**CHE1031 Chapter 1 Homework Problem Key**

Homework problems are organized by topic, in the same order that topics are covered in lecture. ***Once we cover a topic in lecture, the problems for that topic are due at our next class meeting.*** If you have questions about which questions are due, please ask!

**Homework format:** Problems must be solved, or written out, in their entirety with all work shown on engineering graph paper. You must label each set in the upper left hand corner with your name, the date and the chapter. Problems must be identified by number and all work must be shown with answers boxed. Be sure your handwriting is legible.

**1.1: Science and chemistry**

1. What is the difference(s) between science and engineering?

2. What’s the essential difference between physics and chemistry? [Use any resource you need to pin this down.]

3. The scientific method is “iterative” in nature. What does iterative mean and how does it apply to the scientific method.

**1.2: What is matter?**

States of matter

4. In which physical state is matter most:

1. dense
2. energetic
3. most compressible

5. What is unusual about the solid physical state of water? [Imagine a pond of water with ice and compare it to a pond of molten steel with solid steel chunks.]

Pure substance vs. mixture

6. Classify each of the following as a pure substance or as a mixture. If a mixture, is it *homogeneous* or *heterogeneous?*

a. air

b. tomato juice

c. iodine crystals

d. sand

Physical vs. chemical change

7. Label each as a *physical* or *chemical* property of Zn:

1. Zn is a silver-gray metal.
2. Zn melts at 420°C.
3. Zn “disappears” when added to acid, and hydrogen gas is produced.
4. Zn has a hardness of 2.5 Mohs.
5. Zn has a density of 7.13 g/cm3.
6. Zn reacts with oxygen, at elevated temperatures, to produce zinc oxide, ZnO.

8. Identify each as a chemical or physical change:

a. the match burns

b. the metal gets warmer

c. water condenses on the metal

d. soot is deposited on the metal

**1.3: Measurement, metric units & prefixes**

Units

9. What exponential notation do the following abbreviations represent:

a. d

b. c

c. f

d. μ

e. M

f. k

g. n

h. m

i. p

Density

10. The label fell off a bottle of clear liquid. The lab tech thinks that it’s benzene – a nasty carcinogen – and measures its density to try and confirm this. A 25.0-mL volume of the liquid has a mass of 21.95 g. The density of benzene is 0.8787 g/mL at 15°C. Was the tech right?

11. The density of titanium metal is 4.51 g/cm3 at 25°C. What mass of Ti displaces 125.0 mL of water at that temperature?

Exact vs. inexact numbers

12. Which are exact numbers?

a. Mass of a 16-oz. bag of coffee from Vermont Coffee Company

b. Number of students in class

c. The temperature of the surface of the sun

d. The mass of a postage stamp

e. The number of millimeters in a cubic meter of water

f. the average height of students at the college

Uncertainty, precision & accuracy

13. You are using a graduated cylinder calibrated in one mL intervals. The volume of liquid in your cylinder looks to be halfway between 20 and 21 mL. How would you report this volume with proper uncertainty?

14. The US government issues monthly statistics for job growth, unemployment, manufacturing productivity, etc. The numbers are usually revised a few weeks after they are first announced. Is the purpose of the revision to increase:

1. accuracy; or
2. precision?

Significant figures

15. How many significant figures in each of these numbers:

a. 3.774 km

b. 205 m2

c. 1.700 cm

d. 350.00 K

e. 307.080 g

f. 1.3 x 103 m/s

16. The diameter of the Earth at the equator is 7926.381 miles. Round that to 3 sig figs and express it with scientific notation.

17. Express the answer to each problem with the correct number of significant figures.

a. 320.5 – (6104.5/2.3) =

b. ((285.3 x 105) – (1.200 x 103)) x 2.8954 =

c. (0.0045 x 20,000.0) + (281.3 x 12) =

d. 863 x (1255 – (3.45 x 108)) =

Scientific notation

18. Convert these numbers into scientific notation:

1. 25030000
2. 0.00000042600

**1.4: Dimensional analysis**

Single conversion factor

19. A blue whale has a lung capacity of 5.0 x 103 L. Convert that to gallons.

With multiple conversion factors

20. In 2007, it’s estimated that 31 billion tons of CO2 was emitted worldwide due to fossil fuel combustion and cement production. Express this mass in grams using a metric prefix without scientific notation.

21. Bamboo can grow up to 60.0 cm per day. Convert that to inches per hour.

22. The recommended adult dose of Elixophyllin, an asthma drug, is 6 mg/kg of body weight. What’s the dose (mg) for a 185-lb person?

With cubed unit volumes

23. Silicon for computer chips is grown in large cylinder called “boules”. One boule is 300 mm in diameter and 2 m tall. The density of Si is 2.33 g/cm3. Silicon wafers for making integrated circuits are sliced from a 2.0 m boule and are 0.75 mm thick and 300 mm in diameter.

a. How many wafers can be cut from a single boule?

b. What is the mass of one wafer?

24. The concentration of carbon monoxide in an urban apartment is 48 μg/m3. What is the mass (g) of CO in room that measures 11.0 x 11.5 x 20.5 ft?