



Physics Bridging work

Instructions

- On the following slides you will find questions covering a wide range of topics you will study next year.
- Answer the questions on paper showing full working out including equations and units.
- Put a title and your full name on each page and staple your work in the top left corner before you hand it in on your first lesson in September.

Converting units

1. Circle the conversion factor you would choose to solve the following problems.

a. How many inches are in 6 meters?

$$\frac{1 \text{ meter}}{39.4 \text{ inches}} \text{ OR } \frac{39.4 \text{ inches}}{1 \text{ meter}}$$

b. How many liters are in 10 U.S. gallons?

$$\frac{1 \text{ gallon}}{3.79 \text{ liters}} \text{ OR } \frac{3.79 \text{ liters}}{1 \text{ gallon}}$$

c. 100 kilometers is equal to how many miles?

$$\frac{1 \text{ kilometer}}{0.624 \text{ miles}} \text{ OR } \frac{0.624 \text{ miles}}{1 \text{ kilometer}}$$

d. 1,000,000 grams is equal to how many kilograms?

$$\frac{0.001 \text{ kilogram}}{1 \text{ gram}} \text{ OR } \frac{1 \text{ gram}}{0.001 \text{ kilogram}}$$

2. A grocery store just received a shipment of 200 cartons of eggs. Each carton holds one dozen eggs. If $12 \text{ eggs} = 1 \text{ dozen}$, how many eggs did the store receive?
3. A marathon is 26.2 miles long. How many kilometers is a marathon? ($1 \text{ mile} = 1.61 \text{ km}$)
4. The speed limit on many interstate highways in the United States is 65 miles per hour. How many kilometers per hour is that? ($1 \text{ mile} = 1.61 \text{ km}$)
5. Ashley is going on a trip to London. She has saved \$100.00 in spending money. When she arrives in England, she goes to a bank to change her money into pounds. She is told that the exchange rate is 1 British pound = 1.43 American dollars. The bank charges a fee of 4 pounds to change the money from dollars to pounds. How much money, in British pounds, will Ashley have if she changes all of her dollars to pounds?
6. Although it is widely believed that Germany's Autobahn highway has no speed limit whatsoever, much of the highway has regulated speed limits of 130 km/hr or less, and in some places speed is limited to just 60 km/hr.
 - a. How many miles per hour is 130 km/hr? ($1 \text{ mile} = 1.61 \text{ km}$)
 - b. How many miles per hour is 60 km/hr?
7. In England, a person's weight is commonly given in stones. One English stone is equal to 14 pounds. If an English friend tells you he weighs eleven stones, what is his weight in pounds?

Prefixes

Prefix	Symbol	Multiplication Factor	
<i>pico-</i>	p	0.000000000001	= 10^{-12}
<i>nano-</i>	n	0.000000001	= 10^{-9}
<i>micro-</i>	μ	0.000001	= 10^{-6}
<i>milli-</i>	m	0.001	= 10^{-3}
<i>centi-</i>	c	0.01	= 10^{-2}
<i>deci-</i>	d	0.1	= 10^{-1}
<i>deka-</i>	da	10	= 10^1
<i>hecto-</i>	h	100	= 10^2
<i>kilo-</i>	k	1,000	= 10^3
<i>mega-</i>	M	1,000,000	= 10^6
<i>giga-</i>	G	1,000,000,000	= 10^9
<i>tera-</i>	T	1,000,000,000,000	= 10^{12}

1. How many milligrams are in one gram?
2. How many centimeters are in a kilometer?
3. How many microliters are in one liter?
4. How many nanoseconds are in one second?
5. How many micrograms are in one kilogram?
6. How many milliliters are in a megaliter?
7. A deciliter is how many times larger than a milliliter?
8. A micrometer is how many times smaller than a millimeter?
9. The wavelength of red light is 650 nanometers. How much bigger is the wavelength of a water wave that measures 2 meters?
10. A first grader measures 1 meter high. How much bigger is this first grader compared to the height of a bug that measures 1 millimeter high?

