

Grade 8

Science Focus



Lab Workbook

Unit 4

Mechanical Systems

Levers in Action

Problem: How does changing the position of the fulcrum affect the effort force in different levers?

Hypothesis: _____

Investigative Procedure: Follow the directions outlined on pages 272 - 273

Data Collection:

Position of Load	Type of Lever	Effort Force Required ... (Description)
P ₁	Class 1	
P ₂	Class 1	
P ₃	Class 1	
P ₁	Class 2	
P ₂	Class 2	
P ₃	Class 2	
P ₁	Class 3	
P ₂	Class 3	
P ₃	Class 3	

Analysis of Data:

- (a) _____
(b) _____
- _____
- manipulated variable(s) _____
responding variable(s) _____
- _____

Lab Investigation 4-A submitted by _____

Date _____

Gearing Up For Speed

Investigation 4-B
Pages 290 - 291

Problem: How does the speed ratio change as you switch between different gears on a bicycle, and how does this affect the force you need to pedal the bicycle?

Hypothesis: _____

Investigative Procedure: Follow the directions outlined on pages 290 - 291

Data Collection:

Title: _____

Number of Teeth	Front Sprockets		
	1	2	3
1			
2			
3			
4			
5			
6			

Analysis of Data:

1. _____

2. high gear is _____

low gear is _____

3. _____

Conclude and Apply:

4. _____

5. _____

6. _____

Bicycle Gears



Derailer



Lab Investigation 4-B submitted by _____

Date _____

Pick It Up !

Investigation 4-C
Page 294

Problem: What is the best design of a prototype for a **crane**, to lift a **load of 12 N** with an **effort force of 4 N**?

Hypothesis: _____

Plan and Construct: (Directions given on page 294 – Science Focus Textbook)

- Step 1 – Discuss various designs that can accomplish the task
- Step 2 – Select the materials to use for your prototype from the materials provided
- Step 3 – Get permission to build your prototype (Teacher's approval)
- Step 4 – Draw a Blueprint, identifying component parts and their functions
- Step 5 – Construct your prototype
- Step 6 – Test your prototype

Blueprint:



Evaluate:

1. _____

2.

Problem Encountered	Modification Made	Result

Recommendations:

- _____

Lab Investigation 4-C submitted by _____

Date _____

Easy Lifting

Investigation 4-D
Pages 300 - 301

Problem 1: How can you calculate the mechanical advantage of a compound pulley?

Hypothesis: _____

Problem 2: How can you test the efficiency of a pulley system?

Hypothesis: _____

Investigative Procedure: Follow the directions outlined on pages 300-301

Data Collection: (Table Title) _____

Trial	Load	Effort	Number of Ropes
A			
B			
C			
D			
E			

Analysis:

1. Analysis Table Title _____
2. (Calculate the Mechanical Advantage and complete the column in the table)
3. (Record # of Ropes column in the Analysis table below)

Trial	Number of Ropes	Mechanical Advantage
A		
B		
C		
D		
E		

4. manipulated variable _____

responding variable _____

controlled variables were _____

Conclude and Apply:

5. _____

6. Efficiency for the Compound pulley in Trial E is _____

Calculation of Efficiency

Lab Investigation 4-D submitted by _____

Date _____

Egg Drop

Investigation 4-E
Page 306

Problem: How can you design and build a structure that will protect (prevent it from cracking) a raw egg that is dropped from a height of 2 m?

Hypothesis: _____

Design Specifications:

- no more than 50 straws and 1 m of masking tape
- egg must be dropped from a height of at least 2m
- cracks or complete breakage will result in failure of the structure

Plan and Construct: (Directions given on page 306 – Science Focus Textbook)

- Step 1** – Discuss various designs that can accomplish the task
Step 2 – Select the materials to use for your prototype from the materials provided
Step 3 – Get permission to build your prototype (Teacher’s approval)
Step 4 – Draw a Blueprint, identifying component parts and their functions
Step 5 – Construct your prototype
Step 6 – Test

Blueprint:



Evaluate:

1. _____

2.

Problem Encountered	Modification Made	Effect

Extend Your Skills:

1. _____

2. _____

Lab Investigation 4-E submitted by _____

Date _____

What a Lift !

Challenge: Can you calculate how much force, using a hydraulic lift, is needed to lift a minivan, without actually doing it?

Think About It (p. 310) (This will give you the background information you need)

What To Do:

Estimation and Reflection

Analysis:

<p>Show your Estimated Calculations:</p>

1.

2.

