Honors Physics Summer Assignment

I hope you are excited about taking Physics next year! In order to be prepared for this rigorous and exciting course you will need to complete this summer assignment. It must be submitted on **your first day of school.** This will count as a test grade worth 100 pts so make sure you start off the year strong! If you have any problems with this assignment please do not hesitate to contact me. I am excited to hear from you. Good luck with your packet and I can't wait to begin your incredible journey next year in Physics!

Mrs. Canter

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Your summer assignment has multiple parts so make sure to complete them all!

Attached you will find several worksheets that you need to complete.

1 Physics Skills : Mathematics Assessment (2 pages)

2 Physics Skills : Recording Measurements

5 Physics Skills : Dimensional Analysis

6 Physics Skills : Graphing Techniques

7 Physics Skills : Interpreting Graphs (2 pages)

12 Physics Skills : Factor-Label Method for Converting Units

Date _____ Period _____ Name _____

1 Physics Skills

Use with Chapter 2.

Mathematics Assessment

Write the following numbers in scientific notation.

1. 156.90 _____
2. 12 000 _____
3. 0.0345 _____
4. 0.008 90 _____

Expand the following numbers.

5. 1.23×10^{6} _____
6. 2.5×10^{-3} _____
7. 1.54×10^{4} _____
8. 5.67×10^{-1} _____

Solve the following and put your answer in scientific notation.

9. $\dfrac{6.6 \times 10^{-8}}{3.3 \times 10^{-4}} =$ _____
10. $\dfrac{7.4 \times 10^{10}}{3.7 \times 10^{3}} =$ _____
11. $\dfrac{2.5 \times 10^{8}}{7.5 \times 10^{2}} =$ _____
12. $(2.67 \times 10^{-3}) - (9.5 \times 10^{-4}) =$ _____
13. $(1.56 \times 10^{-7}) + (2.43 \times 10^{-8}) =$ _____
14. $(2.5 \times 10^{-6}) \times (3.0 \times 10^{-7}) =$ _____
15. $(1.2 \times 10^{-9}) \times (1.2 \times 10^{7}) =$ _____
16. $(2.3 \times 10^{4}) + (2.0 \times 10^{-3}) =$ _____

Give the number of significant digits in the following measurements.

17. 2.9910 m _____
18. 5600 km _____
19. 0.006 70 kg _____
20. 809 g _____

Solve the following problems and give the answer in the correct number of significant digits.

21. $\dfrac{2.674 \text{ m}}{2.0 \text{ m}} =$ _____
22. 5.25 L × 1.3 L = _____
23. 9.0 cm + 7.66 cm + 5.44 cm = _____
24. 10.07 g − 3.1 g = _____

Name _____

1 Physics Skills

Solve for x in the following problems.

25. $\frac{3x}{y} = \frac{6g}{b}$ _____

26. $d = \frac{t}{x}$ _____

27. $\frac{2x^2}{3} = dg$ _____

28. $\frac{2\sqrt{x}}{c} = y$ _____

Make the following conversions.

29. 4008 g = _____ mg

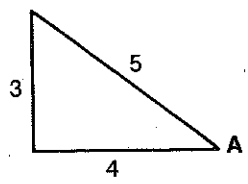
30. 48 mL = _____ L

31. 239 mm = _____ cm

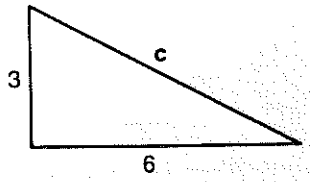
32. 38 kg = _____ mg

Answer the questions that refer to the following triangles.

