

Name _____

Weight vs. Mass: Unpacking the Difference

Open-Ended Response Answer Key

1. On Earth, both the bag of feathers and the bag of lead pellets would have the same mass, and they would weigh the same because they experience the same gravitational acceleration (approximately 9.8 m/s^2). On the Moon, where gravity is weaker (about one-sixth of Earth's), both bags would still have the same mass but weigh significantly less due to the Moon's weaker gravity. In outer space, far from any massive objects, both bags would be weightless, but they would retain their respective masses, as there is no gravitational field to exert a force on them.
2. An everyday scenario where understanding the difference between mass and weight is crucial is in the design and operation of elevators. Engineers need to consider the weight of occupants and the elevator itself to ensure that the cables, pulleys, and counterweights can support the total weight without exceeding safety limits. Mass determines the overall load, while weight accounts for the force exerted on the elevator due to gravity. Misjudging these factors can lead to elevator malfunctions, safety hazards, or inefficient operations.
3. The sensation of weightlessness experienced by astronauts aboard the ISS is similar to the feeling of being in freefall on Earth in that both involve the sensation of floating or being weightless. However, the key difference is the cause of this sensation. On Earth, feeling weightless while in freefall is a temporary state, like when jumping from a plane. In contrast, astronauts aboard the ISS are in continuous freefall around Earth, but they are also moving forward at a speed that matches their freefall, creating a perpetual state of microgravity. This differs from the brief sensation of freefall on Earth, where gravity eventually brings the person back to the ground.

