Instituto de Educación Secundaria
"Ramiro de Maeztu"
C/ Serrano 127 Madrid 28006

CONSEJERÍA DE EDUCACIÓN
Comunidad de Madrid

Lab activity 3º E.S.O.

The scientific method: pendulum inquiry

Purpose

- To formulate hypotheses focused on the pendulum motion
- To test a hypothesis experimentally and state scientific laws

Theory

The scientific method has to be applied following these steps:

- Formulation of a hypothesis
- Experimentation: gathering data and establishing scientific laws
- Making up a theory and deducing new hypothesis

A pendulum is a weight suspended from a string which swings from one side to the other periodically. In other words, it needs the same time (period) to do a whole oscillation.

Equipment needed

Base, support rod, thread, several balls, chronometer, precision balance and tape measure

Procedure

Regarding to the pendulum motion we can raise these questions:

A. Does the pendulum period depend on the mass of the body?
B. Does he pendulum period depend on the mass of the body?

Now we have to test different values of masses or lengths so as to check whether the period changes or not.

Data analysis

- Make a table with masses and periods
- Plot a graph of period of the pendulum versus mass
- What is your conclusion? Was your hypothesis true or false?. Why?
- Make a table with masses and lengths
- Plot a graph of period of the pendulum versus length
- What is your conclusion? Was your hypothesis true or false?. Why?

Questions

- Explain the different steps of the scientific method
- Which are the independent and dependent variables in this experiment?
- Find out a technical application of pendulum

Instituto de Educación Secundaria
"Ramiro de Maeztu"
C/ Serrano 127 Madrid 28006

CONSEJERÍA DE EDUCACIÓN
Comunidad de Madrid

Lab activity 3º E.S.O.

Finding the measurement uncertainty

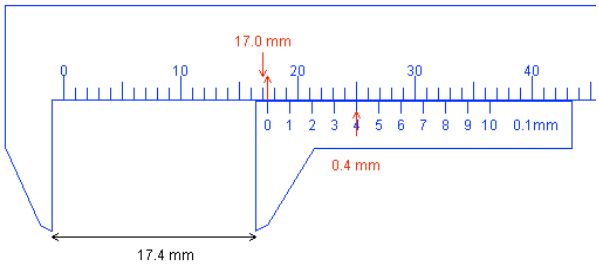
Purpose

- To measure the mass of a chickpea
- To measure the thickness of a sheet of paper
- To find the measurement uncertainty

Theory

Absolute error of a measurement is the difference between the measured value of a physical quantity and the actual one. Relative error is the ratio of the absolute error to the actual value of the measurement

We can increase the accuracy in measurement if we measure substantial values instead of negligible ones. Therefore we can measure tiny masses (e.g. a chickpea) if we weigh a great number of items and find the average



A caliper is a device used to measure distances between two points to high accuray. The main rule gives you the entire value and the Vernier scale, which slides along the caliper, the next figure

Equipment needed

Chickpeas, sheets of paper, precision balance and caliper

Procedure

Take a great number of chickpeas and weigh the set on the precision balance. Repeat this until you get six or seven measurements.

Repeat this procedure to find the thickness of a sheet of paper

Data analysis

- Make a table showing the number of chickpeas, its mass, and the mass of a single chickpea.
- Find the mass average and estimate the uncertainty as the half range and the relative error
- Plot a graph of mass versus the number of pellets
- Make a table showing the number of sheets, its thickness and the thickness of a sheet of paper.
- Find the thickness average and estimate the uncertainty as the half range and the relative error
- Plot a graph showing thickness versus number of sheets

Instituto de Educación Secundaria
"Ramiro de Maeztu"
C/ Serrano 127 Madrid 28006

CONSEJERÍA DE EDUCACIÓN
Comunidad de Madrid

Lab activity 3º E.S.O.

Measurement of density

Purpose

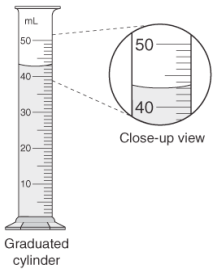
- To measure accurately masses and volumes
- To find the density of a material
- To identify a material by means of its characteristic properties

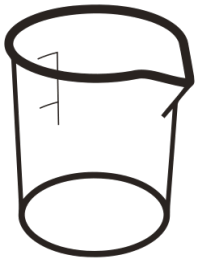
Theory

Mass is a physical quantity which measures the amount of matter of a system. It is measured in kg. Volume measures the amount of space occupied by a system and is expressed in m^3.

Equipment needed

Solids and liquids of different densities, precision balance, graduated cylinder, beaker





Procedure

Masses of different solids can be measured directly with a precision balance, but liquids must be weighed inside a beaker, so you have to subtract the mass of the beaker from the total mass.

Volumes of liquids can be measured directly with a graduated cylinder, but volumes of irregular bodies must be found indirectly by immersion.

