Name: _____ Group: _____ Date: _____

Tech labs

TECH 1

Constraints and deformations

PROGRAMS:	ST, EST, AST
LAB TYPE:	Observation
CONCEPT:	Constraints (deflection, shearing)
STUDENT BOOK:	Chapter 12, page 386
TOOLBOX:	Page 75

GOAL

Observe the effects of various constraints on different types of materials.

OBSERVATION CRITERIA

1. What is a constraint?

_____

2. Fill in the table below with:
- the main types of constraints
- a brief description of each type of constraint

Type of constraint	Description

3. When a material is subjected to a constraint, it becomes deformed. In the table below, write the three types of material deformation. Then, describe how to recognize each type of deformation.

Type of deformation	Indication of the type of deformation

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MATERIALS

- strip of iron (about 126 mm × 20 mm × 2 mm) with a hole drilled through the centre, 1 cm from one end
- strip of polypropylene (about 126 mm × 20 mm × 2 mm) with a hole drilled through the centre, 1 cm from one end
- 3 strips of wood (tongue depressors) each with a hole drilled through the centre, 1 cm from one end
- bar clamp (12.5 cm × 2 cm)
- universal clamp
- retort stand
- ruler
- 1000-g weight with hook

PROCEDURE

Part A: Compression

1. Place the strip of iron between the jaws of the bar clamp and tighten the jaws. (**Warning:** You must compress the strip downward.)
2. Loosen the jaws of the bar clamp and remove the strip of iron.
3. Record the type of deformation you observe.
4. Repeat steps 1 to 3 with the strip of polypropylene and then with a strip of wood.

Part B: Torsion

1. Hold the strip of iron by the ends.
2. Try to twist the strip.
3. Release your grip when you can twist the strip no further. Record the type of deformation you observe.
4. Repeat steps 1 to 3 with the strip of polypropylene and then with a second strip of wood.

Part C: Deflection

1. Firmly clamp the end of the iron strip without a hole, using the universal clamp.
2. Attach the clamp to the retort stand (see the diagram on the following page).
3. Adjust the height of the iron strip to 25 cm above the base of the retort stand.
4. Hook the 1000-g weight to the free end of the iron strip.
5. Measure the height of the iron strip above the base of the retort stand.
6. Remove the weight, measure the height of the iron strip again and record the type of deformation you observe.
7. Repeat steps 1 to 6 with the strip of polypropylene and then with the third strip of wood.

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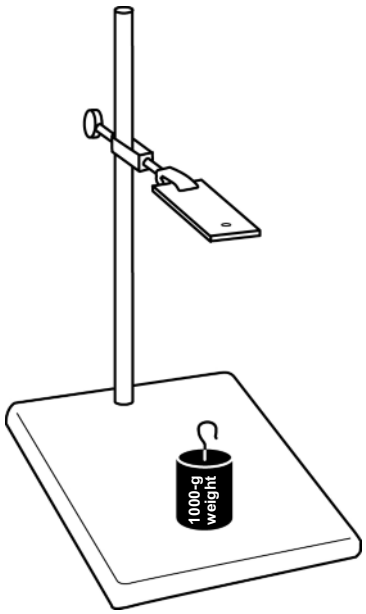
8. Put away the materials.



OBSERVATIONS

Record your observations in the tables below. Give each table a title.

Title: _____

Sample	Type of deformation
Iron	
Polypropylene	
Wood	

Title: _____

Sample	Type of deformation
Iron	
Polypropylene	
Wood	

Title: _____

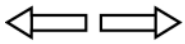
Sample	Height from base of ring stand (cm)	Type of deformation
Iron		
Polypropylene		
Wood		

Name: _____ Group: _____ Date: _____

REFLECTING ON YOUR OBSERVATIONS

1. Under each symbol below, write the constraint it represents.

_____



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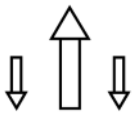

_____

_____

2. Are different materials deformed in the same way when subjected to the same constraint? Explain your answer.

_____

_____

_____

3. Which of the three materials was least resistant to the following three constraints? Explain your answers.

a) compression: _____

b) torsion: _____

c) deflection: _____

4. How could you have reached the point of fracture in all of these materials during your deflection tests?

_____

5. It is midwinter, and your neighbour's temporary car shelter has collapsed under the weight of the snow. Its metal structure and fabric cover are a total loss.

In the table below, write the type or types of constraint and deformation the shelter materials may have undergone.

Material	Constraint	Deformation
Metal structure		
Polyethylene fabric		

6. Your uncle enjoys doing flips on his diving board. During a particularly spectacular attempt, the board breaks under his weight. What type of constraint and what type of deformation have occurred?

_____

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7. A member of your family likes to play on the swing. Most of all, he loves to wind up the swing ropes and then twirl around as the swing unwinds. What type of constraint is he putting on the ropes?

_____

8. Has this lab helped you understand types of constraints and deformations? Explain your answer.

_____

_____

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