Ohio Assessments for Educators (OAE) Middle Grades Science (OAE 029) Sample Study Guide

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Featuring practice questions, answers, and explanations for each question.

Questions

1. What is atomic mass?

A. Number of electrons and protons

B. Number of protons in the nucleus only

C. Number of protons and neutrons

D. Number of neutrons only

2. What is the primary role of respiration in plants?

A. Producing oxygen

B. Creating glucose

C. Utilizing glucose for energy

D. Facilitating nutrient uptake

3. A disaccharide is formed by the bonding of how many monosaccharides?

A. One

B. Two

C. Three

D. Four

4. What term describes all the different populations living together in a specific area?

A. Community

B. Habitat

C. Biome

D. Ecological Zone

5. According to Charle's Law, what happens to gases when they are heated?

A. They contract

B. They evaporate

C. They expand

D. They condense

6. In which type of bond do atoms combine through the sharing of their outermost electrons?

A. Ionization bond

B. Van der Waals bond

C. Covalent bond

D. Electrostatic bond

7. In genetics, what does the term 'gametes' specifically refer to?

A. All body cells

B. Only female reproductive cells

C. Only male reproductive cells

D. Reproductive cells that combine during fertilization

8. What process is described as the release of energy by breaking down glucose in the presence of oxygen?

A. Photosynthesis

B. Cellular Respiration

C. Fermentation

D. Metabolism

9. Which type of symbiotic relationship is characterized by one organism benefiting while the other is unaffected?

A. Commensalism

B. Mutualism

C. Parasitism

D. Competition

10. How do you convert Kelvin to Celsius?

A. C = K - 273

B. C = K + 273

C. C = 273 - K

D. C = K / 273

Answers

1. C
2. C
3. B
4. A
5. C
6. C
7. D
8. B
9. A
10. A

Explanations

1. What is atomic mass?

A. Number of electrons and protons

B. Number of protons in the nucleus only

C. Number of protons and neutrons

D. Number of neutrons only

Atomic mass is defined as the mass of an atomic nucleus and is primarily determined by the number of protons and neutrons present in that nucleus. Protons and neutrons, collectively known as nucleons, contribute to the bulk of an atom's mass because they are much more massive than electrons. The atomic mass is typically expressed in atomic mass units (amu), where one amu is defined as one twelfth the mass of a carbon-12 atom. This measurement reflects the combined weight of protons and neutrons because these two particles are much heavier than electrons, which are not included in the calculation of atomic mass. Understanding atomic mass is crucial in chemistry and physics as it helps in calculating the relative mass of atoms and understanding how they interact in chemical reactions. The option mentioning the number of neutrons only does not account for the significant contribution of protons, and just focusing on the number of electrons and protons fails to provide the complete picture needed for atomic mass, as it omits neutrons, which are also integral to an atom's mass.

2. What is the primary role of respiration in plants?

A. Producing oxygen

B. Creating glucose

C. Utilizing glucose for energy

D. Facilitating nutrient uptake

The primary role of respiration in plants is to utilize glucose for energy. During respiration, plants break down glucose, which is produced during photosynthesis, to release energy stored in its chemical bonds. This energy is essential for various cellular processes and metabolic activities that keep the plant alive and functioning, including growth, reproduction, and repair. In this context, the other choices do not represent the main function of respiration. While producing oxygen is a key aspect of photosynthesis, it is not the primary role of respiration. Similarly, creating glucose is a process that occurs during photosynthesis, not respiration. Facilitating nutrient uptake is also an important plant function, but it is more related to the root systems and does not primarily involve respiration. Therefore, the correct answer highlights the crucial function of respiration in enabling plants to harness the energy they need to sustain their life processes.

3. A disaccharide is formed by the bonding of how many monosaccharides?

A. One

B. Two

C. Three

D. Four

A disaccharide is formed by the bonding of two monosaccharides. This occurs through a condensation reaction, specifically a dehydration synthesis, where two monosaccharide molecules combine, and a water molecule is released in the process. Common examples of disaccharides include sucrose (table sugar), which consists of glucose and fructose, and lactose, which is composed of glucose and galactose. Understanding the formation of disaccharides from monosaccharides is crucial in the study of carbohydrates and their role in biological systems.

4. What term describes all the different populations living together in a specific area?

A. Community

B. Habitat

C. Biome

D. Ecological Zone

The term "community" refers specifically to the various populations of different species that interact and coexist in a particular area. In ecological terms, a community comprises all the living organisms—plants, animals, fungi, and microorganisms—that inhabit a specific environment and interact with each other in various ways, such as through feeding relationships, competition, and symbiosis. A habitat, in contrast, describes the physical environment where a particular species lives, focusing more on the conditions and resources available rather than the interactions between various species. A biome refers to a larger geographical area characterized by specific climate conditions and types of living organisms, categorizing large regions based on similar ecological characteristics. An ecological zone usually refers to specific areas within a biome that have distinct environmental or biological features. Thus, "community" is the correct term for encapsulating the idea of multiple populations coexisting and interacting in a defined environment.