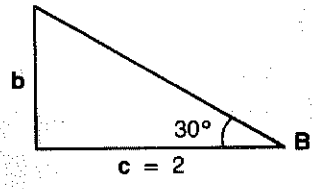
I



II



III



33. For triangle I, what is the cosine of angle A?

_____

34. What is the tangent of angle A for triangle I?

_____

35. Find side c for triangle II.

_____

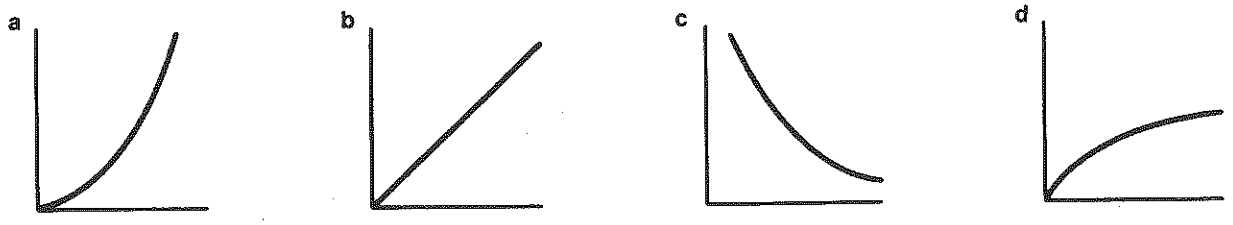
36. For triangle III, express side b in terms of a trigonometric function of angle B and side c.

_____

Name _____

1 Physics Skills

Answer the questions that refer to the following graphs.



37. Which graph represents an inverse relationship? _____

38. Which of the graphs could have the equation $y = kw^2$? _____

39. Plot a graph of the data given in the following table.

x	y
0	2
0.5	8
1	14
2	26
3	38
4	50

40. What is the slope of the line? _____

41. What is the value of y when $x = 4$? _____

42. What is the value of y when $x = 6$? _____

43. What is the value of x when $y = 0$? _____

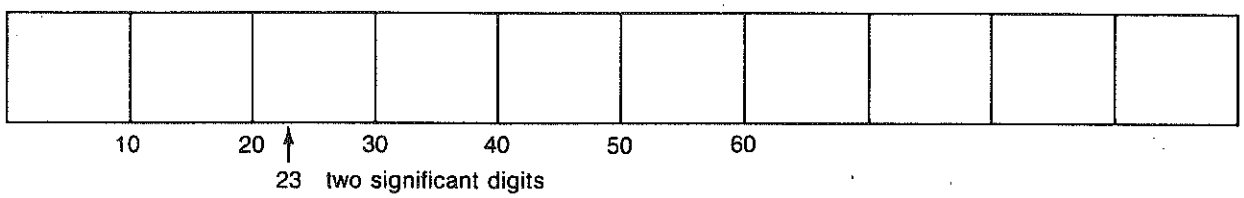
Date _____ Period _____ Name _____

2 Physics Skills

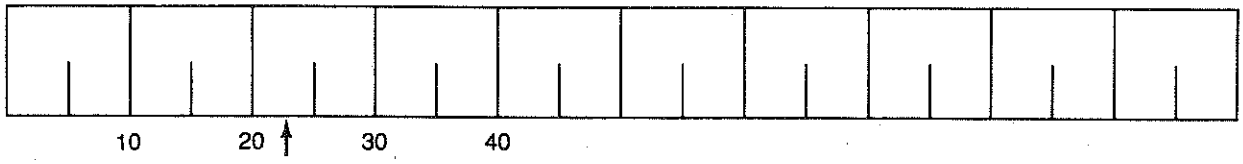
Use with Chapter 2.

Recording Measurements

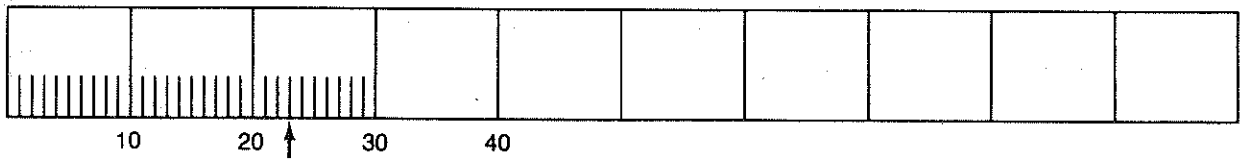
Look at the four metersticks shown below. As you proceed down the page, each meterstick has more divisions marked. When you read any scale, you always record the measurement by reading the smallest division on the scale and then guessing at, or estimating, the tenth of the smallest division. As you proceed down the page, you can see how your measurement becomes more precise, and you have more significant digits in your reading. A significant digit is a digit that has physical meaning.



