



**(ENG) I can't move the cupboard**

**Introduction**

**Step 1 - Motivational Stage**

**Step 2 - Investigational Stage**

**Step 3 - Consolidation Stage**

# Introduction

---



---

#Online activity #Experiential learning #Simulation #Artwork

---

The activity is presenting two forces in movement – friction and fluid resistance.

Pupils will learn about these forces by connecting them to a real life situation. They will also make some experiments of their own for better understanding and connect the topic to one of the most famous artists, Leonardo da Vinci, since he was the first person who systematically studied friction. They will learn about Leonardo da Vinci as an artist as well as from the perspective of him being a scientist.

## Learning Objectives

- ☐ Describe forces friction and fluid resistance.
- ☐ Give examples from everyday life.
- ☐ Conclude from their own experiments.

## ACTIVITY DETAILS

## Activity Details

### Connection of the activity with Art

Renaissance art, Leonardo da Vinci



## Link to local, national School Curriculum —

Forces/ Friction and resistance



## Equipment required —

- A smaller empty box,
- elastic rope,
- marbles,
- empty jar with a lid,
- jar full of water with a lid,
- jar full of oil with a lid,
- thread,
- tissue, small wooden stick



## Duration of activity —



45 minutes



## Sources —

Beznec, B., Cedilnik, B., Gulič T., Lorger J., Vončina, D. (2019). Moja prva fizika 1, samostojni delovni zvezek za fiziko v 8. razredu osnovne šole

Grubelnik L., Zupan D., Gosak M., Markovič R., Ketiš B., Repnik R., Jug, M. (s.a.), Fizika 8, i-učbenik za fiziko v 8. razredu osnovne šole.

Retrieved from: <https://eucbeniki.sio.si/fizika8/index.html>

White, L. (1968). The invention of the parachute. Technology and Culture, 9(3), 462-467. Retrieved from: <https://aspace.repository.cam.ac.uk/bitstream/handle/1810/255781/Hutchings-2016-Wear-AM.pdf?sequence=1&isAllowed=y>

Hutchings, I. M. (2016). Leonardo da Vinci's studies of friction. Wear, 360, 51-66.

Retrieved from: <https://www.jstor.org/stable/3101655>

Photo credit:

Photo 1

Own

Photo 2

Leonardo da Vinci (1452–1519)

Mona Lisa, 1503–1506

oil on wood

77 cm x 53 cm

Louvre, Paris, France

Public domain

Source:

Leonardo da Vinci, Public domain, via Wikimedia Commons

[https://commons.wikimedia.org/wiki/File:Mona\\_Lisa,\\_by\\_Leonardo\\_da\\_Vinci,\\_from\\_C2RMF\\_retouched.jpg](https://commons.wikimedia.org/wiki/File:Mona_Lisa,_by_Leonardo_da_Vinci,_from_C2RMF_retouched.jpg)

Photo 3

Leonardo da Vinci (1452–1519)

Studies of military tank-like machines, (c. 1485)

Pen and brown ink, over stylus (some drawn with a ruler or a compass)

17,3 cm x 24,5 cm

The British Museum

CC

© The Trustees of the British Museum

[https://www.britishmuseum.org/collection/object/P\\_1860-0616-99](https://www.britishmuseum.org/collection/object/P_1860-0616-99)

# Step 1 - Motivational Stage

---



Present your pupils with the following scenario:

Your family decided to rearrange the furniture in your living room. You will switch the position of the couch and television. They gave you a task to move the TV cupboard across the room. You are happy to help but once you try, you realise the cupboard is very heavy and you could damage the parquet floor. There is no one around to ask for help.