5. According to Charle's Law, what happens to gases when they are heated?

A. They contract

B. They evaporate

C. They expand

D. They condense

According to Charles's Law, gases will expand when they are heated. This principle states that when the temperature of a gas increases, the volume also increases, provided the pressure remains constant. This relationship between temperature and volume reflects the kinetic theory of gases, where an increase in temperature leads to an increase in the energy of the gas particles. As these particles move faster, they collide with each other and the walls of their container more forcefully and frequently, causing the gas to occupy a larger volume. The other options do not accurately reflect the relationship illustrated by Charles's Law. For instance, gases do not contract when heated; instead, they occupy more space. Evaporation is a process related to liquids transitioning into gas and doesn't directly pertain to the heating of gases themselves. Lastly, condensation involves the transition from gas to liquid as temperature decreases, which is opposite to the expansion described by Charles's Law. Thus, the principle clearly highlights that heating a gas results in its expansion.

6. In which type of bond do atoms combine through the sharing of their outermost electrons?

A. Ionization bond

B. Van der Waals bond

C. Covalent bond

D. Electrostatic bond

The correct answer, which identifies the type of bond where atoms combine through the sharing of their outermost electrons, is the covalent bond. In a covalent bond, atoms achieve greater stability by sharing one or more pairs of electrons, particularly from their valence shells. This shared electron configuration allows each atom to attain a full outer electron shell, which is a more energetically favorable state. Covalent bonds typically occur between nonmetal atoms that have similar electronegativities, allowing them to share electrons rather than transfer them completely, as seen in ionic bonds. This sharing can involve single, double, or even triple bonds, depending on how many pairs of electrons are shared. The strength and directionality of covalent bonds contribute to the formation of molecules with specific shapes and properties. Understanding this concept is fundamental in chemistry, particularly when analyzing molecular structures and reactivity.

7. In genetics, what does the term 'gametes' specifically refer to?

A. All body cells

B. Only female reproductive cells

C. Only male reproductive cells

D. Reproductive cells that combine during fertilization

The term 'gametes' specifically refers to reproductive cells that combine during fertilization. Gametes are specialized cells involved in sexual reproduction; in humans and many other organisms, these are the sperm and egg cells. When a male's sperm fertilizes a female's egg, the genetic material from both parents combines to form a new organism. This process is key to genetic diversity in sexually reproducing species, as each gamete carries a unique set of genes due to the process of meiosis, which reduces the chromosome number by half and shuffles genetic material. Understanding gametes is crucial in the study of inheritance and the principles of genetics.

8. What process is described as the release of energy by breaking down glucose in the presence of oxygen?

A. Photosynthesis

B. Cellular Respiration

C. Fermentation

D. Metabolism

The process described, where energy is released by breaking down glucose in the presence of oxygen, is known as cellular respiration. This biochemical process occurs in the cells of organisms, enabling them to convert glucose into adenosine triphosphate (ATP), which is the energy currency of cells. During cellular respiration, glucose is oxidized, and oxygen acts as the final electron acceptor in the electron transport chain, which is a part of this process. The overall reaction can be summarized as glucose reacting with oxygen to produce carbon dioxide, water, and ATP. This process is vital for aerobic organisms, as it provides the necessary energy required for various cellular functions and activities. In contrast, photosynthesis involves the production of glucose using sunlight, carbon dioxide, and water, which is fundamentally different from the breakdown of glucose. Fermentation is an anaerobic process that occurs in the absence of oxygen, leading to energy production without utilizing oxygen, often resulting in byproducts like alcohol or lactic acid. Metabolism is a broader term that encompasses all chemical reactions occurring in a living organism, including both anabolism (building up) and catabolism (breaking down), thus not specifically addressing the energy release from glucose.

9. Which type of symbiotic relationship is characterized by one organism benefiting while the other is unaffected?

A. Commensalism

B. Mutualism

C. Parasitism

D. Competition

The relationship described where one organism benefits while the other is unaffected is known as commensalism. In commensalism, one species derives some benefit, such as food or shelter, without harming or benefiting the other species. For example, barnacles that attach to a whale benefit from being transported to various feeding areas without impacting the whale's health or behavior. Mutualism, on the other hand, involves both organisms benefiting from the interaction, such as bees pollinating flowers while obtaining nectar. Parasitism is characterized by one organism benefiting at the expense of the other, like ticks feeding on a host. Competition refers to the struggle between organisms for the same resources, which does not align with the scenario where one organism remains unaffected.

10. How do you convert Kelvin to Celsius?

A. C = K - 273

B. C = K + 273

C. C = 273 - K

D. C = K / 273

To convert Kelvin to Celsius, the correct formula is to subtract 273 from the Kelvin temperature. This is based on the fact that 0 degrees Celsius is equivalent to 273.15 Kelvin. Therefore, when using the simple conversion, you round to 273 for practical purposes, leading to the formula: Celsius (C) is equal to the Kelvin (K) temperature minus 273. The conversion reflects the relationship between the two scales, allowing you to transition from the absolute temperature scale (Kelvin) to the relative temperature scale (Celsius) that is commonly used in most scientific contexts. This understanding is essential for making accurate temperature conversions in scientific experiments, calculations, and discussions.