DIVE Integrated Chemistry and Physics (ICP) Quarterly Exam 3 Practice (Sample)

Study Guide

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Questions

1. What is the SI unit of force or weight?

A. Joule

B. Newton (N)

C. Pound

D. Meter

2. How does increasing temperature affect gas pressure in a closed container?

A. It decreases the gas pressure

B. It has no effect on gas pressure

C. It increases the gas pressure

D. It causes gas to condense into a liquid

3. What is referred to as the effort in the context of machines?

A. The total weight of the object.

B. The force applied to produce work.

C. The distance from the fulcrum.

D. The distance from the effort point.

4. What is the mechanical advantage of a wedge primarily due to?

A. The sharpness of its edge

B. The angle of its inclined planes

C. The material it's made of

D. The length of the wedge

5. Acceleration indicates how quickly what changes over time?

A. Mass

B. Velocity

C. Force

D. Energy

6. What principle states that every action has an equal and opposite reaction?

A. Newton's 1st law

B. Newton's 2nd law

C. Newton's 3rd law

D. Universal gravitation

7. Which of the following describes renewable energy sources?

A. They are finite and cannot be replenished

B. They can be replenished naturally

C. They are derived only from fossil fuels

D. They are always cheaper than non-renewable sources

8. What characterizes an oxidation-reduction reaction?

A. The transfer of thermal energy

B. The transfer of electrons between substances

C. The formation of new compounds

D. The change of state from solid to liquid

9. Which gas is a product of photosynthesis?

A. Carbon dioxide

B. Nitrogen

C. Oxygen

D. Hydrogen

10. Which physical quantity is defined by the mass of an object multiplied by the acceleration due to gravity?

A. Force

B. Weight

C. Inertia

D. Momentum

Answers

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

Explanations

1. What is the SI unit of force or weight?

A. Joule

B. Newton (N)

C. Pound

D. Meter

The SI unit of force, which is also used to denote weight, is the Newton (N). This unit is defined as the force required to accelerate a mass of one kilogram at a rate of one meter per second squared. In formulaic terms, it reflects the relationship described by Newton's second law of motion: force equals mass times acceleration (F = ma). Since weight is the force exerted by gravity on an object, it is measured in Newtons. This cohesive definition reinforces why the Newton is the standard and universally accepted unit for measuring both force and weight in the International System of Units (SI). Other options such as the Joule, Pound, and Meter serve different purposes in the realm of measurements. The Joule measures energy, the Pound is an imperial unit of force rather than SI, and the Meter measures distance. Therefore, none of these options fulfill the requirements of the SI unit specifically designated for force or weight.

2. How does increasing temperature affect gas pressure in a closed container?

A. It decreases the gas pressure

B. It has no effect on gas pressure

C. It increases the gas pressure

D. It causes gas to condense into a liquid

Increasing temperature in a closed container directly affects gas pressure due to the kinetic molecular theory. As the temperature rises, the particles of gas gain kinetic energy, moving more rapidly and colliding more forcefully with the walls of the container. These more frequent and harder collisions increase the overall pressure exerted by the gas on the container's walls. This relationship is described by Gay-Lussac's Law, which states that the pressure of a gas is directly proportional to its absolute temperature (Kelvin) when the volume remains constant. Therefore, as temperature increases, the gas pressure must also increase, leading to the conclusion that higher temperatures result in higher gas pressure within a closed system.

3. What is referred to as the effort in the context of machines?

A. The total weight of the object.

B. The force applied to produce work.

C. The distance from the fulcrum.

D. The distance from the effort point.

In the context of machines, "effort" refers to the force applied to a machine to perform work. This is a fundamental concept in mechanics, particularly when discussing simple machines like levers, pulleys, and inclined planes. When you apply effort, you exert a force that enables the machine to move or lift an object. To better understand this, consider how machines are designed to make work easier by either multiplying force or changing the direction of the applied effort. For example, in a lever system, the effort is the force that you exert on one end of the lever to lift a load at the other end. The relationship between the effort, the load, and the distances involved (like the distances from the fulcrum) are key to understanding mechanical advantage and how machines minimize the required effort to accomplish tasks. The other options bring important related terms into the discussion, but they do not describe the concept of effort itself. The total weight of the object relates to the load being moved, the distance from the fulcrum pertains to the leverage mechanics, and the distance from the effort point does not encapsulate the idea of effort in the same way as the force applied does. Therefore, recognizing effort as the force applied to produce work is

4. What is the mechanical advantage of a wedge primarily due to?

A. The sharpness of its edge

B. The angle of its inclined planes

C. The material it's made of

D. The length of the wedge

The mechanical advantage of a wedge is primarily due to the angle of its inclined planes. This angle affects how effectively the wedge can convert the applied force into a useful output force, allowing it to split or lift objects with less effort. When the angle is smaller, the wedge can more easily push through materials, utilizing the force applied over a longer distance, which translates to a greater advantage. The sharpness of its edge does help in reducing the effort needed to penetrate the material, but it is not the primary source of mechanical advantage. The material the wedge is made of can influence its durability and how well it performs, yet it does not inherently change the mechanical principles at play. The length of the wedge can affect how much distance is covered when force is applied but again is not the main factor determining the mechanical advantage — that factor lies in the angle of the inclined planes.

