CONVERT THE FOLLOWING METRIC MEASUREMENTS

1. 275m = ____________cm
2. 220kg = ____________g
3. 2ml = ____________L
4. 3298mg = ____________kg
5. 67,832cm = ____________Hm
6. 756Dg = ____________mg
7. 24ml = ____________Dl
8. 432,587mm = ___________m
9. 26L = ____________kl
10. 35Hg = ____________mg

Kilo  Hecto  Deca  Base  deci  centi  milli

kg  Hg  dg  g  cg  mg

\[10^3 \quad 10^2 \quad 10^1 \quad 10^0 \quad 10^{-1} \quad 10^{-2} \quad 10^{-3}\]

Remember

King Henry Died By Drinking Chocolate Milk
Conversion of Units

1 meter = 3.28 ft
1 meter = 100 cm
1000 mg = 1 g
1000 g = 1 kg
1 mile = 1.6 km
1 hr = 3600 sec
1 gallon = 3.785 liter
1 liter = 1000 cm³

1. 20 miles / hr = ____________ meter/sec
2. 15 meter³ = ______________ cm³
3. 32 ft / sec² = ______________ m / sec²
4. 4 m² = ______________ cm²
5. 200 mg = ______________ kg
6. 38 miles / gallon = ______________ km / liter
7. 6380 km = ______________ miles

8. What is the area of a rectangle of side 'a' = 4 m and side 'b' = 5 ft.
   (hint: Area = a.b)

9. 15 lt = ______________ cm³
10. $10^7$ erg = 1 Joule
    1 erg = ___________ Joule

Planck’s constant = $6.626 \times 10^{-34}$ Joule-sec; express it in erg-sec

Example

\[
20 \text{ m/sec} \times \frac{1600 \text{ m}}{1 \text{ mi}} \times \frac{1 \text{ hr}}{3600 \text{ sec}} = 8.89 \text{ m/sec}
\]

1 m = 1600 m
1 hr = 3600 sec
Math Review for Regular Physics

Name: ____________________________  Date: ____________________________
Block: ____________________________

1. 
\[ \sin \theta = \]
\[ \cos \theta = \]
\[ \tan \theta = \]

Pythagorean theorem: \[ a^2 + b^2 = c^2 \]
If \( a = 3 \) and \( b = 4 \) then \( c = ? \)
If \( a = 12 \) and \( c = 20 \), then \( b = ? \)

2. 
- Straight line: \[ \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1 \]
- Parabola: \[ \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \]
- Hyperbola: \[ x^2 + y^2 = r^2 \]
- Circle: \[ y = mx + b \]
- Ellipse: \[ y^2 = 4ax \]

4. Solve for \( x \), find the roots of a quadratic equation.
\[ x^2 + 9x + 20 = 0 \]

4. \( (x + 3)(x - 2)(x - 1) = ? \)

5. \( e^x \cdot e^y = e^z \)
then \( z = ? \)

6. \( (10^{20} / 10^{-4})^{1/2} = \)
7. If \( x^2 \cdot y = z \cdot t \), then \( x = (z \cdot t / y)^{1/2} \)

similarly solve for \( r \) in the equation \( F = G \cdot m_1 \cdot m_2 / r^2 \)

then \( r = \)

8. If \( T = 2 \pi (L/g)^{1/2} \), then \( L = ? \)

9. Write down the following formulas

Volume of a sphere of radius \( 'r' \) = 
Surface area of a sphere of radius \( 'r' \) = 
Volume of a cube of side \( 'a' \) = 
Area of a rectangle of sides \( 'a' \) and \( 'b' \) = 
Perimeter of rectangle of side \( a \) and \( b \) = 
Circumference of a circle of radius \( 'r' \) = 
Area of a circle of radius \( 'r' \) = 
Area of a triangle of height \( 'h' \) and base \( 'b' \) =

10. If radius is measured in meter, then area of a circle which is \( \pi \) times radius \( x \) radius is measured in meter\(^2\). So what should the volume of a sphere which is \( (4 \pi /3) \) times radius \( x \) radius \( x \) radius, measured in?

11. \( \log_b(a) = \log_{10}(a) / \log_{10}(b) \)

\( \log (a^b) = \)
\( \log (a/b) = \)
\( \log (a \cdot b) = \)

12. \( 5x + 3y = 9 \quad ---- \quad 1 \)
\( 4x - 3y = 18 \quad ---- \quad 2 \)
Name: ____________________  Date: ____________________
Block: ____________________

1. If ‘d’ is the distance traveled and ‘t’ the time taken, the velocity ‘v’ is given by \( v = \frac{d}{t} \). Using that fill in the following: A car going at a speed of 45 km/hr covers _______ km in 20 minutes.

