

TABLE 2.2 SI Prefix Multipliers

| Prefix | Symbol | Multiplier |
|--------|--------|--------------|
| tera- | T | (10^{12}) |
| giga- | G | (10^9) |
| mega- | M | (10^6) |
| kilo- | k | (10^3) |
| deci- | d | (10^{-1}) |
| centi- | c | (10^{-2}) |
| milli- | m | (10^{-3}) |
| micro- | μ | (10^{-6}) |
| nano- | n | (10^{-9}) |
| pico- | p | (10^{-12}) |
| femto- | f | (10^{-15}) |

Important Conversion Factors

Length: SI unit = meter (m)

- 1 m = 39.37 in.
- 1 in. = 2.54 cm (exactly)
- 1 mile = 5280 ft = 1.609 km
- 1 angstrom (Å) = 10^{-10} m

Volume: SI unit = cubic meter (m^3)

- 1 L = 1000 cm^3 = 1.057 qt (U.S.)
- 1 gal (U.S.) = 4 qt = 8 pt
= 128 fluid ounces
= 3.785 L

Mass: SI unit = kilogram (kg)

- 1 kg = 2.205 lb
- 1 lb = 16 oz = 453.6 g
- 1 ton = 2000 lb
- 1 metric ton = 1000 kg = 1.103 tons
- 1 g = 6.022×10^{23} atomic mass units (amu)

Pressure: SI unit = pascal (Pa)

- 1 Pa = 1 N/ m^2
- 1 bar = 10^5 Pa
- 1 atm = 1.01325×10^5 Pa (exactly)

- = 1.01325 bar
- = 760 mmHg
- = 760 torr (exactly)

Energy: SI unit = joule (J)

- 1 J = 1 N · m
- 1 cal = 4.184 J (exactly)
- 1 L · atm = 101.33 J

Conversion Factors and Relationships

Length

- SI unit: meter (m)
- 1 m = 1.0936 yd
 - 1 cm = 0.39370 in
 - 1 in = 2.54 cm (exactly)
 - 1 km = 0.62137 mi
 - 1 mi = 5280 ft
 - = 1.6093 km
 - 1 Å = 10^{-10} m

Temperature

- SI unit: kelvin (K)
- 0 K = -273.15°C
 - = -459.67°F
 - K = $^\circ\text{C} + 273.15$
 - $^\circ\text{C} = \frac{^\circ\text{F} - 32}{1.8}$
 - $^\circ\text{F} = 1.8(^\circ\text{C}) + 32$

Energy (derived)

- SI unit: joule (J)
- 1 J = 1 kg · m^2/s^2
 - = 0.23901 cal
 - = 1 C · V
 - = 9.4781×10^{-4} Btu
 - 1 cal = 4.184 J
 - 1 eV = 1.6022×10^{-19} J

Pressure (derived)

- SI unit: pascal (Pa)
- 1 Pa = 1 N/ m^2
 - = 1 kg/($m \cdot s^2$)
 - 1 atm = 101,325 Pa
 - = 760 torr
 - = 14.70 lb/ in^2
 - 1 bar = 10^5 Pa
 - 1 torr = 1 mmHg

Volume (derived)

- SI unit: cubic meter (m^3)
- 1 L = $10^{-3} m^3$
 - = 1 dm^3
 - = 10^3 cm^3
 - = 1.0567 qt
 - 1 gal = 4 qt
 - = 3.7854 L
 - 1 cm^3 = 1 mL
 - 1 in^3 = 16.39 cm^3
 - 1 qt = 32 fluid oz

Mass

- SI unit: kilogram (kg)
- 1 kg = 2.2046 lb
 - 1 lb = 453.59 g
 - = 16 oz
 - 1 amu = $1.66033873 \times 10^{-27}$ kg
 - 1 ton = 2000 lb
 - = 907.185 kg
 - 1 metric ton = 1000 kg
 - = 2204.6 lb

Geometric Relationships

- $\pi = 3.14159 \dots$
- Circumference of a circle = $2\pi r$
- Area of a circle = πr^2
- Surface area of a sphere = $4\pi r^2$
- Volume of a sphere = $\frac{4}{3}\pi r^3$
- Volume of a cylinder = $\pi r^2 h$

NAME _____

Su2019/1301/Exam 1/Dr. Dooley

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(4 Points Each) Multiple Choice: Place the letter of the correct answer in the blank provided.

