The 5th International Young Naturalists' Tournament
Municipal Autonomous Institution of General Education
of the city of Novosibirsk «Gymnasium №12»

Problem № 15
«Water from the air»

Team *«12FM»*,
Novosibirsk
Suluianova Kseniia
chnmk@mail.ru

Statement of the problem

Design and construct a device allowing collection of water by condensing moisture from air. Determine if the water obtained with your device is suitable for drinking. What amount of water is possible to collect during one Science Fight?

Hypothesis:

if air contains water vapor, then it can be condensed.

Purpose

to model the device allowing to receive water from air at the room temperature.

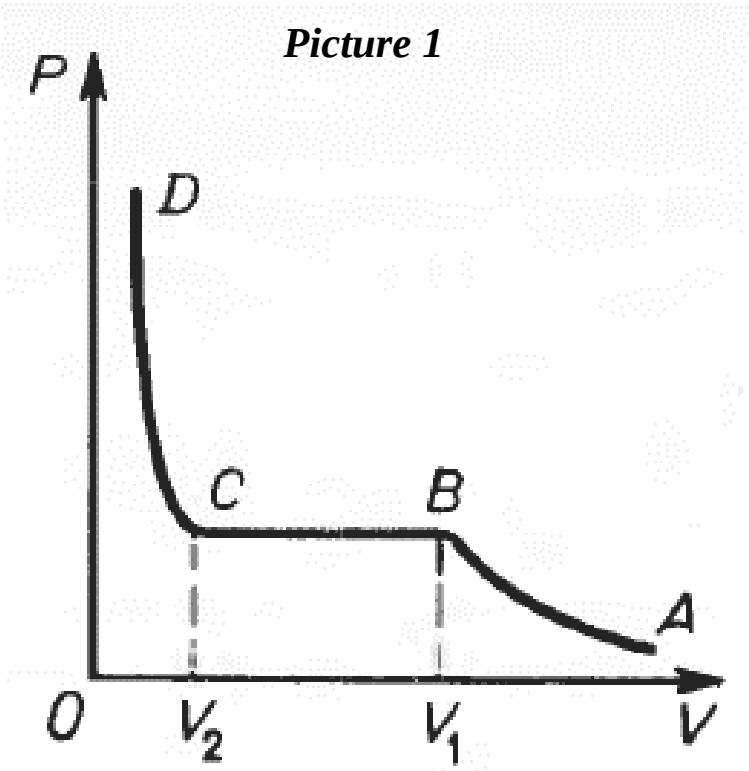
Objectives

1. to study scientific publications on the problem.
2. to analyze the process of condensation of water vapor out of air at the room temperature;
3. to model the device allowing to receive water out of air;
4. to define suitability for drink of the received water;

Theoretical part of the project

Condensation is a process of transition of substance to a liquid or firm state from gaseous. All real gases are capable to turn into liquid under certain conditions. However, such transformation can happen only at temperatures below the certain, so-called critical temperature.

Theoretical part of the project



CD	*Compression of liquid*
C	*All vapor condensed*
BC	*Condensation*
B	*Saturated vapor*
AB	*Compression of unsaturated vapor*

Transition of unsaturated steam to liquid can happen in two ways: changing of its volume and changing of its temperature.

