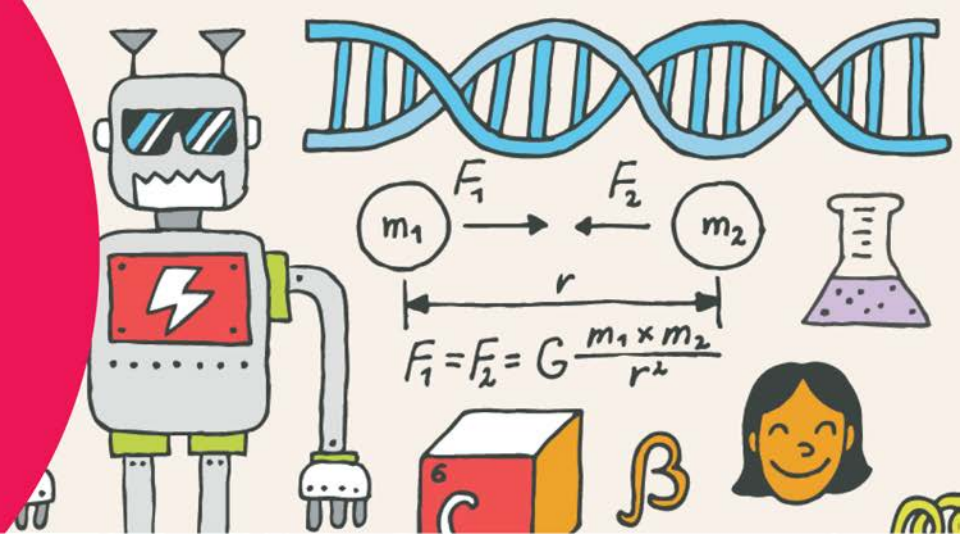


# Bridge Builders

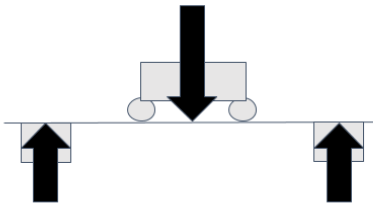
Museum Mission Answer Key



## Steam City Train Set (p. 3)

Exhibit: Steam: A World in Motion – Model Train Set

**Find** any bridge in the playset. Place a train on the bridge and using arrows, draw where the forces are acting on the bridge.



**Think:** Why are these types of bridges used for trains?

*These bridges are strong and stable and so are ideal for trains.*

## Railways (p. 4)

Exhibit: Steam: A World in Motion – Locomotives

Pick any locomotive and read its infographic. Can you **find** what it means to be a **4-8-4** locomotive?

*4-8-4 describes the wheel arrangement of the locomotive. 4 leading wheels on 2 axles, 8 driving wheels on 4 axles and 4 trailing wheels on 2 axles.*

**Think:** Examine the railway. Does it remind you of any other structure – which one?

*The rail becomes little post and beam bridges between each tie. Students may also say it looks like a ladder, etc.*

## Snowshoes (p. 5)

Exhibit: Into the Great Outdoors – Snowshoe Interactive

**Find** and test the different snowshoes. Circle the one which works best.



**Think:** How do snowshoes work? Circle your answer:

- b. Snowshoes distribute a person's weight across a wide surface

## Bicycle Vortex (p. 6)

**Exhibit:** Into the Great Outdoors – Freedom on Two Wheels

**Find** the bikes in the vortex. What are two changes that have been made to bikes over time? (Hint: the closer you get to the ceiling, the newer the bike)

*The addition of gears, stronger and lighter materials used in construction, rubber wheels, wheel size, seat etc.*

**Think:** How are the bikes being supported? (Hint: the two bottom bikes are held differently than the rest!)

*The majority are suspended upward by strong cables – the vortex ramp is not strong enough to hold them, nor would it keep them balanced. The bottom two are attached to the back of the artifact case using strong metal bars.*

## Structure Models (p. 7)

**Exhibit:** Steam: A World in Motion - Locomotives

**Find** the locomotive model. This model tests how real locomotives interact with wind. Draw a vehicle you think is aerodynamic (low wind resistance). Use arrows to show how wind will affect it.



