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Tiered Graphic Organizers Overview

One way to improve the learning and performance of diverse students across grade levels in a wide range of content areas is by utilizing graphic organizers in classroom lessons. Graphic organizers are visual representations that help students gather and sort information, see patterns and relationships, clarify concepts, and organize information. Graphic organizers have a way of connecting several pieces of isolated information by taking new information and filing it into an existing framework. Old information is retrieved in the process, and the new information is attached. By using graphic organizers in the classroom, teachers are helping students make connections and assimilate new information with what they already know.

Understanding how the brain works helps us understand why graphic organizers are valuable tools for learning. Educational brain research says that our brains seek patterns so that information can become meaningful. In her book, Karen Olsen (1995) states, "From brain research we have come to understand that the brain is a pattern-seeking device in search of meaning and that learning is the acquisition of mental programs for using what we understand." Other researchers believe that graphic organizers are one of the most powerful ways to build semantic memories (Sprenger 1999). Eric Jensen (1998) states that semantic memory is "activated by association, similarities, or contrasts." Graphic organizers assist students with such necessary connections.

The brain does this by storing information similar to how a graphic organizer shows information. It screens large amounts of information and looks for patterns that are linked together. The brain is able to extract meaning more easily from a visual format like a graphic organizer than from written words on a page. Graphic organizers not only help students manage information, they also offer information in a way that students can understand at a glance. When these connections happen, the brain transfers the information from short-term memory to long-term memory. This means that teachers who use graphic organizers help their students manage all the information they are presented with each day.

Because students are at different readiness levels, it makes sense to differentiate lessons with tiered graphic organizers. Ideas for tiering graphic organizers for different readiness levels are listed on the following page. Some teachers, especially high school teachers, worry that students will just copy from other students who have modifications on their graphic organizers. They also note that some of their students do not like to be singled out with modified work. This can be resolved by assigning groups different types of graphic organizers within one lesson. An example of this would be to give one group Venn diagrams, another group T-charts, and a third group matrices. The information can still be modified as needed, but it won't be so obvious that the answers can be copied, because they are being recorded on different organizers.

Tiered Graphic Organizers Overview *(cont.)*

Steps for Using Tiered Graphic Organizers to Differentiate

1. Pick the grade level objective you will be covering.

2. Decide upon the specific skills, concepts, or generalizations to be learned.

3. Choose a graphic organizer for your on-grade-level students to use as an assignment. Then, make modifications to the graphic organizer so that it is accessible to all students. Below are some ideas for making these modifications.

   - **English Language Learners**—level the text in examples on the graphic organizers, use a word bank with definitions, allow students to answer in pictures and/or words instead of writing sentences to summarize, label the titles and parts on the graphic organizers, let them verbally explain the graphic organizers, give individual or small group instruction, provide recorded instructions or reminders using podcast software, etc.

   - **Below Grade Level**—provide a few examples already filled in on the graphic organizers, give them an appropriately leveled word bank, let them write only one or two sentences to summarize the graphic organizer, label the titles and parts on the graphic organizers, provide lines to write on in the graphic organizers, simplify the directions, ask for fewer examples, etc.

   - **On Grade Level**—These students receive the on-grade-level graphic organizer that is appropriate for their level of readiness.

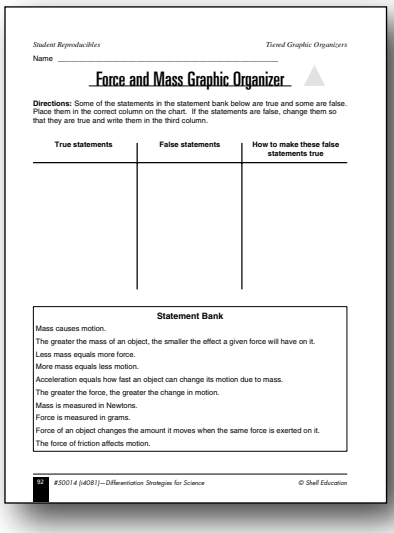
   - **Above Grade Level**—increase complexity by adding another circle to a Venn diagram or another column to the T-chart, assign more ambiguous items to compare/contrast, give students a sophisticated word bank, let them work in homogeneous groups, let them summarize the graphic organizers and then provide their evaluation of the situation, etc.

4. Distribute the graphic organizers to students. You can have them work in homogeneous groups or individually.

5. Assess students as they work on the graphic organizers to see if the appropriate accommodations have been made. Make adjustments as needed.

6. After students have completed the graphic organizers, assess their work and make notes for future tiered graphic organizers. Some students might need more modification and others will need less. Keep the groups flexible and move students as necessary.

Forces and Mass



Student Reproducibles — Tiered Graphic Organizers

Name _____

Force and Mass Graphic Organizer

Directions: Some of the statements in the statement bank below are true and some are false. Place them in the correct column on the chart. If the statements are false, change them so that they are true and write them in the third column.