2. 55 miles/hr is ___________ m/sec. (1 mile = 1.6 km, 1 km = 1000 m, 1 hr = 3600 sec)

3. 160 km/hr is ______________ miles/hr.

4. Fill in units of length mass and time in SI. As an example the CGS is done.

<table>
<thead>
<tr>
<th>SI</th>
<th>CGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>cm</td>
</tr>
<tr>
<td>Mass</td>
<td>gram</td>
</tr>
<tr>
<td>Time</td>
<td>second</td>
</tr>
</tbody>
</table>

5. Gravitational force is
   (a) always attractive
   (b) always repulsive
   (c) Both
   Gravitational forces between two masses
   (a) increases with distance
   (b) decreases with distance
   (c) is independent of distance

6. When no external forces act on a body in motion along a straight line,
   (a) it goes around in a circle
   (b) it continues to move along the straight line
   (c) comes to rest eventually

7. If you drop a feather and a rock on the moon
   (a) they will hit the surface at the same time
   (b) the rock will hit first
   (c) the feather will hit first
   (d) cannot be determined
8. When you roll a marble on a polished floor it comes to rest eventually because
   (a) it is the tendency of all bodies to rest
   (b) the marble has inertia
   (c) you need to apply a continuous force to keep an object moving
   (d) even a polished floor and smooth marble have friction which slows it down

9. If you throw an object in the air (neglect air resistance) its path will approximate a
   (a) a circle
   (b) an ellipse
   (c) two straight lines one up and one down
   (d) a parabola

10. Electrical forces between two charged objects are
    (a) always attractive
    (b) always repulsive
    (c) depends on the type of charge on the objects

11. Nucleus of an atom consists of one or more of the following. Tick all applicable choices
    (a) electrons
    (b) protons
    (c) neutrons
    (d) photons
    (e) all of the above

12. Fill in the blanks with the choice given. Metals are usually _________ (good / bad) conductors of heat and _________ (good / bad) conductors of electricity.

13. The colors of a rainbow are

14. If the Sun were to suddenly disappear, what would happen to the Earth? How long would it take for Earthlings to know, that their Sun no longer exists?

15. What are the four fundamental forces in nature?
Physics Skills

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. $1.23 \times 10^6$
6. $2.5 \times 10^{-3}$
7. $1.54 \times 10^4$
8. $5.67 \times 10^{-1}$

Solve for $x$ in the following problems.

4. $\frac{3x}{y} = \frac{6g}{b}$
5. $d = \frac{r}{x}$
6. $\frac{2x^2}{3} = dg$
7. $\frac{2\sqrt{x}}{c} = \gamma$

Make the following conversions.

8. $4008 \text{ g} = \text{ mg}$
9. $48 \text{ mL} = \text{ l}$
10. $239 \text{ mm} = \text{ cm}$
11. $38 \text{ kg} = \text{ mg}$

Answer the questions that refer to the following triangles.

For triangle I, what is the cosine of angle A?
What is the tangent of angle A for triangle I?

Find side c for triangle II.

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

Answer the questions that refer to the following graphs.

Which graph represents an inverse relationship?

Which of the graphs could have the equation $y = kx^2$?

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

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>0.5</td>
<td>8</td>
</tr>
<tr>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>2</td>
<td>26</td>
</tr>
<tr>
<td>3</td>
<td>38</td>
</tr>
<tr>
<td>4</td>
<td>50</td>
</tr>
</tbody>
</table>

What is the slope of the line?

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

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

What is the value of $x$ when $y = 0$?
Practice Graphing – Blue

1. On the graph provided answer the following

   a. Label the x and y axis in order to plot the following data points

   b. Plot the following data points on the graph provided and draw a line that best fits the shape of the graph

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>25</td>
</tr>
</tbody>
</table>

   c. Determine the slope of the graph above $$slope = \frac{\Delta y}{\Delta x} = \frac{y_f - y_i}{x_f - x_i}$$
Sasha, Kim, and Barry decided to have a 10-km bicycle race after school. They asked the coach to show them how far 10 km was on the school track. They then had their race on the track. Their race results are shown on the time-distance graph below. Use this graph to fill in the table of race results, calculate average speeds, and answer the questions.

1. Which cyclist kept a constant speed during the entire race? What was this speed?

2. Which cyclist won the race? What was the winning time?

3. Which cyclist placed second in the race? What was second place time?

4. Which cyclist placed last? What was last place time?

5. Which cyclist started off fastest?
Graphing
Distance vs Time

On the graph provided perform the following.

