



CREST
Olympiads
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CREST Science Olympiad (CSO) **Worksheet** *for* **Class 9**



Topic

Physical Nature of Matter



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Worksheet on Physical Nature of Matter

1. **Imagine you have a solid metal cube and a liquid-filled container of the same volume. When subjected to the same amount of external force, the metal cube doesn't change shape, but the liquid in the container adapts its shape. Which fundamental property is primarily responsible for this difference?**
 - a. Density
 - b. Intermolecular forces
 - c. Particle size
 - d. Kinetic energy
2. **Select the statement that accurately distinguishes an extensive property from an intensive property.**
 - a. Extensive properties are independent of the quantity of matter, while intensive properties depend on quantity.
 - b. Extensive properties are constant regardless of changes in conditions, while intensive properties change with conditions.
 - c. Extensive properties are directly proportional to volume, while intensive properties are inversely proportional.
 - d. Extensive properties include density and temperature, while intensive properties include mass and energy.
3. **A car's tyres experience more wear and tear during summer compared to winter. How can the behaviour of particles in the tyre material explain this phenomenon?**
 - a. The particles in the tyre material freeze during winter.
 - b. The particles in the tyre material vibrate less during summer.
 - c. The particles in the tyre material move more rapidly in warm temperatures.
 - d. The particles in the tyre material become more rigid in cold temperatures.
4. **You are tasked with developing a temperature-resistant material for spacecraft re-entry. Which property of matter should your material primarily focus on to withstand the extreme heat?**
 - a. Rigidity to maintain its shape under pressure.
 - b. Conductivity to transfer heat away from the surface.
 - c. Ability to expand and contract with changing temperatures.
 - d. High melting point to resist deformation from heat.
5. **A student conducts an experiment to compare the diffusion rates of two gases, A and B. She places gas A at one end of a long tube and gas B at the other end, separated by a partition. After a certain time, she observes that gas A has diffused farther than gas B. Which factor most likely explains this observation?**
 - a. Gas A has a higher molecular weight than gas B.
 - b. Gas B has a higher temperature than gas A.
 - c. Gas A has a lower density than gas B.
 - d. Gas B has stronger intermolecular forces than gas A.

Answer Key

1. b - The primary factor responsible for the difference in behaviour between the solid metal cube and the liquid-filled container is the strength of intermolecular forces. In a solid, the intermolecular forces are strong, causing the particles to maintain their fixed positions and resist changes in shape. This rigidity allows the metal cube to retain its shape.

In contrast, the intermolecular forces in liquids are weaker, allowing the particles to move more freely and adapt their shape to the container they are placed in. This is why the liquid-filled container can change its shape when subjected to external forces.

2. a - Extensive properties, such as mass and volume, depend on the quantity or amount of matter present. If you have more of a substance, its extensive properties will increase proportionally.

Intensive properties, on the other hand, are independent of the quantity of matter and remain constant regardless of how much of the substance is present. Examples of intensive properties include density, temperature, and colour.

3. c - In warmer temperatures, the particles in the tyre material gain energy and move more rapidly due to increased kinetic energy. This increased motion results in a softer tyre compound and can lead to greater friction between the tyre and the road surface. As a result, the tyre wears down more quickly during summer because the increased kinetic energy of the particles in the tyre material contributes to higher friction and more wear and tear.
4. d - When a spacecraft re-enters the Earth's atmosphere, it experiences extreme temperatures due to the friction between the spacecraft and the air molecules. To withstand this heat, the material needs to have a high melting point. A high melting point ensures that the material remains solid and retains its structural integrity even under the extreme temperatures encountered during re-entry. This prevents the material from deforming, melting, or becoming structurally compromised due to heat.
5. a - Heavier molecules diffuse more slowly than lighter ones. In this scenario, gas A having a higher molecular weight than gas B would explain why gas A has diffused less compared to gas B. The lighter molecules of gas B would move faster and travel farther in the same time period, resulting in the observed difference in diffusion distances.

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