---



*“What could you do to move the cupboard easier and prevent possible floor damages by yourself?”*

---

---



*“Your sister comes in the room and leaves 5 books on a cupboard. You don't like this. Why?”*

---

## Step 2 - Investigational Stage

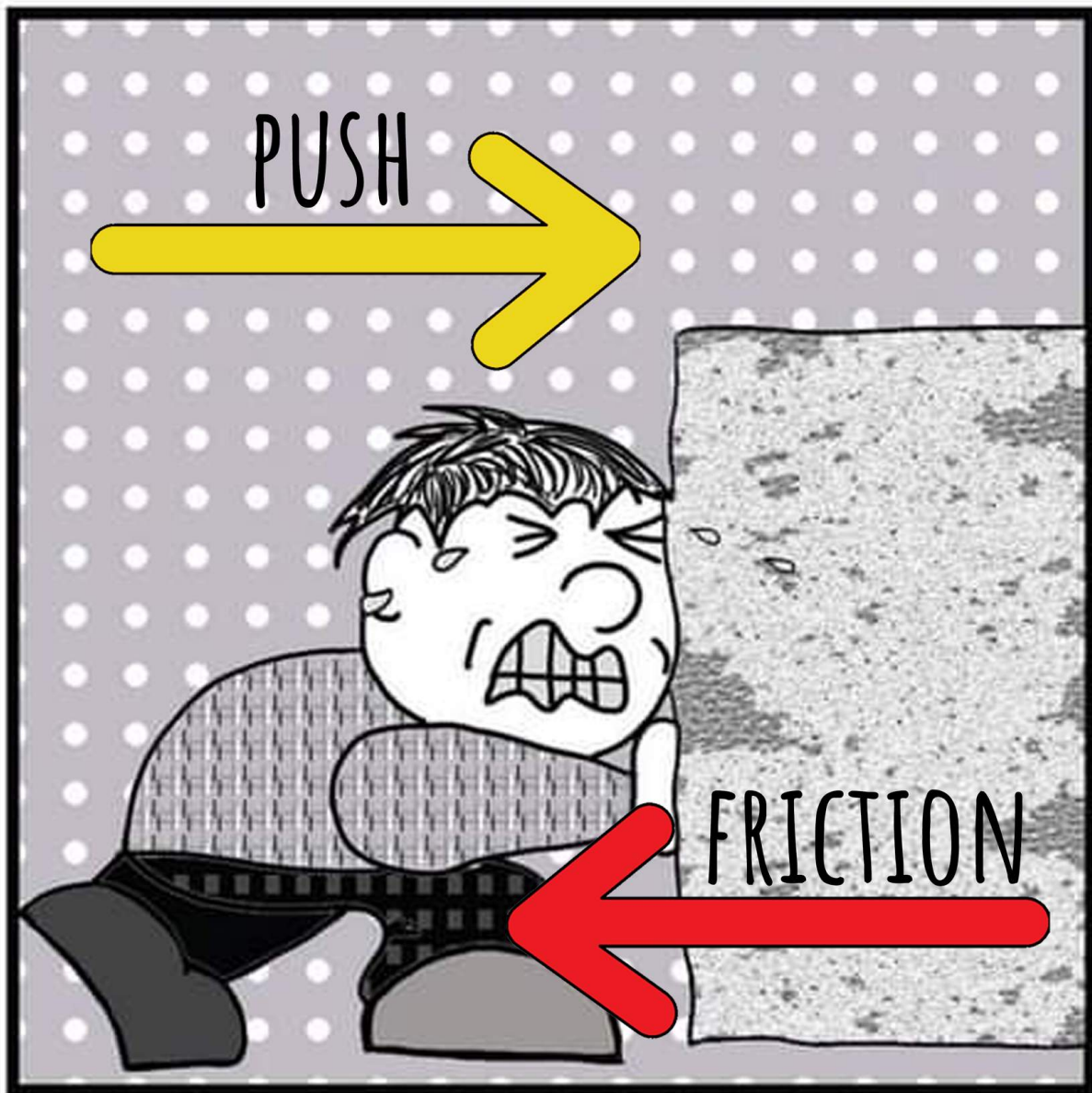
---



**i** The force that resists the movement of the cupboard is called **friction**.

Friction is a force that **acts between two surfaces**.

Friction is a force that **opposes motion**.



## STUDENTS' TASKS

1

### Task 1

Ask your pupils to make an experiment:

Take an elastic rope and tie it around an empty box. Pull the box and observe how much the rope stretched.  
Put marbles in a box and pull it. Observe how much the rope stretches this time.



*"In which case did the rope stretch more?"*

---

Take a box full of marbles and try to pull it on different surfaces (for example: on the table, on the bed, on the carpet, on a parquet floor, on tiles).



