

# ISSA CPT - Quiz Questions with Answers

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## I. Applied Science (Anatomy, Kinesiology, Physiology)

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1.

Golfer's elbow is an example of what type of injury?

**Pattern overload**

Unbalanced training

Suboptimal positioning

Hypomobility

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*Correct answer: Pattern overload*

*Pattern overload involves excessive repetition of the same pattern of motion, which may place abnormal stresses on the body. This can result from either numerous small patterns or a few impactful movements. Golfer's elbow is a result of inflammation within the soft tissues inside the elbow and is caused by improper positioning and improper muscle recruitment.*

*Unbalanced training, suboptimal positioning, and hypomobility are all examples of what can lead to pattern overload when there is a dysfunction present within the kinetic chain. These are not types of injuries.*

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2.

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

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*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.*

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3.

Growth hormone is stimulated by all of the following **except**:

**Catecholamines**

Deep sleep

Testosterone

Vigorous exercise

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*Correct answer: Catecholamines*

*Growth hormone is an anabolic hormone that is responsible for increases in the development of bone and muscle mass; additionally, it promotes protein synthesis and fat burning. Estrogen, testosterone, deep sleep, and vigorous exercise all stimulate the production of growth hormone.*

*Catecholamines (epinephrine and norepinephrine) are hormones produced by the adrenal glands. These hormones help prepare the body for activity. They do not stimulate the production of growth hormone.*

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4.

Relative flexibility can **best** be described as:

**The human movement system's way of finding the path of least resistance during movement**

The neuromuscular system allowing agonists, antagonists, and stabilizers to synergistically produce muscle forces

The range through which a joint may be freely moved with no resistance or pain

The increase in normal movement and functionality of a joint, which affects range of motion

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*Correct answer: The human movement system's way of finding the path of least resistance during movement*

*The body's goal is to always move as efficiently as possible. This means that if a person is dealing with a tight muscle group in one area, the body will alter its movement patterns to achieve movement. This is one of the ways compensations and dysfunctions develop.*

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5.

Inside the myofibrils of muscle tissue, which two types of contractile myofilaments can be found?

**Actin and myosin**

Sarcoplasm and plasma

Tropomyosin and troponin

Agonist and synergist

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*Correct answer: Actin and myosin*

*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.*

*Muscle contractions are made possible by tropomyosin and troponin, which are both found on the actin filament. If a muscle is relaxed, then tropomyosin blocks myosin binding sites on the actin filament. Contrastingly, during contraction, troponin provides binding sites for tropomyosin and calcium along the actin filament.*

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6.

Torque can **best** be described as:

**A force that generates rotation**

The speed at which a movement is performed

The amount of force that gravity has on the body

A push or pull that creates, stops, or changes movement

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*Correct answer: A force that generates rotation*

*When the amount of torque increases in a joint, the joint is more likely to rotate. The attachment sites and the line of pull cannot be altered. Therefore, moving the resistance is the easiest way to alter the amount of torque produced at a joint. More torque is created with the weight farther away from the joint, and less torque is created with the weight closer to the joint.*

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7.

Overactivity and tightness in a muscle tend to have what type of relationship?

**A direct relationship**

An inverse relationship

There is no relationship

A relative relationship

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*Correct answer: A direct relationship*

*If a muscle is overactive, more than likely it is also tight. After being activated repetitively, sometimes due to a synergistic dominance, a muscle can become overly tight, thus leading to altered movement patterns and compensations.*

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8.

Within the muscle, where does the exchange of oxygen and carbon dioxide take place?

**Within the capillaries**

Within the mitochondria

Within the myoglobin

Within the mechanoreceptors

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*Correct answer: Within the capillaries*

*Capillaries are small blood vessels within the muscle fiber and specifically within Type I fibers. There is a large number of capillaries that facilitate the exchange of oxygen and carbon dioxide. This allows for a highly effective oxygen delivery system to the working muscles of Type I fibers, unlike in Type II fibers where the capillary count is much lower.*

*Mitochondria are often referred to as the "powerhouse of the cell" because of their ability to convert energy from the breakdown of carbohydrates and fatty acids into usable energy for the cell.*

*Myoglobin is a protein contained within the liquid of the muscle fiber, whose specific role is to "pull in" oxygen and act as a temporary oxygen holding cell.*

*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.*

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9.