True statements	False statements	How to make these false statements true

Statement Bank

Mass causes motion.
The greater the mass of an object, the smaller the effect a given force will have on it.
Less mass equals more force.
More mass equals less motion.
Acceleration equals how fast an object can change its motion due to mass.
The greater the force, the greater the change in motion.
Mass is measured in Newtons.
Force is measured in grams.
Force of an object changes the amount it moves when the same force is exerted on it.
The force of friction affects motion.

92 #50014 (i4081)—Differentiation Strategies for Science © Shell Education

Skills Summary

Science Content
Forces and motion

Differentiation Strategy
Tiered graphic organizers (See pages 78–79 for more information.)

Differentiation Management Tip

Your English language learners may represent all ability levels. For the graphic organizer activity, assign the page at their scientific ability levels. Then make audio recordings of the information on the pages and allow them to listen to the recording. They can replay the recording as necessary to complete the page.

Overview of Activity

- Review the terms *force* and *motion* and have students complete an activity in which they draw these terms.
- Students will make launchers and complete their force, motion, and mass experiments using the appropriate tiered graphic organizers.
- Students will report what they have learned to the class and reflect on how the activity helped them increase their understanding of mass and force on the movement of an object.

How This Strategy Benefits Students

- Students who are **above grade level** will benefit from using tiered graphic organizers because they get the opportunity to design an experiment and use higher-level critical and creative thinking skills.
- **On-grade-level** students will benefit from using tiered graphic organizers because they can complete experiments with the appropriate level of challenge.
- The **below-grade-level** students will benefit from using tiered graphic organizers because they will learn new concepts without being frustrated.
- **English language learners** will benefit from using tiered graphic organizers because they will develop new vocabulary and learn new concepts in a concrete way.

Learning Standards

- Students will demonstrate their knowledge of the relationship between the strength of a force and its effect on an object.
- Students will know that when a force is applied to an object, the object either speeds up, slows down, or goes in a different direction.

Forces and Mass *(cont.)*

Materials

- toilet paper or paper towel rolls cut into 4 $\frac{1}{2}$ inch segments*;* tape; 6-inch plastic rulers*;* thin rubber bands; objects of different masses, such as a board eraser, a trade book, a textbook, a box of tissues, and a tape dispenser; a scale that measures ounces or grams; sand paper; ping-pong ball; golf ball; and wax paper

Whole-Class Activity

1. Review the terms below and have students work in pairs to make up a charades game that defines the terms and demonstrate them to the class.
   - **force**—the push or pull on an object
   - **motion**—the change in the position or place of an object
   - **friction**—the force that resists the relative motion of an object
   - **mass**—the amount of matter in an object; on Earth's surface, it is thought of as the object's weight
   - **acceleration**—a change in the speed or direction of an object
2. Ask students the following questions: Which object would move faster with the same amount of force—one brick alone or two bricks of that same size glued together? Ask them why this might be true. (The single brick would be easier to push because there would be less weight and therefore less friction). Then, ask which object would move faster with the same amount of force—a free-floating canoe or a free-floating ocean liner and why? *(The canoe would be easier to move because you have to change the motion of a much smaller mass.)*
3. Demonstrate the relative force needed to move objects with different masses as follows: Flick a ping-pong ball and a golf ball from the same starting point using your thumb and index finger. Have them observe which ball moved faster. For a more extreme example, you can compare pushing a bowling ball and a beach ball of the same size with approximately the same amount of force.
4. Ask students why they think the lighter object moved faster than the heavier object with the same force. *(The ping-pong ball moves faster than the golf ball, and the beach ball moves faster than the bowling ball because they have a smaller amount of mass.)*
5. Then, to demonstrate that an object will move faster when more force is exerted on it, flick a ping-pong ball as gently as possible. Then, throw the ping-pong ball with great force to make it land on the opposite side of the room. Ask students why they think the ping-pong ball moved faster when greater force was exerted on it. *(The ping-pong ball moves faster with greater force because greater force equals greater distance.)*

Forces and Mass *(cont.)*

Whole-Class Conclusion Activity *(cont.)*

6. Students will work in homogeneous groups to complete their force, motion, and mass experiments. First, all groups will follow the instructions to create a launcher using the *Create a Launcher* activity sheet (page 91). Then students use the appropriate tiered *Force and Mass Graphic Organizer* (pages 92–94) for their group.

The below-level-students (circle activity) will conduct experiments to determine how the mass of an object changes the distance it moves when the same force is exerted on it. They will also conduct an experiment to determine the distance the same object will move when a different force is exerted on it.

The **on-level-students** (square activity) will design simple experiments to determine how the mass of an object changes the amount it moves when the same force is exerted on it and the distance the same object will move when a different force is exerted on it.

