

# VACUUM

CAT# 80-50-W022



An absolute fact of nature, the vacuum as a scientific concept and the machine that we all have in our homes are the same. How does it function? With this simple design and build, students can see how we can create a vacuum on a small scale that will do work for us.

## PRIMARY DIVISION: GRADES 1-3

### Overall Expectation

Explore structures and mechanisms, including the roles of materials in supporting structures and making devices work.

### Specific Expectation

Identify and describe the purpose of simple machines such as levers and pulleys.

### Activity

Students use the Scale Model Vacuum to understand how air pressure and suction work. They explore how creating a vacuum can help lift and move small objects. This introduces them to basic concepts of air pressure and force in an engaging and interactive way.

## JUNIOR DIVISION: GRADES 4-6

### Overall Expectation

Investigate the principles of forces, energy, and control in simple machines and structures.

### Specific Expectation

Explore the relationships between the components of simple machines and the forces acting on them.

### Activity

With the Scale Model Vacuum, students investigate the concept of air pressure and how it can be used to perform work. They experiment with different vacuum strengths and observe how it affects the ability to lift various objects. This helps them understand the principles of pressure differences and force.

## INTERMEDIATE DIVISION: GRADES 7-8

### Overall Expectation

Investigate how technological problem-solving meets human needs and leads to innovation.

### Specific Expectation

Analyze the impact of friction and lubrication on the efficiency of mechanisms.

### Activity

Students use the Scale Model Vacuum to explore factors affecting its performance, such as air leaks and seal quality. They experiment with different materials to improve the efficiency of the vacuum seal, learning about the importance of minimizing friction and air resistance in practical applications.

## SECONDARY DIVISION: GRADES 9-12

### Overall Expectation: Physics Focus

Apply principles of physics to understand the operation and efficiency of mechanical systems.

### Specific Expectation

Analyze mechanical advantage and efficiency in simple and compound machines.

### Activity

Using the Scale Model Vacuum, students delve into concepts of air pressure, suction, and mechanical advantage. They calculate the efficiency of the vacuum system and discuss how effectively it converts electrical energy into mechanical work. They also explore real-world applications and advancements in vacuum technology.

## CROSS-CURRICULAR CONNECTIONS

### Mathematics

Students can calculate air pressure, force, and efficiency using mathematical formulas.

### Technology

They explore different designs and materials for optimizing the vacuum's performance.

### Language Arts

Students can write reports or presentations on the principles of vacuum technology and its applications in various engineering fields.

### Summary

By experimenting with the Scale Model Vacuum, students engage in hands-on learning experiences that deepen their understanding of mechanical principles and air pressure while meeting curriculum expectations. This project promotes critical thinking and curiosity in STEM disciplines, encouraging students to explore the world of engineering and technology and understand the importance of creating efficient and practical solutions.