

# DIVE Chemistry Quarterly Exam 1 Practice (Sample)

## Study Guide



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SAMPLE

## **Questions**

- 1. Which particle is distinguished by the number of protons in its nucleus?**
  - A. Neutron**
  - B. Electron**
  - C. Proton**
  - D. Quark**
- 2. What theory states that particles are in constant motion, with varying speeds depending on the state of matter?**
  - A. Kinetic theory**
  - B. Particle theory**
  - C. Molecular theory**
  - D. Atomic theory**
- 3. What term refers to the standard in an experiment where tested factors are not applied?**
  - A. Control**
  - B. Variable**
  - C. Experiment**
  - D. Outcome**
- 4. What do we call an ion that has a negative charge?**
  - A. Cat-ion**
  - B. Anion**
  - C. Neutral atom**
  - D. Positron**
- 5. Which element's atomic mass is used as the standard for defining an atomic mass unit?**
  - A. Carbon-14**
  - B. Oxygen-16**
  - C. Carbon-12**
  - D. Hydrogen-1**

- 6. Why is it important to verify scientific findings?**
- A. To assist in funding applications**
  - B. To ensure truthfulness of statements**
  - C. To gain publication opportunities**
  - D. To support educational initiatives**
- 7. What is often required alongside verification in scientific research?**
- A. Random sampling**
  - B. Statistical analysis**
  - C. Peer collaboration**
  - D. Prediction formulation**
- 8. What should the number of digits known for certain, plus one estimated digit, be called?**
- A. Significant digit**
  - B. Estimated value**
  - C. Precision digit**
  - D. Rounding figure**
- 9. What defines the area occupied by a specific group of electrons orbiting the nucleus?**
- A. Sublevel**
  - B. Principal energy level**
  - C. Orbital**
  - D. Electron cloud**
- 10. Which physical change occurs during freezing?**
- A. Gas to liquid**
  - B. Solid to liquid**
  - C. Liquid to solid**
  - D. Liquid to gas**

## **Answers**

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

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## **Explanations**

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**1. Which particle is distinguished by the number of protons in its nucleus?**

**A. Neutron**

**B. Electron**

**C. Proton**

**D. Quark**

The proton is the particle distinguished by the number of protons in its nucleus, as it is the defining characteristic of an element's atomic number. Each element on the periodic table is identified by its atomic number, which corresponds to the number of protons found in the nucleus of its atoms. For instance, hydrogen, with one proton, has an atomic number of 1, while carbon, with six protons, has an atomic number of 6. This unique number of protons determines not just the identity of the element, but also its chemical properties, as the arrangement of electrons around the nucleus and the interactions they have with other atoms are largely influenced by how many protons are present. In contrast, neutrons and electrons do not define the element itself; neutrons contribute to the atomic mass and can vary in number, leading to different isotopes of the same element, while electrons are involved in chemical interactions but do not affect the atomic number. Quarks, on the other hand, are the fundamental constituents of protons and neutrons; however, they are not the particles that directly determine the identity of an element. Thus, the proton uniquely serves as the key identifier of an atom's element based on the count of its protons

**2. What theory states that particles are in constant motion, with varying speeds depending on the state of matter?**

**A. Kinetic theory**

**B. Particle theory**

**C. Molecular theory**

**D. Atomic theory**

The correct choice is informed by the understanding of the kinetic theory of matter, which posits that all matter is composed of tiny particles that are in perpetual motion. This motion is influenced by the temperature and energy of the particles, which leads to different behaviors and states of matter—solid, liquid, and gas. For example, in solids, particles vibrate in fixed positions, leading to a definite shape and volume. In liquids, particles move more freely, allowing the liquid to take the shape of its container while maintaining a definite volume. In gases, particles are widely spaced and move rapidly and freely, resulting in neither fixed shape nor volume. Thus, kinetic theory effectively explains how temperature changes lead to variations in particle motion and the resultant properties of substances in different states of matter. The other theories presented, while relevant to the study of matter, do not specifically address the constant motion of particles. Particle theory generally refers to the composition of matter, molecular theory often deals with interactions at the molecular level, and atomic theory focuses on atoms as fundamental units, rather than the dynamic behavior of particles in different states.

**3. What term refers to the standard in an experiment where tested factors are not applied?**

**A. Control**

**B. Variable**

**C. Experiment**

**D. Outcome**

The term that refers to the standard in an experiment where tested factors are not applied is the control. In scientific experiments, a control group serves as a baseline that allows researchers to compare the effects of the independent variable. It typically consists of the same conditions as the experimental group, except for the factor being tested. This is crucial in determining whether the variable being tested truly has an effect on the outcome. For example, if researchers were testing a new fertilizer's effectiveness on plant growth, the control group would consist of plants that do not receive the fertilizer, while the experimental group would receive it. By comparing the growth of both groups, researchers can assess the fertilizer's impact accurately. Without a control, it would be challenging to draw meaningful conclusions about the variable's effect.

**4. What do we call an ion that has a negative charge?**

**A. Cat-ion**

**B. Anion**

**C. Neutral atom**

**D. Positron**

An ion that has a negative charge is specifically referred to as an anion. This term is derived from the Greek word "anions," which means "to go up." In the context of chemistry, anions are formed when an atom or a molecule gains one or more electrons, resulting in a net negative charge due to the increased number of negatively charged electrons compared to positively charged protons. In contrast to anions, cations are positively charged ions that result from the loss of electrons. A neutral atom has an equal number of protons and electrons, leading to no net charge, while a positron is the antiparticle of an electron and carries a positive charge, but is not considered an ion. Hence, the correct term describing a negatively charged ion is anion, as it directly captures the essential characteristic of having an excess of negatively charged electrons.

