Displacement, Speed, Velocity, Momentum and Acceleration Packet

General Science

Displacement, Speed and Velocity

Directions: Watch the videos and practice the problems on this khan academy website for displacement, velocity, and speed. Then answer the questions that follow, pay attention to units!
https://www.khanacademy.org/science/physics/one-dimensional-motion/displacement-velocity-time/a/what-is-velocity

Useful Equations: v (velocity) = d (distance) / t (time), v * t = d, t = d / v
Note: v can be substituted for s (speed) for scalar quantities.

1. **What is the difference between a vector and a scalar quantity?**

2. **Grace drives her car 40 km in 75 minutes. What is her average speed in kilometers per hour?**

3. **Emily drives her car with a constant speed of 80 miles per hour. How far can she travel in 165 minutes?**

4. **Pete rides his motorcycle 270 km in 135 minutes. What is his average speed in kilometers per hour?**

5. **Sarah roller skates with a constant speed of 20 km/h. How far can she travel in 30 minutes?**

6. An airplane flies 975 miles in 75 minutes. What is its average speed in miles per hour?

7. An airplane flies with a constant speed of 800 km/h. How far can it travel in 75 minutes?

8. Abigail travels in an airplane a distance of 1440 km. For one-third of the distance, the airplane flies at a speed of 640 km/h, and for the rest of the distance, it flies at a speed of 680 km/h. How long does the trip take?

9. A van moves for 3.5 hours with a constant speed of 71 mph and then for another 4 hours 5 minutes with a constant speed of 72 mph. What is its average speed for the total trip?

10. Cindy travels in an airplane a distance of 840 km. For one-fourth of the distance, the airplane flies at a speed of 1000 km/h, and for the rest of the distance, it flies at a speed of 600 km/h. How long does the trip take?

Relative Velocity

Directions: Watch the khan academy video and practice the problems offered in their unit and then complete the problems below. Make sure that you have the correct units and show your work! Drawing pictures is usually a good way to start these problems.

1. Two cars leave the Canadian border at the same time. One is heading toward Jackman (S) and is moving at 58 miles per hour. The other is headed toward Canada (N) at 71 miles per hour.
    a. What is the speed of the Canadian traveler relative to the speed of the American traveler.

    b. After 1.5 hours what is the distance between the two travellers?

2. Two boats are racing West across big wood pond. Boat A is moving at 20 miles per hour and boat B is moving at 32 miles per hour
    a. How fast is boat B moving relative to boat A?

    b. After 3 hours how far apart are the two boats?

3. **Mr. Worster is on a passenger train that is headed East at 45 miles per hour. Suddenly he gets very hungry, so he gets up and walks West toward the vending machine at 3 miles per hour.**

   a. **If someone on the ground were watching the train go by, how fast would it appear Mr. Worster is moving?**

4. **Two boats head out on the Moose River headed East. Boat A travels 53 Km in 1 hour and 45 minutes while boat B travels 22Km in 25 minutes. What is boat B's relative velocity compared to boat A?**

5. **Two track athletes are in a 400m dash. When the starting gun is fired, athlete A is running at 8 m/s and athlete B is running at 11.5 m/s. After 15 seconds, how far apart are athletes A and B?**

   a. **If athlete A accelerates to a velocity of 14m/s, how long will it take athlete A to catch athlete B?**

Momentum

Directions: Watch this khan academy video and answer the questions I have provided below.
https://www.khanacademy.org/science/ap-physics-1/ap-linear-momentum/introduction-to-linear-momentum-and-impulse-ap/v/introduction-to-momentum

Useful Equations: p (momentum) = m (mass) * v (velocity)
Given the following data, solve for momentum.

Object	Mass (kg)	Velocity (m/s)	Momentum (kg * m/s)
Bird	.04	19	.76
Football player	100	10	
Skier	60	20	
Bullet	.004	600	
Frog	.9	12	
Meteorite	.1	1,000	
Baseball	.14	30	
Wagon	2	3	
Satellite	3,000	8,000	

22.) A steel ball whose mass is 2.0 kg is rolling at a rate of 2.8 m/s. What is its momentum?
Looking for?
Given?
Relationships? (Some form of p = m * v, p / v = m, v = p / m

23.) A marble is rolling at a velocity of 1.5 m/s with a momentum of 0.10 kgm/s. What is its mass?
Looking for?
Given?
Relationships?

Challenge

Directions: Using some things that you can find around your house, develop an experiment where you compare two masses, two velocities, and two momentums. Use your phones and take pictures or video of the process and e-mail it to the class (me and your peers).

Procedure: Take two items inside of your house that roll. Use your household scale to get the mass of each, this will likely be in pounds so please convert (1lb. = .45kg). Caution your items will have to be large enough to get a mass using whichever scale you have available. Then using rulers, yard sticks, meter sticks, tape measures, etc., lay out a 2-5 meter strip. You will then have to time how long the rolling item takes to complete whatever distance you choose and record that time. Now you can find the object's speed, using v = d/t. Next repeat the previous steps for the other object. Finally find each momentum and compare. Fill in table provided.

Object	Mass (kg)	Distance (m)	Velocity (m/s)	Momentum (kg*m/s)

Post-Lab:
1. **Did the object with greater mass, velocity, or both, have the greater momentum?**

2. **Could the lighter object ever have a greater momentum?**

3. **Could the slower object ever have a greater momentum?**

4. **Why couldn't we use pounds, feet, and minutes for units?**