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

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*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.*

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10.

How does the body use the central nervous system to create movement?

**Through integrative function, which is its capacity to evaluate sensory information and choose a suitable reaction**

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

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*Correct answer: Through integrative function, which is its capacity to evaluate sensory information and choose a suitable reaction*

*The central nervous system (CNS — brain and spinal cord) and peripheral nervous system (PNS — nerves) work together to sense, evaluate, and respond to sensory information. The CNS regulates the activity of all parts of the body by understanding and analyzing the sensory data provided by the PNS. The CNS then communicates the appropriate responsive action to the body through the PNS.*

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11.

All of the following are major joint motions **except**:

Twisting

Rolling

Sliding

Spinning

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*Correct answer: Twisting*

*Joints are formed by one bone joining with another bone. Joints are categorized by their structure or their function. Arthrokinematics is the term used to describe joint motion. The three major joint motions are roll, slide, and spin.*

- **Rolling:** *An example of a rolling movement is when the femoral condyles move over the tibial condyles during a squat.*
  - **Sliding:** *An example of a sliding movement is when, during a knee extension, the tibial condyles move across the femoral condyles.*
  - **Spinning:** *An example of a spinning movement is when the head of the radius rotates on the end of the humerus during both pronation and supination of the forearm.*
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12.

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

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*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.*

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13.

In upper crossed syndrome, all of the following are overactive muscles in the head and neck **except**:

**Deep cervical flexors**

Upper trapezius

Sternocleidomastoid

Levator scapulae

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*Correct answer: Deep cervical flexors*

*There are three basic compensatory patterns to be aware of as a fitness professional. Upper crossed syndrome is one of these three common distortion patterns. It is characterized by rounded shoulders and the head jutting forward. This distorted posture is often caused by an overactive upper trapezius, sternocleidomastoid, and levator scapulae in the head and neck. Deep cervical flexors are typically lengthened (underactive) in this distortion pattern.*

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14.

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

**Teres major**

Supraspinatus

Subscapularis

Infraspinatus

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*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.*

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15.

Cardiac output is comprised of what two factors?

**Heart rate × stroke volume**

Heart rate / stroke volume

Heart rate × systolic blood pressure

Systolic blood pressure / heart rate

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*Correct answer: Heart rate × stroke volume*

*Stroke volume is the amount of blood that is contracted out with each heartbeat. Multiply the stroke volume by an individual's heart rate (number of times the heart beats per minute) to find the cardiac output.*

*Simply put, the total volume of blood pumped out of the heart per minute is called the cardiac output.*

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16.

All of the following are potential side effects of elevated cortisol levels **except**:

Decreased breathing rate

Breakdown of muscle tissue

Decreased fat utilization

Increased body composition (specifically abdominal fat)

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*Correct answer: Decreased breathing rate*

*Cortisol is a catabolic hormone, which means it is associated with the breakdown of tissue. The adrenal glands secrete cortisol in response to acute stress, both physical and emotional.*

*When there is chronic stress placed upon the body, whether it be from overtraining, poor sleep, or inadequate nutrition, it can lead to potentially harmful side effects such as breakdown of muscle tissue, decreased fat utilization, increased body composition (specifically abdominal fat), and decreased metabolism.*

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17.

An underactive muscle is generally considered to be:

**Lengthened and weak**

Shortened and strong

Shortened and weak

Lengthened and strong

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*Correct answer: Lengthened and weak*

*An overactive muscle is a type of muscle imbalance that forces compensation to occur. It is considered to be shortened, tight, and strong, whereas an underactive muscle, another type of muscle imbalance, is considered to be lengthened and weak.*

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18.

In the heart, once the blood leaves the **right** ventricle, where does it go?

**It goes to the lungs, via the pulmonary valve and pulmonary artery**

It goes to the left ventricle via the left AV (mitral) valve

It goes to the right atrium via the right AV (tricuspid) valve

It goes to the aorta via the aortic valve

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*Correct answer: It goes to the lungs, via the pulmonary valve and pulmonary artery*

*The path of blood flow in the heart begins on the right side, starting in the atrium and then going into the ventricle. From there, blood pumps from the right ventricle into the lungs and then returns to the left atrium. Next, the blood travels to the left ventricle before being pumped into the aorta, where it is transported into systemic circulation.*

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19.