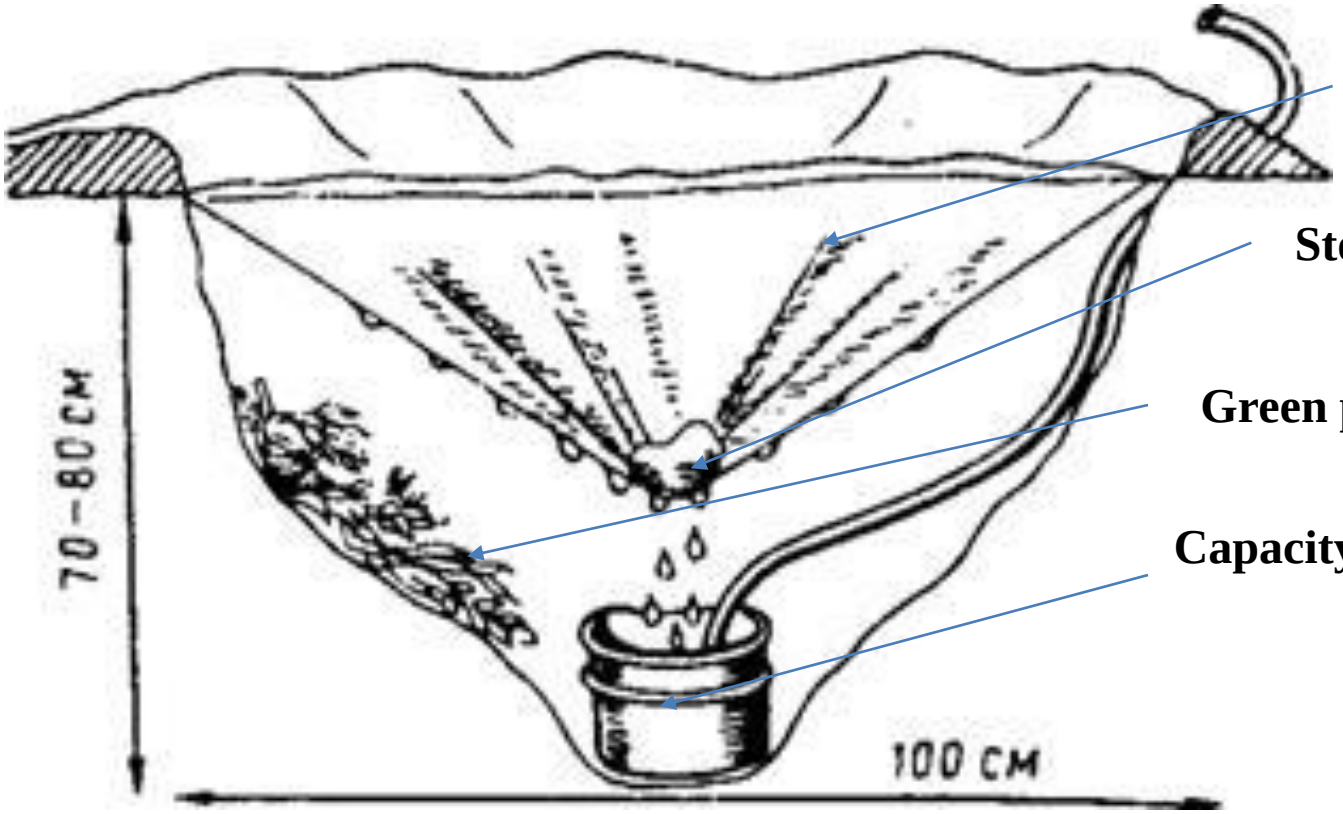
Theoretical part of the project

$$T_p = \frac{b(\frac{aT}{b+T} + lnRH)}{a - (\frac{aT}{b+T} + lnRH)}$$

Dew point - temperature, to which the air must be cooled, so that the water vapor contained in it becomes saturated.

http://planetcalc.ru/248/ - dew point calculator

Theoretical part of the project



Membrane

Stone

Green plants

Capacity for collecting water

Experimental part of the project

The aim is to collect water from air by method of collecting water condensate in the conditions of a campaign on the nature.

Devices and materials: a polyethylene membrane, a stopwatch, a stone, a green plant (1,5 kg), capacity for collecting water.

Experimental part of the project

The modelled device is capable to collect water from air. The volume of the received liquid is 5 ml in 6 hours.

We put forward a hypothesis:

the volume of water will depend on the area of a membrane, mass of green plants.

Experimental part of the project

The aim is to define dependence of volume of collected water on the mass of green plants.

Devices and materials: a polyethylene membrane, a stop watch, a stone, green plants (1,5 and 3 kg), capacity for collecting water.

Experimental part of the project

Experiment	Water volume, ml	Area of a membrane, cm	Time, hours
Mass of green plants 1,5 kg	5	169	6
Mass of green plants 3 kg	8	169	6

Conclusion: the volume of the received water depends on the mass of green plants.

Experimental part of the project

The aim is to find out dependence of volume of collected water on the area of a polyethylene membrane.

Devices and materials: a polyethylene membrane of various area, a stop watch, a stone, a green plant (1,5kg), capacity for collecting water. On the slide the photo of installation and the course of an experiment are presented.

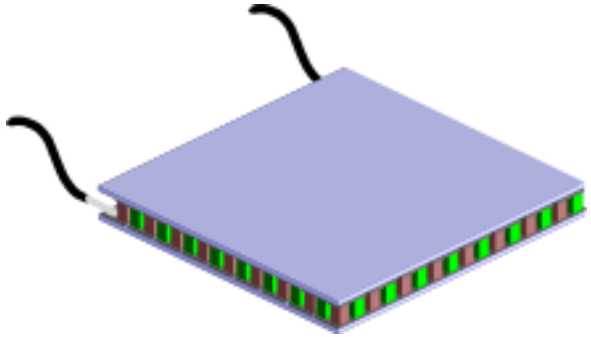
Experimental part of the project

Experiment	Water volume, ml	Mass of green plants, kg	Time, hours
Area of a membrane, 169 cm^2	5	1,5	6
Area of a membrane, 378 cm^2	9	1,5	6

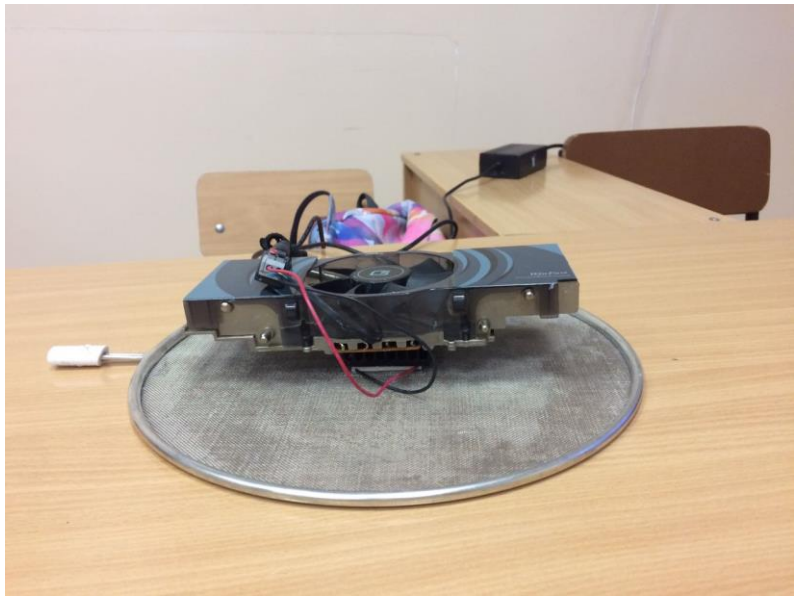
The conclusion: the more the area of a membrane is, the more volume of collected water is . However if not to changing the mass of green plants, increasing only the area of a membrane, then the amount of collected water won't be able to increase when the membrane is only a surface for subsidence of droplets of water.

Experimental part of the project

The Peltie element is a thermoelectric converter, the principle of which is based on the Peltie effect - the occurrence of a temperature difference in the course of an electric current.



Appearance of the Peltier element. When the current is passed, heat is transferred from one side to the other.

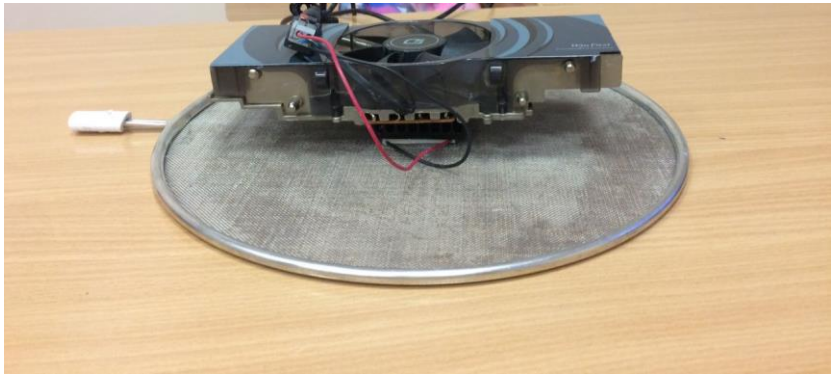


Generator for receiving water from the air

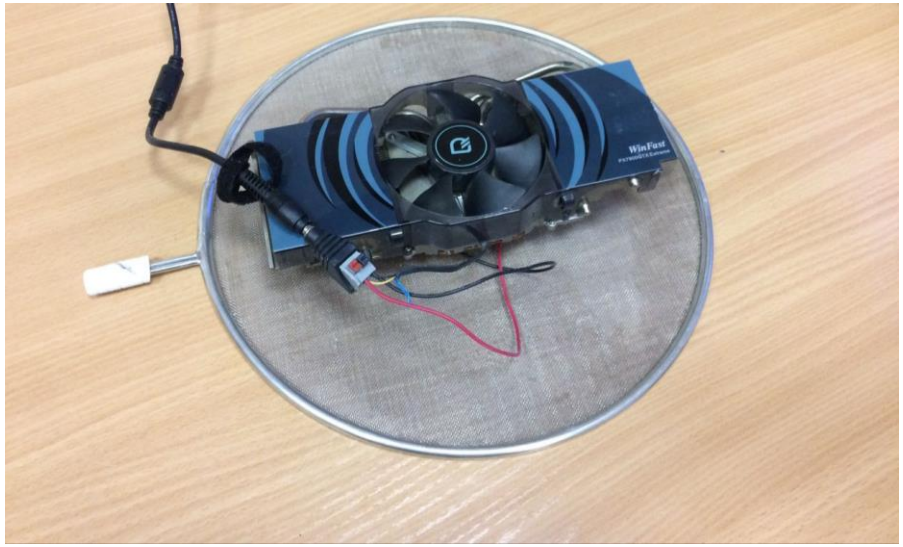
The following elements were used for the design of the developed device:

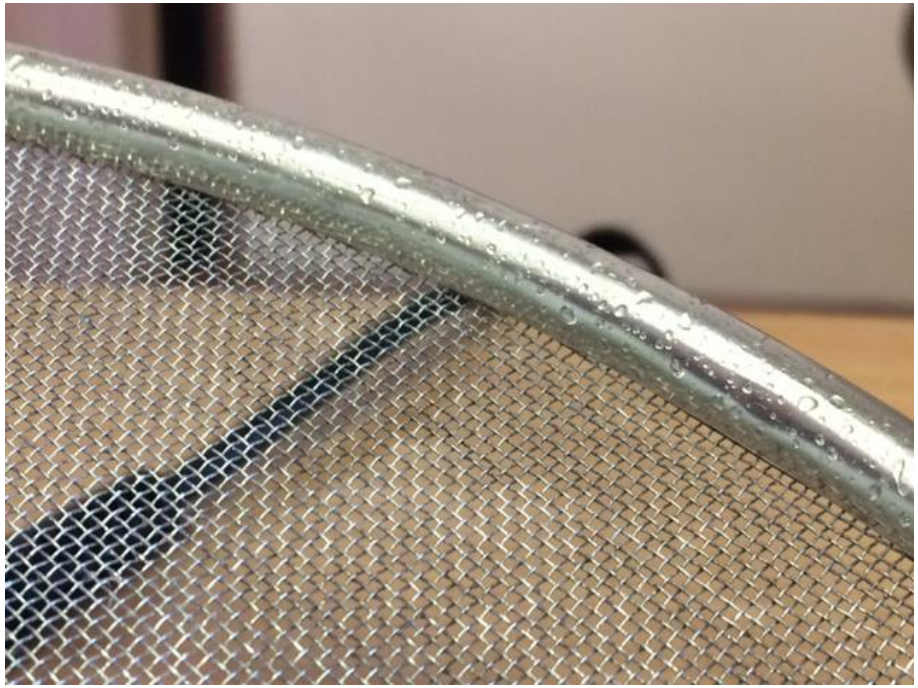
- TES-12704-40 module Peltier, 4A
- Power supply pulse 12V 4A, desktop.
- Fan for radio equipment 50x50x10
- Cable products, network cords.
- Mounting boards.
- Radiators HS 183-50, and 50h50h17

Experimental part of the project



When the installation is connected to the network, snow forms in the area where the grid is closely adjacent to the Peltie module. When cooling down, snow melts and you can collect water