Mass and weight

1. What is the weight (in pounds) of a 7.0-kilogram bowling ball on Earth's surface?
2. What is the weight of a 7.0-kilogram bowling ball on the surface of the moon?
3. What is the mass of a 7.0-kilogram bowling ball on the surface of the moon?
4. Describe what would happen to the spring in a bathroom scale if you were on the moon when you stepped on it. How is this different from stepping on the scale on Earth?
5. Would a balance function correctly on the moon? Why or why not?

Acceleration

1. While traveling along a highway a driver slows from 24 m/sec to 15 m/sec in 12 seconds. What is the automobile's acceleration? (Remember that a negative value indicates a slowing down or deceleration.)

Looking for	Solution
Given	
Relationship	

2. A parachute on a racing dragster opens and changes the speed of the car from 85 m/sec to 45 m/sec in a period of 4.5 seconds. What is the acceleration of the dragster?
3. The cheetah, which is the fastest land mammal, can accelerate from 0.0 mi/hr to 70.0 mi/hr in 3.0 seconds. What is the acceleration of the cheetah? Give your answer in units of mph/sec.
4. The Lamborghini Diablo sports car can accelerate from 0.0 km/hr to 99.2 km/hr in 4.0 seconds. What is the acceleration of this car? Give your answer in units of kilometers per hour/sec.
5. Which has greater acceleration, the cheetah or the Lamborghini Diablo? (To figure this out, you must remember that there are 1.6 kilometers in 1 mile.) Be sure to show your calculations.

Acceleration due to gravity

1. A penny dropped into a wishing well reaches the bottom in 1.50 seconds. What was the velocity at impact?
2. A pitcher threw a baseball straight up at 35.8 meters per second. What was the ball's velocity after 2.50 seconds? (Note that, although the baseball is still climbing, gravity is accelerating it downward.)
3. In a bizarre but harmless accident, Superman fell from the top of the Eiffel Tower. How fast was Superman traveling when he hit the ground 7.80 seconds after falling?
4. A water balloon was dropped from a high window and struck its target 1.1 seconds later. If the balloon left the person's hand at -5.0 m/sec, what was its velocity on impact?
5. A stone tumbles into a mine shaft and strikes bottom after falling for 4.2 seconds. How deep is the mine shaft?

Momentum

1. If the truck has a mass of 2,000 kilograms, what is its momentum? Express your answer in $\text{kg}\cdot\text{m}/\text{sec}$.
2. If the car has a mass of 1,000 kilograms, what is its momentum?
3. An 8-kilogram bowling ball is rolling in a straight line toward you. If its momentum is $16 \text{ kg}\cdot\text{m}/\text{sec}$, how fast is it traveling?
4. A beach ball is rolling in a straight line toward you at a speed of $0.5 \text{ m}/\text{sec}$. Its momentum is $0.25 \text{ kg}\cdot\text{m}/\text{sec}$. What is the mass of the beach ball?
5. A 4,000-kilogram truck travels in a straight line at $10.0 \text{ m}/\text{sec}$. What is its momentum?

Work

1. In your own words, define work in scientific terms. Be complete in your definition.
2. How are work, force, and distance related?
3. What are two different units that represent work?
4. For the following situations, determine whether work was done. Write “work done” or “no work done” for each situation.
 - a. An ice skater glides for two meters across ice.
 - b. The ice skater’s partner lifts her up a distance of 1 meter.
 - c. The ice skater’s partner carries her across the ice a distance of 3 meters.
 - d. After setting her down, the ice skater’s partner pulls her across the ice a distance of 10 meters.
 - e. After skating practice, the ice skater lifts her 20-newton gym bag up 0.5 meter.