**5. Which element's atomic mass is used as the standard for defining an atomic mass unit?**

- A. Carbon-14**
- B. Oxygen-16**
- C. Carbon-12**
- D. Hydrogen-1**

The atomic mass unit (amu) is defined based on the mass of carbon-12. Specifically, one atomic mass unit is defined as one twelfth of the mass of a carbon-12 atom. This choice is significant because carbon-12 is a stable isotope, and using it as a reference point allows for a standardized way to express the masses of other elements. The decision to use carbon-12 is historical and practical; carbon is a fundamental building block of life, and its isotopes are commonly found in nature. Using carbon-12 provides a consistent scale for the atomic masses of all elements, making it easier to compare their relative masses. Other isotopes, such as carbon-14 or oxygen-16, while they can represent an atomic mass, do not serve as the standard definition for atomic mass units. Hydrogen, being the lightest element, also has a relatively simple mass, but the universal standard remains carbon-12 for its stability and abundance in natural processes.

**6. Why is it important to verify scientific findings?**

- A. To assist in funding applications**
- B. To ensure truthfulness of statements**
- C. To gain publication opportunities**
- D. To support educational initiatives**

Verifying scientific findings is crucial for ensuring the truthfulness of statements made within the scientific community. The scientific method is built on the foundation of reproducibility and peer review, which serve to confirm that results are reliable and valid. When findings are verified, it enhances the credibility of the research and the scientists conducting it. This leads to a stronger trust in scientific literature and helps in building a consistent body of knowledge. Truthfulness in scientific findings is essential not only for advancing science but also for informing public policy, guiding healthcare decisions, and influencing technology development in meaningful ways. A verified finding minimizes the risk of misinformation and fosters scientific integrity, which is vital in maintaining the objectivity of the scientific enterprise.

**7. What is often required alongside verification in scientific research?**

- A. Random sampling**
- B. Statistical analysis**
- C. Peer collaboration**
- D. Prediction formulation**

Statistical analysis plays a crucial role in scientific research alongside verification. When scientists conduct experiments or studies, they collect quantitative data that often need rigorous analysis to determine if the findings are statistically significant. Verification confirms that the results can be reproduced and are reliable, while statistical analysis helps interpret data, assess variability, and draw conclusions about the validity and applicability of the results. Using statistical methods allows researchers to evaluate the strength and relevance of the evidence they have gathered. It enables them to determine the likelihood that observed effects are genuine rather than due to random chance. This is especially important in experiments where sample sizes or conditions might lead to variation in results. By conducting proper statistical analysis, researchers can confidently report their findings, making it easier for the scientific community to accept, challenge, and build upon their work.

**8. What should the number of digits known for certain, plus one estimated digit, be called?**

- A. Significant digit**
- B. Estimated value**
- C. Precision digit**
- D. Rounding figure**

The term that describes the total number of digits known for certain, plus one estimated digit, is "significant digit." Significant digits are crucial in conveying the precision of a measurement and indicate how much confidence we have in the figures reported. The certain digits reflect the accuracy of the measuring instrument, while the estimated digit provides an inference about the measurement beyond what is known precisely. Together, they communicate the degree of precision in scientific reporting. In contrast, the other terms do not accurately describe this concept in the context of measurement in science. "Estimated value" typically refers to a value that is not precisely known and lacks the structure of significant digits. "Precision digit" is not a standard term recognized in measurement terminology, and "rounding figure" does not account for the concept of significant digits as it pertains primarily to the process of adjusting a number to a certain degree of accuracy. Hence, "significant digit" is the appropriate term to define the described combination of certain and estimated digits.

**9. What defines the area occupied by a specific group of electrons orbiting the nucleus?**

**A. Sublevel**

**B. Principal energy level**

**C. Orbital**

**D. Electron cloud**

The area occupied by a specific group of electrons orbiting the nucleus is best defined by the concept of an orbital. An orbital is a mathematical function that describes the wave-like behavior of an electron in an atom, representing regions in space where there is a high probability of finding an electron. In a more nuanced understanding, while the principal energy level provides information about the energy of electrons and their distance from the nucleus, it does not specifically describe the shape or orientation of the space occupied by those electrons. Rather, each principal energy level can contain multiple sublevels and orbitals, which are more focused concepts that define where electrons are likely to be found within that energy level. The term "electron cloud" is often used to describe the overall distribution of electrons in an atom, indicating that electrons exist in a cloud-like region around the nucleus. However, this is a broader concept and does not specifically focus on the precise areas defined by orbitals. Thus, the most accurate term for describing the specific regions where electrons can be found is "orbital."

**10. Which physical change occurs during freezing?**

**A. Gas to liquid**

**B. Solid to liquid**

**C. Liquid to solid**

**D. Liquid to gas**

The physical change that occurs during freezing is the transformation from liquid to solid. This process happens when a liquid loses energy, typically due to a decrease in temperature. As the temperature drops, the molecules in the liquid move slower and begin to form organized structures, which we observe as a solid. In contrast, the other options describe different phase transitions: converting a gas to a liquid is called condensation; turning a solid into a liquid is termed melting; and changing a liquid to a gas is referred to as evaporation. Each of these processes involves distinct energy changes and molecular motions that are characteristic of their respective transitions.