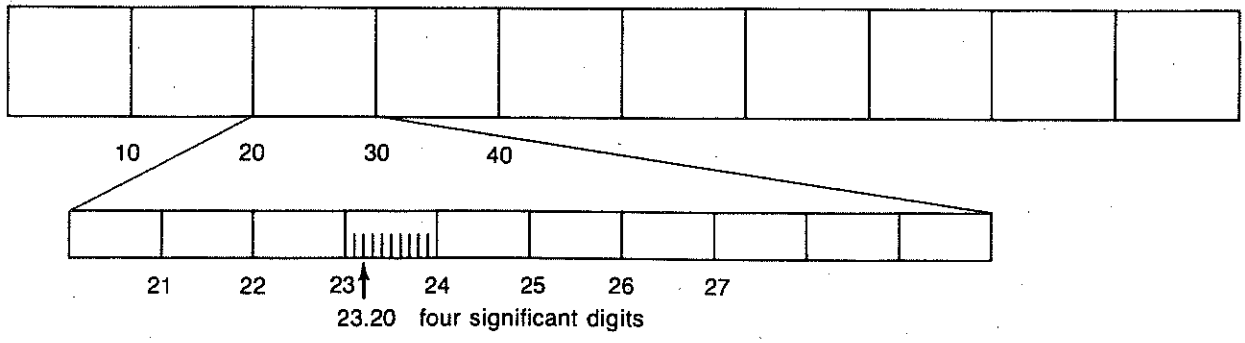
23 two significant digits



23 two significant digits



23.0 three significant digits



23.20 four significant digits

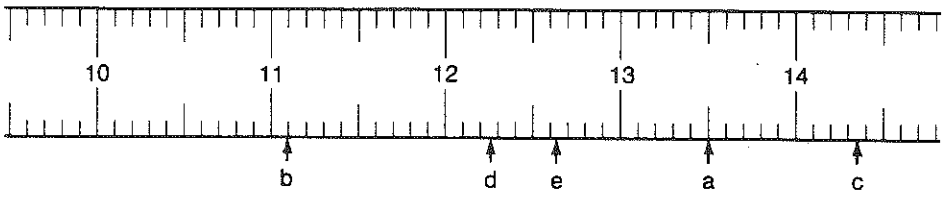
Name _____

2 Physics Skills

For the instruments shown below, record the correct reading.

1.

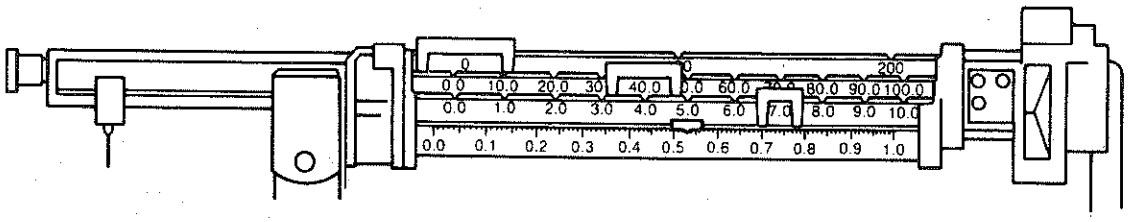
Metric Ruler



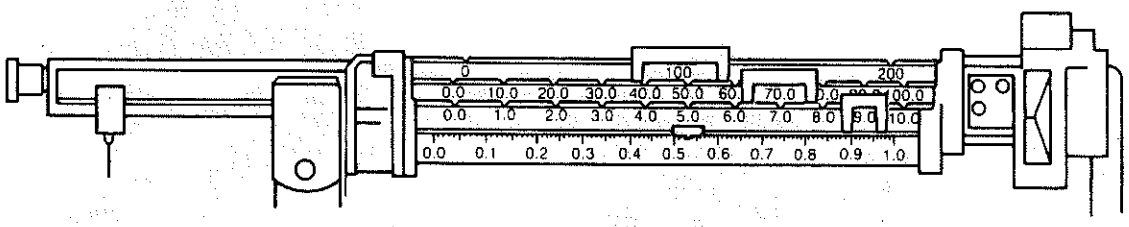
a. _____ **b.** _____ **c.** _____ **d.** _____ **e.** _____

2.

