risks such as cancer.

67.

Which of the following foods is highest on the glycemic index (GI)?

Rice cakes

Sweet potato

Peanuts

Popcorn

Correct answer: Rice cakes

The glycemic index (GI) is a rating system used to assess how different food sources of carbohydrate raise blood sugar when eating on an empty stomach and how much insulin is released subsequently. Complex carbohydrates, which are high in fiber and more nutrient-dense than simple carbohydrates, are lower on the GI scale. Rice cakes are very high on the GI, followed by popcorn, sweet potatoes, and peanuts.

68.

Which of the following foods ranks lowest on the glycemic index (GI)?

Grapefruit

Dates

Watermelon

Apple

Correct answer: Grapefruit

The glycemic index (GI) is a rating system used to assess how different food sources of carbohydrate raise blood sugar when eating on an empty stomach and how much insulin is released subsequently.

Complex carbohydrates, which are high in fiber and more nutrient-dense than simple carbohydrates, are lower on the GI scale. Out of these choices, grapefruit has the lowest GI score, followed by apples, watermelon, and dates.

69.

The rotator cuff is comprised of all the following muscles, except:

Teres major

Supraspinatus

Subscapularis

Infraspinatus

Correct answer: Teres major

The rotator cuff is comprised of four muscles: supraspinatus, infraspinatus, teres minor, and subscapularis. Together, these four muscles help stabilize the shoulder girdle by eccentrically decelerating shoulder internal and external rotation as well as adduction of the arm.

70.

Which type of exercise does caffeine supplementation not seem to have an ergogenic effect on?

Sprint-type efforts lasting 90 seconds or less

Endurance exercise lasting more than an hour

High-intensity, short-duration exercise lasting about 5 minutes

It is beneficial for every type and duration of exercise

Correct answer: Sprint-type efforts lasting 90 seconds or less

Ergogenic effects from caffeine have been demonstrated in controlled studies. Caffeine seems to be especially effective on well-trained athletes performing 60 minutes or more of endurance exercise or 5 minutes of high-intensity exercise. No ergogenic effect has been shown from caffeine with 90 seconds or less of sprint-type effort.

71.

Flexion occurs in a posterior direction for all of the following body segments, except:

Neck

Knee

Shoulder

Elbow

Correct answer: Neck

Cervical flexion occurs when the chin moves down toward the chest, thus occurring in the anterior direction. Extension of the neck involves a posterior (backward bending) motion. Flexion at the knee, shoulder, and elbow occurs in a posterior direction.

72.

How many vertebrae make up the lumbar spine?

5

4

7

12

Correct answer: 5

The vertebral column (spinal column) is made up of differently shaped bones called vertebrae. There are five categories of vertebrae, divided according to their location.

- **Cervical vertebrae (cervical spine, C1-C7):** The first seven vertebrae at the top of the spinal column. Cervical vertebrae provide support and motion for the head within a flexible framework.
 - **Thoracic vertebrae (thoracic spine, T1-T12):** These are the next 12 vertebrae in the upper and middle back. The bones form the rear anchor of the rib cage and move flexibly with the ribs. The lower their placement, the greater their size, and they are larger than the cervical vertebrae.
 - **Lumbar vertebrae (lumbar spine, L1-L5):** These five vertebrae are the largest bones in the spinal column and are below the thoracic vertebrae. They are attached to many of the back muscles. Because of their integral involvement in supporting much of the strain and stress of the body's weight, it is common for these vertebrae to become damaged and cause pain.
 - **Sacrum:** Located below the lumbar vertebrae, this triangular bone is fused from four or five sacral vertebrae that existed during childhood.
 - **Coccyx (tailbone):** At the base of the spinal column, the coccyx is also fused from three to five bones during childhood and connects to many muscles.
-

73.

In regard to anatomical location, where is the rectus femoris in relation to the tensor fasciae latae?

Medial

Superior

Lateral

Distal

Correct answer: Medial

From an anatomical point of view, the rectus femoris is medial to the tensor fasciae latae. The rectus femoris is one of the quadriceps, located on the front of the leg, and the tensor fasciae latae is located on the outside of the leg. "Medial" is the term used when a body part is located toward or closest to the midline of the body.

Distal refers to a location farthest from the point of reference or the center of the body. Lateral refers to a position toward the outside of the body. Superior refers to a location closer to the head or above the point of reference.

74.

If an individual is doing prolonged, intense exercise, about how long will it take for their glycogen stores to become depleted?