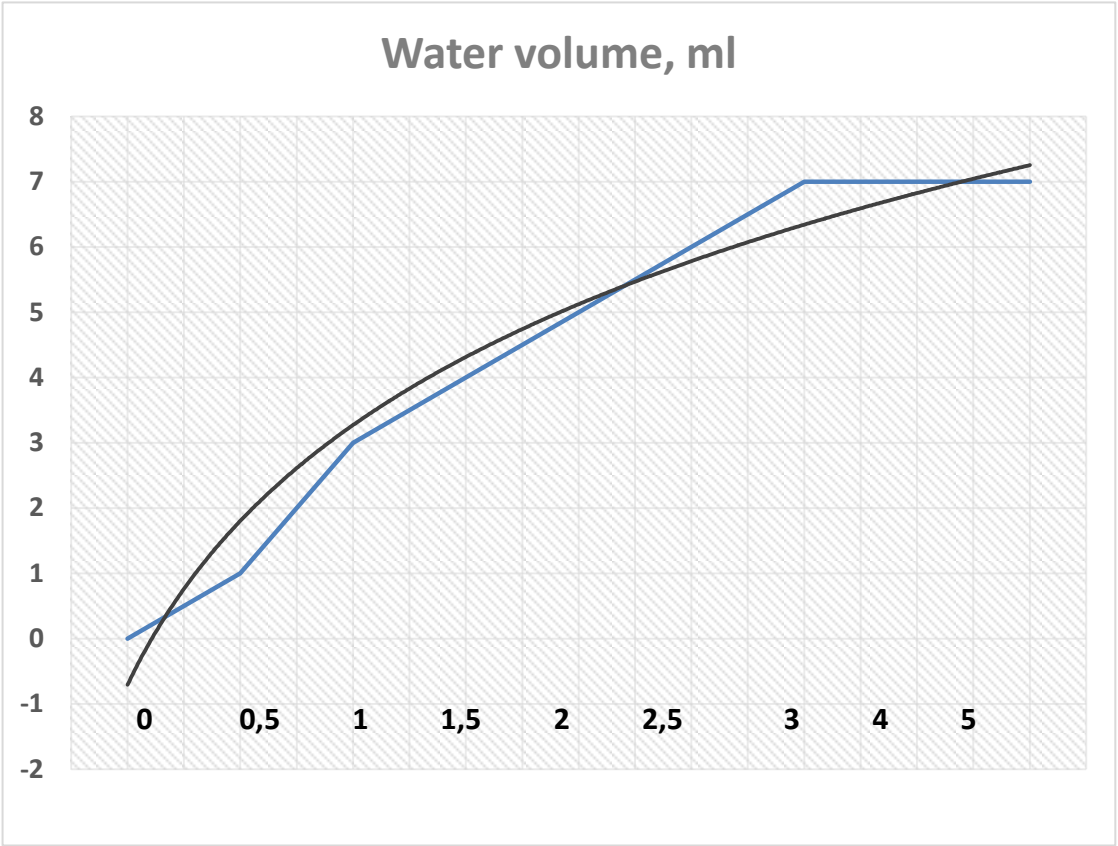




Experimental part of the project

During the experiment, the amount of water formed was recorded at regular intervals. Temperature of air is 25°C, relative humidity is 21% in the volume of air 180m^3

Times, minutes	Water volume, ml
0	0
0,5	1
1	3
1,5	4
2	5
2,5	6
3	7
4	7
5	7



Conclusion

1. The result of this research project the modelled installations for receiving drinking water from air at the room temperature.
2. The water received by condensation during the experiment was checked in school chemical laboratory. It is distilled. It water is theoretically suitable for drinking. But there are no salts in it which are necessary for a person. So people can be sick.

Sources information

1. Mustafayev R.A. «Physics. To help those entering universities»
2. http://namalte.ru/генератор-воды-из-воздуха/
3. http://www.findpatent.ru/patent/216/2169237.html
4. http://www.freepatent.ru/patents/2146744
5. http://www.findpatent.ru/patent/216/2169032.html
6. http://www.freepatent.ru/patents/2245967
7. http://acule.ru/generator-vody-dobycha-vody-iz-vozduxa/
8. http://www.newchemistry.ru/letter.php?cat_id=23&n_id=3882&page_id=3