Balance



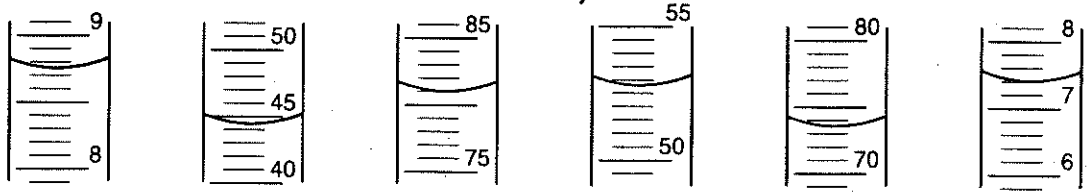
a. _____



b. _____

3.

Graduated Cylinder



a. _____ **b.** _____ **c.** _____ **d.** _____ **e.** _____ **f.** _____

Date _____ Period _____ Name _____

5 Physics Skills

Use with Chapter 2.

Dimensional Analysis

Quantities such as length, speed, and area are called dimensional quantities. A measured dimensional quantity has a numerical value that depends upon the system of units used. For example, an area of 1 square meter can also be stated as 10 000 square centimeters. When making a measurement, use the most convenient unit.

When substituting values into an equation in physics, you must state the units as well as the numerical values. Including units in your calculations helps you keep units consistent throughout and assures you that your answer will be dimensionally correct. You may also use the units or dimensions of your measurements to check the correctness of your equation. A dimensionally-correct equation is shown in Example 1. Note that some of the units on the right side of the equation cancel out. The final dimensions on both sides are the same. The equation is dimensionally correct.

Example 1

$$\text{mass} \stackrel{?}{=} (\text{density})(\text{volume})$$

$$\text{kg} \stackrel{?}{=} \frac{\text{kg}}{\text{m}^3} \left| \frac{\text{m}^3}{} \right.$$

$$\text{kg} = \text{kg}$$

A dimensionally-incorrect equation is shown in Example 2. Note that the final units on the right do not equal those on the left. By inspecting the dimensions, you should be immediately aware that the equation is not correctly written.

Example 2

$$\text{velocity} \stackrel{?}{=} (\text{distance})(\text{time})$$

$$\frac{\text{m}}{\text{s}} \stackrel{?}{=} \frac{\text{m}}{} \left| \frac{\text{s}}{} \right.$$

$$\frac{\text{m}}{\text{s}} \neq \text{m} \cdot \text{s}$$

Use the method described above to determine if the following equations are correctly written. The proper units for the variables are listed below.

Table 1

Variable	Quantity	Unit
d	distance	m
t	time	s
v, v_i, v_f, $\bar{v}$	velocity	m/s
a	acceleration	m/s^2

1. $v_f \stackrel{?}{=} v_i t + a$

Name _____

5 Physics Skills

2. $v \stackrel{?}{=} \frac{v_i + v_f}{2}$

3. $d \stackrel{?}{=} \sqrt{v_i t^2 + \frac{1}{2} at}$

4. $v_f \stackrel{?}{=} v_i^2 + 2ad^2$

5. $d \stackrel{?}{=} \frac{1}{2} v_i t + at^2$

Date _____ Period _____ Name _____

6 Physics Skills

Use with Chapter 2.

Graphing Techniques

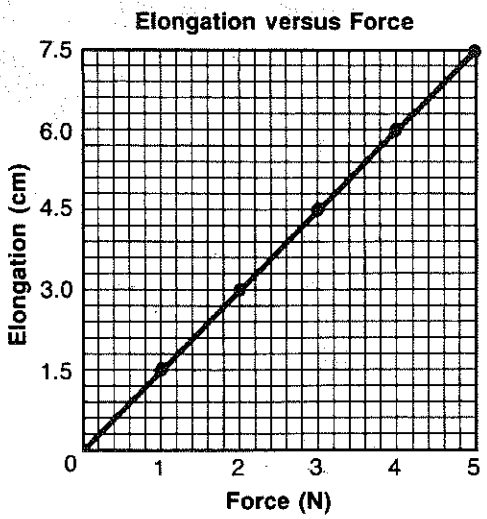
Frequently an investigation will involve finding out how changing one quantity affects the value of another. The quantity that is deliberately manipulated is called the *independent variable*. The quantity that changes as a result of the independent variable is called the *dependent variable*.

The relationship between the independent and dependent variables may not be obvious from simply looking at the written data. However, if one quantity is plotted against the other, the resulting graph gives evidence of what sort of relationship, if any, exists between the variables. When plotting a graph, take the following steps.

