Name _____ Date _____ Class _____

MATH HANDBOOK TRANSPARENCY MASTER 1

Scientific Notation

Use with Appendix B, Scientific Notation

Scientists need to express small measurements, such as the mass of the proton at the center of a hydrogen atom (0.000 000 000 000 000 000 000 000 001 673 kg), and large measurements, such as the temperature at the center of the Sun (15 000 000 K). To do this conveniently, they express the numerical values of small and large measurements in scientific notation, which has two parts.

A number in which only one digit is placed to the left of the decimal → $N \times 10^n$ ← An exponent of 10 by which the number is multiplied

Thus, the temperature of the Sun, 15 million kelvins, is written as 1.5×10^7 K in scientific notation.

Positive Exponents Express 1234.56 in scientific notation.

1234.56

Each time the decimal place is moved one place to the left,

$1234.56 \times 10^0 = 123.456 \times 10^1$

$123.456 \times 10^1 = 12.3456 \times 10^2$

$12.3456 \times 10^2 = 1.234\,56 \times 10^3$

the exponent is increased by one.

$1.234\,56 \times 10^3$

Negative Exponents Express 0.006 57 in scientific notation.

0.006 57

Each time the decimal place is moved one place to the right,

$0.006\,57 \times 10^0 = 0.0657 \times 10^{-1}$

$0.0657 \times 10^{-1} = 0.657 \times 10^{-2}$

$0.657 \times 10^{-2} = 6.57 \times 10^{-3}$

the exponent is decreased by one.

6.57×10^{-3}

Name _____ Date _____ Class _____

MATH HANDBOOK TRANSPARENCY WORKSHEET 1

Scientific Notation

Use with Appendix B, Scientific Notation

1. Express each of the following numbers in scientific notation.
   a. 230
   b. 5601
   c. 14 100 000
   d. 56 million
   e. 2/10
   f. 0.450 13
   g. 0.089
   h. 0.000 26
   i. 0.000 000 698
   j. 12 thousandth

2. Express each of the following measurements in scientific notation.
   a. speed of light in a vacuum, 299 792 458 m/s
   b. number of seconds in a day, 86 400 s
   c. mean radius of Earth, 6378 km
   d. density of oxygen gas at 0°C and pressure of 101 kPa, 0.001 42 g/mL
   e. radius of an argon atom, 0.000 000 000 098 m

Name _____ Date _____ Class _____

MATH HANDBOOK TRANSPARENCY MASTER 2

Operations with Scientific Notation

Use with Appendix B, Operations with Scientific Notation

Addition and Subtraction

Before numbers in scientific notation can be added or subtracted, the exponents must be equal.

Not equal — Equal

$$(3.4 \times 10^2) + (4.57 \times 10^3) = (0.34 \times 10^3) + (4.57 \times 10^3)$$

The decimal is moved to the left to increase the exponent.

$$= (0.34 + 4.57) \times 10^3$$

$$= 4.91 \times 10^3$$

Multiplication

When numbers in scientific notation are multiplied, only the number is multiplied. The exponents are added.

$$(2.00 \times 10^3)(4.00 \times 10^4) = (2.00)(4.00) \times 10^{3+4}$$

$$= 8.00 \times 10^7$$

Division

When numbers in scientific notation are divided, only the number is divided. The exponents are subtracted.

$$\frac{9.60 \times 10^7}{1.60 \times 10^4} = \frac{9.60}{1.60} \times 10^{7-4}$$

$$= 6.00 \times 10^3$$

Name _____ Date _____ Class _____

MATH HANDBOOK TRANSPARENCY WORKSHEET 2

Operations with Scientific Notation

Use with Appendix B, Operations with Scientific Notation

1. Perform the following operations and express the answers in scientific notation.
   a. $(1.2 \times 10^5) + (5.35 \times 10^6)$

   b. $(6.91 \times 10^{-2}) + (2.4 \times 10^{-3})$

   c. $(9.70 \times 10^6) + (8.3 \times 10^5)$

   d. $(3.67 \times 10^2) - (1.6 \times 10^1)$

   e. $(8.41 \times 10^{-5}) - (7.9 \times 10^{-6})$

   f. $(1.33 \times 10^5) - (4.9 \times 10^4)$

2. Perform the following operations and express the answers in scientific notation.
   a. $(4.3 \times 10^8) \times (2.0 \times 10^6)$

