Name: _____

Physics Summer Assignment

Due: First day back - September

Part 1 - Thinking Physics

Have you ever noticed that your breakfast cereal tends to clump together or cling to the sides of a bowl of milk? This clumping phenomenon applies to anything that floats, including fizzy soda bubbles and hair particles in water after a morning shave. Your task is to develop a model explaining why you think this is occurring. Using as many scientific principles as you can draw and write an explanation as to why/how this is occurring.

Part 2- Math operations:

The following are some of the basic math operations that you will always use.
These operations also have counterparts; which is basically its opposite operation.

(addition)	+	counterpart	-
(subtraction)	-	counterpart	+
(multiplication)	x	counterpart	/
(division)	/	counterpart	x

Other operations that you may not know involve exponents & square roots.

(square)	a^2	counterpart	$\sqrt{}a$
(square root)	$\sqrt{}a$	counterpart	a^2

Knowing the counterparts of math operation is very important in the scientific world, you will see this later.

Addition:
When adding, you need to make sure that you have *like terms*. All numbers are considered like terms and that is why you can add them.

- Numbers with the same sign you add and keep the sign that is being used.
  - 5 + 3 = 8 -9 + -3 = -12

- Numbers with different sign you subtract and keep the sign of the larger number.
  - 5 + -3 = 2 4 + -7 = -3

In science you will encounter various symbols. Most of these symbols will be variables, others will represent constants. In order for you to add, you need to have *identical variables*.

Ex.
A + A = 2A, but A + a = A + a the reason is that they are two different variables; not identical and therefore not like terms.

3 + A + A + 2 = in this case you have to combine like terms 3 + 2 & A+A = 5+2A

1. Solve the following Problems:

3 + 2 + 5 + 8 =	7 + 3 + 2 + 6 + 1 =	10 + 5 + 6 =
3 + A + a + 2 =	2 + A + A + a + 3 =	2A + 2B + 2 =

Exponents. Exponents change the value of a variable. If there are two identical symbols but one of them has an exponent, they no longer mean the same and are not like terms.

A is not equal to A^2. Therefore $A + A^2 = A + A^2$

Subscripts. Subscripts are different from exponents. Exponents have a mathematical value but subscripts don't. They are simply used to tell two variables apart. In physics variables represent certain actions. For example v; v stands for velocity. What would happen if you have three different objects and you write v for all three of them? Exactly you will get confused. You will think that they are the same.
This is when subscripts are used; to tell variables apart, v_1, v_2, & v_3.

Solving for a variable.

When solving for a variable you can end up with a number answer, or you can end up with an answer that includes other variables.
3+2+5 = A in this case A = 10
3+2+b = A in this case A = 5 + B *you solved for A in terms of B*

When you are solving for a variable, you have to keep it by itself on one side of the equal sign. If not, you have to re-arrange the equation to solve for the variable.

To move variables and numbers to the other side of the equal sign you must do the opposite mathematic operation (counterparts).

Ex. 5 + 2 + A + B **=** 12 solve for A.

In this case A is not alone; you have 5, 2 & B next to it. This means that you must re-arrange the equation by moving the unwanted characters to the other side of the equal sign. One side **=** other side
IF you have like terms, you may combine them before re-arranging the equation.

5 + 2 + A + B = 12

7 + A + B = 12
- 7 -7
0 + A + B = 5
- B -B

0 + A + 0 = 5 – B since 0 is not going to affect your variable you can drop them
A = 5 – B

2. Solve for A in the following problems:

5 + 3 + a = A + 4 + a	7 + A + B = 10	A + a + a = B + c
10 + A + a = 2A + a	3A + 10 + 2 + c = A + A + 20 + c	

Subtraction.

