ond) system of units is still very much in use in the United
y is declining as we aim toward a conversion to metric units.
ɔt, pound, and second, the fps system uses slugs, foot-pounds,
d in Appendix A.1.

auditory sensation in the ear or the disturbance in a medium
ɔund is carried by waves in a solid, liquid, or gas. Unwanted
ɔ as noise.
:an be described by expressing its distance, speed, and accel-
A graphical representation of the motion consists of a plot
ration as a function of time. Two other basic quantities, force
eleration through Newton's second law of motion: $F = ma$.
area, and is especially important in describing the behavior of
or gas.
n of an object expresses its kinetic energy (energy of motion)
energy) as functions of time. Power is the rate at which energy
hich work is done. The preferred system of units is the mks
:rs, kilograms, and seconds as its basic units, but also includes
s, joules, watts, and so forth.

)98). Kirkpatrick, L. D., and G. F. Wheeler (1998). *Physics, A*
vare. *World View*, 3rd ed. Forth Worth: Saunders.
:ove, Rossing, T. D. (1982). *Acoustics Laboratory Experiments.*
DeKalb: Northern Illinois University.
?ork:

newton A unit of force.

ɔng a **potential energy** Stored energy; the capacity to do work by virtue of position.

it to **power** The rate of doing work; equal to work or energy divided by time.

ɔn or **pressure** Force divided by area.

speed The rate at which distance is covered; equal to distance divided by time.

, one **stroboscope** A light that flashes at a regular rate, making possible a photographic record of motion.

rk by

y (or **watt** A unit of power; equal to one joule per second.

work The net force on an object times the distance through which the object moves.

ıal to

Δ The Greek letter *delta*, denoting change in some quantity.

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REVIEW QUESTIONS

1. What are two different meanings of the word *sound*?
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, 4×10^{-5} km, 4×10^{-5} μm.
10. What is the difference between *pressure* and *force*?
11. Compare the pressure on the top and the bottom sides of a thin plate immersed in water.
12. What is the pressure of the atmosphere on our bodies?
13. What is a waveform of a sound?
14. What unit is used to express energy? work?
15. What is *kinetic energy*? *potential energy*?
16. Give a formula for the potential energy of a displaced guitar string and explain each symbol.
17. What is the difference between *power* and *energy*?
18. When you pay your electricity bill, are you paying for power used or for energy used?

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/s^2, 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) 10^7 m; **(b)** 10^3 m; **(c)** 1 m; **(d)** 10^{-3} m; **(e)** 10^{10} 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/cm^3 and that of ice is 0.92 g/cm^3. What are the corresponding densities in SI units (kg/m^3)?
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).
5. A car accelerates from rest to 50 mi/h in 12 s. Calculate its average acceleration in m/s^2. Compare this to the acceleration of an object in free fall (1 mi/h = 0.447 m/s).
6. 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.
7. Express your own mass in kilograms and your weight in newtons.
8. Calculate average speed in each of the following cases: