Problems: Name _____

1. 125 g to Kg 0.125 kg
2. 21.3 Km to cm 2.13 E6 cm
3. 3.34 mm to cm 0.334 cm
4. 728 nm to m 7.28 E-7 m
5. 40.4 Km to cm 4.04 E6 cm
6. 1.23 ml to L 1.23 E-3 L
7. 8.32 cg to mg 83.2 mg
8. 8.98 mg to g 8.98 E-3 g
9. 50.1 mm to Km 5.01 E-5 km
10. 30 m/s to mph 67 mph
11. $[3.0 \times 10^{-3}][2.0 \times 10^{5}] = 600$
12. $\frac{[4.6 \times 10^{1}][2.1 \times 10^{-4}]}{[1.64 \times 10^{34}]} = 5.89 \text{ E-}37$
13. $\frac{[2.3 \times 10^{14}]}{[4.17 \times 10^{9}]} = 5.51 \text{ E4}$
14. $[27.3 \times 10^{-22}][2.0 \times 10^{18}] = 5.46 \text{ E-}3$
15. $\frac{[4.2 \times 10^{14}][9.4 \times 10^{7}]}{[6.4 \times 10^{9}]} = 6.17 \text{ E12}$
16. $[789.23 \times 10^{2}][0.0045 \times 10^{15}] = 3.55 \text{ E17}$
17. $\frac{[1.7 \times 10^{9}][3.9 \times 10^{7}]}{[1.40 \times 10^{-6}]} = 4.74 \text{ E22}$
18. $\frac{[4.50 \times 10^{9}]}{[6.636 \times 10^{-34}]} = 6.78 \text{ E42}$
19. $\frac{[7.4 \times 10^{6}][1.9 \times 10^{-3}]}{[5.3 \times 10^{6}][1.7 \times 10^{-8}][2.4 \times 10^{5}]} = 0.65$

Distance versus displacement

1. A baseball player run 27.4 meters from the batter's box to first base, overruns first base by 3.0 meters, and then returns to first base. Compared to the total distance traveled by the player, what is the magnitude of the player's total displacement from the batter's box?
   Distance = 33.4 m / Displacement = 27.4

Hansel and Gretel walk 6 km north, 4 km east and then 3 km south.

2. How many km did they walk? 13 km
3. What is their displacement from home? 5 km

The high school is 12 km from my home.

4. If I only drive to and from work, how far do I drive each day? 24 km
5. What is my displacement? 0 km

$v = d/t$ or $d = vt$ or $t = d/v$

1. In a drill during basketball practice, a player runs the length of the 30-meter court and back. The player does this three times in 60 seconds. What is the average speed of the player during the drill? 3 m/s
2. On a highway, a car is driven 80 kilometers during the first 1.00 hour of travel, 50 kilometers during the next 0.50 hour, and 40 kilometers in the final 0.50 hour. What is the car's average speed for the entire trip? 85 km/h
3. A high-speed train in Japan travels a distance of 300 kilometers in 3.60×10^{3} seconds. What is the average speed of this train in m/s? 83.3 m/s
4. A group of bike riders took a 4.0-hour trip. During the first 3.0 hours, they traveled a total of 50 kilometers, but during the last hour they traveled only 10 kilometers. What was the group's average speed for the entire trip? 15 km/h
5. How long will it take an object to move 100 meters if the object is traveling with an average speed of 0.5 meter per second? 200 s
6. Two cars, A and B, are 400 meters apart. Car A travels due east at 30 meters per second on a collision course with car B, which travels due west at 20 meters per second. How much time elapses before the two cars collide? 8 s

$a = (v_f - v_i)/ t$

1. An object accelerates uniformly from 3.0 meters per second east to 8.0 meters per second east in 2.0 seconds. What is the magnitude of the acceleration of the object? 2.5 m/s^2
2. A car increases its speed from 9.6 meters per second to 11.2 meters per second in 4.0 seconds. What is the average acceleration of the car during this 4.0-second interval? 0.4 m/s^2
3. The speed of a wagon increases from 2.5 meters per second to 9.0 meters per second in 3.0 seconds as it accelerates uniformly down a hill. What is the magnitude of the acceleration of the wagon during this 3.0-second interval? 2.167 m/s^2
4. A child riding a bicycle at 15 m/s accelerates at -3.0 m/s^2 for 4.0 seconds. What is the child's speed at the end of this 4.0-second interval? 3 m/s
5. My 1996 Camry accelerates from 0 to 30 m/s in 8.3 s. What is its acceleration? 3.6 m/s^2 If it can brake to a stop in 5.7 s, what is its acceleration? – 5.2 m/s^2

