

(ENG) Finding Mass Center

Introduction

Step 1 - Motivational Stage

Step 2 - Investigational Stage

Step 3 - Consolidation Stage

Introduction



#In-class activity #Inquiry-based learning #Experiential learning #Artwork

During this experimental activity, pupils will use everyday material to explore the concept of center of mass (CM). The initial step is to start with an object which has a CM that is easy to understand and find. Then, progressively, pupils will be introduced to slightly more complex components, formed by two forks and combinations of other materials.

Encourage your pupils to experiment with the CM of the compounds that will construct and take notes of the procedure they have followed.

Learning Objectives

- ☐ define the center of mass of an object as the point from which the force of its weight acts (in a uniform gravitational field)
- ☐ visually estimate the position of the center of mass of regular compound objects
- ☐ recognize that the center of mass of an object can be a point that consists of empty space within or outside the object
- ☐ identify the common center of mass of multiple objects

ACTIVITY DETAILS

Activity Details

Connection of the activity with Art

Mixing materials and colors



Link to local, national School Curriculum —

Forces/ Centre of gravity



Equipment required —

- two forks
- a cork
- a needle (alternative: small pieces of wood or matches)
- a coin
- a glass



Duration of activity —

45 minutes



Sources —

- https://www.youtube.com/watch?v=tMRSFUy_aAw

<https://www.youtube.com/watch?v=GIP2c1ZtcJU>

Artists experiment with balance sculptures

- https://en.wikipedia.org/wiki/Michael_Grab
- <https://maloupalmqvist.com/>
- https://en.wikipedia.org/wiki/Alexander_Calder

Step 1 - Motivational Stage



Introduce pupils to the topic:

Center of gravity (CG) and center of mass (CM) are the same thing in a uniform gravitational field — which is usually the case here on Earth. In general, it is hard to define CM. But almost everyone has been experimenting with this concept!

You can try to define the CM of objects, when trying to balance things. Once an object is balanced, wherever you are holding up that object is where its CM is. When an object has some form of symmetry it is easier to guess where its center of mass is. For example, a ruler's CM is in the middle of its length. But if you add some extra weight to the end, its CM will shift accordingly.

There is nothing particularly special about that location of the centre of mass. If you were to find yourself at the precise spot that is the centre of mass of the earth-moon system, the only thing unusual that you would notice is that there would be one thousand miles of rock on top of your head.

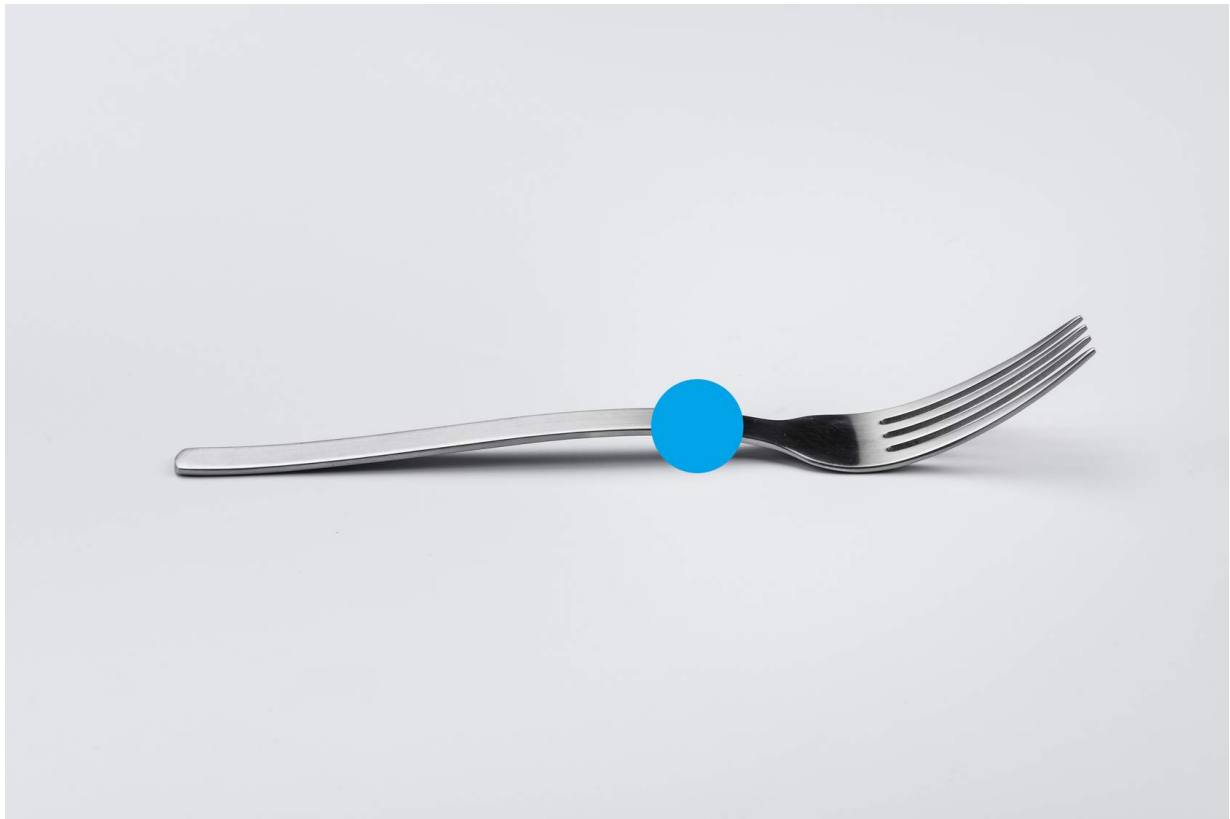
You can also bring examples of finding your own center of gravity. The first video in the sources section can trigger your pupils' interest.