The patella is considered to be which type of bone?

**Sesamoid bone**

Flat bone

Irregular bone

Short bone

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*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.*

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20.

Flexion and extension are two movements that occur in which plane of motion?

**Sagittal**

Frontal

Transverse

Longitudinal

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*Correct answer: Sagittal*

*The sagittal plane is an imaginary plane that bisects the body into equal halves, producing a left and a right half. Biceps curls, squats, and calf raises are examples of flexion and extension, all of which occur in the sagittal plane.*

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21.

Which of the following is considered the **best** time increment for measuring heart rate during exercise?

6 seconds

10 seconds

15 seconds

60 seconds

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*Correct answer: 6 seconds*

*By measuring an individual's heart rate for 6 seconds, all that is required is a simple multiplication by 10, or addition of zero, to receive an accurate estimate of beats per minute.*

*Example: Number of beats in 6 seconds = 15. Multiply by 10 ( $15 \times 10$ ) = 150; or addition of zero = 150*

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22.

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

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*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.*

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23.

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

**Muscle spindles**

Golgi tendon organs (GTOs)

Afferent neurons

Efferent neurons

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*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.*

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24.

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

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*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.*

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25.

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

**Medial**

Superior

Lateral

Distal

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*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.*

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26.

Which type of joint is considered to be the **most** mobile by allowing movement in all three planes?

**Ball-and-socket joint**

Gliding joint

Nonsynovial joint

Saddle joint

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*Correct answer: Ball-and-socket joint*

*The ball-and-socket joint is considered the most mobile of joints because it moves in all three planes of motion. The hip and shoulder joints are examples of this type of joint.*

*Gliding joints have no axis of rotation; instead, they move by sliding side to side or back and forth. The carpals of the wrist are an example of this type of joint.*

*Nonsynovial joints have no joint cavity or connective tissue and exhibit little to no movement at all. This type of joint can be found in the sutures of the skull.*

*There is only one saddle joint in the entire body, the carpometacarpal (CMC) in the thumb, and it moves mainly in two planes of motion, the sagittal and frontal.*

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27.

Which of the following is an example of a long bone?

**Femur**

Scapulae

Patella

Carpals of hand

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*Correct answer: Femur*

*The skeletal system has five major types of bones. They are categorized by their shape, size, and distribution of bone tissue. Long bones are so named because of their long cylindrical body and irregular or widened bony ends.*

*Examples of long bones include the femur and the humerus.*

*Carpals of the hands are classified as short bones, scapulae are considered to be flat bones, and the patella is a sesamoid bone.*

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28.

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

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*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.*

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29.

What is the unique feature of Type **Ila** muscle fibers?

**They are capable of creating energy from both aerobic and anaerobic metabolism in nearly equal amounts**

They can produce the most speed and strength

They can provide the most stabilization force without fatiguing as quickly

They contain the most mitochondria, myoglobin, and capillaries

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*Correct answer: They are capable of creating energy from both aerobic and anaerobic metabolism in nearly equal amounts*

*Type Ila muscle fibers are considered intermediate fast-twitch muscle fibers because of their ability to use both aerobic and anaerobic metabolism. They have a higher oxidative capacity and fatigue more slowly than other type II fibers.*

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30.

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

**Tranverse**

Sagittal

Frontal

Longitudinal

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*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*
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31.

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

Glycogen

Acetyl-CoA

Fat

Amino acids

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*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.*

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32.

When the body is trying to regulate its temperature properly, what sensory receptors does it rely on?

Thermoreceptors

Mechanoreceptors

Nociceptors

Chemoreceptors

*Correct answer: Thermoreceptors*

*Thermoreceptors are not only responsible for helping the brain regulate body temperature but also for alerting the brain to unusually cold or warm body temperatures that might warrant action, such as putting on a coat if it is cold outside.*

*Thermoreceptors are part of a category of receptors called sensory receptors. Sensory receptors are divided into thermoreceptors, mechanoreceptors, nociceptors, chemoreceptors, and photoreceptors. Sensory receptors exist throughout the body and translate stimuli into sensory information. The brain uses this information to respond with output information.*

- **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 of pain. For example, if an individual experiences pain from 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 (used for vision). There are two types of photoreceptors in the eye: rods and cones. They are responsible for an individual's perception of changes in colors, shapes, and shades.
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**33.**

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

**Superior**

Inferior

Anterior

Posterior

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*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.*

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34.

