Dimensional Analysis Practice Name: Key

Solve the following problems. Show all work (including a unit next to each number, at each step).

1. To make his famous huge angel-food cake, Emeril Lagasse needs the whites of 36 eggs. How many dozen eggs does he need to buy at the grocery store?

$$\frac{36 \text{ eggs}}{1} \times \frac{1 \text{ dozen}}{12 \text{ eggs}} = \boxed{3 \text{ dozen}}$$

2. How many quarters must Mr. Link save to purchase an $18,000 Mini Cooper? How many nickels must Ms. Tully save to purchase $25,000 Dodge Ram truck?

$$\frac{\$18,000}{1} \times \frac{4 \text{ quarters}}{\$1} = \boxed{72,000 \text{ quarters}}$$

$$\frac{\$18000}{1} \times \frac{1 \text{ quarter}}{\$0.25}$$ also works!

$$\frac{\$25,000}{1} \times \frac{1 \text{ nickel}}{\$0.05} = \boxed{500,000 \text{ nickels}}$$

3. In the Olympics, a marathon is 26 miles and 385 yards. How many feet is this?
(3 ft = 1 yard; 5280 ft = 1 mile)

$$\frac{26 \text{ miles}}{1} \times \frac{5280 \text{ ft}}{1 \text{ mi}} = 137,280 \text{ ft}$$

$$\frac{385 \text{ yd}}{1} \times \frac{3 \text{ ft}}{1 \text{ yd}} = 1155 \text{ ft}$$

$$137280 \text{ ft} + 1155 \text{ ft} = \boxed{138435 \text{ ft}}$$

4. A beaker contains 50.0 grams of pure water. How many molecules of water are inside the beaker? (18.0 grams of water = 6.02×10^{23} molecules of water)

$$\frac{50.0 \text{g water}}{1} \times \frac{6.02 \times 10^{23} \text{ molecules water}}{18.0 \text{g water}} = \boxed{1.67 \times 10^{24} \text{ molecules water}}$$

5. Mexican free-tail bats can fly at a speed of 60 miles per hour. How fast is this in feet per second?

$$\frac{60 \text{ mi}}{1 \text{ hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1 \text{ min}}{60 \text{ sec}} \times \frac{5280 \text{ ft}}{1 \text{ mi}} = \boxed{88 \text{ ft/sec}}$$

6. Ms. Allen is hosting a pizza party for her amazing students. (In this alternate Universe, she is also paid $1,000,000/year, so don't get your hopes up!) If Ms. Allen has 5 classes with an average of 27 students each, each student will eat exactly 3 slices of pizza, and each pizza has 8 slices, how many pizzas will she need to order?

$$\frac{5 \text{ classes}}{1} \times \frac{27 \text{ students}}{1 \text{ class}} \times \frac{3 \text{ slices}}{\text{student}} \times \frac{1 \text{ pizza}}{8 \text{ slices}} = 50.625 \text{ pizzas, so } \boxed{51 \text{ pizzas}}$$

Key

7. The average hummingbird lives seven years. Assume, that a hummingbird is awake on average for eight hours per day. If a hummingbird beats its wings 80 times per second while it is awake, on average, how many times will a hummingbird beat its wings in its lifetime?

$$\frac{7\text{ years}}{1} \times \frac{365\text{ days}}{1\text{ year}} \times \frac{24\text{ h}}{1\text{ day}} \times \frac{8\text{ h awake}}{24\text{ h}} \times \frac{60\text{ min}}{1\text{ h}} \times \frac{60\text{ sec}}{1\text{ min}} \times \frac{80\text{ beats}}{1\text{ sec}} = \boxed{5.8\text{ billion beats}}$$

Second question: If an average hummingbird's heart beats 1.5 billion times over its lifetime of 7 years, how many times does it beat each minute?

$$\frac{1500000000\text{ beats}}{7\text{ years}} \times \frac{1\text{ year}}{365\text{ days}} \times \frac{1\text{ day}}{24\text{ h}} \times \frac{1\text{ h}}{60\text{ min}} = \boxed{408\ \frac{\text{beats}}{\text{min}}}$$

*8. The average human heart rate is approximately 80 beats per minute, with each beat pumping approximately 66 mL of blood through the heart. If an average American has a life expectancy of 78.7 years, how many Olympic-sized swimming pools worth of blood would their heart pump over their lifetime?
(An Olympic sized swimming pool is 50 meters long, 25 meters wide, and 2 meters deep.)

$$\frac{78.7\text{ years}}{1} \times \frac{365\text{ days}}{1\text{ year}} \times \frac{24\text{ h}}{1\text{ day}} \times \frac{60\text{ min}}{1\text{ h}} \times \frac{80\text{ beats}}{1\text{ min}} \times \frac{66\text{ mL}}{1\text{ beat}} \times \frac{1\text{ cm}^3}{1\text{ mL}} \times \frac{1\text{ m}}{100\text{ cm}} \times \frac{1\text{ m}}{100\text{ cm}} \times \frac{1\text{ m}}{100\text{ cm}} \times \frac{1\text{ pool}}{50\text{ m} \times 25\text{ m} \times 2\text{ m}} = \boxed{87.4\text{ pools}}$$

*9. An average Bic ballpoint pen can write for approximately 2 km before it runs out of ink. The 100 billionth pen was sold in 2006. If all of those pens were completely used up, for the sole purpose of drawing a single line following the Equator, how many times would that line be able to circle the Earth?

$$\frac{100{,}000{,}000{,}000\text{ pens}}{1} \times \frac{2\text{ km}}{1\text{ pen}} \times \frac{1\text{ Earth circumference}}{40{,}075\text{ km}} = \boxed{4{,}990{,}000\text{ times}}$$

*10. Humans have been using "drinking tubes" for over 7,000 years. These days, Americans use 500 million plastic straws every day – more than one straw a day for each of the 309 million Americans. Nearly every piece of plastic ever made still exists, because plastic doesn't break down like biodegradable substances. Furthermore, more than 5 trillion plastic pieces, weighing over 250,000 tons, are now afloat at sea, affecting wildlife and habitat. <u>Based on your age (in years), assuming you have been using plastic straws your entire life at the same rate of an average American, how many miles' worth of plastic straws have you used in your lifetime?</u> Assume each straw is 8 inches long, and has a mass of 0.3 grams. (1 ton = 2000 pounds; 1 pound = 453.6 g)

$$\frac{16\text{ years}}{1} \times \frac{365\text{ days}}{1\text{ year}} \times \frac{500\text{ million straws}}{\text{day}} \times \frac{8\text{ inches}}{1\text{ straw}} \times \frac{1\text{ ft}}{12\text{ in.}} \times \frac{1\text{ mi.}}{5280\text{ ft}} = 368{,}686{,}868\text{ mi}$$

(for all Americans)

$$\div\ 309{,}000{,}000 = \boxed{1.19\text{ miles}}$$

for you!