5. Acceleration indicates how quickly what changes over time?

A. Mass

B. Velocity

C. Force

D. Energy

Acceleration is defined as the rate of change of velocity with respect to time. It measures how quickly an object's speed and/or direction of motion is changing. When an object accelerates, its velocity increases or decreases, which can be due to a change in speed, a change in direction, or both. Velocity itself is a vector quantity that includes both the speed and the direction of an object. Therefore, when we discuss acceleration, we are specifically focusing on how the velocity of an object is altering over time—whether it speeds up, slows down, or changes direction. The other options do not relate to the concept of acceleration in the same manner. Mass is a measure of the amount of matter in an object and does not change with time under normal circumstances. Force is related to the mass of an object and its acceleration (as defined by Newton's second law) but does not indicate a change over time by itself. Energy can change during physical processes, but it is not directly linked to the concept of how rapidly something changes with respect to time like velocity is with acceleration.

6. What principle states that every action has an equal and opposite reaction?

A. Newton's 1st law

B. Newton's 2nd law

C. Newton's 3rd law

D. Universal gravitation

The principle that states every action has an equal and opposite reaction is known as Newton's Third Law of Motion. This law emphasizes the interaction between two objects. When one object exerts a force on another, the second object exerts a force of equal magnitude but in the opposite direction on the first object. This fundamental principle illustrates the nature of forces and how they operate in pairs, contributing to our understanding of how objects move and interact in physical systems. For example, if you push against a wall, the wall pushes back against you with the same amount of force, allowing us to understand the balance and conservation of momentum in different scenarios.

7. Which of the following describes renewable energy sources?

A. They are finite and cannot be replenished

B. They can be replenished naturally

C. They are derived only from fossil fuels

D. They are always cheaper than non-renewable sources

Renewable energy sources are characterized by their ability to be replenished naturally over a relatively short time frame. Examples of renewable energy include solar, wind, hydroelectric, and geothermal energy. These sources harness natural processes and are replenished continuously; for instance, sunlight is constantly available, and wind is generated by natural atmospheric conditions. In contrast to finite sources, such as fossil fuels, which take millions of years to form and can be depleted, renewable sources offer a sustainable alternative for energy production. While factors like cost can vary based on technology and location, the essence of renewable energy lies in their sustainability and potential for continuous use without the risk of depletion. Thus, the statement regarding their capacity for natural replenishment accurately captures the fundamental nature of renewable energy sources.

8. What characterizes an oxidation-reduction reaction?

A. The transfer of thermal energy

B. The transfer of electrons between substances

C. The formation of new compounds

D. The change of state from solid to liquid

An oxidation-reduction reaction, commonly known as a redox reaction, is fundamentally characterized by the transfer of electrons between substances. In these reactions, one substance gets oxidized, meaning it loses electrons, while another substance gets reduced, gaining those electrons. This electron transfer is crucial because it alters the oxidation states of the reactants involved, leading to chemical changes. Understanding redox reactions is essential in various contexts, including combustion, respiration, and corrosion processes. The relationship between the oxidized and reduced states directly influences the properties and reactivity of the substances involved. Therefore, the focus on electron transfer is what defines these specific types of chemical reactions. Other choices don't fit the definition of redox reactions. The transfer of thermal energy refers to heat and is not involved in the electron transfer central to redox. The formation of new compounds can occur in redox reactions, but it is not a defining characteristic, as many reactions can produce new compounds without involving electron transfer. The change of state from solid to liquid pertains to physical changes in matter rather than a chemical reaction, which is a different concept altogether. Thus, it is the transfer of electrons that is the hallmark of oxidation-reduction reactions.

9. Which gas is a product of photosynthesis?

A. Carbon dioxide

B. Nitrogen

C. Oxygen

D. Hydrogen

The correct answer is oxygen, which is produced during the process of photosynthesis. During photosynthesis, plants, algae, and some bacteria convert carbon dioxide and water into glucose and oxygen using sunlight as energy. The overall equation for this process can be summarized as: $6CO_2 + 6H_2O + \text{light energy} \rightarrow C_6H_{12}O_6 + 6O_2$ In this equation, six molecules of carbon dioxide and six molecules of water react to produce one molecule of glucose and six molecules of oxygen. The oxygen produced is released into the atmosphere, which is essential for the survival of aerobic organisms, including humans. The other gases listed do not play a direct role as a product of photosynthesis. Carbon dioxide is a reactant, while nitrogen and hydrogen are not products of this specific biological process and do not directly contribute to the photosynthetic pathway in plants. Thus, oxygen stands out as the significant byproduct that makes photosynthesis crucial not only for plant life but also for life on Earth as a whole.

10. Which physical quantity is defined by the mass of an object multiplied by the acceleration due to gravity?

A. Force

B. Weight

C. Inertia

D. Momentum

The physical quantity defined by the mass of an object multiplied by the acceleration due to gravity is known as weight. Weight is a measure of the gravitational force acting on an object, which means it is directly proportional to both the mass of the object and the gravitational field strength at that location. The formula for weight is given by: $$\text{Weight} = \text{Mass} \times \text{Acceleration due to gravity}$$ This relationship highlights how heavier objects experience a greater force due to gravity, while lighter objects experience less force. In contrast, force is a more general term that can refer to any interaction that causes a change in the motion of an object, while inertia refers to an object's resistance to changes in its motion, irrespective of gravity. Momentum, on the other hand, is the quantity of motion an object has, which is the product of its mass and its velocity, rather than its relationship to gravity. Thus, these other options describe different concepts that are not confined to the context of gravitational force.