When subtracting you must follow the same rules as addition. Make sure you have like terms. The counterpart of subtraction is addition

- When subtracting you will keep the sign of the larger number
  - 5 – 2 = 3 6 – 10 = -4
- When subtracting a negative, you will end up with the same sign, therefore you add.
  - -5 – 9 = -14 -4 – 1 = -5
- When subtracting by a negative the sign will change and become addition.
  - 8 - -2 = 8 + 2 = 10 5 - -3 = 5 + 3 = 8

A – A + 10 = A – 5 10 + A - B = 15 + B A + B + C – D = 5 + C + D + B

Multiplication & Division.

When multiplying or dividing you do not need to have like terms. Remember in science you final answer could include variables.

- When you have numbers with the same sign the product is a positive number.
  - 3 * 5 = 15 -2 * -8 = 16
- When you have numbers of different signs the product is a negative number.
  - -3 * 5 = -15 2 * -8 = -16
- When you multiply different variables your answer will be in terms of the variable.
  - 3 * A * B = 3AB $3*3*A*A = 3^2A^2 = 9A^2$
  - 4*3*A*a = 12Aa $2A*3A*4*5 = 2*3*4*5*A*A = 120A^2$
  - $A^2 * B^3 = A^2B^3$
  - $A^2 * A^3 = A^5$ when multiplying, if you have the same variable you add the exponent.
- When you divide you follow the same rules as in multiplication, the only exception happens when we involve exponents.
  - 4A / 2A = 2

  **** if you have the same variable in the numerator and denominator then they cancel each other****
  - 6abCD /2ACdb = 3aD / Ad only like terms cancel out.
  - $A^5 / A^2 = A^3$ when dividing, if you have the same variable you subtract the exponent.

3. Solve the following problems.

$4*5*A*B*A =$	$10A*5B*2a =$	$5A*2A*3A =$
$20abc / 5ab =$	$8AaBb / ABb =$	$9\ GHI / 9GHI =$
$4A^3B^2 / 2A^2B =$	$10AB^3 / 5A^2b =$	

Solving for a variable.

When solving for a variable during multiplication or division you must follow similar steps as before. You must keep that variable by itself on one side of the equal sing. All other variables must be moved by using the opposite operation.

$5ABC = 10A$ solve for B. since you are solving for B, you must keep B by itself on one side of the equal sign.
In this case you must get rid of 5, A & C. Since you are multiplying, the opposite would be division.

$\frac{5ABC}{5AC} = \frac{10A}{5A\ C}$ this cancels out the 5AC on the left and moves it to the right. Now just simplify your answer.
$B = 10A / 5AC \Rightarrow B = 2/C$

$ABC / 2 = 10A$ solve for C. In this case you are dividing by two. To get rid of this two you must multiply both sides by 2
$ABC = 2*10A \Rightarrow ABC = 20A$
Now we must get rid of AB.
$C = 20A / AB$ since we have the same variable in the numerator and denominator, they cancel out.

$C = 20/B$

4. Solve the following problems.

$10\ ABC = 20C$ solve for B	$6ABC = 12\ A^2$ solve for C
$ABC^2 / X = XYC^3$ solve for A	$ABCD / EFG = HIBCE$ solve for D.

Special cases.
One special case is when the variable you are solving for is in the denominator. Whenever you are solving for a variable you always want it in the numerator. Therefore you must find a way to bring your variable to the numerator.
Ex.

20ABC /2DE = 5A Solve for D. since you are dividing by D on one side you must bring it to the other side.

20ABC / 2E = 5AD now you want to keep D by itself, this means you must get rid of 5 & A.

D = 20ABC / 2E5A simplify your equation D = 20ABC / 10AE D = 2BC/E

Another special case is when you are dealing with exponents or square roots. Remember their counterparts.

Ex.

$X^2 = 100$ solve for X. When you are solving for a variable you want it by itself, if it has an exponent it is not alone. To get rid of that square, we must do the square root. Whatever you do to one side you must do to the other.

$\sqrt{X^2} = \sqrt{100}$ $X = \sqrt{100} = 10$

Mixed operations.
When you are solving a problem where more than one math operation is used, you must follow the order of operations.