- C 1. Which of the following statements is best described as a scientific theory?
- a) When 2.42 g of a sample is burned in the presence of 3.58g of oxygen, the result is 6.00g total of product.
 - b) Mass is conserved during a chemical reaction.
 - c) A gas is a collection of particles that move in straight line paths and do not interact with each other.
 - d) Falling barometric pressure occurs just before stormy weather.
 - e) The pressure of a gas increases inside a closed container when the temperature of the container is increased.
- D 2. Which of the following statements describes a liquid?
- a) The particles are far apart, and take on the shape and size of their container.
 - b) The particles are close together and do not move past one another.
 - c) The particles are close together, but are easily compressed into a smaller volume.
 - d) The particles are close together, but are free to move past one another.
 - e) The particles arrange themselves in a pattern with long-range repeating order.
- A 3. Which of the following statements about the phases of matter is TRUE?
- a) In both solids and liquids, the atoms or molecules pack closely to one another.
 - b) Solids are highly compressible.
 - c) Gaseous substances have long-range repeating order.
 - d) There is only one type of geometric arrangement that the atoms or molecules in any solid can adopt.
 - e) Liquids have a large portion of empty volume between molecules.
- B 4. A substance that can't be chemically or physically broken down into simpler substances is
- a) a homogeneous mixture.
 - b) an element.
 - c) a heterogeneous mixture.
 - d) a compound.
 - e) none of the above

- D 5. How would you classify sweet tea?
- pure substance-compound
 - mixture-heterogeneous
 - pure substance-element
 - mixture-homogeneous
 - none of the above
- A 6. Which of the following is an example of physical change?
- sugar is dissolved in water
 - wood is burned
 - A DNA molecule decomposes in sunlight
 - iron rusts
 - All of these are examples of physical change.
- C 7. Which of the following represents a chemical property of hydrogen gas?
- It is gaseous at room temperature.
 - It is less dense than air.
 - It reacts explosively with oxygen.
 - It is colorless.
 - It is tasteless.
- C 8. When elemental sodium reacts with elemental chlorine, the only product is sodium chloride. In a particular instance of this reaction, 70.0 grams chlorine react with 23.0 grams of sodium. What mass of sodium chloride is expected to form?
- 73.0 g
 - 47.0 g
 - 93.0 g
 - 23.0 g
 - none of the above
- C 9. Boiling point can be defined as the temperature when a liquid becomes a gas. The boiling point of the chemical *ethanol* is 75.0°C. Which state of matter would you expect to exist for ethanol at a temperature of 80.0°C?
- solid
 - liquid
 - gas
 - plasma
- A 10. Express the number 2,548,000,000,000 in scientific notation.
- 2.548×10^{12}
 - 2.548×10^{-12}
 - 2.548×10^9
 - 2.548×10^{-11}
 - none of the above

- C 11. The correct decimal representation of 2.358×10^{-4} is:
- a) 23580
 - b) .00002358
 - c) .0002358
 - d) 2358
 - e) none of the above

- C 12. The correct number of significant figures in the number 0.0015800 is:
- a) 7
 - b) 8
 - c) 5
 - d) 3
 - e) none of the above

- C 13. The correct number of significant figures in the number 30.080 is:
- a) 3
 - b) 4
 - c) 5
 - d) 2
 - e) none of the above