Lab Investigation 4-F submitted by _____

Date _____

Build Your Own Hydraulic Lift

Investigation 4-G

Page 311

Challenge: Design and build a model of a hydraulic lift that will exert a large enough force on a load when you exert a small force on the lift. To make it more interesting, see if your design will incorporate

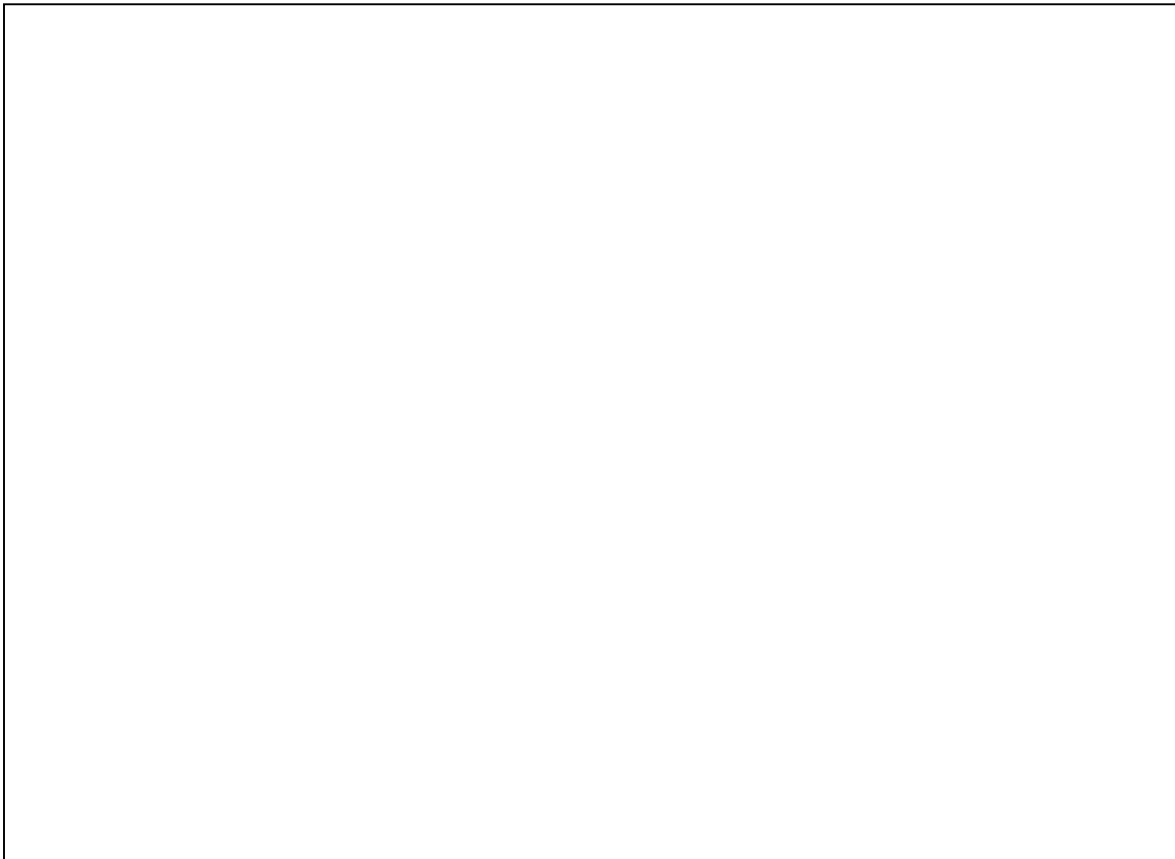
Design Specifications:

- your lift must exert a force in one place when you exert a force in a different place
- no air bubbles (in tubing or syringes)
- an observable mechanical advantage must be evident

Plan and Construct: (Directions given on page 311 – Science Focus Textbook)

- Step 1** – Discuss various designs that can accomplish the task
(predict an arrangement that will allow you to balance the 250g and 1 kg masses on the two modified syringes)
- Step 2** – Decide on a design that will attempt to raise the 1kg mass with the least force
(test your design)
- Step 3** – Build your prototype
- Step 4** – Draw a Blueprint, identifying component parts and their size specifications
- Step 5** – Test your design

Blueprint:



Evaluate:

1. _____

2. _____

Problem Encountered	Modification Made	Effect

Extend Your Skills:

3. _____

4. _____

Lab Investigation 4-G submitted by _____

Date _____

Comparing Pressure Exerted on a Gas and on a Liquid

Investigation 4-H
Pages 314 - 315

Problem: What happens when you exert the same amount of pressure on a gas and on a liquid?

Hypothesis: _____

Investigative Procedure: Follow the directions outlined on pages 314 - 315

Data Collection:

Trial	Syringe 1 (Water) Time (s)	Syringe 2 (Air) Time (s)
<i>Prediction</i>		
Closed 1		
Closed 2		
Closed 3		
<i>Prediction</i>		
Open 1		
Open 2		
Open 3		

Analyze:

1. _____

2. _____

3. _____

4. manipulated variable _____
responding variable _____
controlled variables were _____

Conclude and Apply:

5. _____

6. _____

Lab Investigation 4-H submitted by _____

Date _____

How Silly Can It Be?