$v_f^2 = v_i^2 + 2a(x_f - x_i)$

1. What is the magnitude of the car's acceleration if a car accelerates uniformly from rest to 15 m/s over a distance of 100 meters? 1.125 m/s^2
2. A race car starting from rest accelerates uniformly at a rate of 4.90 m/s^2. What is the car's speed after it has traveled 200 meters? 44.3 m/s
3. A skater increases her speed uniformly from 2.0 meters per second to 7.0 meters per second over a distance of 12 meters. The magnitude of her acceleration as she travels this 12 meters is 1.875 m/s^2
4. A car initially traveling at a speed of 16 meters per second accelerates uniformly to a speed of 20 meters per second over a distance of 36 meters. What is the magnitude of the car's acceleration? 2 m/s^2
5. An object with an initial speed of 4.0 meters per second accelerates uniformly at 2.0 meters per $second^2$ in the direction of its motion for a distance of 5.0 meters. What is the final speed of the object? 36 m/s

$d = \frac{1}{2} at^2$ ($g = 9.8$ m/s^2 or 10 m/s^2)

1. A baseball dropped from the roof of a tall building takes 3.1 seconds to hit the ground. How tall is the building? 47 m
2. A rock falls freely from rest a total of 32 meters near the surface of a planet where the acceleration due to gravity is 4.0 m/s^2. How many seconds does it take to reach the ground? 4 s

3. A student standing on the roof of a 50.0-meter-high building kicks a stone. How much time is required for the stone to reach the level ground below? 3.2 s
4. If a ball hits the ground 4.0 seconds after being released, approximately how high is the cliff? 80 m
5. A clam dropped by a sea gull takes 3.0 seconds to hit the ground. What is the sea gull's approximate height above the ground at the time the clam was dropped? 45 m

$d = v_o t + \frac{1}{2} at^2$

1. A baseball thrown at 3 m/s from the roof of a tall building takes 3.1 seconds to hit the ground. How tall is the building? 57.35 m
2. If a ball hits the ground 4.0 seconds after being thrown with an initial speed of 10 m/s, approximately how high is the cliff? 120 m
3. A clam that is tossed downward at 1.5 m/s by a sea gull takes 3.0 seconds to hit the ground. What is the sea gull's approximate height above the ground at the time the clam was dropped? 49.5 m
4. A rock falls freely a total of 33 meters near the surface of a planet where the acceleration due to gravity is 6.0 m/s^2. If it is thrown initially at 2 m/s, how many seconds does it take to reach the ground? 3 s

$d = d_o + v_o t + \frac{1}{2} at^2$

1. A baseball thrown down at 3 m/s from the penthouse window, which is 10 m below the top of a tall building. How tall is the building if it takes 8.0 seconds to hit the ground? 354 m
2. A soccer play starts at the 20 meter line with the center running at 3 m/s. What meter line will she end up on if she accelerates for 4 seconds at 1.5 m/s^2? 44 m
3. A manned spaceship has just undocked from the international space station which is traveling at 7700 m/s when the rockets accelerated it at 12 m/s^2 at a tangent to the orbit. If the ISS is350 km above Earth, how many km will the spaceship be from Earth in 1 hour? 105,830

Freefall

1. Fill in the following chart for free fall on Earth (10 m/s^2)

Time	Final Speed	Average Speed	Distance this second	Total Distance	(Distance this second) (1/2a)	(Total Distance) (1/2a)
0 second	0 m/s		0 m	0 m		
1	10 m/s	5 m/s	5 m	5 m	1	1
2	20	15	15	20	3	4
3	30	25	25	45	5	9
4	40	35	35	80	7	16
5	50	45	45	125	9	25

2. Fill in the following chart for free fall on Mars (3.8 m/s^2)

Time	Final Speed	Average Speed	Distance this second	Total Distance	(Distance this second) (1/2a)	(Total Distance) (1/2a)
0 second	0 m/s		0 m	0 m		
1	3.8	1.9	1.9	1.9	1	1
2	7.6	5.7	5.7	7.6	3	4
3	11.4	9.5	9.5	17.1	5	9
4	15.2	13.3	13.3	30.4	7	16
5	19	17.1	17.1	47.5	9	25

3. A rock dropped off a bridge takes 5 seconds to hit the water. Approximately what was the rock's velocity just before impact? 50 m/s
4. A ball dropped from rest falls freely until it hits the ground with a speed of 20 m/s. What is the time the ball is in free fall? 2 s
5. An object, initially at rest, falls freely near the Earth's surface. How long does it take the object to attain a speed of 98 m/s? 9.8 or 10 s