(ENG) The Apple's Fall

Introduction

Step 1 - Motivational Stage

Step 2 - Investigational Stage

Step 3 - Consolidation Stage

Introduction

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

This activity aims to provide your pupils with key information for understanding the measurement of forces.

The main objective is to make them understand the difference between weight and mass, theoretically and practically, through the exercise; to make them apply the formula and explain Newton's concept.

Learning Objectives

- [ ] Know the difference between mass and weight.
- [ ] Know Newton unit of measurement

ACTIVITY DETAILS

Activity Details

Connection of the activity with Art

Classical painting

Link to local, national School Curriculum

Forces/ Measurement of forces

Equipment required

- Spring balance,
- balances,
- any object that pupils have at home and can easily bring to school to weigh them,
- sheet.

Duration of activity

45 minutes

Sources

Photo credit:

Robert Hannah (1812 - 1909.)
Master Isaac Newton in His Garden at Woolsthorpe, in the Autumn of 1665, before 1856
oil, canvas, 86 x 125.5 cm
The Royal Institution
public domain

Step 1 - Motivational Stage

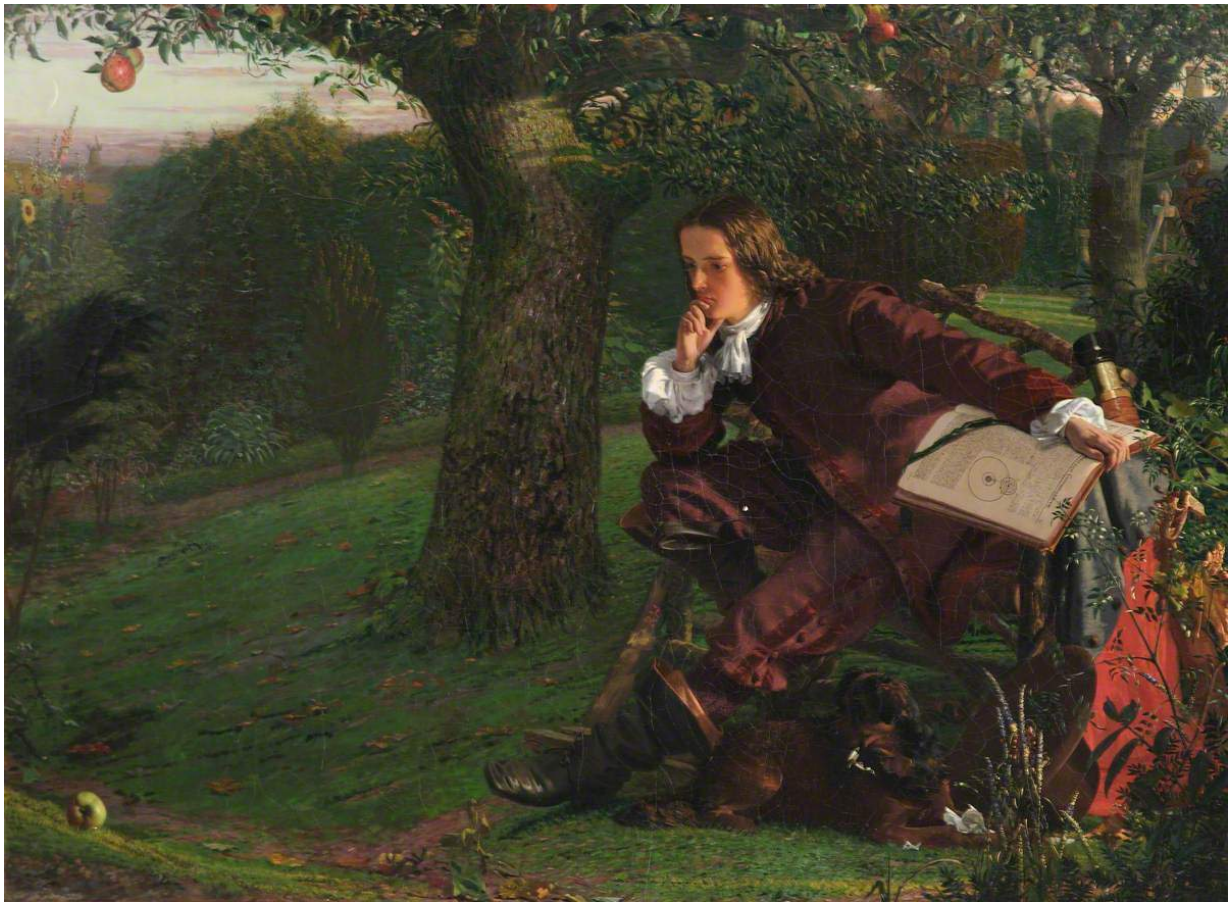
Start the lesson by asking the class to "weight" any object on the balance (e.g. a book or a telephone).