Which of the following is **not** a major type of muscle activation?

Isolated activation

Concentric activation

Isometric activation

Eccentric activation

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*Correct answer: Isolated activation*

*Concentric, isometric, and eccentric are all types of muscle activation, each being responsible for facilitating different joint actions.*

- **Concentric:** *This muscle action occurs when the contractile force is greater than the resistive force, resulting in a visible shortening of the muscle.*
  - **Isometric:** *This muscle action occurs when the contractile force is equal to the resistive force.*
  - **Eccentric:** *This muscle action occurs when a muscle develops tension while lengthening.*
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35.

What is isokinetic muscle action?

**A muscle contracts while maintaining a constant speed throughout the range of motion**

A muscle contracts with force equal to the resisting force

A muscle contracts with greater force than the resisting force

A muscle extends with force equal to its agonist

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*Correct answer: A muscle contracts while maintaining a constant speed throughout the range of motion*

*Isokinetic muscle action is achieved with specialized equipment and is unlikely to be seen in a typical gym.*

*Isometric muscle action occurs when a muscle contracts with force equal to the resisting force. Concentric muscle action occurs when a muscle contracts with greater force than the resisting force. Eccentric motion occurs when a muscle extends with force equal to its agonist.*

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36.

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

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*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.*

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37.

For an individual who is looking to improve their bone mass, which of the following exercises would be the **best** choice?

**Bodyweight squats**

Swimming

Bicycling

Elliptical intervals

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*Correct answer: Bodyweight squats*

*Bone reacts to exercise by increasing in density. Greater peak bone mass (bone density) exists in people who exercise regularly. Weight-bearing exercise requires bones to work against gravity and supports the most bone density growth. Weight-bearing exercises include bodyweight squats, push-ups, walking, hiking, climbing stairs, and weight lifting.*

*Swimming, bicycling, and elliptical intervals are all modes of exercise that are non-weight-bearing.*

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38.

When muscle contracts, what happens within the sarcomere?

**It shortens**

It stays the same

It lengthens

It awaits an electrical impulse from the CNS

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*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.*

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**39.**

What are the two interdependent divisions of the nervous system?

**The central nervous system (CNS) and the peripheral nervous system (PNS)**

The central nervous system (CNS) and the proximal nervous system (PNS)

The cerebral nervous system (CNS) and the peripheral nervous system (PNS)

The cardiorespiratory nervous system (CNS) and the pulmonary nervous system (PNS)

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*Correct answer: The central nervous system (CNS) and the peripheral nervous system (PNS)*

*The central nervous system (CNS) is made up of the brain and the spinal cord, which are mainly responsible for coordinating the activity of the body systems and parts.*

*The peripheral nervous system (PNS) is made up of nerves that connect the CNS to the rest of the body as well as to the outside world through sensory data. The PNS can be broken down further into the somatic and autonomic nervous systems.*

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40.

Which of the following is the body's **most** usable form of energy?

Adenosine triphosphate

Micronutrients (minerals, vitamins, phytonutrients)

Macronutrients (protein, fat, carbohydrates)

Adenosine diphosphate

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*Correct answer: Adenosine triphosphate*

*Although carbohydrates, proteins, and fats contain potential energy for the body, these three macronutrients cannot be used in their digested form.*

*Think of it in terms of a car. The food we eat is like crude oil; it contains all the necessary chemical energy, but it must be processed into a form that our "engine" (the mitochondria in our cells) can use. Metabolism essentially represents the body's internal "oil refinery." It processes the "crude" input such as macronutrients into something that can be specifically used by the cells for fuel.*

*In this case, macronutrients are broken down into the high-energy chemical, adenosine triphosphate or ATP, which is the most usable form of energy in the body.*

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41.

Which of the following is classified as a sesamoid bone?

Patella

Vertebra

Humerus

Carpals of the hand

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*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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42.

What position does wearing shoes with a high heel put the ankle in?