**Think:** Why would engineers build a model before building a structure?

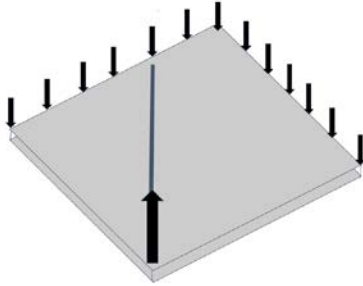
*It's costly and sometimes hazardous to make mistakes in large-scale projects, so models help engineers refine the design cheaply and safely as well as test the structure on a much smaller scale.*

## Living Small (p. 8)

### Exhibit: Technology in Our Lives – Tiny House

Can you **find** the bed in the tiny house? How is it being supported? Using arrows show where the bed is applying forces to its supports.

*The bed pushes down on the small beams along the back and side walls and pulls on the support post in the front corner.*



**Think:** The tiny house is incomplete! What would you add to finish it?

*Roofing, closed walls, an area for a washer dryer maybe near the bathroom, etc*

## Under Pressure (p. 9)

### Exhibit: Wearable Tech – Newtsuit

**Find** two physical features of the suit that allow it to function in the deep sea:

*The suit is the first rigid-body diving suit. It has low friction arm and leg joints, on-board oxygen and optional thrust pack*

**Think:** What depths can the suit reach while keeping atmospheric pressure?

*The suit can maintain pressure even at 305 metres underwater.*

## Snow Levels (p. 10)

### Exhibit: The Great Outdoors – Snow Fall Column

**Find** which city gets:

Most snow: *St John's*

Least snow: *Victoria*

**Think:** Name one feature that helps a house support the load of heavy snow:

*Sloped roofs, strong roof supporting structure using strong beams and triangles, strong supports in walls to support weight of roof and snow, etc.*

Name one feature that helps a house cope with heavy rainfall:

*Sloped roofs, eavestroughing, sump pump in basement, landscaping sloping away from house, etc.*

## Curriculum Connections

### Ontario: Grade 5 – Science and Technology

#### Understanding Structures and Mechanisms – Forces Acting on Structures and Mechanisms

##### 2. investigate forces that act on structures and mechanisms;

2.3 use scientific inquiry/research skills to investigate how structures are built to withstand forces

2.5 use appropriate science and technology vocabulary, including tension, *compression*, *torque*, *system*, and *load*, in oral and written communication

2.6 use a variety of forms (*e.g., oral, written, graphic, multimedia*) to communicate with different audiences and for a variety of purposes

##### 3. identify forces that act on and within structures and mechanisms, and describe the effects of these forces on structures and mechanisms.

3.1 identify internal forces acting on a structure (*e.g., compression [squeezing], tension [stretching]*), and describe their effects on the structure

3.2 identify external forces acting on a structure (*e.g., the weight of people and furniture in a house, wind blowing on a tent, the movement caused by a passing train*), and describe their effects on the structure, using diagrams

3.4 describe forces resulting from natural phenomena that can have severe consequences for structures in the environment (*e.g., a house loses its roof in a wind storm*), and identify structural features that help overcome some of these forces

### Ontario: Grade 7 – Science and Technology

#### Understanding Structures and Mechanisms – Form and Function

##### 1. analyse personal, social, economic, and environmental factors that need to be considered in designing and building structures and devices;

1.1 evaluate the importance for individuals, society, the economy, and the environment of factors that should be considered in designing and building structures and devices to meet specific needs

1.2 evaluate the impact of ergonomic design on the safety and efficiency of workplaces, tools, and everyday objects

##### 3. demonstrate an understanding of the relationship between structural forms and the forces that act on and within them.

3.3 identify the magnitude, direction, point of application, and plane of application of the forces applied to a structure

### Quebec: Primary Cycle 3– Science and Technology

#### Material World – C. Forces and motion

##### 6. Effects if a force on the direction of an object,

d. Describes the effects of a force on a material or structure.

##### 7. Combined effects of several forces on an object

a. Predicts the combined effect of several forces on an object at rest or an object moving in a straight line

### Quebec: Secondary Cycle 1– Science and Technology

#### The Technological World – B. Mechanical engineering

##### 1. Forces and motion

b. Effects of a force