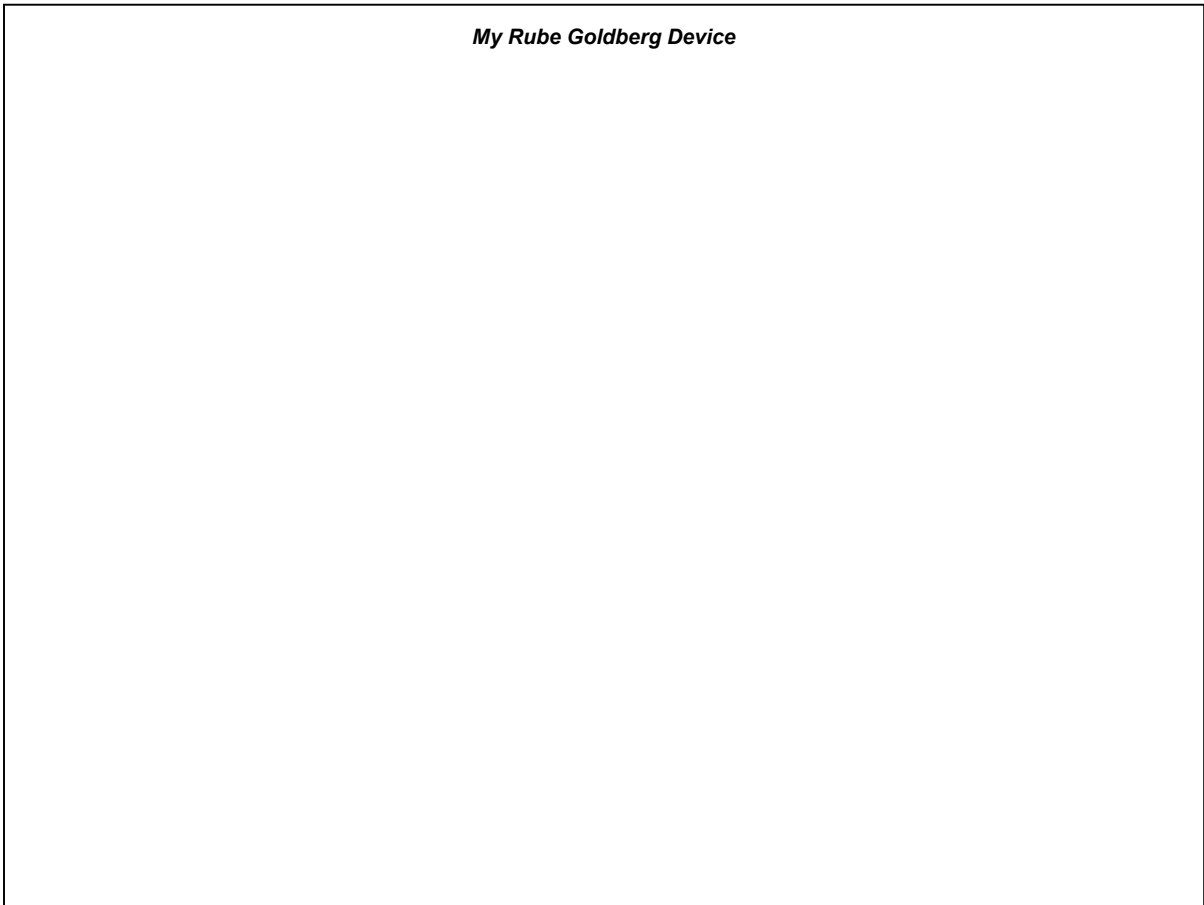
Investigation 4-I
Page 328

Think About It: Are machines always practical? What about the one pictured on p. 328?

Thoughts: _____

What To Do: Follow the directions outlined on page 328:

My Rube Goldberg Device



Analyze:

1. _____

2. _____

3. Partner's comments:

4. Optional Application

Lab Investigation 4- I submitted by _____

Date _____

New, Improved Robots Required!

Investigation 4-J

Page 329

Challenge: Can you design a robot arm by applying what you have learned from Topics 1-6?

Design Specifications:

- your robot arm must be **powered**
- must be able to pick up a container and move it **10cm** and drop it
- this powered action must be done in **less than 1 min.**
- the robotic arm must be able to **move up and down** as well as from **side to side**
- it must have an **operational jaw mechanism**
- **three different mechanisms** must be combined in the working prototype (model)
- you are **not allowed to touch the device** during **pickup, transport or unloading**

Plan and Construct: (Directions given on page 311 – Science Focus Textbook)

Step 1 – Discuss various designs that can accomplish the task
(predict which design will allow you to meet all the specifications)

Step 2 – How will your arm manoeuvre and stop?

Step 3 – Build your prototype

Step 4 – Draw a Blueprint, identifying component parts and their size specifications

Step 5 – Test it (does it balance the load?)

Blueprint



Evaluate:

Problem Encountered	Modification Made	Effect

1. _____

2. _____

3. _____

4. _____

Lab Investigation 4- J submitted by _____

Date _____

The Real Costs (Alternative to Bicycles)

Think About It

(Choosing the most **AWESOME** Skateboard)

	Model / Type	Cost	Other Features
Deck			
Wheels			
Trucks			
Bearings			
Stickers			
Safety Equipment			
	Budget	\$200	

Criteria used to make final selection of each component needed to make your Skateboard:

What it looks like ...

Lab Investigation 4- K submitted by _____

Date _____