Label "time" on the x-axis and "distance" on the y-axis. Choose an appropriate scale. Plot both graphs on the same grid. They represent two different objects.

<table>
<thead>
<tr>
<th>Distance#1 (m)</th>
<th>Distance#2 (m)</th>
<th>Time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>15</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>15</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>15</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Find the slope of each line. \( M = \frac{\Delta y}{\Delta x} = \frac{\Delta distance}{\Delta time} \)

Which line has the greatest slope?

What does that tell you about the speed of each object?
Graphing
Velocity (speed) vs Time

On the graph provided perform the following.

Label "time" on the x-axis and "speed" on the y-axis. Chose an appropriate scale.

<table>
<thead>
<tr>
<th>Speed (m/s)</th>
<th>Time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>25</td>
<td>5</td>
</tr>
</tbody>
</table>

Find the slope of the line.  \( M = \frac{\Delta y}{\Delta x} = \frac{\Delta \text{speed}}{\Delta \text{time}} \)

What does the slope of the line tell you about speed.

When the speed increases we call it acceleration.
Bell Ringer
Graphing

On the graph provided perform the following.

a.) Finish labeling the x-axis and y-axis. Put distance on the y-axis and time on the x-axis.
b.) Plot the following data points on the graph provided

c.)

<table>
<thead>
<tr>
<th>Time (s)</th>
<th>Position (m)</th>
<th>Time (s)</th>
<th>Position (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>5</td>
<td>6.0</td>
<td>?</td>
</tr>
<tr>
<td>2.0</td>
<td>7</td>
<td>?</td>
<td>17</td>
</tr>
<tr>
<td>3.0</td>
<td>?</td>
<td>8.0</td>
<td>19</td>
</tr>
<tr>
<td>?</td>
<td>11</td>
<td>9.0</td>
<td>21</td>
</tr>
<tr>
<td>5.0</td>
<td>13</td>
<td>10.0</td>
<td>?</td>
</tr>
</tbody>
</table>
c.) Calculate the slope of the line. \( m = \frac{\Delta y}{\Delta x} \)

d.) What is the y-intercept of the graph?

e.) What is the meaning of the slope of the line?

f.) Fill in the values for the "?" in the data table.
   When time is 3.0s then position is ________.
   When time is 6.0s then position is ________.
   When time is 10.0s then position is ________.
   When position is 11m then time is ________.
   When position is 17m then time is ________. 
1. Graphical Analysis: distance-time graph

Determine the velocity of the particle at the time intervals requested.

<table>
<thead>
<tr>
<th>Time (s)</th>
<th>Velocity (m/s)</th>
<th>Time (s)</th>
<th>Velocity (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.2</td>
<td></td>
<td>22.4</td>
<td></td>
</tr>
<tr>
<td>3.8</td>
<td></td>
<td>13.3</td>
<td></td>
</tr>
</tbody>
</table>

Answer the following using the Position vs Time Graph

a. List the interval(s) were the particle was moving in a positive direction.

b. List the interval(s) where the particle was stopped.

c. List the interval(s) where the particle was moving in a negative direction.

d. What was the displacement of the particle during the first 22 seconds?
2. Graphical Analysis: velocity-time graph

Determine the acceleration of the particle at the time intervals requested.

<table>
<thead>
<tr>
<th>Time (s)</th>
<th>Acceleration (m/s²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3</td>
<td></td>
</tr>
<tr>
<td>11.9</td>
<td></td>
</tr>
<tr>
<td>23.8</td>
<td></td>
</tr>
<tr>
<td>6.4</td>
<td></td>
</tr>
</tbody>
</table>

Determine the displacement of the particle at the intervals requested.

<table>
<thead>
<tr>
<th>Position</th>
<th>Displacement (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A - B</td>
<td></td>
</tr>
<tr>
<td>B - C</td>
<td></td>
</tr>
<tr>
<td>C - D</td>
<td></td>
</tr>
<tr>
<td>D - E</td>
<td></td>
</tr>
<tr>
<td>A - E</td>
<td></td>
</tr>
</tbody>
</table>
1. Determine the acceleration of the particle at the intervals requested.