**A plantarflexed position**

A dorsiflexed position

A pronated position

A supinated position

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*Correct answer: A plantarflexed position*

*Plantarflexion can cause postural imbalance when it is maintained for an extended period of time. This is due to tightness in the gastrocnemius, soleus, and Achilles tendon.*

*Dorsiflexion is the opposite position of plantarflexion and is a good stretch for those who wear high heels.*

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43.

The Golgi tendon organs (GTOs) are what kind of sensory receptors?

**Mechanoreceptors**

Nociceptors

Photoreceptors

Chemoreceptors

*Correct answer: Mechanoreceptors*

*Sensory receptors exist throughout the body and translate stimuli into sensory information. The brain uses this information to respond with output information. 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.
- **Nociceptors** are responsible for alerting individuals of pain. For example, if an individual experiences pain from 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 eye: rods and cones. They are responsible for an individual's perception of changes in colors, shapes, and shades.

*The Golgi tendon organs (GTOs) measure the rate of tension in a muscle, and if there is too much tension, the GTOs are responsible for sending a signal to that muscle to relax. This is why the GTO is a mechanoreceptor; tension and pressure are just two of the sensations that feed into an individual's proprioception and muscle movement.*

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**44.**

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

**Hand**

Skull

Rib cage

Vertebral column

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*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.*

---

**45.**

What amount of time is recommended to hold a stretch for the Golgi tendon organs (GTOs) to signal a muscle to relax?

**30 seconds**

10 seconds

15 seconds

45 seconds

---

*Correct answer: 30 seconds*

*During static stretching, muscle spindles cause the protective muscular contraction to make sure the stretch is not taken too far. After approximately 30 seconds of applied tension, the Golgi tendon organ (GTO) will signal for the muscle to relax. After 30 seconds, the muscle becomes uninhibited, and that is when a greater stretch can be achieved.*

---

46.

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.*

---

47.

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.*

---



48.

The sliding filament theory can be **best** described as:

**How thick and thin filaments within the sarcomere move past one another, resulting in shortened muscle and force production**

The process of neural stimulation creating a muscle contraction

The process of electrical impulses sliding from the CNS down the axon of the neuron, thus releasing neurotransmitters to initiate muscle contraction

Troponin providing binding sites along the actin filament for both calcium and tropomyosin when a muscle needs to contract

---

*Correct answer: How thick and thin filaments within the sarcomere move past one another, resulting in shortened muscle and force production*

*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.*

---

49.

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

**Latissimus dorsi**

Quadratus lumborum

Gluteus medius

Rectus abdominis

---

*Correct answer: Latissimus dorsi*

*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 quadratus lumborum, psoas major, external obliques, portions of the internal oblique, rectus abdominis, gluteus medius, and adductor complex.*

---

50.

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.*

---

51.

Which of the following muscles commonly causes a decreased neural drive of the gluteus maximus?

**Psoas**

Gluteus medius

Hamstrings

Adductors

---

*Correct answer: Psoas*

*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.*

*An example of altered reciprocal inhibition is having a tight psoas, which decreases neural drive of the gluteus maximus.*

---

52.

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.*

---

53.

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.*

---

**54.**

What is the role of veins as they relate to blood flow?

**Veins carry blood toward the heart**

Veins carry blood away from the heart

Veins are the site of water and gas exchange between blood and tissues

Veins transport blood toward the lungs

---

*Correct answer: Veins carry blood toward the heart*

*Arteries, capillaries, and veins are the three major types of blood vessels, and they each have their specific roles in blood transportation.*

*Arteries are vessels that carry blood away from the heart, and veins carry blood from the capillaries toward the heart.*

*Capillaries are the site where water and gas exchange (including carbon dioxide) occurs between blood and tissues.*

---

**55.**

In regard to size, what is **unique** about thoracic vertebrae?

**The thoracic vertebrae increase in size from the top down**

The thoracic vertebrae are all the same size

The thoracic vertebrae decrease in size from the top down

The thoracic vertebrae are smaller than the cervical vertebrae

---

*Correct answer: The thoracic vertebrae increase in size from the top down*

*The thoracic vertebrae are larger than the cervical vertebrae and increase in size from the top down, each articulating with a pair of ribs on either side.*

---



56.

