

Solar Sails Worksheet **Answer Key**

Please complete all questions and sections below, writing text answers in complete sentences.

1. Why do aerospace engineers want to develop forms of space travel other than rockets?
Example answers: Rockets have limited speed and distance because they can only carry a set amount of fuel. Rockets cannot travel into deep space in a reasonable amount of time, so we cannot explore very far using them.
2. What are some of the benefits of using solar sails?
Example answers: Solar sails can accelerate indefinitely, so they can be used to travel and explore deep into space. Solar sails use light for propulsion, so no fuel needs to be carried in order to propel them through space.
3. Draw a schematic of your solar sail below, labeling all materials needed to construct it.

	Materials List

4. Describe Newton's three laws of motion.
 - An object in motion tends to stay in motion, and an object at rest tends to stay at rest (inertia).
 - An object's acceleration is proportional to the force applied to it and inversely proportional to the mass of the object. $\text{Force} = \text{mass} * \text{acceleration}$
 - For every force acting on an object, an equal and opposite force opposes it on the object enacting the force.
5. Where in this experiment did you observe each of these three laws of motion?
 - The solar sail resisted motion at first because it was at rest.
 - A heavier solar sail moves slower with the same amount of light (wind) acting on it.
 - The light (wind) pressing on the solar sail was pushed backward after it contacted and pushed the solar sail.

Name: _____ Date: _____ Class: _____

Testing

Complete the table below with information from each solar sail trial.

Solar Sail Design Name/Description	Trial #	Distance Traveled (m)
Design 1:	1	
	2	
	3	
Design 2 (redesign):	1	
	2	
	3	

Design and Improvements

1. If you could redesign your solar sail, what would you change to make it travel farther?
Example answers: Make it lighter, make the sail bigger, change the sail shape.

2. What are the most important design considerations when constructing and testing solar sails?
Example answers: The sail size is important because it changes the amount of force the sail experiences by increasing or decreasing the number of photons contacting it. The mass of the satellite affects the amount of acceleration it experiences for a given force.

Fill in the Blanks

In order for solar sails to propel probes through space, light/wave energy is converted into

kinetic/mechanical energy when the photons impact the solar sail and enact a force on the satellite.