Chemistry: Unit 2, conversions practice

Name: Answer key

1. Carry out the following conversions:

a. 68.3 cm to ft

$$68.3\text{ cm}\cdot\frac{1\text{ in}}{2.54\text{ cm}}\cdot\frac{1\text{ ft}}{12\text{ in}} = 2.24\text{ ft}$$

b. 4589 tons to Mg

$$4589\text{ ton}\cdot\frac{2000\text{ lbs}}{1\text{ ton}}\cdot\frac{1\text{ kg}}{2.2046\text{ lb}}\cdot\frac{1\text{ Mg}}{1000\text{ kg}}$$

4163 Mg

c. 29.00 lbs/in^2 to kilopascals (kPa)

$$\frac{29.00\text{ lbs}}{\text{in}^2}\cdot\frac{\text{in}^2\ \ 1\text{ atm}}{14.7\text{ lbs}}\cdot\frac{101.325\text{ kPa}}{1\text{ atm}}$$

200.0 kPa

d. 8.75 mg/m^3 to oz/in^3

$$\frac{8.75\text{ mg}}{\text{m}^3}\cdot\frac{1\text{ g}}{1000\text{ mg}}\cdot\frac{1\text{ oz}}{28.35\text{ g}}\cdot\frac{1\text{ m}^3}{100^3\text{ cm}^3}\cdot\frac{2.54^3\text{ cm}^3}{1\text{ in}^3}$$

5.06×10^{-9} oz/in^3

2. The distance between Lincoln High School and the Empire State building is 1299 mi. How long will it take to make this trip in the LHS hovercraft, if going nonstop, at a speed of 16.4 m/s?

$$1299\text{ mi}\cdot\frac{1.61\text{ km}}{1\text{ mi}}\cdot\frac{1000\text{ m}}{1\text{ km}}\cdot\frac{\text{s}}{16.4\text{ m}}\cdot\frac{1\text{ min}}{60\text{ s}}\cdot\frac{1\text{ hr}}{60\text{ min}}\cdot\frac{1\text{ day}}{24\text{ hr}} =$$

1.27×10^5 s

2.13×10^3 min

35.4 hr

1.48 days

3. Visible light, as well as ultraviolet, infrared, X-ray, and other radiation, is characterized by what is called wavelength. The wavelength of certain infrared light is 3.0 x 10^1 μm. How long is this in feet?

$$3.0\times10^1\ \mu\text{m}\cdot\frac{1\text{ cm}}{1\times10^4\ \mu\text{m}}\cdot\frac{1\text{ ft}}{2.54\text{ cm}} = 0.0012\text{ ft}$$

4. You are in Paris and you want to buy some peaches for lunch. The sign in the fruit stand indicates that peaches are 11.5 euros per kilogram. Given that there are approximately 1.5 dollars per euro, how many peaches can you buy with $5.00. Assume the mass of a peach is 8.0 oz.

$$\$5.00\cdot\frac{1\text{ Euro}}{\$1.5}\cdot\frac{1\text{ kg}}{11.5\text{ Euro}}\cdot\frac{2.2046\text{ lbs}}{1\text{ kg}}\cdot\frac{16.0\text{ oz}}{1\text{ lb}}\cdot\frac{\text{peach}}{8.0\text{ oz}} = 1.3\text{ peaches}$$

= 1 peach

5. A spherical ball has a radius of 0.50 cm and weighs 2.0 g. Will this ball float or sink when placed in water which is near 4°C? Recall that for a substance to float in water its density must be less than water's density.

$$2.0\text{ g}\cdot\frac{3}{4}\cdot\frac{1}{\pi}\cdot\frac{1}{0.50^3\text{ cm}^3} = 3.8\text{ g/cm}^3$$

it is > 1.0 g/cm^3

so it will sink

$d = \frac{m}{V}$

$V_{sphere} = \frac{4}{3}\pi r^3$

6. How are the frequency, energy and wavelength of a particular type of radiation related? (Give an equation, defining all symbols)

frequency is inversely proportional to wavelength and directly proportional to energy

$c = \lambda \nu$ and $E = h\nu$

c = speed of light, E = energy, λ = wavelength, h - Planck's constant, ν = frequency

7. What is the frequency in hertz of blue light having a wavelength of 425 nm?

$\nu = \frac{c}{\lambda}$

$$\frac{2.998 \times 10^{8}\,m}{s} \cdot \frac{1}{425\,nm} \cdot \frac{1 \times 10^{9}\,nm}{1\,m} = 7.05 \times 10^{14}\,s^{-1}$$

8. A certain substance strongly absorbs infrared light having a wavelength of 6.50μm. What is the frequency in hertz of this light?

$\nu = \frac{c}{\lambda}$

$$\frac{2.998 \times 10^{8}\,m}{s} \cdot \frac{1}{6.50\,\mu m} \cdot \frac{1 \times 10^{6}\,\mu m}{1\,m} = 4.61 \times 10^{13}\,s^{-1} = 4.61 \times 10^{13}\,Hz$$

9. Radar signals are electromagnetic radiation in the microwave region of the spectrum. Typical radar has a wavelength of 3.19 cm. What is the frequency in hertz?

$\nu = \frac{c}{\lambda}$

$$\frac{2.998 \times 10^{8}\,m}{} \cdot \frac{1}{3.19\,cm} \cdot \frac{1 \times 10^{2}\,cm}{1\,m} = 9.40 \times 10^{9}\,s^{-1} = 9.40 \times 10^{9}\,Hz$$

10. In Lincoln, KLIN AM 1400 broadcasts it AM signal at a frequency of 1400 kilohertz (kHz). What is the wavelength of this signal in meters?

1400 kHz = 1400×10^{3} Hz

$\lambda = \frac{c}{\nu}$

$$\frac{2.998 \times 10^{8}\,m}{s} \cdot \frac{s}{1400 \times 10^{3}} = 210\,m$$

11. Sodium vapor lamps are often used in residential street lighting. They give off a yellow light having a frequency of 5.09×10^{14}Hz. How many joules of energy does each photon possess?

$E = h\nu$

$$6.626 \times 10^{-34}\,J \cdot s \cdot \frac{5.09 \times 10^{14}}{s} = 3.37 \times 10^{-19}\,J$$

12. Ozone protects the earth's inhabitants from the harmful effects of ultraviolet light arriving from the sun. This shielding is a maximum for UV light having a wavelength of 295 nm. What is the frequency and energy for this UV radiation?

$\nu = \frac{c}{\lambda}$

$$\frac{2.998 \times 10^{8}\,m}{s} \cdot \frac{1}{295\,nm} \cdot \frac{1 \times 10^{9}\,nm}{1\,m} = 1.02 \times 10^{15}\,s^{-1}$$

$E = h \cdot \nu = h\frac{c}{\lambda}$

$$6.626 \times 10^{-34}\,J \cdot s \cdot \frac{2.998 \times 10^{8}\,m}{s} \cdot \frac{1}{295\,nm} \cdot \frac{1 \times 10^{9}\,nm}{1\,m} = 6.73 \times 10^{-19}\,J$$