1. Identify the independent and dependent variables.
2. Choose your scale carefully. Make your graph as large as possible by spreading out the data on each axis. Let each space stand for a convenient amount. For example, choosing three spaces equal to ten is not convenient because each space does not divide evenly into ten. Choosing five spaces equal to ten would be better. Each axis must show the numbers you have chosen as your scale. However, to avoid a cluttered appearance, you do not need to number every space.
3. All graphs do not go through the origin (0,0). Think about your experiment and decide if the data would logically include a (0,0) point. For example, if a cart is at rest when you start the timer, then your graph of speed versus time would go through the origin. If the cart is already in motion when you start the timer, your graph will not go through the origin.
4. Plot the independent variable on the horizontal (x) axis and the dependent variable on the vertical (y) axis. Plot each data point. Darken the data points.
5. Label each axis with the name of the variable and the unit. Using a ruler, darken the lines representing each axis.
6. If the data points appear to lie roughly in a straight line, draw the best straight line you can with a ruler and a sharp pencil. Have the line go through as many points as possible with approximately the same number of points above the line as below. Never connect the dots. If the points do not form a straight line, draw the best smooth curve possible.
7. Title your graph. The title should clearly state the purpose of the graph and include the independent and dependent variables.

The graph shown was prepared using good graphing techniques. Go back and check each of the items mentioned above.

Force (N)	Elongation (cm)
0	0.0
1	1.5
2	3.0
3	4.5
4	6.0
5	7.5



Name _____

6 Physics Skills

Graph the following sets of data, using proper graphing techniques.

1.

Pressure (torr)	Volume (mL)
100	800
200	400
400	200
600	133
700	114
800	100
1000	80

2.

Time (s)	Distance (m)
0	0
1	5
2	20
3	45
4	80
5	125

3.

Time (s)	Speed (m/s)
0	0
1	20
2	45
3	60
4	84
5	105

Date _____ Period _____ Name _____

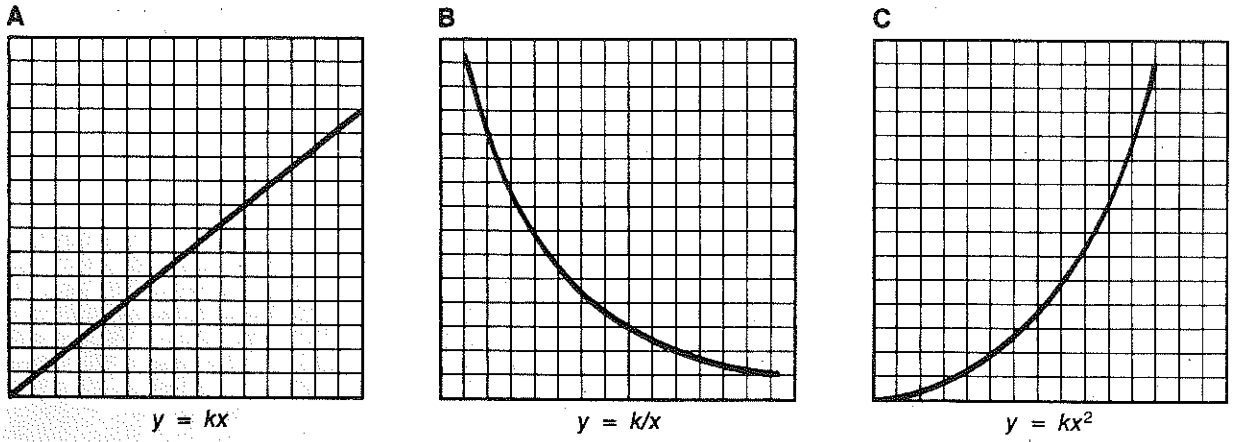
7 Physics Skills

Use with Chapter 2.

Interpreting Graphs

In laboratory investigations, you generally control one variable and measure the effect it has on another variable while you hold all other factors constant. For example, you might vary the force on a cart and measure its acceleration while you keep the mass of the cart constant. After the data are collected, you then make a graph of acceleration versus force, using the techniques for good graphing. The graph gives you a better understanding of the relationship between the two variables.