ORDER OF OPERATION:

1. Parenthesis [()]
2. Exponents [X^{exp}]
3. Multiplication [X]
4. Division [/]
5. Addition [+]
6. Subtraction [-]

A good phrase to remember the orders is **P**lease **E**xcuse **M**y **D**ear **A**unt **S**ally.

Ex.

(1+3) * 2^3 + 8 – 10 → 4 * 2^3 + 8 – 10 → 4 * 8 + 8 - 10 → 32 + 8 – 10 → 40 – 10 → 30

5. Solve the following problems.

7 * 8 / 2 – 5+10 =	(85 + 15) * 5 / 50 =	(5 - -8 * 5) * 2 – 9 =

Solving for a variable.
When given a mix operation problem where a variable is included, you *do not follow PEMDAS*.

- To solve for a variable you must do the following:
  - Try to separate the variable

- Use the opposite Math Operations whenever you have to get rid of a number
- You will use the order of operations backwards
  - P. E. M. D. A. S. *S. A. D. M. E. P.*

Ex. $X + 10 = 15$
$- 10 \quad -10$
$X = 5$

$Y * 3 + 4 = 19$
$- 4 \quad -4$
$Y * 3 = 15$
$/3 \quad / 3 = Y = 5$

$(2A + B) – C = D$
$+ C \quad +C$
$(2A + B) = D + C$
$- B \quad - B$
$2A = (D + C – B)$
$/2 \quad /2$
$A = (D + C – B) / 2$

6. Solve the following problems:

$A + 5 – 3 = 20$	$B * 2 / 4 = 10$	$(3X + 5) – 2 = 18$
$3 (A + X + B + Y) – 10 = 2$ Solve for X.	$Y^2 – 5 = 20$	$\sqrt{X} + 7 = 9$

7. Rearrange the following physics equations:

Speed = distance ÷ time **s = d/t**

solve for d =

solve for t =

Force = mass x acceleration **F = ma**

solve for m =

solve for a =

Final velocity = initial velocity – acceleration x time **$v_2 = v_1 + at$**

solve for v_1 =

solve for a =

solve for t =

Gravitational Potential Energy = mass x gravity x height **GPE = mgh**

solve for m =

solve for g =

solve for h =

Kinetic Energy = half the mass x velocity squared **KE = ½ m v^2**

solve for m =

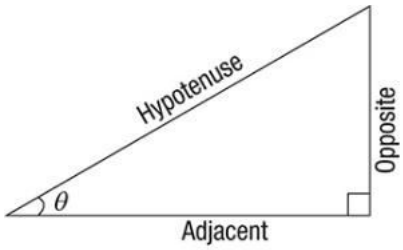
solve for v =

Part 3: Trigonometry Functions- Right Triangle

Sine, Cosine and Tangent are the main functions used in Trigonometry and are based on a Right-Angled Triangle.

Before getting stuck into the functions, it helps to give a **name** to each side of a right triangle:

- "Opposite" is opposite to the angle θ
- "Adjacent" is adjacent (next to) to the angle θ
- "Hypotenuse" is the long one
  Sine, **Cosine** and **Tangent** (often shortened to **sin**, **cos** and **tan**) are each a **ratio of sides** of a right angled triangle:
  For a given angle θ each ratio stays the same no matter how big or small the triangle is
  To calculate them: **Divide the length of one side by another side**



$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}} \qquad \csc\theta = \frac{\text{hypotenuse}}{\text{opposite}}$$

$$\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}} \qquad \sec\theta = \frac{\text{hypotenuse}}{\text{adjacent}}$$

$$\tan\theta = \frac{\text{opposite}}{\text{adjacent}} \qquad \cot\theta = \frac{\text{adjacent}}{\text{opposite}}$$

Practice: **Find the value of *x.* Round to the nearest tenth.**