*"In which cases was it easier for you to pull the box?"*

---

---

2

## Task 2

Ask the pupils:



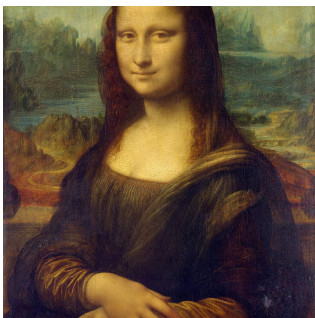
*“What does the force of friction depend on?”*

- **Answer: Friction depends on the weight of the moving object and the material of the bodies in contact.**
- 

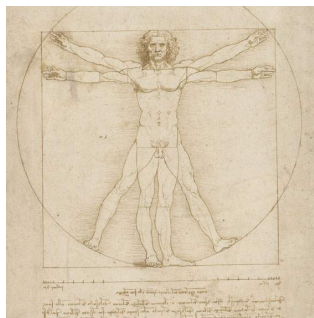
3

## Task 3

Show your pupils the following works of art:



Leonardo da Vinci, Mona Lisa, 1503–1506, oil on wood, Louvre, Paris, France



Leonardo da Vinci, Vitruvian man, app. 1490, ink on paper, Gallerie dell'Accademia, Venice, Italy

Ask your pupils:





*“Are these two artworks familiar to you? Can you name the author of both artworks? Can you name the era these artworks were made in?”*

---

## **Explanation**

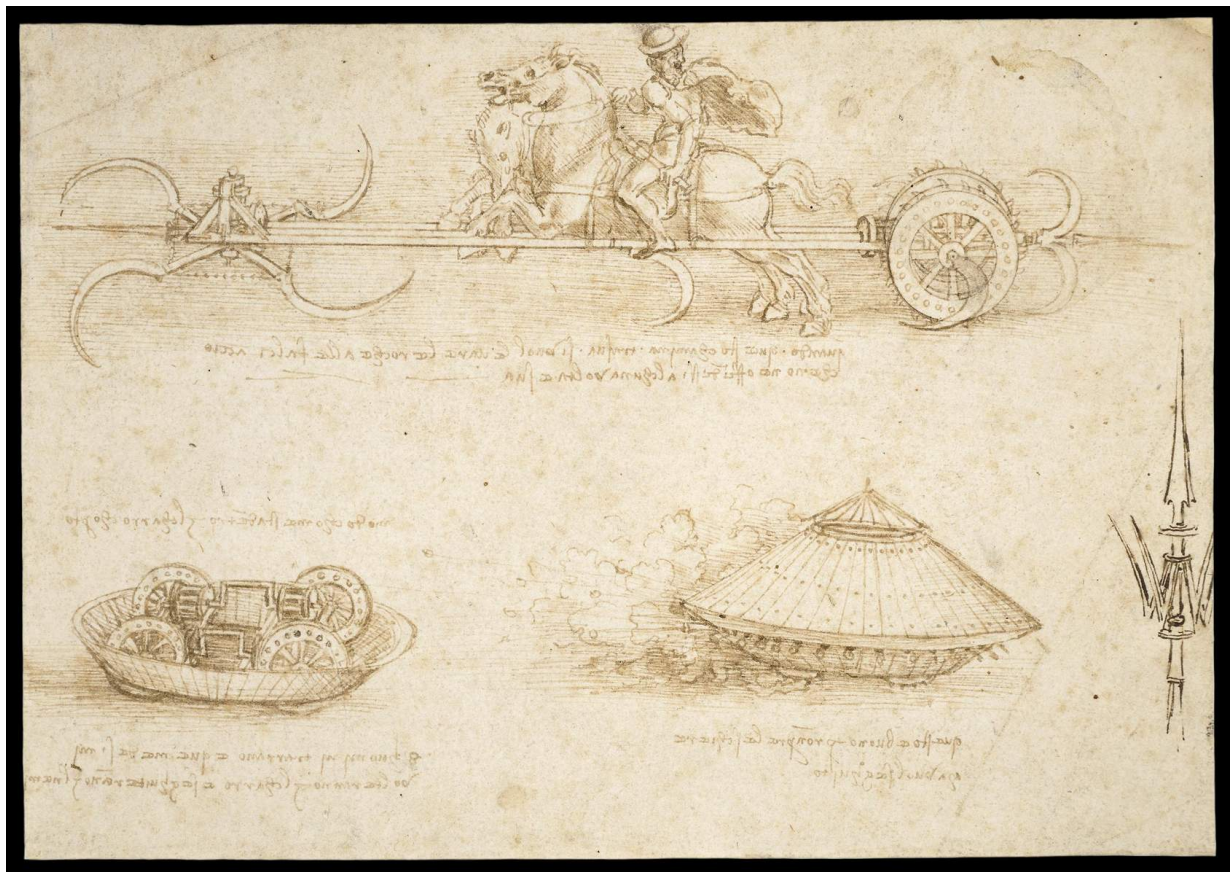
The same man, an artist Leonardo da Vinci, made these two works of art. He created them in an era called the Renaissance. The first one is the painting called Mona Lisa and it is considered the most famous portrait ever painted. The girl in the portrait has a mysterious look in her eyes and a sly smile. People from all around the world are travelling to Paris to the Louvre Museum to see this portrait live.