The **above-level-students** (triangle activity) will design a more complex experiment to determine how the mass of an object will change the distance it moves when the same force is exerted on it. They will also experiment to see how friction affects this process.

7. Students will report what they have learned to the class and reflect on how the activity helped them increase their understanding that the more massive an object, the smaller the effect of a given force on the object will be, and the greater the force on an object, the greater the change in motion will be. You will create a chart that includes their information.

Assessment

1. Observe students' participation in whole-class and group activities. You can use a checklist to make sure all students stay on task and are grasping key concepts as they work.

2. Review student projects and explanations to see how well they understood the concepts below.

Force causes motion.	The greater the mass of an object, the smaller the effect a given force will have on it.
The greater the force, the greater the change in motion.	More mass equals less motion.
Acceleration equals how fast an object can change its motion due to force.	Less mass equals more motion.
The force of friction affects motion.	The mass of an object changes the amount it moves when the same force is exerted on it.
Force is measured in Newtons.	Mass is measured in grams.

Anchor Activity

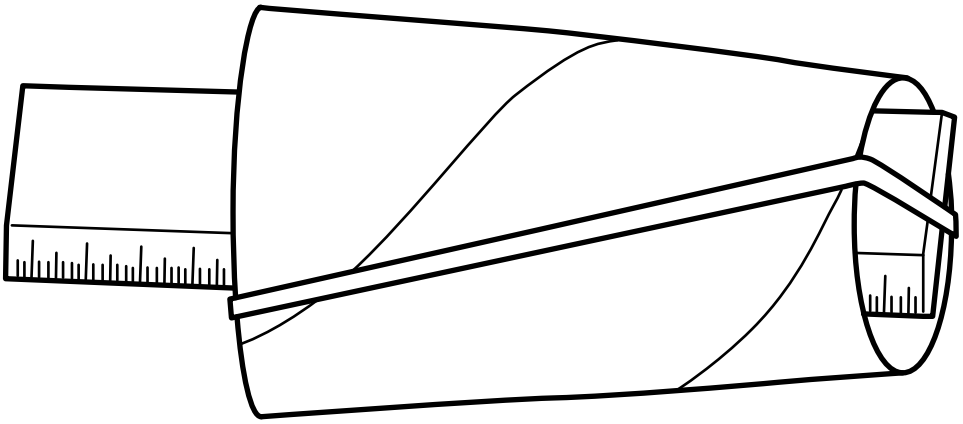
- Let students design their own experiments that show forces and motion. They can videotape or perform their experiments live for the class.

Name _____

Create a Launcher

Directions: You will need the following materials: 6-inch plastic ruler, thin rubber band, tape, and a paper roll cut into 4 $\frac{1}{2}$ inch segments. Follow the directions below to make your launcher.

1. Pinch one end of the roll flat.
2. Wrap the rubber band around the roll.
3. Secure the rubber band with tape, but tape it so that the end of the roll is not covered.



4. Push a 6-inch ruler into the tube through the folded end of the tube. Push the ruler all the way down until the end is even with the fold. Make sure that the rubber band is stretched the length of the ruler.
5. Pinch the folded end of the tube to hold the ruler in place.
6. Point the side of the ruler you are holding at the object you want to move with your launcher. Let go and your launcher will exert force on the object you would like to move.

Please note: Two things affect the force of the launcher. The farther you push the ruler into the rubberband, the more force it will give when you release it. The thicker the rubber band, the more force it will have. So if you want less force, do not push the ruler in all the way and use a thin rubber band.

Name _____

Force and Mass Graphic Organizer

Directions: Some of the statements in the statement bank below are true, and some are false. Place them in the correct column on the chart. If the statements are false, change them so that they are true and write them in the third column.

True statements	False statements	How to make these false statements true

Statement Bank

Mass causes motion.

The greater the mass of an object, the smaller the effect a given force will have on it.

Less mass equals more force.

More mass equals less motion.

Acceleration equals how fast an object can change its motion due to mass.

The greater the force, the greater the change in motion.

Mass is measured in Newtons.

Force is measured in grams.

The force of an object changes the amount it moves when the same force is exerted on it.

The force of friction affects motion.

Name _____

Force and Mass Graphic Organizer

Directions: List information about force and mass on the T-chart below. Include at least 5 pieces of information for each column.

Force	Mass

Name _____

Force and Mass Graphic Organizer

Directions: Complete the information about force and mass on the chart below.

Force is the push or pull on an object. 	**Mass** is the amount of matter in an object. On Earth we think of it as the object's weight. 
Force causes _____ . The greater the force, the greater the _____ . Acceleration equals _____ . The force of friction affects _____ . Force is measured in _____ .	More mass equals a smaller effect of a _____ . More mass equals _____ . Less mass equals _____ . The mass of an object changes the amount it moves when _____ . Mass is measured in _____ .