   b. $(6.0 \times 10^3) \times (1.5 \times 10^{-2})$

   c. $(1.5 \times 10^{-2}) \times (8.0 \times 10^{-1})$

   d. $\dfrac{7.8 \times 10^3}{1.2 \times 10^4}$

   e. $\dfrac{8.1 \times 10^{-2}}{9.0 \times 10^2}$

   f. $\dfrac{6.48 \times 10^5}{(2.4 \times 10^4)(1.8 \times 10^{-2})}$

Name _____ Date _____ Class _____

MATH HANDBOOK TRANSPARENCY MASTER 3

Significant Figures

Use with Appendix B, Significant Figures

Rules for Significant Figures

1 All nonzero figures are significant.

721 mm — *3 significant figures*

2 When a zero falls between nonzero digits, that zero is significant.

106 K — *3 significant figures*

3 When a zero falls after the decimal point and after a significant figure, that zero is significant.

1.50 L — *3 significant figures*

4 When a zero is used merely to indicate the position of the decimal, that zero is *not* significant.

1 210 m — *3 significant figures*

0.0**53** m — *2 significant figures*

5 All counting numbers and exact numbers are treated as if they have an infinite number of significant figures.

10 pairs — *infinite number of significant figures*

Name _____ Date _____ Class _____

MATH HANDBOOK TRANSPARENCY WORKSHEET 3

Significant Figures

Use with Appendix B, Significant Figures

1. For each of the measurements in the table below, determine if the underlined number is significant or not significant. Place a check mark in the appropriate box and in the box under the rule that you used to make your determination.

Measurement	Significant	Not Significant	Rule				
			1	2	3	4	5
a. 30<u>3</u>8 m							
b. 1.5<u>6</u>1 L							
c. 0.<u>0</u>74 mm							
d. 505<u>0</u> s							
e. 3.<u>0</u>07 km							
f. 6.1<u>0</u>°C							
g. 82<u>1</u>.0 g							
h. <u>0</u>.560 g							

2. Determine the number of significant figures in each of the following measurements.

a. 56 m _____
b. 1104 mL _____
c. 15 pairs _____
d. 0.20 mol _____
e. 105 000 mm _____
f. 6.02 L _____
g. 0.176 kPa _____
h. 819 000.0 g _____
i. 4.030 m^3 _____
j. 0.005 42 s _____
k. 49 000 km _____
l. 7.81 kg _____
m. 7.01 m/s _____
n. 0.0021 m _____
o. 30 015 g _____
p. 90 km _____
q. 12.0 cm _____
r. 0.0305 kPa _____
s. 50 gross _____
t. 83.90 m/s^2 _____
u. 0.100 50 cg _____
v. 0.0510 kg _____
w. 6.12×10^5 mm _____
x. 4.01×10^2 s _____
y. $60\,000 \times 10^3$ g _____
z. 1.000×10^2 kPa _____

Name _____ Date _____ Class _____

MATH HANDBOOK TRANSPARENCY MASTER 4

Unit Conversion

Use with Appendix B, Unit Conversion

Common SI Prefixes

Prefix	Symbol	Exponential Notation	Prefix	Symbol	Exponential Notation
peta	P	10^{15}	deci	d	10^{-1}
tera	T	10^{12}	centi	c	10^{-2}
giga	G	10^{9}	milli	m	10^{-3}
mega	M	10^{6}	micro	μ	10^{-6}
kilo	k	10^{3}	nano	n	10^{-9}
hecto	h	10^{2}	pico	p	10^{-12}
deka	da	10^{1}	femto	f	10^{-15}

Express 42 kilograms in grams.

You are given the number of kilograms. To convert to the number of grams, use the table to determine the relationship between kilograms and grams. Set up conversion factors relating the number of kilograms and the number of grams.

$$\frac{1\text{ kg}}{1000\text{ g}} \text{ and } \frac{1000\text{ g}}{1\text{ kg}}$$

Choose the conversion factor that cancels units of kilograms and gives an answer in number of grams.

$$42\ \cancel{\text{kg}} \times \frac{1000\text{ g}}{1\ \cancel{\text{kg}}} = 42\,000\text{ g} = 4.2 \times 10^{4}\text{ g}$$

The answer is expressed in the desired unit, grams. When you convert from a large unit to a small unit, the number of units increases.

Name _____ Date _____ Class _____

MATH HANDBOOK TRANSPARENCY WORKSHEET 4

Unit Conversion

Use with Appendix B, Unit Conversion

Convert the following measurements as indicated. Express each answer in scientific notation.

1. 6 km = _____ m

2. 4.9 mg = _____ g

3. 7.6 dm = _____ mm

4. 32.1 g = _____ cg

5. 5.6×10^3 cm = _____ m

6. 760 g = _____ kg

7. 4.50 km^2 = _____ m^2

8. 1.23 g/mL = _____ kg/L

9. 12 km = _____ nm

10. 6.4 mg = _____ pg