"How much does this object weigh?"

The answer will correspond to the number in kg they saw marked on the balance. But this is an incorrect answer.

Introduce the concepts of weight and mass by saying that what they have just calculated is actually the mass of that object and that its weight is not expressed in kg but in newton.

Show this image of Newton to your pupils.



Ask them:

"Who was Newton? What are his most important discoveries?"

Who was Isaac Newton?

Sir Isaac Newton PRS (25 December 1642 – 20 March 1726/27) was an English mathematician, physicist, astronomer, alchemist, theologian, and author (described in his time as a "natural philosopher"), widely recognised as one of the greatest mathematicians and physicists and among the most influential scientists of all time. His book Philosophiæ Naturalis Principia Mathematica (Mathematical Principles of Natural Philosophy), first published in 1687, established classical mechanics. Newton also made seminal contributions to optics, and shares credit with German mathematician Gottfried Wilhelm Leibniz for developing infinitesimal calculus.
In the Principia, Newton formulated the laws of motion and universal gravitation that formed the dominant scientific viewpoint until it was superseded by the theory of relativity. Newton used his mathematical description of gravity to derive Kepler's laws of planetary motion, account for tides, the trajectories of comets, the precession of the equinoxes and other phenomena, eradicating doubt about the Solar System's heliocentricity. He demonstrated that the motion of objects on Earth and celestial bodies could be accounted for by the same principles. Newton's inference that the Earth is an oblate spheroid was later confirmed by the geodetic measurements of Maupertuis, La Condamine, and others, convincing most European scientists of the superiority of Newtonian mechanics over earlier systems.
Newton built the first practical reflecting telescope and developed a sophisticated theory of colour based on the observation that a prism separates white light into the colours of the visible spectrum. His work on light was collected in his highly influential book Opticks, published in 1704. He also formulated an empirical law of cooling, made the first theoretical calculation of the speed of sound, and introduced the notion of a Newtonian fluid. In addition to his work on calculus, as a mathematician Newton contributed to the study of power series, generalised the binomial theorem to non-integer exponents, developed a method for approximating the roots of a function, and classified most of the cubic plane curves." (Source: Wikipedia)

Now, tell them how Newton is said to have discovered gravity: myth has it that it all originated from an incident in 1666. It seems that in that year Newton was retired to his maternal home in Woolsthorpe Manor, when he witnessed an apple fall from a tree in his garden. As is the case with the most brilliant minds, the physicist did not stop at the event itself but used the falling fruit to ask a question that has transformed the

way we view the universe. More precisely, Newton wondered why the apple always falls towards the centre of the earth and not transversely or upwards.

It took decades before we arrived at the theory of gravity that is now studied in physics, but it is important and inspiring to observe how observing everything around us actually allows us to understand how our world works.

"What does Newton have to do with our lesson?"

Stimulate discussion among your pupils by giving them input and then talk about the difference between mass and weight.

Step 2 - Investigational Stage

STUDENTS' TASKS

1

Task 1

Give them the main elements that enable them to distinguish the two concepts and distribute (or send if the lesson is online) the table on the Worksheet (you can find it at the end of the activity) . Read it with them and then begin the exercise part.

2

Task 2

Place all the objects whose masses and weights you have decided to calculate; place them on the desk along with a pair of balances and a spring balance (instruments they have just read from the worksheet you gave them).

Start putting everything on the balance and ask your pupils whether that is the weight or the mass.

Your pupils should write down all the results from the scales on a sheet of paper.

3

Task 3

Then introduce the formula for calculating the weight and write it on the board or on a poster that you will hang so that it is visible to everyone.

p=m*g

p	weight

m	Mass
g	gravitational

Give the additional fact that gravitational acceleration on earth's surface is **a constant and is 9.81 N/kg.**

4

Task 4

Now your pupils' task will be to calculate the weight having already the mass of the objects. Give them the necessary minutes for the calculation.

5

Task 5

Do the test using the spring balance.

Step 3 - Consolidation Stage

Pupils will understand that what is erroneously described in common sense as weight is mass. They will know how to use both instruments and formulas to measure different quantities.

Worksheet for Step 2 - Task 1

PDF

Measurament of forces _ Worksheet.docx.pdf

19 KB

End of the activity

EXIT