



# Science Competencies and Activities

## Tweetsie: The Forces With Her

### Grade 8

*Tweetsie Site:* Tweetsie (or classroom activities)

(Teacher note: Say the following to your students: A force is defined as an action that imparts an acceleration to any mass that is free to move. The push or pull upon an object resulting from an interaction with another object is a force. Every time Tweetsie's whistle blows and the locomotive slowly begins to move, a variety of physical forces affect the train and its passengers. This lesson will help you understand various scientific forces that you will encounter during your visit to Tweetsie.

You will also experience a short course in economics as you consider very different kinds of forces—the social, political, and economic forces—that changed transportation in Western North Carolina during the past century. Specifically, you will understand how Tweetsie changed from a working freight train serving the people of Western North Carolina and East Tennessee, to a passenger train thrilling thousands of visitors at Tweetsie Railroad each year.)

### *Connection to the Standard Course of Study:*

**Science Competency Goal 4:** The learner will build an understanding of motion and forces

**Social Studies Competency Goal 5:** Economic, social and technological changes on life in North Carolina from 1900–1930.

This lesson will give the students opportunities to:

- Demonstrate ways simple machines can change force.
- Determine how the force of friction retards motion.
- Understand that objects in motion are always judged relative to some other object or point.
- Describe and measure quantities that characterize moving objects and their interaction—time, distance, mass, force, velocity.
- Apply Newton's Laws of Motion to the way the world works—inertia, acceleration, gravitation, action/reaction.
- Identify technological advances and evaluate their influence on the quality of life.
- Analyze the extent and significance of economic changes in North Carolina.
- Assess the influence of political, legal, and social movements on the political system and the quality of life in North Carolina.

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*Activity:* Provide students with a copy of the fictional newspaper article, *The End of an Era: Train Service Ends*, and ask them to read it. Have them do the following:

- Make a list of at least five reasons (*decline in passengers, decline in freight, improvement in highway system, increase in truck freight, damage to track by floods, lack of capital funds for repairs, development of diesel locomotives, increase in automobile travel*) the East Tennessee & Western North Carolina Railroad ceased rail service between Johnson City, Tennessee, and Boone, North Carolina.
- Next, make a list of at least five groups of people (*passengers dependent on the train, loggers and miners, railroad employees, owners of sawmills and manufacturing plants, owners of hotels on rail route, owners of businesses supplying track and railroad ties, towns along the route*) directly affected by the closing of the railroad operation.

*Tweetsie Site:* Tweetsie or classroom.

*Activity:* Provide each student with a copy of the Tweetsie Railroad Fact Sheet found in the opening Resource Section. Ask the students to observe Tweetsie carefully as the train begins its run. Using their fact sheets, have the students estimate the total weight of the train.

Explain the following: Assume the locomotive is carrying a full capacity of water and coal, pulling eight cars weighing approximately 8,000 pounds each loaded with passengers. Your calculations will tell you that Tweetsie represents a tremendous amount of weight to move down the track and around the mountain. Think about your study of forces acting on an object at rest or in motion. Refer to your science text if you need to review.

*Activity:* Ask your students the following question—Which of the following forces and properties affect Tweetsie as she begins to move down the track from the station?

**INERTIA:** The inherent property of an object that resists any change in that object's motion.

**FRICITION:** When two objects in contact with one another are in motion relative to one another, the force that opposes that motion.

**GRAVITY:** The attraction of the earth's mass on other bodies and objects at or near the earth's surface.

The answer, of course, is that all three affect every movement of the train.

**INERTIA:** *If Tweetsie is motionless, she will stay motionless unless acted upon by some force.* In your own words, describe how energy from the steam engine and friction between the track and the wheels, enable Tweetsie to move.

*If Tweetsie is moving, she will move in a straight line unless acted upon by a force.* In your own words, explain how Tweetsie turns the curves around the mountain. Compare Tweetsie to a NASCAR race car speeding around a track. How do the same forces affect both? Does Tweetsie have a steering wheel like the car? Does the car have a track like Tweetsie? How do the differences in weight between the car and Tweetsie affect movement and turning?