KE and GPE

1. What is the potential energy of a 2-kilogram potted plant that is on a 1 meter-high plant stand?
2. What is the kinetic energy of a 3-kilogram ball that is rolling at 2 meters per second?
3. The potential energy of an apple is 6.00 joules. The apple is 3.00-meters high. What is the mass of the apple?
4. Determine the amount of potential energy of a 5-newton book that is moved to three different shelves on a bookcase. The height of each shelf is 1.0 meter, 1.5 meters, and 2.0 meters.
5. Two objects were lifted by a machine. One object had a mass of 2 kilograms, and was lifted at a speed of 2 m/sec. The other had a mass of 4 kilograms and was lifted at a rate of 3 m/sec.
 - a. Which object had more kinetic energy while it was being lifted?
 - b. Which object had more potential energy when it was lifted to a distance of 10 meters? Show your calculation. (Remember that $g = 9.8 \text{ m/sec}^2$)

Power

1. A motor does 5,000 joules of work in 20 seconds. What is the power of the motor?
2. A machine does 1,500 joules of work in 30 seconds. What is the power of this machine?
3. A hair dryer uses 72,000 joules of energy in 60 seconds. What is the power of this hair dryer?
4. A toaster oven uses 67,500 joules of energy in 45 seconds to toast a piece of bread. What is the power of the oven?
5. A horse moves a sleigh 1.00 kilometer by applying a horizontal 2,000-newton force on its harness for 45 minutes. What is the power of the horse? (Hint: Convert time to seconds.)

Displacement

1. What is the total displacement of a bee that flies 2 meters east, 5 meters north, and 3 meters east?
2. What is the total displacement of an ant that walks 2 meters west, 3 meters south, 4 meters east, and 1 meter north?
3. A ball is kicked 10 meters north, 5 meters west, 15 meters south, 5 meters east, and 5 meters north. Find the total displacement and the total distance it traveled.

Density

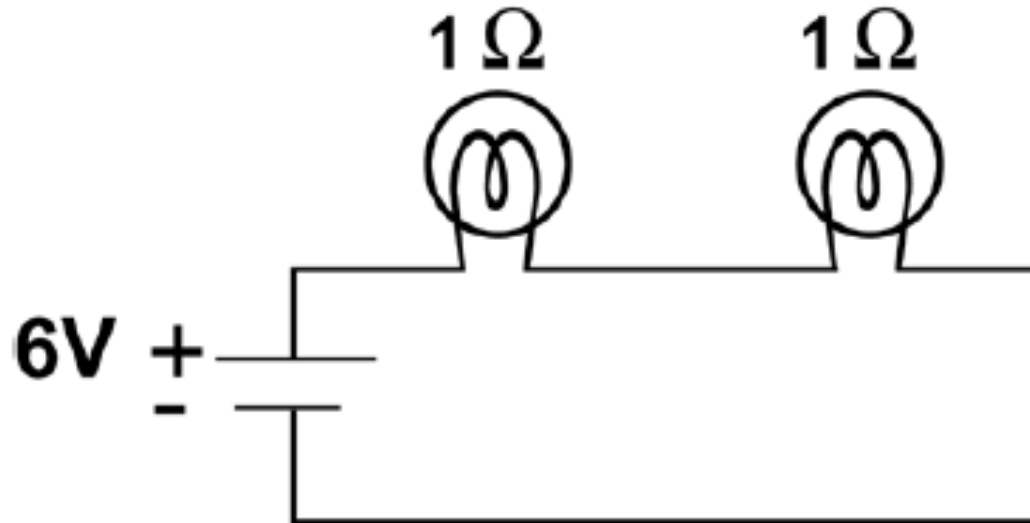
1. A solid rubber stopper has a mass of 33.0 grams and a volume of 30.0 cm^3 . What is the density of rubber?
2. A chunk of paraffin (wax) has a mass of 50.4 grams and a volume of 57.9 cm^3 . What is the density of paraffin?
3. A marble statue has a mass of 6,200 grams and a volume of $2,296 \text{ cm}^3$. What is the density of marble?
4. The density of ice is 0.92 g/cm^3 . An ice sculptor orders a one cubic meter block of ice. What is the mass of the block? Hint: $1 \text{ m}^3 = 1,000,000 \text{ cm}^3$. Give your answer in grams and kilograms.
5. What is the mass of a pure platinum disk with a volume of 113 cm^3 ? The density of platinum is 21.4 g/cm^3 . Give your answer in grams and kilograms.