The other artwork is a drawing, named Vitruvian man. It is Leonardo da Vinci's presentation of ideal proportions.

In the Renaissance people were exploring, studying and experimenting in different fields. Leonardo da Vinci was not only interested in visual arts, but also in different fields of science, such as physics. His drawing skills enabled him to draw clear sketches.

## **Task 4**

Show pupils the picture below:



© The Trustees of the British Museum

Leonardo da Vinci, Studies of military tank-like machines, (c. 1485), Pen and brown ink, over stylus (some drawn with a ruler or a compass), The British Museum

---

These are drawings of Leonardo da Vinci.

They are studies of military machines. Beside some functions of the machines these studies are showing, you can also observe how skilful da Vinci was. There are a lot of his studies and sketches preserved. A lot of his inventions stayed only in sketches, meaning they were never executed.

Ask pupils to browse the internet with keywords:

*Leonardo da Vinci friction.*

## Explanation

These drawings are also Leonardo da Vinci's work. They show his interest in friction. Leonardo da Vinci is the first person in the history of humankind who studied the force of friction systematically.

---

5

## Task 5

Ask your pupils to make an experiment:

Take an empty jar, a jar full of water and a jar full of oil. Put a marble in each jar and close it. Move each jar in a random direction and observe the movement of the marble.

Ask pupils:



*"In which case did the marble move fastest and in which case slowest? Try to explain why."*

---

## Explanation

The force that is slowing down the ball is fluid resistance (resistance, drag). Fluid resistance (drag) is acting opposite to the motion of any moving object surrounded by fluid. It depends on the type of the fluid in which the object is moving.

---

## Task 6

Now ask your pupils to browse the internet with the following keywords:

Leonardo da Vinci, Parachute.

### Explanation

This is another sketch made by Leonardo da Vinci, showing an object which was never realised in his time of living.

Ask pupils:

---



*“What do you see on a sketch? Explain why the parachute is drawn in this specific shape.”*

---

### Explanation

Fluid resistance (drag) depends on the cross-sectional/frontal area of the body. The bigger the size, the bigger the resistance.

Ask pupils:



*“Why do you think the fastest trains are shaped almost in an arrow?”*

---

## **Explanation**

This shape is called aerodynamic shape, and it helps for the drag–resistance of the air to be smaller.

Fluid resistance (drag) depends on the shape of the body. It also depends on the speed of the body. The faster the body is, the bigger is the fluid resistance.

## Step 3 - Consolidation Stage

---



Divide pupils in pairs and pass on the questions below for discussion:

- Name some aerodynamic shaped objects you are familiar with.
- Name a surface with a big magnitude of friction and with a very low magnitude of friction.
- Do we need friction to write?
- Describe friction on a road after the snowstorm.
- Describe fluid resistance of a skier.
- Use the knowledge you gained in this lesson to explain what was happening in the task from the beginning of the lesson – the moving of the cupboard.

Ask pupils to:

- Take a tissue and a thread. Create a parachute. Tie wooden sticks to a parachute and throw.
  - Observe.
  - Throw a stick without a parachute. Did you notice any difference?
  - Make a new parachute with some changes (bigger, smaller, different shape).
  - Observe.
  - Write down your observations and explain why they happened.
- 

## End of the activity

EXIT