The length–tension relationship (LTR) can **best** be described as:

**The ability of a muscle to produce force at its current range**

A neuromuscular reflex that inhibits opposing muscles during movement

A muscle group moving together to produce movement around a joint

A muscle group whose primary function is to provide joint support and stabilization

---

*Correct answer: The ability of a muscle to produce force at its current range*

*If a muscle is too short or too long, it is weakened. Thus, finding the optimal length for a muscle where it can produce optimal strength is important. This is why fitness professionals should assess a client's static and dynamic posture as well as positioning to see where, if any, deviations from ideal alignment exist that may inhibit force production.*

---

57.

Which of the following bones move with the ribs to form the rear anchor of the rib cage?

Thoracic vertebrae

Lumbar vertebrae

Cervical vertebrae

Sacrum

*Correct answer: Thoracic vertebrae*

*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):** These are 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):** The next 12 vertebrae are in the upper and middle back. These 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 exist 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.

58.

In regard to anatomical position, where is the gastrocnemius in relation to the soleus?

Superior

Lateral

Medial

Inferior

---

*Correct answer: Superior*

*From an anatomical point of view, the gastrocnemius is superior to the soleus. The gastrocnemius overlaps the soleus, but its position is slightly higher than that of the soleus.*

- **Superior** is the term used when a body part is located above a landmark or closest to the head.
  - **Lateral** refers to a location toward the outside of the body.
  - **Medial** indicates a location toward the midline of the body.
  - **Inferior** refers to a location below the point of reference.
-

59.

Static stretching is considered to be which type of flexibility?

**Corrective flexibility**

Active flexibility

Functional flexibility

Immobile flexibility

---

*Correct answer: Corrective flexibility*

*The integrated flexibility continuum is made up of three types of flexibility: corrective, active, and functional.*

*Corrective flexibility focuses on increasing joint range of motion as well as improving muscle imbalances and correcting dysfunctional joint motion.*

*Corrective flexibility techniques include self-myofascial release, which can be done using a foam roller and static stretching.*

*Furthermore, static stretching can involve either reciprocal inhibition or autogenic inhibition to achieve the desired outcome, depending on how the stretch is performed.*

---

60.

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.*

---

61.

If a client is in the **prone** position, how are they situated?

Lying facedown

Lying faceup

Lying on their side

Standing on one leg

---

*Correct answer: Lying facedown*

*Prone is the position where one is lying with their face downward; supine is the position where one is lying on their back with their face upward.*

*Supine is when an individual is lying faceup.*

---

62.

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

Asthma

Obesity

Fractured ribs

A neuromuscular disease

---

*Correct answer: Asthma*

*Chronic lung disease is divided into two basic categories:*

- **Chronic obstructive lung disease** results in normal lung tissue with restricted airflow.
- **Restrictive lung disease** results in fibrotic, dysfunctional lung tissue. With this condition, the lungs might have restricted expansion capabilities. This can be caused by fractured ribs, neuromuscular disease, or obesity.

*Asthma is considered a chronic obstructive lung disease.*

---

63.

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.
-



**64.**

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.*

---

65.

When overtraining occurs, which hormone is typically present in the bloodstream?

**Cortisol**

Growth hormone

Norepinephrine

Epinephrine

---

*Correct answer: Cortisol*

*Cortisol is a catabolic hormone, which means it is associated with the breakdown of tissue. The adrenal glands secrete cortisol in response to acute stress, both physical and emotional.*

*When there is chronic stress placed upon the body, whether it be from overtraining, poor sleep, or inadequate nutrition, cortisol can cause excessive breakdown of muscle and other harmful effects. This excessive production of cortisol outweighs any production of growth hormone, an anabolic hormone.*

---

66.

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.*

---

67.

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.*

---

68.

Which of the following is **not** a division of the vertebral (spinal) column?

Sternum

Sacrum

Thoracic

Coccyx

---

Correct answer: Sternum

*The sternum (breastbone) is a long, narrow bone that serves as the origin for the rib cage and for many muscles of the upper body. It is not part of the vertebral column.*

*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):** These are 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):** The next 12 vertebrae are in the upper and middle back. These 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 exist 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.
-

69.

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.*

---

70.

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.*

---

71.

How many vertebrae make up the lumbar spine?

