auditory sensation in the ear or the disturbance in a medium is carried by waves in a solid, liquid, or gas. Unwanted noise can be described by expressing its distance, speed, and acceleration. A graphical representation of the motion consists of a plot of position as a function of time. Two other basic quantities, force and energy, are related through Newton’s second law of motion: \( F = ma \).

The slope of a graph of position versus time is equal to what quantity?

The following quantities are related by Newton’s second law of motion:

1. Describe the motion of an object when no net force is applied.
2. Arrange the following in order from largest to smallest: 0.004 m, 0.4 mm, 4 \( \times 10^{-5} \) km, 4 \( \times 10^{-5} \) μm.

A. What is the difference between pressure and force?
B. What is the pressure of the atmosphere in the United States?
C. What is a waveform of a sound?
D. What is the speed at which sound travels in air?
E. What is the wavelength of a sound wave?
F. What is the frequency of a sound wave?

1. What is the difference between sound and noise?
2. What is the science of sound generally called?
3. What is the difference between a longitudinal and a transverse wave? Give an example of each.
4. What are four different processes that can produce sound? Give an example of each.
5. What is the difference between speed and velocity?
6. The slope of a graph of position versus time is equal to what quantity?
7. What three quantities are related by Newton’s second law of motion?
8. Describe the motion of an object when no net force is applied.
9. Arrange the following in order from largest to smallest: 0.004 m, 0.4 mm, 4 \( \times 10^{-5} \) km, 4 \( \times 10^{-5} \) μm.

Questions for Thought and Discussion

1. At the same time a rifle is fired in an exactly horizontal position over level ground, a bullet is dropped from the same height. Both bullets strike the ground at the same time. Can you explain why?
2. What are some advantages of using the metric (SI) system of units rather than the English system?
3. In the sixteenth century, Galileo is said to have dropped objects of various weights from the Leaning Tower of Pisa. Since all objects in free fall accelerate at 9.8 m/s², one would expect them to reach the ground at the same time. Careful observation, however, indicates that an iron ball will strike the ground sooner than a baseball of the same diameter. Can you explain why? Would the same be true on the moon? (The Apollo astronauts actually photographed a free-fall experiment on the moon using a hammer and a feather.)
4. Think of an object comparable in size to each of the following:
   (a) 10³ m; (b) 10³ m; (c) 1 m; (d) 10⁻³ m; (e) 10⁻¹ m.
5. Does shifting to a lower gear increase the power of an automobile? Explain.
6. Draw a diagram, similar to Fig. 1.10, showing how pressure acts on a floating object.

Exercises

1. Letting your classroom serve as the “origin” (\( x = 0, y = 0 \)), express the approximate coordinates (\( x, y \)) of your place of residence. Let \( x = \) the distance east and \( y = \) the distance north, as on a map. Use any convenient unit of distance.
2. The speed of a bicycle increases from 5 mi/h to 10 mi/h in the same time that a car increases its speed from 50 mi/h to 55 mi/h. Compare their accelerations.
3. The density of water is 1.00 g/cm³ and that of ice is 0.92 g/cm³. What are the corresponding densities in SI units (kg/m³)?
4. If the speed limit is posted as 55 mi/h, express this in km/h and in m/s (1 mi = 1.61 km).

A car accelerates from rest to 50 mi/h in 12 s. Calculate its average acceleration in m/s². Compare this to the acceleration of an object in free fall (1 mi/h = 0.447 m/s).

1. An object weighing 1 lb (English units) has a mass of 0.455 kg. Express its weight in newtons and thereby express a conversion factor for pounds to newtons.
2. Express your own mass in kilograms and your weight in newtons.
3. Calculate average speed in each of the following cases: