

# Statements of Problems *Invent Yourself*

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## Belarus-Pahonia

### 13. Blood pressure

Studying the accuracy of various methods to measure blood pressure and studying the influence of emotional stress on blood pressure in gender groups.

### 14. Dendrochronology

Explore the climate change in your area by annual growth rings of trees.

### 15. Laser pointer

If you direct the laser beam to the glycerine film under certain conditions, you can see a lot of light channels. Explain and explore this optical effect.

### 16. Granular materials

Explore the phenomenon of adsorption for the substances purification using the granular materials.

### 17. Chronophotographic gun

Demonstrate and explore the features of python movement in different conditions.

## Bulgaria-Awkward Turtles

### 13. Blood pressure

The relation between blood pressure and pulse at various states of body exercise was studied.

### 14. Dendrochronology

The process of tree sampling and sample analysis was studied and conclusions were drawn.

### 15. Laser pointer

A laser pointer was used for measuring an object.

### 16. Granular materials

The different behavior of powder and granular materials was observed.

### 17. Chronophotographic gun

Chronophotographic pictures were used to study gestures.

## Bulgaria-Sofia

### 13. Blood pressure

Investigate how external and internal factors influence the blood pressure and pulse.

### 14. Dendrochronology

Investigate the changes that occur in the tree rings during periods of extreme climatic conditions.

### 15. Laser pointer

Use a laser pointer to investigate a non-homogenous medium.

### 16. Granular materials

Investigate the behavior of granular materials in liquids.

### 17. Chronophotographic gun

Sometimes the motions of the vertebrate animals are interesting from physical points view. Investigate quantitatively such a phenomenon, using a high-speed camera.

## Croatia

### 13. Blood pressure

Study the accuracy of various methods to measure blood pressure and investigate the change in pulse and blood pressure caused by the change of body position.

### 14. Dendrochronology

Annual growth rings of trees are often used to date important historical events or environmental conditions of the past. How does the climate influence the growth of different species of trees from the same area?

### 15. Laser pointer

Construct an optical device that uses a laser pointer and allows contactless determination of thickness. How precise can you measure the width of a single hair using such device?

### 16. Granular materials

Granular materials are all around us. They are even part of our daily eating habits. How does the size of the granular materials affect their properties?

### 17. Chronophotographic gun

Étienne-Jules Marey pioneered the use of time resolved photography to study physiology of humans and animals, and in particular their postures and locomotion. Using the same method analyse motion of flowers under different wavelength and frequencies of light. Investigate motion properties as a function of relevant parameters.

## Georgia-Komarovi

### 13. Blood pressure

Create your own setup to measure blood pressure. Study the accuracy of your device and investigate how human's blood pressure depends on various situations.

### 14. Dendrochronology

Investigate how tree rings are changing through years and which environmental events effect different parameters of the rings. Is it possible to determine past environmental changes using tree rings?

### 15. Laser pointer

Use a laser pointer in such a way that it allows you to determine thickness and other optical properties of transparent objects (glass sheet, soap bubble etc.).

### 16. Granular materials

Investigate how characteristics vary with different parameters such as orientational order, kissing number or fraction of space taken up, while granular materials are poured into a vessel.

### 17. Chronophotographic gun

Chronophotography can be used to investigate how humans' emotions change by observing on persons facial expressions. Investigate this physiological phenomenon and provide a way to determine person's emotion with slightest details.

## Georgia-National

### 13. Blood pressure

We examine on what relevant parameters is blood pressure depended on (such as blood velocity, diameter and elasticity of blood vessel etc.). We also study the errors of different methods that is applied to measure blood pressure.

### 14. Dendrochronology

We use tree rings to analyze atmospheric conditions of different periods of time. We compare the results to real data.

### 15. Laser pointer

We use laser pointer to measure the thickness and refraction index of glass. Also, we measure the wavelength of different lasers and the concentration of sugar in liquids.

### **16. Granular materials**

We study thermal and sound conductivity of granular different granular materials.

### **17. Chronophotographic gun**

We study the growth rate of fur for different animals and examine how it is depended on several parameters.

