NHU/NASA Summer Institute

Lesson Plan

Student Name _Justin Trinh-Halperin_ Date _November 1, 2003_

Lesson Plan Title	Controlled Propulsion and Acceleration
Grade Level	8th Grade
Concept/Topic to Teach	The concept of how jet and rocket engines provide adequate thrust to propel a vehicle to an established distance and how decreased propulsion acts as a braking mechanism.
Standards	8.2. Unbalanced forces cause changes in velocity. As a basis for understanding this concept: a. *Students know* a force has both direction and magnitude. d. *Students know* how to identify separately the two or more forces that are acting on a single static object, including gravity, elastic forces due to tension or compression in matter, and friction. e. *Students know* that when the forces on an object are unbalanced, the object will change its velocity (that is, it will speed up, slow down, or change direction). f. *Students know* the greater the mass of an object, the more force is needed to achieve the same rate of change in motion.
General Goals	The goal of this lesson is to give students the understanding of how thrust as a force agent can be controlled to accurately place an object at a specific location. The concept that a rocket ship or the space shuttle does not need brakes while accelerating or orbiting.
Specific Objectives	How the amount of force applied to an object will determine the distance the object will travel. Students will take into account resistance forces working against the object.
Required Materials	Vocabulary Worksheet

	Card Stock Paper Space Shuttle Cut-outs http://spacelink.nasa.gov/Instructional.Materials/NASA.Educational.Products/Space.Shuttle.Glider/Space.Shuttle.Glider.pdf Tape Glue Card-Stock Paper Scissors Drinking Straws Fishing Line Long Balloons (not figurine balloons)
Anticipatory Set	1. How come when a rocket is sent up, it doesn't just keep on going? 2. How does a jet plane slow down while in the air? 3. How does a football player know how hard to throw a football to reach a player 20 yards away?
Step-by-Step Procedures	Advance Work: Download the space shuttle glider kit from the following NASA web site: http://spacelink.nasa.gov/Instructional.Materials/NASA.Educational.Products/Space.Shuttle.Glider/Space.Shuttle.Glider.pdf Make enough copies onto card-stock paper for your entire class to have one. String fishing line across your class room, placing a straw that has been cut in half, on the string before you secure it to one side of your room. Make sure the straw slides smoothly across the line. 1. Introduce the concept that an unbalanced force is needed to start an object in motion along with the concept of thrust. Have students complete the vocabulary worksheet to further their knowledge and understanding of the terms used in this lesson. 2. Have students follow the directions on the NASA space shuttle glider cut-out to make their own shuttle. 3. Provide each student with a thrust lab worksheet to record their data. The problem or question the students are challenged with is, "How much air (aka force) is needed to propel the space shuttle glider across the room, stopping within three feet of the wall?" 4. Have students create a hypothesis based on their knowledge of balloons as to how many balloons will be needed to propel the glider and how full they should be. 5. Once students have generated a hypothesis, test it by taping the shuttle upside down to the straw that is threaded on the fishing line. 6. Tape one or two inflated balloons (not sealed or tied) to each side of the shuttle and to the wings. Have one student hold the air in the balloon while the other student tapes the balloon to the shuttle. The longer

	balloons work best for this. 7. Have a 3..2..1 blast off count down and let it go. 8. Record each try in the lab log book noting how many balloons, how much air and how far the shuttled traveled. 9. Have students repeat this process until they can consistently reach their target mark. (In my classroom, two long balloons, inflated to about 75% worked perfectly. 10. Have students analyze their data and draw their conclusion.
Plan for Guided Practice	1. Have students follow the directions on the NASA space shuttle glider cut-out to make their own shuttle. 2. Discussion - How do you think scientists figured out how much propulsion and thrust a rocket needed to leave the atmosphere? 3. Watch the movie October Sky, and draw similarities to the processed you used to determine needed thrust and the needs of the students in the movie.
Plan for Independent Practice	Have students develop a list of objects and actions they do at home or at school that use controlled force.
Assessment (based on objectives)	Students will be assessed through a series of questions including cloze, short answer, word bank and multiple choice. Students will also be assessed on their completion of their science lab worksheet and their participation during the activity.
Adaptations (ELL students or special populations)	Students can be paired with other students for literary support. Students may opt to use a template of the scientific process. Home language support materials may be available through various text book publishers
Extensions (for gifted students)	