- C 14. Determine the answer to the following equation with correct number of significant figures:
 $(14.632 + 9.14) \times .004230 =$ _____
- Handwritten work:
 $23.772 \times .004230$
 $.100556$
- a) .10
 - b) .101
 - c) .1006
 - d) .10056
 - e) none of the above

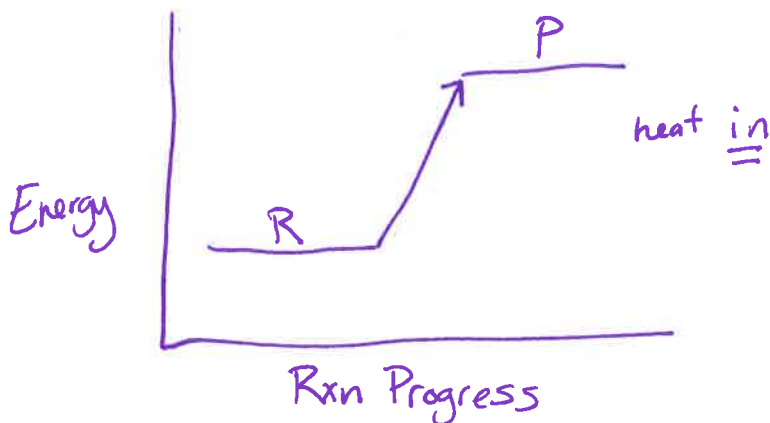
- C 15. Round 425.687 to 3 sig figs.
- a) 425.7
 - b) 425
 - c) 426
 - d) 430.0
 - e) 430

- B 16. A reaction is exothermic. Which of the following statements is true?
- a) When I place my hand on the beaker that contains it, it feels cold.
 - b) When I place my hand on the beaker that contains it, it feels warm.
 - c) The reaction absorbs heat from the surroundings.
 - d) The reaction expands in volume as it occurs.

Short Answer/Problems Show your work for credit in this section. All calculated numbers should contain correct number of sig figs and units!

1. (4 Points) The process of dissolving potassium nitrate in water is ENDOTHERMIC.

I have started an energy diagram for you where I have placed the axes, and the position of the Reactants. Finish this diagram by adding (1) an appropriate position for the Products relative to the position of the reactants, and (2) an arrow indicating the energy change.



2. (8 Points) A sample has a mass of 12.62 pounds (lbs) and a density of 9.3604 g/cm^3 . What is the volume of the ball? Report your answer in cm^3 .

$$12.62 \text{ lbs} \left(\frac{453.6 \text{ g}}{1 \text{ lb}} \right) \left(\frac{1 \text{ cm}^3}{9.3604 \text{ g}} \right) = \boxed{611.6 \text{ cm}^3}$$

↑ ↑
4sf -2 units
(-1)

3. (8 Points) Convert 4.265 tons (NOT metric tons) to oz (ounces).

$$4.265 \text{ tons} \left(\frac{2000 \text{ lbs}}{1 \text{ ton}} \right) \left(\frac{16 \text{ oz}}{1 \text{ lb}} \right) = \boxed{1.365 \times 10^5 \text{ oz}}$$

4. (8 Points) Convert 125 in^3 to cm^3 .

$$125 \text{ in}^3 \left(\frac{16.3871 \text{ cm}^3}{1 \text{ in}^3} \right) = 2048.38 \text{ cm}^3$$
$$= \boxed{2.05 \times 10^3 \text{ cm}^3}$$

$$1 \text{ in} = 2.54 \text{ cm}$$

$$1 \text{ in}^3 = 16.3871 \text{ cm}^3$$

5. (8 Points) Convert $9.65 \times 10^{10} \text{ ng}$ to kg .

$$9.65 \times 10^{10} \text{ ng} \left(\frac{10^{-9} \text{ g}}{1 \text{ ng}} \right) \left(\frac{1 \text{ kg}}{10^3 \text{ g}} \right) =$$

$$\boxed{9.65 \times 10^{-2} \text{ kg}}$$

-2
for flipped
cf.

