Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Math of Science

Scientific Notation, Metric System, & Unit Conversion Review Worksheet Scientific Notation

1. Rewrite the following numbers in scientific notation, in simplest form. Include units. Use appropriate significant figures!

a. Altitude of summit of Mt. Ka‘ala (highest point on O‘ahu): 4020 ft =

b. Altitude of summit of Mauna Kea: 13,796 ft =

c. Thickness of a human hair: 0.015 cm =

d. Wavelength of reddish light: 0.0000007 m =

e. Height of your instructor: 1.80 m =

f. Number of galaxies in the universe: 1 trillion galaxies =

g. Age of the universe in seconds: 430,000,000,000,000,000 s =

h. Volume of a hydrogen atom: 0.000 000 000 000 000 000 000 000 621 cm3 =

2. Calculate the following, and write your answer to each in scientific notation. Try to do (a)–(i) first without the aid of your calculator, then check your answers by redoing them with your calculator. Assume that parts (a)–(h) contain exact numbers with infinite precision; for parts (i)–(n), express only the appropriate number of significant figures in your final answer. [Note that (b), (c), (g), (l), and (m) contain division signs, not plus signs.]

a. 1010 × 104 =

b. 1010 ÷ 104 =

c. 1010 ÷ 10–4 =

d. 1010 + 104 =

e. 1010 − 104 =

f. (2 × 105) × (3 × 1012) =

g. (3.5 × 1017) ÷ (7 × 108) =

h. 107 − (3 × 106) =

i. (42.3 × 10–5) + (5.77 × 10–4) =

j. (34.9 × 106) × (212 × 10–15) =

k. (0.88 × 10–3) × (6.3 × 10–10) =

l. (9.876 × 1035) ÷ (5.4321 × 10–13) =

m. mass of Earth ÷ mass of Moon = (5.974 × 1027 g) ÷ (7.348 × 1025 g) =

n. mass of Earth − mass of Moon = (5.974 × 1027 g) − (7.348 × 1025 g) =

Powers of Ten

3. Insert the correct metric prefix abbreviations (be careful to distinguish upper case from lower case!):

10–2 m = 1 \_\_\_\_\_m 109 y = 1 \_\_\_\_\_y 103 W = 1 \_\_\_\_\_W

10–3 m = 1 \_\_\_\_\_m 106 W = 1 \_\_\_\_\_W 10–6 s = 1 \_\_\_\_\_s

10–9 m = 1 \_\_\_\_\_m 103 g = 1 \_\_\_\_\_g 109 bytes = 1 \_\_\_\_\_B

106 Hz = 1 \_\_\_\_\_Hz 10–12 s = 1 \_\_\_\_\_s 1012 bytes = 1 \_\_\_\_\_B

(units: m = meter; g = gram; s = second; Hz = hertz, a unit of frequency; y = year; W = watt, a unit of power; B = byte, a unit of computer information)

4. Match each of the following length units to the distance that it is best or most frequently used to describe:

A. Size of an ant \_\_\_\_\_ 0.1 nm = 1 Å

B. Size of a person \_\_\_\_\_ 100 nm = 1000 Å

C. Distances between neighboring stars \_\_\_\_\_ 100 µm

D. Diameter of human hair \_\_\_\_\_ 1 mm

E. Size of an atom \_\_\_\_\_ 100 cm = 1 m

F. Size of viruses and small bacteria \_\_\_\_\_ 1 km

G. Distances within our Solar System \_\_\_\_\_ 108 km

H. Distances around Oahu \_\_\_\_\_ 1013 km

Significant Figures

5. How many significant figures are represented in each of the following numbers?

a. 579.420 b. 3.14159265

c. 2 × 1011 d. 50.

e. 3800 f. 5.60 × 1048

g. 243. h. 9.0000 × 10–9

i. 0.00000030 j. 8

Unit Conversions

6. a. Starting with your age in years, calculate your age in days. (You do not need to be exact: forget about leap days, etc.) b. Approximately how many days long is your total life expectancy?

7. Use your weight in pounds (while standing on the surface of the Earth) to calculate your mass in kilograms and in grams. (1 kg weighs approx. 2.205 lb on the surface of the Earth) This is a useful thing to know, since almost every other country in the world uses kilograms!

8. a. Convert the speed 1.0000 m/s [meter/second] to mi/h [miles/hour], expressing your answer to 5 significant figures. (Useful info: 1 mile = 5280 feet exactly, and 1 inch = 2.54 cm exactly.)

b. Perform the following unit conversions: (Try NOT looking up the metric prefixes… see how many you can do from memory!)

1.5 TB = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ GB (Note: “B” = byte)

1.5 TB = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ MB

1.5 TB = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ kB

1.5 TB = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ B

45 µg = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mg

45 µg = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ng

45 µg = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ kg

550 nm = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ km

6328 Å = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ nm (Note: 1 Å = 10–10 m)

15 ps = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ns

15 ps = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ µs

15 ps = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ms

14 Gy = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ s (Note: 1 y = 3.156 × 107 s)

1 km2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ m2

1 m2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cm2

1 km2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mm2

1 m3 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cm3

1 m3 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mm3

200 cm3 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mL (Note: 1 m3 = 1000 L)

1 km3 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ L

1.000 atm = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mbar (Note: 1 atm = 1.013 bar)

100. km/h = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ m/s

1 kg·m/s = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ g·cm/s

9.80 kg·m2/s2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ g·cm2/s2

330 g·cm2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ kg·m2

Scientific Hypotheses

9. Is each of the following statements a testable scientific hypothesis, or not?

a. Light travels slower in glass than in air.

b. Love is more important than knowledge.

c. All objects fall 4.9 meters during the first second after release in a vacuum.

d. The universe is filled with tiny particles called hypotons, which have no mass, no charge, and no known form of interaction with ordinary matter.

e. Vanilla tastes better than chocolate.

f. The majority of Americans prefer vanilla to chocolate.

g. All human actions and choices are predestined.

10. Imagine that you are living long ago, and you are having a discussion about the shape of the world with your colleagues. Devise a simple test or experiment that you could perform to test (either support or disprove) one of the following hypotheses: a1. The surface of the Earth is an infinite flat plane, or a2. The surface of the Earth is (nearly) spherical.

For a bigger challenge: similarly devise a test for each of the following two scientific hypotheses. (Thought question: How do we even know today, with modern technology, that they are true?) b. The Earth spins. c. The Earth orbits the Sun, and not the other way around