## **Iran-AYIMI 1**

### **13. Blood pressure**

To measure blood pressure:

What is blood pressure? How does it changes in human body? What parameters affect on blood pressure ? Is it different in human and animal? How does for example stress affect on it? To do the experiment what devices are needed?

### **14. Dendrochronology**

What is the relation between the rings in tree and its age? Is it possible to find the environmental situations which may affect on these rings? How can we measure these rings without damaging the tree? Is the amount of water which tree got can change the number of rings or is there any difference between trees's rings in humid area and desert?

### **15. Laser pointer**

How can we study an optical beam from a laser pointer ? What is the difference between this beam and a light beam? What important parameters should we investigate? What is interesting in laser beam in this experiment?

### **16. Granular materials**

What is granular material? How can we study different properties of granular material? What is the difference among different granular materials? Is it different doing experiments in several temperature?

### **17. Chronophotographic gun**

How can we understand animal and human physical situation from the pictures? What is the role of angle which are make? How can the postures and locomotion of humans and animals be analyzed by video processing? How are the size, color or other parameters of an organ used to process the function of an organ in animal or human?

## **Iran-AYIMI 2**

### **13. Blood pressure**

What devices are proposed to measure pulse and blood pressure? What parameters are effective on blood pressure?

### **14. Dendrochronology**

How can we measure the rings of the tree? What is the method or devices to determine the age of the trees without cutting them, and did this study for various trees.

### **15. Laser pointer**

What is an interesting optical effect that is not seen in everyday life in comparing by a visible light and its properties? What parameters can be studied in this optical effect?

### **16. Granular materials**

What is Granular material? What is the difference between Granular material and normal one? How can we find the properties of these materials and compare them with each other?

### **17. Chronophotographic gun**

What is the method of analyzing the physiology of human, and animals like the way they walk or the way the body is developed by photography?

## **Kazakhstan**

### **13. Blood pressure**

Measurement of blood pressure and pulse with piezoelectric sensors. Comparison of the accuracy of the results obtained with classical methods.

### **14. Dendrochronology**

The research of annual tree rings and the compilation of climatic maps of the last decade, depending on the width and shape of individual rings.

### **15. Laser pointer**

If a light is an electromagnetic radiation perceived by the human eye, and a laser is a device for emitting stream light. Using an experiment using a laser, find the wavelength of this stream.

### **16. Granular materials**

Investigation of factors affecting the magnitude of the angle of the natural slope of loose materials. The determination of the coefficient of internal friction of bulk materials through the angle of a natural slope.

### **17. Chronophotographic gun**

Investigation of the peculiarity of a person's character and the behaviour of animals with the help of photography obtained by a high-speed camera.

## **New Zealand**

### **13. Blood pressure**

Blood Pressure is inherently variable. Investigate how this phenomena affects the reliability of different methods used to diagnose hypertension.

### **14. Dendrochronology**

Compare climate and age data gathered from tree ring samples to the actual age of the tree and climate data from where the tree grew. Explain any differences that are found.

### **15. Laser pointer**

Rosalind Franklin confirmed the structure of DNA by taking photos of x-ray diffraction patterns directed through a crystal of DNA. Most famously Photo 51. Investigate if the shape of a similar helical structure is decipherable using a laser pointer.

### **16. Granular materials**

When a mixture made up of two different sized granular materials is poured, it can separate into alternating layers of the different materials. Explain this phenomenon.

### **17. Chronophotographic gun**

Investigate the physiological function of lift generation by birds. Explain what affect the ecological niche a bird inhabits has on this ability.

## **Russia-12FM**

### **13. Blood pressure**

Study the accuracy of different methods for measuring blood pressure and pulse at different types of physical activity of school-age children.

### **14. Dendrochronology**

Study how the size of the annual ring changes under the influence of human activity and weather conditions.

### **15. Laser pointer**

Suggest a way to measure the Planck constant using a laser.

### **16. Granular materials**

Study the properties of bulk materials that are necessary in industry.

### **17. Chronophotographic gun**

Observe the reaction of the human and animal pupils under different light conditions, using a series of consecutive photographs.