Five

Four

Seven

Twelve

Correct answer: Five

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 exist 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.
-



72.

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.*

---

73.

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
-

74.

Motor neurons are also referred to as which of the following?

**Efferent neurons**

Afferent neurons

Interneurons

Sensory neurons

---

*Correct answer: Efferent neurons*

*Efferent neurons stimulate muscle contraction, which is why they are also referred to as motor neurons because they create movement.*

*Afferent (sensory) neurons are responsible for recognizing environmental stimuli, thus eventually leading to a response of movement, stimulated by efferent neurons. Interneurons transmit information between neurons.*

---

75.

Which of the following is **not** a kinetic chain checkpoint term?

Core

Foot

Shoulders

Knee

---

*Correct answer: Core*

*For every postural assessment, the fitness professional should assess checkpoints throughout the kinetic chain. These checkpoints refer to major joint regions of the body and include the following:*

- *Foot and ankle*
- *Knee*
- *Lumbo-pelvic-hip complex (LPHC)*
- *Shoulders*
- *Head and cervical spine*

*When assessing these checkpoints, the fitness professional should view the body from an anterior, lateral, and posterior view.*

---

76.

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.*

---

77.

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.*

---

78.

Which of the following is the **fastest** of energy systems?

ATP-PC system

Glycolysis

Oxidative system

The Krebs cycle

---

*Correct answer: ATP-PC system*

*The process of creating a new ATP molecule from a phosphocreatine molecule (ATP-PC system) is the simplest and fastest of the energy systems and occurs without the presence of oxygen (anaerobic).*

*The ATP-PC system supports high-intensity, short rounds of exercise. For example, during a sprint with 100% effort, ATP and PC stores could supply energy for up to 15 seconds before being spent.*

*Glycolysis is also an anaerobic process, but it takes more time and also results in more energy than the ATP-PC system. The Krebs cycle is part of the oxidative system, which uses oxygen to create ATP (aerobic) and is more time-consuming.*

---

79.

In a repetition tempo written as 4:2:1:1, what phase of exercise does the number 4 represent?

**Eccentric**

Isometric

Concentric

Isotonic

---

*Correct answer: Eccentric*

*With repetition tempo, the first number always represents the eccentric or lowering phase of the exercise; the second number represents the isometric or pause of the exercise, the third number represents the concentric phase, and the fourth number represents another isometric point of the exercise.*

*So in this case, the repetition tempo of 4:2:1:1 means the following:*

- *Four seconds for the eccentric phase of the exercise*
  - *Two-second pause at the isometric point of the exercise*
  - *One second for the concentric phase of the exercise*
  - *One-second pause at the isometric point of the exercise*
-



80.

In what two ways should a fitness professional observe a client's posture and alignment patterns?

**Statically and dynamically**

Seated and standing

Supine and prone

Anteriorly and posteriorly

---

*Correct answer: Statically and dynamically*

*While assessing a client's posture, it is important to be able to see which alignment patterns are altered within their kinetic chain. To best do this, a fitness professional should observe the client in both static and dynamic positions to get a more complete idea of areas of potential weakness.*

*Static posture provides the baseline position from which all movement for an individual occurs. Posture is important to observe without movement, but assessing dynamic posture can show the fitness professional how an individual's body performs during certain movement patterns.*

---

81.

In regard to working with the internal obliques, what is the **main** muscular role of the transverse abdominis?

To isometrically stabilize the lumbo-pelvic-hip complex

To assist in trunk flexion

To facilitate lateral flexion

To facilitate contralateral rotation

---

*Correct answer: To isometrically stabilize the lumbo-pelvic-hip complex*

*Along with the internal obliques, the transverse abdominis is primarily responsible for providing stability to the lumbo-pelvic-hip complex.*

*Additionally, when activated, this muscle can create tension in the thoracolumbar fascia, supporting a straight line and protective tension in the spine.*

*This muscle can also compress the sacroiliac joint, which increases stability.*

---

82.

Shoulder abduction is a result of the force-coupling between which muscles?

**Deltoid and rotator cuff**

Pectoralis major and deltoid

Upper trapezius and serratus anterior

Upper trapezius and rotator cuff

---

*Correct answer: Deltoid and rotator cuff*

*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 deltoid and muscles comprising the rotator cuff create a force-couple to allow for shoulder abduction. However, this only happens when both muscles have the right length–tension relationship and joint motion.*

---

83.