About 90 minutes

About 2 hours

30-60 minutes

2-3 hours

Correct answer: About 90 minutes

Once enough carbohydrates have been consumed to meet the body's immediate energy needs, the body stores the remaining glucose by converting it to glycogen for storage. However, these stores are limited and can become depleted after about 90 minutes of prolonged, intense exercise.

75.

Which of the following is true of the right ventricle of the heart?

It pumps deoxygenated blood to the lungs.

It pumps oxygenated blood out to the rest of the body.

It pumps deoxygenated blood into the right atrium.

It pumps oxygenated blood into the left atrium.

Correct answer: It pumps deoxygenated blood to the lungs.

Deoxygenated blood flows into the right atrium from the body. Then, it is pumped into the right ventricle. From there, the deoxygenated blood is pumped to the lungs, where it is oxygenated. Then, it is pumped to the left atrium, which pumps the blood to the left ventricle, which pumps the blood out to the rest of the body.

76.

What is the main characteristic of motor (efferent) neurons?

They stimulate muscle contraction and create movement

They are located within the spinal cord

They rely on sensory receptors to recognize environmental stimuli

They process information from the dendrite and send it along to the axon

Correct answer: They stimulate muscle contraction and create movement

Motor (efferent) neurons are responsible for carrying signals away from the central nervous system to initiate an action. For example, if you are thirsty, your afferent neurons will send a signal to your central nervous system, which then leads to your brain processing that information and sending a signal out to your efferent neurons to initiate the movements required to walk to the kitchen and get a glass of water.

Interneurons are located only in the spinal cord and are responsible for processing the signal from the afferent neurons and producing a new signal to send out to the efferent neurons.

Sensory receptors, or afferent neurons, exist throughout the body and translate stimuli into sensory information. The brain uses this information to respond with output information. These receptors include mechanoreceptors, nociceptors, chemoreceptors, and photoreceptors.

- **Mechanoreceptors** allow individuals to detect touch and similar sensations, such as pressure on their shoulders from a heavy backpack. These receptors are also responsible for monitoring limb and muscle movement through proprioception.
- **Nociceptors** are responsible for alerting individuals to pain. For example, if an individual gets a paper cut, the nociceptors in that specific area will alert the brain that something is wrong.
- **Chemoreceptors** allow individuals to respond to taste and smell through the use of their taste buds and olfactory cells, respectively.
- **Photoreceptors** respond to light (vision). There are two types of photoreceptors in the body: rods and cones. They are responsible for an individual's perception of changes in colors, shapes, and shades.

The cell body is one of the three main parts of a neuron whose role is to sort out the incoming information from the dendrite and send it on through to the axon, where impulses are transmitted away from the cell body.

77.

How does joint connective tissue function?

Joint connective tissues are both fibrous and flexible, providing stability and proprioception

Joint connective tissues are both tender and inflexible, providing stability and mobility

Joint connective tissues are both stiff and refractory, providing support and proprioception

Joint connective tissues have both cartilage and synovial fluid, providing mobility and lubrication

Correct answer: Joint connective tissues are both fibrous and flexible, providing stability and proprioception

Joint connective tissues (ligaments) are fibrous tissues that connect bone to bone, providing stability and sensory input (proprioception). Primarily made of collagen and some elastin, these tissues are both durable and flexible with the percentage of flexibility dependent upon the function of each specific ligament. Joint connective tissues have poor vascularity, do not heal quickly, and may adapt slowly to the stress of increased exercise.

Synovial joints contain cartilage and synovial fluid.

78.

The Tolerable Upper Intake Level (UL) represents which of the following?

The highest level of a nutrient per day that is unlikely to pose a risk of adverse health effects

The amount of a nutrient per day by which the needs of 50% of the population will be met

The amount of nutrient per day consumed by people assumed to be maintaining adequate nutrition

A general term for a set of reference values to plan and assess nutrient intake of healthy individuals

Correct answer: The highest level of a nutrient per day that is unlikely to pose a risk of adverse health effects

The Dietary Reference Intakes (DRIs) are reference values used to help plan and assess the nutrient intake of healthy individuals. There are four nutrient-based values that are considered DRIs:

- *Recommended Dietary Allowance (RDA)*
- *Adequate Intake (AI)*
- *Estimated Average Requirement (EAR)*
- *Tolerable Upper Intake Level (UL)*

Specifically, the highest average daily nutrient intake level which is unlikely to cause risk of adverse health effects to most individuals in a particular life stage and female or male group is classified as the Tolerable Upper Intake Level (UL).

79.

What is the recommended daily protein intake for endurance athletes?