Data analysis

- Make a table with masses, volumes, experimental densities and the name of the material

Questions

- Do you know the relationship between states of matter and density?
- Find out information about Archimedes and the crown of Hiero of Syracus
- Compare the mass of a litre of mercury, a litre of water and a litre of air

Material	ρ (kg/m^3)	Material	ρ (kg/m^3)
Air	1,2	Aluminium	2700
Water	1000	Zinc	7140
Alcohol	780	Copper	8960
Glycerin	1260	Iron	7874
Mercury	13600	Lead	11340

Instituto de Educación Secundaria
"Ramiro de Maeztu"
C/ Serrano 127 Madrid 28006

CONSEJERÍA DE EDUCACIÓN
Comunidad de Madrid

Lab activity 3º E.S.O.

Separation methods of mixtures

Purpose

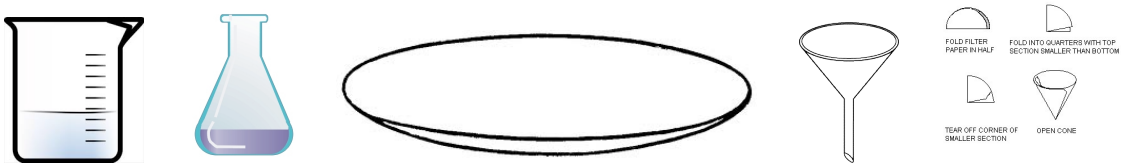
- To recognize different kinds of mixtures
- To separate the components of heterogeneous and homogeneous mixtures

Theory

A mixture is a portion of matter which consists of two or more components. A heterogeneous mixture has visibly several portions of matter or phases of different appearance. On the other hand, a mixture is homogeneous when we can distinguish just one phase.

Equipment needed

Magnet, beaker, erlenmeyer flask, watch glass, stand, rod, clamp, funnel, filter paper, sand, iron fillings, copper (II) sulphate



Procedure

First we have to separate the iron from the rest of the mixture using a magnet. To isolate the sand we have to add a little amount of water to solve the copper (II) sulphate and filter the solution. Sand will be retained in the filter paper and the solution can be collected with an erlenmeyar. Crystallisation let us separate solute from solvent

Data analysis

- Explain the type of mixture and the separation method used in each stage

Questions

- What are the main differences between heterogeneous and homogeneous mixtures?
- What are the most usual separation methods?. Point out the material you need
- What are the separation methods you can use in your kitchen?
- Find out information about the separation methods used in the sewage treatment plants

Instituto de Educación Secundaria
"Ramiro de Maeztu"
C/ Serrano 127 Madrid 28006

CONSEJERÍA DE EDUCACIÓN
Comunidad de Madrid

Lab activity 3º E.S.O.

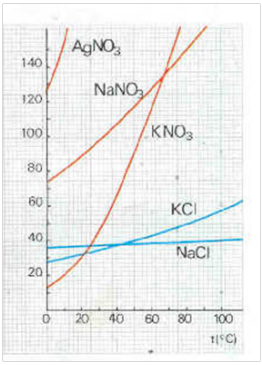
Solubility of a solution

Purpose

- To measure the solubility of potassium iodide at room temperature
- To identify the physical factors which affect the solubility of a solution

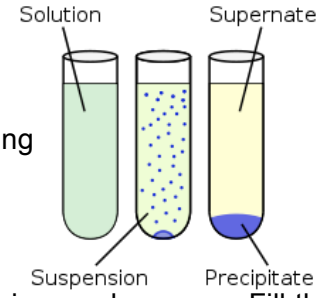
Theory

A ***solution*** is a homogeneous mixture in liquid phase. The components of a solution are called ***solute*** and ***solvent***.



Concentration of a solution is the relative amount of solute. A solution is saturated when it is impossible to solve an extra amount of solute. ***Solubility*** is the concentration of solute in a saturated solution.

Precipitation is the formation of a solid in a solution by means of a chemical reaction. This process takes place when concentration becomes greater than solubility of the substance. Solubility usually depends on temperature, so it is easy to precipitate a solid changing different physical factors. ***Dissolution*** is the opposite process, in which a solute is solved in a solvent forming a solution.



Equipment needed

Beaker, erlenmeyer, buret, stand, rod, clamp, stirring rod, potassium nitrate, potassium iodide

Procedure

Take a 2 grams-sample of potassium iodide and put it in an erlenmeyer. Fill the buret with water and add the solvent little by little until the sample is completely solved. Repeat the process two or three times trying to improve the accuracy of the measurement.

Potassium nitrate is a salt whose solubility changes dramatically with temperature, so it is very easy to precipitate changing the temperature of the solution

Data analysis

- Express the average solubility of potassium iodide in grams per litre and its uncertainty

Questions

- Explain the dissolution and precipitation processes of limestone
- Why does the sea water contain mainly sodium chloride?
- Why are soft drinks always served very cold?