## **Russia-12 kids of science**

### **13. Blood pressure**

Investigate the influence of different products (cold and warm water, warm water with honey, coffee and glycine) on the pulse and blood pressure.

#### **14. Dendrochronology**

Investigate the change of climate of Voronezh over last 50 years on the base of analyses of tree rings. Determine the most favorable years for the trees growth.

#### **15. Laser pointer**

When the lighting objects are pictured in the darkness, there can appear bright symmetric rays around the object on the photo. Explain the phenomenon and conduct the model experiment using laser pointer.

#### **16. Granular materials**

Investigate the influence of grinding size of powder on the optical properties of this powder.

#### **17. Chronophotographic gun**

Investigate the change of skin color under the influence of natural ultraviolet light during the spring using the series of photos.

## **Russia-Easy Science**

#### **13. Blood pressure**

Blood pressure and pulse measurements were performed using three different methods.

We studied pressure fluctuations of adults & adolescents depending on the time of the day and sweet food and drinks consuming under physical burden as well.

All the results are presented as tables, charts and graphs.

#### **14. Dendrochronology**

Cross-section of a poplar, falling because of strong wind not far from our school, was researched. The tree growth was measured, the table of growth and dendrochronological scale according to the data for 6 years were formed. The data of precipitation and average temperatures for the last 6 years were analyzed, the corresponding graphs were constructed, the age of the tree was determined and the reason for its fall was presumably established.

#### **15. Laser pointer**

The effects of refraction, total internal reflection, which occur when the laser beam passes through the environment with different optical density, and through the fiber optic cable as well. The paper presents a photo report and calculations of the refractive index of the environment.

#### **16. Granular materials**

The research relates to traits and behaviour of bulk materials on the example of semolina and sand:

- a) comparison of the depth of immersion of the unbroken tin can and a tin can with punched holes on the bottom;
- b) changes in sand and liquid pressure, dependant on the height of the column of substance;
- c) comparison of speed of sand and liquid moving from different compartments of the reservoir;
- d) behaviour of semolina during constant vibration.

#### **17. Chronophotographic gun**

Process of human foot functioning during walking and running is fixed with the method of time-lapse photography; it was determined, what physiological functions a foot perform as a walking pattern link; analyzed, why it is necessary to follow the proper walking regime and try to avoid factors of violation of foot functions, when possible.

Method of the research: physical modeling of approximate ideal moving trajectory with the help of a treadmill.

## **Russia-Voronezh Kvantorium**

#### **13. Blood pressure**

Study various methods of measuring heart rate and blood pressure and determine their accuracy. Examine, which factors affect the change of blood pressure and heart rate most strongly.

#### **14. Dendrochronology**

Tree rings are used for dating various events or describing climate of past centuries. Explain and study this phenomenon and provide the way of proper understanding of the tree rings.

#### **15. Laser pointer**

Use several laser pointers in order to determine the focal length of converging lens. Determine the accuracy of this method.

**16. Granular materials**

When poured, bulk materials form a conical pile. Investigate and explain this phenomenon.

**17. Chronophotographic gun**

Perform a study of a cat's jump, especially from the start to the significant height, using the storyboard of the jump's video.

## Switzerland

**13. Blood pressure**

We used different methods to measure vital signs both automatically and manually. This was done for several subjects in a few different settings to allow for a detailed comparison of the utilised methods.

**14. Dendrochronology**

By combining the analysis of growth rings in trees with other methods such as C14, we were able to recover information about medieval climate conditions in the Swiss Alps.

**15. Laser pointer**

Using light from a laser source, we determined the thickness of human hair by analysing diffraction patterns.

**16. Granular materials**

Under certain circumstances, granular material can behave fluid-like. In an attempt to determine how much a fluid granular material can be, we tried to determine fluid-properties like viscosity and barometric pressure experimentally.

**17. Chronophotographic gun**

With the help of pictures of both professional and amateur athletes we analysed the accuracy of their sport-specific motion, in particular standing long jump. This was used to spot areas, where specific training would lead to the greatest performance improvements.