Ohm's Law

1. How much current is in a circuit that includes a 9-volt battery and a bulb with a resistance of 3 ohms?
2. How much current is in a circuit that includes a 9-volt battery and a bulb with a resistance of 12 ohms?
3. A circuit contains a 1.5 volt battery and a bulb with a resistance of 3 ohms. Calculate the current.

Series circuits

- Use the diagram below to answer the questions on the following slide.

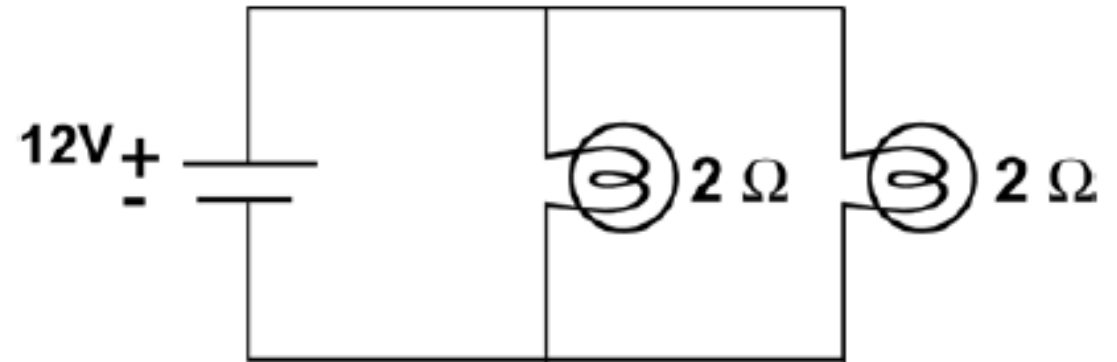


Series circuits – see previous slide

1. Use the series circuit pictured to the right to answer questions (a)-(e).
 - a. What is the total voltage across the bulbs?
 - b. What is the total resistance of the circuit?
 - c. What is the current in the circuit?
 - d. What is the voltage drop across each light bulb?
(Remember that voltage drop is calculated by multiplying current in the circuit by the resistance of a particular resistor: $V = IR$.)
 - e. Draw the path of the current on the diagram.

Parallel circuits

1. Use the parallel circuit pictured right to answer questions (a) - (d).
 - a. What is the voltage across each bulb?
 - b. What is the current in each branch?
 - c. What is the total current provided by the battery?
 - d. Use the total current and the total voltage to calculate the total resistance of the circuit.



Electrical power

1. Your oven has a power rating of 5000 watts.
 - a. How many kilowatts is this?
 - b. If the oven is used for 2 hours to bake cookies, how many kilowatt-hours (kWh) are used?
 - c. If your town charges \$0.15/kWh, what is the cost to use the oven to bake the cookies?
2. You use a 1200-watt hair dryer for 10 minutes each day.
 - a. How many minutes do you use the hair dryer in a month? (Assume there are 30 days in the month.)
 - b. How many hours do you use the hair dryer in a month?
 - c. What is the power of the hair dryer in kilowatts?
 - d. How many kilowatt-hours of electricity does the hair dryer use in a month?
 - e. If your town charges \$0.15/kWh, what is the cost to use the hair dryer for a month?