Step 2 - Investigational Stage

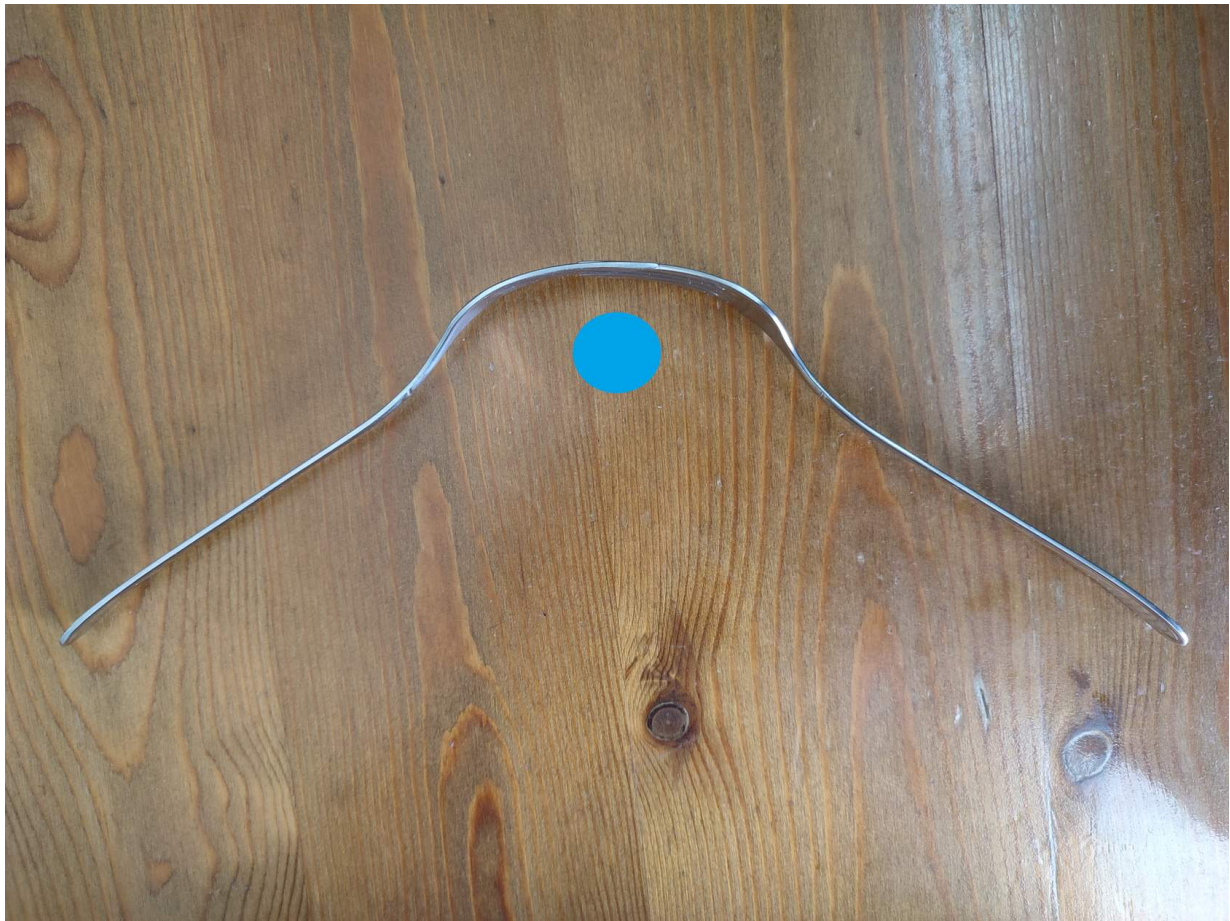


Explain to your pupils:

Finding the CM of a fork is relatively easy, you can find it in the same way as you experiment with the ruler.



But if you try to balance 2 forks on your fingers, you probably won't make it. This happens because the two forks are forming a system. And the weird part is that the center of mass for this system is not identified at any point of mass of this system. In fact, it ends up being just right outside of it.



STUDENTS' TASKS

1

Task 1

Ask pupils to take the two forks, the cork and a needle. Explain that since these objects are often on tables at restaurants, this might be a good trick to do, while you are waiting for your meal.

1

Pin the cork with the two forks.

2

Insert the needle halfway into the cork.

3

Rest the needle on the edge of a glass or other object.



Explain that exactly the same can be done with a coin, instead of a cork and the needle. The principle remains the same. The CM of the system is located at a spot outside the system of the two forks. Therefore, with some practice, you will be able to find it.



Task 2

As soon as pupils understand the principle, they can decorate their constructions, make them look like birds, butterflies etc, adding details from paper and other materials.

Step 3 - Consolidation Stage



You can evaluate pupils based on the notes they will take, including all steps of the procedure, their design of their construction and the understanding they have acquired for the concept of CM.

If you have adequate time, you could ask your pupils to experiment, building their own balancing construction, using any of the proposed methodologies or experiment with their own. The artistic design of their creations is also important with the balance principles. Students must engage to decorate their creations, reaching both aesthetic as well as learning results, by taking notes for every step they take and justify their choices or reflect on their experimentations.

Students can also explore the artwork of artists that have been experiment with balance sculpture (see sources section)

Those notes will reveal the depth in which they have understood the experimentation with the center of gravity, or they experiment randomly following their instinct.

End of the activity

EXIT