*If Tweetsie is moving at a constant speed, she will continue at that speed unless acted upon by a force.* In your own words, explain why Tweetsie slows as she goes up a hill. What forces affect her speed? Likewise, why does Tweetsie tend to go faster as she goes down a hill? What force enables Tweetsie to stop as she enters the station?

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Consider one other ride in the park (your choice). Describe what forces act on that ride and how forces affect the working of the ride.

The fictional newspaper article, *The End of An Era: Train Service Ends*, describes a real situation involving Tweetsie many years ago. In this story, you read an explanation of how economic forces affected the East Tennessee & Western North Carolina Railroad, contributing to the decision to shut down train service completely in 1950.

This section is an introduction to the concept of Supply and Demand. Supply is the quantity of goods or services that a supplier or business person has available for sale. For example, if the ice cream store has fifty (50) cartons of your favorite flavor, you might assume this is a good supply of ice cream.

Demand is the quantity of goods or services that consumers or customers are willing to purchase. If everyone in your class likes the same ice cream flavor you like, and everyone goes to the same ice cream shop to buy it, you can assume that the demand is very great.

(Teacher note: Please consider the following points before you begin the next activity.)

- Supply varies depending on such factors as price, availability, and circumstances of manufacturing, shipping, weather, and raw material availability. Suppose, for example, that your favorite ice cream flavor has chocolate in it. The manufacturer cannot buy enough chocolate. Suppose the freezer breaks and all the ice cream melts. Suppose the ice cream truck has an accident and delays delivery by several days. Any of these factors could affect the supply available.
- Supply also depends on the amount of profit both the manufacturer and the store make on a particular item or service. If your favorite ice cream is cheap and easy to make, the manufacturer may make a lot of it. Ice cream stores may try to sell as much as possible; therefore, the supply may be great or very limited.
- If supply is greater than demand, then the manufacturer may lose money since he produced too much of an item that does not sell that well. Likewise, the owner of the store may lose because he bought too much of an item and cannot sell it at a profit. If you are the only person in town who likes that flavor, the manufacturer may stop making it and the store may stop selling it.
- If demand is greater than supply, then the manufacturer and the store owner may be pleased because they can charge more for the product. However, the consumer may be unhappy since he cannot get the product he wants at a good price. In our ice cream example, you may decide to take another flavor. Or, you may not buy ice cream at all if the price is too high or your flavor is unavailable.

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*Activity:* Have your students think about how the forces of supply and demand affected the decision to stop train service in Western North Carolina and Eastern Tennessee. Remember that the railroad provided a specific service – transportation – for which it charged fees. Those fees paid for equipment, track, and salaries. When the demand for those services was high, the railroad made profits. However, both the demand for services and the ability of the railroad to provide those services (supply) at reasonable prices dropped so much, the railroad shut down.

*Choose one of the following problems and develop a solution.*

- You are the President of the East Tennessee & Western North Carolina Railroad. You know that you need to close your railroad. In a letter to your stockholders, explain why you have made that decision.
- The railroad has hired you to develop a plan to keep the operation running and to restore service on the damaged track. In a letter to the Railroad President, explain what needs to be done to keep the trains running. Hint: Think about the money involved in repair and the cost of railroad service after the repairs.
- About the time Tweetsie made the last run in 1950 as a freight train, the railroad company opened both a bus line and a trucking company. Explain how the forces of supply and demand affected the decisions to begin these new services.

*Activity:* Taking Tweetsie Home

Each of the forces discussed in this lesson affect you on a daily basis. Think about your ride to Tweetsie on an activity bus or in another vehicle. Choose either the physical forces (inertia, gravity, friction) or the economic forces (supply and demand) that we have covered in this lesson. Be very specific in explaining how those forces affect you and your classmates on this trip.