<table>
<thead>
<tr>
<th>Position</th>
<th>Acceleration (m/s^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A - B</td>
<td></td>
</tr>
<tr>
<td>B - C</td>
<td></td>
</tr>
<tr>
<td>C - D</td>
<td></td>
</tr>
<tr>
<td>D - E</td>
<td></td>
</tr>
<tr>
<td>E - F</td>
<td></td>
</tr>
</tbody>
</table>
Answer the following using the Velocity Time Graph

a. List the interval(s) where the particle was at a constant velocity.

b. List the interval(s) where the particle was going faster.

c. List the interval(s) where the particle was slowing down.

d. Find the distance traveled during each interval.

e. Find the total distance traveled.
1. Determine the acceleration of the particle at the intervals requested.

<table>
<thead>
<tr>
<th>Position</th>
<th>Acceleration $(m/s^2)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>A - B</td>
<td></td>
</tr>
<tr>
<td>B - C</td>
<td></td>
</tr>
<tr>
<td>C - D</td>
<td></td>
</tr>
<tr>
<td>D - E</td>
<td></td>
</tr>
</tbody>
</table>
1. Determine the velocity of the particle the intervals requested.

<table>
<thead>
<tr>
<th>Intervals</th>
<th>Velocity (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A - B</td>
<td></td>
</tr>
<tr>
<td>B - C</td>
<td></td>
</tr>
<tr>
<td>C - D</td>
<td></td>
</tr>
<tr>
<td>D - E</td>
<td></td>
</tr>
</tbody>
</table>
**TRIGONOMETRY – FINDING ANGLES**

**Notes:**
1. Label sides: $o, a, h$
2. Choose a suitable ratio:
   \[
   \sin y = \frac{o}{h} \quad \cos y = \frac{a}{h} \quad \tan y = \frac{o}{a} \quad \checkmark
   \]
3. Calculate angle using $\sin^{-1}$, $\cos^{-1}$ or $\tan^{-1}$
   (You will need to use INV, 2NDF or SHIFT on your calculator)
   \[
   \tan y = \frac{15}{10} \quad \text{[INV tan (15 + 10) =]}
   \]
   \[
   y = 56.31^\circ \quad \text{or} \quad 15 + 10 = \text{INV tan}
   \]

**Exercises:**

1. Calculate the angle in each of the following:
   - a) $\sin a = 0.34$
   - b) $\cos b = 0.5$
   - c) $\tan c = 0.466$
   - d) $\sin d = 0.951$
   - e) $\cos e = 0.574$
   - f) $\tan f = 0.268$

2. Calculate the marked angle in each of the following:

3. A ladder 3m long leans against a wall. It reaches 2m up the wall. What angle does the ladder make with the ground?
VECTOR ADDITION

Sketch a diagram for each problem, then solve it.

1. Two people are pushing a disabled car. One exerts a force of 200 N east, the other a force of 150 N east. What is the net force exerted on the car? (Assume friction to be negligible.)

2. Two soccer players kick a ball simultaneously from opposite sides. Red #3 kicks with 50 N of force while Blue #5 kicks with 63 N of force. What is the net force on the ball?

3. An airplane flies due north at 100 m/s through a 30 m/s cross wind blowing from the east to the west. Determine the resultant velocity of the airplane.

4. A mountain climbing expedition establishes a base camp and two intermediate camps, A and B. Camp A is 11,200 m east of and 3200 m above base camp. Camp B is 8400 m east of and 1700 m higher than Camp A. Determine the displacement between base camp and Camp B.

5. A plane flies with a velocity of 52 m/s east through a 12 m/s cross wind blowing the plane south. Find the magnitude and direction (relative to due east) of the resultant velocity at which it travels.

6. An ambitious hiker walks 25 km west and then 35 km south in a day. Find the magnitude and direction (relative to due west) of her resultant displacement.

7. A boat heads directly across a river with a velocity of 12 m/s. If the river flows at 6.0 m/s find the magnitude and direction (with respect to the shore) of the boat's resultant velocity.

8. I went for a walk the other day. I went four avenues east (0.80 miles), then twenty-four streets south (1.20 miles), then one avenue west (0.20 miles), and finally eight streets north (0.40 miles).
   a. What distance did I travel?
   b. What's my resultant displacement?

9. A plane intends to fly north with a speed of 250 m/s relative to the ground through a high altitude cross wind of 50 m/s coming from the east. Determine ...
   a. the bearing that the plane should take (relative to due north) and
   b. the plane's speed with respect to the air.

10. At a particular instant, a stationary observer on the ground sees a package falling from a moving airplane with a speed \( v_{\text{observer}} \) at an angle \( \theta \) to the vertical. To the pilot flying horizontally at a constant speed relative to the ground the package appears to be falling vertically with a speed \( v_{\text{pilot}} \) at that same instant. What is the speed of the pilot relative to the ground in terms of the given quantities?