2.04 Thermal Energy and Chemical Change Activity

Instructions: In this engineering activity, you will build trains to reach the finish line without crashing. You will need to repeat tests of your device to make sure it does not need to be redesigned or improved. ***Complete all the areas shaded in purple.***

Note: Please contact your instructor for assistance if you cannot complete this activity as directed.

Student Name	
Instructor	
Date	

Objective:

The goal of this activity is to build steam engine trains that can carry cargo to the end of three different tracks.

Energy Engineers

To create working trains, you must learn about the different parts that power the train. Take notes on each part.

	Is this an endothermic or exothermic process?
Evaporative cooler	
Woodburning heater	
Steam engine	

Runaway Trains

You will need tools to design a train to reach the target station without crashing. **Match each tool in the virtual activity to its description.**

Tool Options: springs, empty train cars, helium balloons, steam engines, evaporative coolers, wood-burning heaters

Description	Tool Option
These can carry items and have wheels that let the train move.	
These move a train forward or backward on the track.	
These produce more energy and make the train go 30% faster.	
These can be attached to the front and back of the train to make it float.	
These can help the train move 20% faster.	
These allow the train to bounce. They work best at the bottom of train cars or in front of the steam engine to prevent a crash at the station.	

Design Ideas

Describe three design ideas you have for your train. But first, consider these design limitations.

- Each train needs *at least one* train car, panda, cargo box, and steam engine.
- OPTIONAL OBJECTS are springs, balloons, and the choice of an evaporative cooler or wood-burning heater.
- You can have more than one balloon or spring on your train.
- Track one has one hill. Tracks two and three have two hills. Track three has missing tracks and a jump.
- You can use action buttons for the optional items to control the train's speed and movement to the finish line.

Train 1 Design on Track 1	Train 2 Design on Track 2	Train 3 Design on Track 3

Data

Record the results of each test run to the train station. Be sure to describe any changes you make to your design.

	Trial 1	Trial 2
Train 1	**Did your train get to the station?**	**Did your train get to the station?**
	Place an X by the one that applies: ___ It crashed early. ___ It made it halfway. ___ It almost made it. ___ Yes, it made it there.	Place an X by the one that applies: ___ It crashed early. ___ It made it halfway. ___ It almost made it. ___ Yes, it made it there.
		Describe tools you added to your train.
Train 2	**Did your train get to the station?**	**Did your train get to the station?**
	Place an X by the one that applies: ___ It crashed early. ___ It made it halfway. ___ It almost made it. ___ Yes, it made it there.	Place an X by the one that applies: ___ It crashed early. ___ It made it halfway. ___ It almost made it. ___ Yes, it made it there.
		Describe the tools you added to your train.
Train 3	**Did your train get to the station?**	**Did your train get to the station?**
	Place an X by the one that applies: ___ It crashed early. ___ It made it halfway. ___ It almost made it. ___ Yes, it made it there.	Place an X by the one that applies: ___ It crashed early. ___ It made it halfway. ___ It almost made it. ___ Yes, it made it there.
		Describe the tools you added to your train.

Analyze Data and Conclusion

This section will include an analysis of your test results and plans for redesigning your train. Please write in complete sentences.

1. Review the results of your train trials and (a) describe the train design that made it closest to the finish line without crashing and (b) why you think this design was successful.
a) b)
2. What are the benefits of using repeated trials and replication in a scientific investigation?
3. Reflect on the lesson and your new knowledge of steam engines, and (a) define thermal energy and (b) explain how thermal energy changed the movement of the water particles in the steam engine.
a) b)
4. Reflect on your new knowledge of wood-burning engines and (a) explain the difference between endothermic and exothermic reactions and (b) explain why the reactions in wood-burning stoves are exothermic.
a) b)