1.2-1.4 grams per kilogram of body weight

1.6-1.7 grams per kilogram of body weight

0.8 grams per kilogram of body weight

1.0-1.2 grams per kilogram of body weight

Correct answer: 1.2-1.4 grams per kilogram of body weight

Every individual requires a different amount of protein, depending on their activity level. The more active an individual is, the more protein the body requires to repair, maintain, and develop muscle. For example, it is suggested that endurance athletes require 1.2-1.4 grams per kilogram of body weight per day, and strength athletes require 1.2-1.7 grams per kilogram of body weight per day.

80.

A dietary regimen characterized by an elevated consumption of saturated fats is correlated with heightened levels of which of the following?

Low-density-lipoprotein (LDL) cholesterol

Blood pressure and low-density-lipoprotein (LDL) cholesterol

High-density-lipoprotein (HDL) cholesterol

Total cholesterol and high-density-lipoprotein (HDL) cholesterol

Correct answer: Low-density-lipoprotein (LDL) cholesterol

A diet rich in saturated fats has long been a topic of research and discussion within the realm of nutritional science, particularly concerning its impact on cardiovascular health. Saturated fats, found primarily in animal products and certain oils, have been associated with various changes in blood lipid profiles, among which the most significant is the effect on cholesterol levels.

Low-Density-Lipoprotein (LDL) cholesterol, often referred to as bad cholesterol, is a primary focus when assessing the impact of saturated fats on health. Elevated levels of LDL cholesterol are a well-established risk factor for the development of atherosclerosis, a condition characterized by the hardening and narrowing of the arteries due to plaque buildup. This can lead to serious cardiovascular events, such as heart attacks and strokes. Diets high in saturated fats have been correlated with increased LDL cholesterol levels, as saturated fats can influence the body's lipid metabolism, leading to higher production of LDL particles.

Below are explanations for the other answer options:

- **Blood pressure and Low-Density-Lipoprotein (LDL) cholesterol:** *While a diet high in saturated fats is directly associated with increased LDL cholesterol levels, its impact on blood pressure is more complex and less direct. Hypertension (high blood pressure) has multifactorial causes, including genetics, lifestyle, and dietary patterns, particularly those high in salt. However, the overall dietary pattern that includes high saturated fat can contribute to the development of obesity, a risk factor for hypertension.*
- **High-Density-Lipoprotein (HDL) cholesterol:** *HDL cholesterol, often termed good cholesterol, helps remove other forms of cholesterol from the bloodstream. The relationship between saturated fat intake and HDL cholesterol levels is complex. Some studies suggest that while saturated fats may raise LDL cholesterol, they can also increase HDL cholesterol levels. However, the*

increase in HDL does not offset the risks associated with the rise in LDL cholesterol and total cholesterol.

- **Total cholesterol and high-density-lipoprotein (HDL) cholesterol:** *Total cholesterol is a measure that includes LDL cholesterol, HDL cholesterol, and other lipid components. A diet high in saturated fats typically leads to an increase in total cholesterol, which includes both an increase in LDL and potentially a smaller increase in HDL cholesterol. Nonetheless, the health implications of a rise in total cholesterol are primarily driven by the increase in LDL cholesterol.*

Among the listed impacts, the most well-supported and significant correlation between a diet high in saturated fats is the increase in LDL cholesterol levels. This correlation is crucial for dietary recommendations and interventions aimed at reducing cardiovascular disease risk. While changes in HDL cholesterol and blood pressure are also important to consider, the direct relationship between saturated fat intake and LDL cholesterol levels is a key factor in dietary guidelines aimed at improving heart health.

Therefore, it is recommended that individuals get less than 10% of their total calories from saturated fat.

81.

A client is sitting in a chair and performing a stretch where they extend their thoracic spine backward, over the top of the chair. Which of the following will happen to the natural curve of the thoracic spine in this stretched position?

The natural curve will decrease or reverse.

The natural curve will increase.

The natural curve will increase and then decrease.

The natural curve will decrease and then increase.

Correct answer: The natural curve will decrease or reverse.

The natural thoracic curve is kyphotic, or a forward curve. When a person extends backward, they will decrease or even reverse this curve, depending on how far they go.

82.

Which of the following best describes the sliding filament theory?

How thick and thin filaments in the sarcomere slide past each other

How thick and thin filaments in the motor unit slide past each other

How thick and thin filaments in the capillary slide past each other

How thick and thin filaments in the epimysium slide past each other

Correct answer: How thick and thin filaments in the sarcomere slide past each other

The sliding filament theory describes how the filaments shorten the entire length of the sarcomere and thus shorten the muscle and produce force. Specifically, the sarcomere causes contraction in the muscle and is made up of recurrent sections of actin and myosin.