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.*

---

84.

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.*

---

85.

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.*

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## II. Nutrition

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86.

What is the recommended daily intake of water for sedentary adult females and males, respectively?

**75 oz/day, 100 oz/day**

85 oz/day, 115 oz/day

80 oz/day, 105 oz/day

155 oz/day, 190 oz/day

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*Correct answer: 74 oz/day, 100 oz/day*

*Water serves many important purposes for the body, which is why as a fitness professional you need to ensure that your clients are consuming enough water daily. Water needs can be met either by drinking water or by consuming foods that have a high water content. Daily recommendations are as follows:*

- **Adult females:** Approximately 75 oz/day (2.2 L)
- **Adult males:** Approximately 100 oz/day (3.0 L)

*Additional fluid is needed if a person is on a weight-loss plan, exercises, has a physical job, or spends a lot of time outside.*

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**87.**

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

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*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.*

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**88.**

All of the following foods contain primarily saturated fat **except**:

**Avocados**

Meat

Cheese

Eggs

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*Correct answer: Avocados*

*The types of fat an individual consumes, as opposed to the total amount of fat, is an important influence on overall health as well as the risk of cardiovascular disease. A higher intake of saturated fats has been associated with increased levels of LDL cholesterol, which can increase the risk for heart disease.*

*Therefore, it is recommended that adults limit their calories from saturated fats and instead consume healthy fats, such as polyunsaturated and monounsaturated fats.*

*Avocados are primarily made up of monounsaturated fats.*

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**89.**

Which of the following is considered a micronutrient?

**Magnesium**

Omega-6

Fructose

Lactose

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*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.*

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**90.**

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.*

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**91.**

What is the recommended intake of water post exercise?

**16-24 ounces for every pound of body weight lost during exercise**

12-14 ounces for every pound of body weight lost during exercise

6-12 ounces for every pound of body weight lost during exercise

14-18 ounces for every pound of body weight lost during exercise

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*Correct answer: 16-24 ounces for every pound of body weight lost during exercise*

*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 the following:*

- **Before Exercise:** 14-22 oz. of fluid two hours before exercise
  - **During Exercise:** 6-12 oz. of water or sports drink every 15-20 minutes of exercise
  - **After Exercise:** 16-24 oz. of water or sports drink for every pound of body mass lost during exercise
-

92.

Which of the following describes the thermic effect of food (TEF)?

**The energy used to process and store food that is expended above the resting metabolic rate (RMR)**

The energy used in physical activity that is expended above the resting metabolic rate (RMR)

The energy expended for basic body functions

The energy expended when processing macronutrients

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*Correct answer: The energy used to process and store food that is expended above the resting metabolic rate (RMR)*

*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 different 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 that is expended above the RMR*
  - **Energy expended during physical activity:** *The energy used in physical activity that is expended above the RMR*
-

**93.**

When does protein become a significant fuel source?

**During starvation**

During protein synthesis

During high-intensity exercise

During steady-state exercise

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*Correct answer: During starvation*

*Carbohydrates, fats, and protein are the chemical energy for humans. All biochemical reactions in the body require energy from the oxidation of these macronutrients. Specifically, protein rarely supplies much energy during exercise. It becomes a significant fuel source during starvation.*

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**94.**

All of the following are commonly fortified foods **except**:

**Peanut butter**

Breakfast cereal

Energy bars

Protein powder

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*Correct answer: Peanut butter*

*Today's food supply is not devoid of nutrients; however, it is possible to select a diet composed of mostly overly refined foods that provide limited amounts of vitamins and minerals as well as an overabundance of calories. With fortified foods such as breakfast cereals, energy bars, and protein powder, it is quite possible to consume excessive amounts of some nutrients even without taking a dietary supplement.*

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**95.**

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

**Gastrointestinal irritation**

Fatigue

Impaired immune function

Kidney stones

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*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.*

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**96.**

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

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*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.*

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**97.**

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.*

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**98.**

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

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*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.*

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**99.**

All of the following are monounsaturated fats **except**:

**Flaxseeds**

Avocados

Peanuts

Almonds

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*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.*

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