Inverse square law

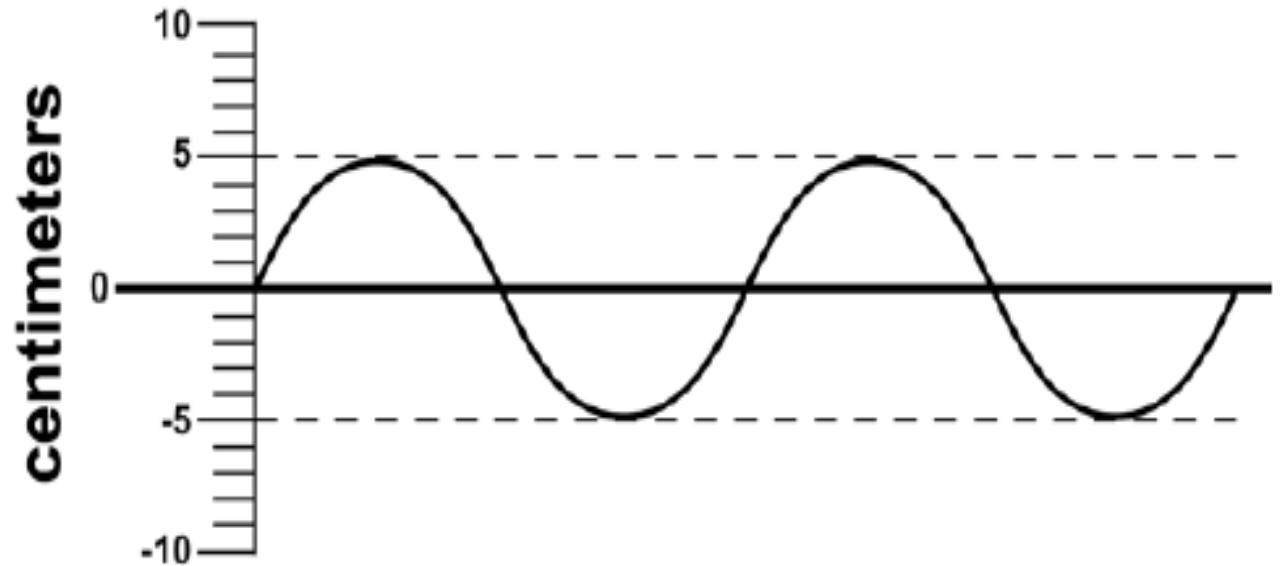
1. You stand 4 meters away from a light and measure the intensity to be 1 W/m^2 . What will be the intensity if you move to a position 8 meters away from the bulb?
2. You are standing 1 meter from a squawking parrot. If you move to a distance three meters away, the sound intensity will be what fraction of its original value?
3. Venus has a gravitational force of 8.9 N/kg . Its radius is 6,051 kilometers. How far away from the surface of Mercury would you need to move in order to experience a gravitational force of 0.556 N/kg ?
4. Earth's radius is 6,378 kilometers. If you weigh 500 newtons on Earth's surface, what would you weigh at a distance of 19,134 kilometers from Earth?
5. Compare the intensity of light 2 meters away from a lit match to the intensity 6 meters away from the match.

Frequency and period

1. A string vibrates at a frequency of 20 Hz. What is its period?
2. A speaker vibrates at a frequency of 200 Hz. What is its period?
3. A swing has a period of 10 seconds. What is its frequency?
4. A pendulum has a period of 0.3 second. What is its frequency?
5. You want to describe the harmonic motion of a swing. You find out that it take 2 seconds for the swing to complete one cycle. What is the swing's period and frequency?

Waves

1. On the graphic at right label the following parts of a wave: one wavelength, half of a wavelength, the amplitude, a crest, and a trough.
 - a. How many wavelengths are represented in the wave above?
 - b. What is the amplitude of the wave shown above?



The electromagnetic spectrum

1. Yellow light has a longer wavelength than green light. Which color of light has the higher frequency?
2. Green light has a lower frequency than blue light. Which color of light has a longer wavelength?
3. Calculate the wavelength of violet light with a frequency of 750×10^{12} Hz.
4. Calculate the frequency of yellow light with a wavelength of 580×10^{-9} m.
5. Calculate the wavelength of red light with a frequency of 460×10^{12} Hz.
6. Calculate the frequency of green light with a wavelength of 530×10^{-9} m.