There are three relationships that occur frequently in physics. If the dependent variable varies directly with the independent variable, the graph will be a straight line, as shown in graph A. If y varies inversely with x, the graph will be a hyperbola as shown in graph B. The third relationship, in which y varies directly with the square of x, gives a parabola (graph C).



Sometimes you need information about a value that you have not determined experimentally. Reading from the graph between data points is called *interpolation*. Reading from the graph beyond the limits of your experimentally determined data points is called *extrapolation*. Extrapolation must be used with caution because you cannot be sure that the relationship between the variables remains the same beyond the limits of your investigation.

1. Suppose you recorded the following data during a study of the relationship of force and acceleration. Prepare a graph showing these data.

Force (N)	Acceleration (m/s^2)
10	6.0
20	12.5
30	19.0
40	25.0

Name _____

7 Physics Skills

a. Describe the relationship between force and acceleration as shown by the graph.

_____

b. What is the slope of the graph? Remember to include units with your slope. One newton equals 1 kg · m/s^2.

c. What physical quantity does the slope represent?

_____

d. Write an equation for the line.

e. What is the value of the force for an acceleration of 15 m/s^2?

f. What is the acceleration when the force is 50.0 N?

2. The following data show the distance an object travels in certain time periods. Prepare a graph showing these data.

Time (s)	Distance (cm)
0	0
1	3
2	12
3	27
4	48

a. Describe the relationship between x and y and write a general equation for the curve.

_____

b. Is the distance traveled greater between 0 s and 1 s or 3 s and 4 s?

_____

c. Is the slope of the curve greater between 1 s and 2 s or 3 s and 4 s?

_____

Name _____

7 Physics Skills

3. Answer the questions about the sets of data below. First try answering the questions by simply looking at the data. Then prepare a graph of each set and see if the questions are easier to answer.

A.

x	y
1	3
2	6
3	9
4	12
5	15

B.

x	y
0	0
1	2
2	8
3	18
4	32

C.

x	y
1	80
2	40
3	27
4	20
5	16

D.

x	y
0	2
1	4
2	6
3	3
4	2

a. In which graph is y directly proportional to x?

_____

b. In which graph does y decrease as x increases?

_____

c. In which set of data is y inversely proportional to x?

_____

d. Which graph does not seem to picture a simple relationship?

_____

e. Which graph has the general equation $y = kx^2$?

_____

Date _____ Period _____ Name _____

12 Physics Skills

Use with Chapter 2.

Factor-Label Method for Converting Units

A very useful method of converting one unit to an equivalent unit is called the factor-label method of unit conversion. You may be given the speed of an object as 25 km/h and wish to express it in m/s. To make this conversion, you must change km to m and h to s. If a quantity is multiplied by 1, its value does not change. Any quantity divided by its equivalent is equal to 1. Because 1000 m = 1 km and 60 s = 1 min and 60 min = 1 h,

$$\frac{1000\text{ m}}{1\text{ km}} = 1 \qquad \frac{1\text{ min}}{60\text{ s}} = 1 \qquad \frac{1\text{ h}}{60\text{ min}} = 1$$

To change 25 km/h to m/s, you must multiply by a series of factors so that the units you do not want will cancel out and the units you want will remain.

$$\frac{25\ \cancel{\text{km}}}{1\ \cancel{\text{h}}} \left| \frac{1000\text{ m}}{1\ \cancel{\text{km}}} \right| \frac{1\ \cancel{\text{h}}}{60\ \cancel{\text{min}}} \left| \frac{1\ \cancel{\text{min}}}{60\text{ s}} \right. = 1$$

To convert 80 milliliters to liters, first choose the factor. Because 1 L = 1000 mL,

$$\frac{1\text{ L}}{1000\text{ mL}} = 1$$

Use this factor for your conversion as follows.

$$\frac{80\ \cancel{\text{mL}}}{} \left| \frac{1\text{ L}}{1000\ \cancel{\text{mL}}} \right. = 0.08\text{ mL}$$

Carry out the following conversions using the factor-label method.

1. How many seconds are in a year?

2. Convert 28 km to cm.

3. Convert 45 kg to mg.

Name _____

12 Physics Skills

4. Convert 450 m/s to m/h.

5. Convert 85 cm/min to m/s.

6. Convert the speed of light, 3.0×10^8 m/s, to km/day.