83.

How many calories per gram do fats (lipids) provide?

9 calories per gram

4 calories per gram

7 calories per gram

5 calories per gram

Correct answer: 9 calories per gram

Macronutrients are nutrients that provide calories to the body for energy and include carbohydrates, fats, and protein.

- **Protein:** 4 calories per gram
 - **Carbohydrates:** 4 calories per gram
 - **Fats (Lipids):** 9 calories per gram
-

84.

Which exercise is most effective for enhancing bone density in an individual seeking to improve their bone mass?

Bodyweight squats

Lat pulldowns

Leg curls

Bench presses

Correct answer: Bodyweight squats

Bodyweight squats are highly effective for enhancing bone density, particularly in the lower body. This exercise involves multiple large muscle groups, including the quadriceps, hamstrings, glutes, and lower back, engaging them in a way that applies stress to the bones of the lower spine, hips, and legs.

The mechanical stress induced by bodyweight squats stimulates osteoblastic activity (bone formation), which is crucial for bone mass improvement. Additionally, squats are weight-bearing exercises, which are known to be particularly beneficial for increasing bone density because they force the body to work against gravity.

While lat pulldowns do engage major upper body muscles, including the latissimus dorsi, biceps, and shoulders, they are primarily an upper-body strength exercise that does not significantly impact the lower body or core areas critically involved in bone density enhancement like the hips and spine. Unlike squats, lat pulldowns are not a weight-bearing exercise, as they do not require the body to support its own weight against gravity in a way that impacts bone density effectively.

Leg curls target the hamstrings at the back of the thigh and involve flexing the knee against resistance. While they are useful for muscle conditioning and strengthening the hamstrings, leg curls do not provide substantial stress to the bones in a manner that would lead to increased bone density. This exercise is typically performed in a seated or prone position, reducing the weight-bearing impact, which is critical for stimulating bone growth.

The bench press is a popular upper body exercise focusing on the pectoral muscles, triceps, and anterior deltoids. Although it can contribute to upper body strength, it is not predominantly effective in enhancing bone density in the regions most susceptible to osteoporosis, such as the hips and spine. The exercise is performed in a lying position, which minimizes the weight-bearing effect needed for optimal bone density improvement.

While exercises like lat pulldowns, leg curls, and bench presses are beneficial for muscle strength and conditioning, they do not offer the same benefits as bodyweight squats in terms of enhancing bone density. Bodyweight squats are superior for this purpose due to their weight-bearing nature and the extensive engagement of muscles and bones in the lower body and core areas, which are critical for bone health.

85.

What is the daily recommended amount of protein for a sedentary individual?

0.8 g per kg of body weight

1.2 g per kg of body weight

1.6 g per kg of body weight

1.0 g per kg of body weight

Correct answer: 0.8 g per kg of body weight

Every individual requires a different amount of protein, depending on their activity level. The more active an individual, the more protein the body requires to repair, maintain, and develop muscle.

Specifically for sedentary individuals, it is recommended that they get 0.8 g of protein per kg of body weight daily.

Furthermore, it is suggested that endurance athletes require 1.2-1.4 grams per kilogram of body weight, and strength athletes require 1.2-1.7 grams per kilogram of body weight.

86.

Which of the following is not one of the three major muscle types in the body?

Rough

Smooth

Cardiac

Skeletal

Correct answer: Rough

There are three major muscle types in the body:

- **Skeletal muscles** are voluntary muscles, which means they are able to be consciously controlled and undergo adaptations such as changes in strength and size.
 - **Cardiac muscles** are another group of involuntary muscles that are found solely within the walls of the heart. Cardiac muscle is similar to skeletal muscle because its cells contain myofibrils and sarcomeres aligned side by side.
 - **Smooth muscles** are also known as involuntary muscles due to the inability to control their movements. They lie within the walls of blood vessels as well as in hollow organs such as the stomach.
-

87.

When muscle contracts, what happens within the sarcomere?

It shortens

It stays the same

It lengthens

It awaits an electrical impulse from the CNS

Correct answer: It shortens

Myofibrils contain both actin and myosin, which together form a sarcomere. During contraction, the myosin (thick) filaments bind with the actin (thin) filaments by forming crossbridges. The thick filaments pull the thin filaments past them, making the sarcomere shorter.
