

# DIMENSIONAL ANALYSIS, THE METRIC SYSTEM AND SIGNIFICANT FIGURES

## Exponents

The rules:

What is an exponent?

$10^6$  means 10 times itself 6 times.

Multiplying numbers with exponents:

$$a^r \cdot a^s = a^{r+s}$$

this means:

$$\begin{aligned} \cdot &= + = \\ - \cdot &= - + = = \end{aligned}$$

but what is the meaning of  $10^{-3}$ ?

$$= \text{---}$$

Dividing numbers with exponents:

$$\frac{a^r}{a^s} = a^{r-s}$$

$$10^{-3} \cdot 10^4 = \frac{10^4}{10^3} = \frac{10^{3+1}}{10^3} = 10^1 = 10 \quad (\text{write it out with 10s})$$

Raising numbers with exponents to other powers:

$$(a^r)^s = a^{rs}$$

$$(10^4)^3 = 10^{(4 \cdot 3)} = 10^{12}$$

$$\text{why? } 10^4 \cdot 10^4 \cdot 10^4 = 10^{4+4+4}$$

and

$$10^4 \cdot 10^4 \cdot 10^4 = 10^{12} \quad \frac{1}{10^{12}}$$



### Significant Figures

Do a bunch of examples of numbers and how many sig figs they have

26 ! 2

2006 ! 4

2600 ! 2

0.4 ! 1

0.00004 ! 1

0.400 ! 3

7400 ! 2

7400. ! 4

For multiplication and division, do all your steps, then look at what you started with. Whichever number has the fewest sig figs is the answer.

3. defined numbers (1 hogshead = 63 gallons)

Now, let's look at the Metric System:

Just go straight off the handout...

Ok, now we're ready to combine them.

Let's return to the question on the diagnostic:

If  $1 \text{ cm} = 0.01 \text{ m}$ , then  $1 \text{ cm}^3 =$  how many  $\text{m}^3$ ?

So, if  $1 \text{ cm} = 10^{-2} \text{ m}$ , then  $(1 \text{ cm})^3 = (10^{-2} \text{ m})^3 = 10^{-6} \text{ m}^3$

Now, if a cell is  $10^{-5} \text{ m}$  wide,  $10^{-5} \text{ m}$  tall and  $20 \times 10^{-5} \text{ m}$  long



- 3) Calculate the quantity of heat that must be transferred to 15.0 g of water to raise its temperature from 20.0 °C to 50.0 °C?

(Water has a specific heat of 4.18  $\frac{\text{J}}{\text{g}\cdot^\circ\text{C}}$  )

Heat transferred = (specific heat)(mass)( $\Delta T$ )

$\Delta T = 30.0\text{ }^\circ\text{C}$