

## „STEM JAM” CHALLENGE



### Aim and tasks

**Aim:** Accept the STEM jam challenge and reveal the roles of different school subjects in the course of jam making.

#### Tasks:

1. Make two types of STEM jam from the chosen fruit and berries.
2. Observe biochemical and physical phenomena in the course of jam making.
3. After stating the parameters, carry out qualitative and quantitative estimations.
4. Discuss results of former observation and research and make conclusions.
5. Organise project presentation and jam tasting.

### Challenge course photo gallery:

<https://www.youtube.com/watch?v=rt88GQcJ0d0>

### TECHNOLOGIES

**Aim:** Make two types of jam from the chosen ingredients (fruit, vegetables) in a safe and technologically reasonable way.

#### Tasks:

1. Analyse technological processes of marmelade and jam making.
2. Plan technological processes and choose the ingredients properly in accordance with similar jam recipes.
3. Carry out technological processes safely.
4. Pour the final product (jam) into proper containers (jars) and design labels.

## **Pumpkin and Cranberry jam**


### **Ingredients**

600 g pumpkin,  
3 glasses of cranberry (ca. 450 g)  
600 g sugar  
200 g (a glass) water  
5 g cinnamon (optional)

### **Crockery, cutlery, equipment**

Pot  
Scales  
Jars 0,5 l; 2 pcs.  
Thermometer  
Ladle  
Teaspoon  
Glass measurement vessel  
Electric cooker  
Electric blender

## **Technological process – Making Pumpkin and Cranberry jam**

	<ol style="list-style-type: none"> <li>1. Prepare the pumpkin –wash and peel it.</li> <li>2. Pour the due amount of water into the pot.</li> <li>3. Weigh the due amount of sugar and pour it into the pot.</li> <li>4. Melt the sugar.</li> <li>5. Cut the pumpkin into small cubes, weigh the due amount of it.</li> <li>6. Put pumpkin cubes into the water and sugar mixture.</li> <li>7. Simmer constantly stirring until pumpkin cubes soften - ca. 60 min.</li> <li>8. Add clean and dry cranberries.</li> <li>9. Simmer for ca. 15 min.</li> <li>10. Add cinnamon and simmer for 5 min.</li> <li>11. If you want smooth jam, use a blender then. Usually, cranberries do not soften while simmering and are heated shorter and in lower temperature to save vitamin C and useful nutrients.</li> <li>12. Pour the jam into clean jars.</li> </ol>
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### Pumpkin and Lemon jam

#### Ingredients

600 g pumpkin  
 600 g (4-5 pcs.) average size lemons  
 600 g sugar  
 200 g (a glass) water

#### Crockery, cutlery, equipment

Pot  
 Scales  
 Jars 0,5 l; 2 pcs.  
 Thermometer  
 Ladle  
 Glass measurement vessel  
 Electric cooker  
 Electric blender

### Technological process – Making Pumpkin and Lemon jam



1. Prepare the pumpkin – wash and peel it.
2. Cut the pumpkin into small cubes, weigh the due amount of it.
3. Wash and peel the lemons, cut them into cubes and weigh.
4. Weigh the due amount of sugar and pour it into the pot.
5. Pour the due amount of water into the pot.
6. Melt the sugar.
7. Put pumpkin cubes into the water and sugar mixture.
8. Simmer constantly stirring until pumpkin starts to soften – ca. 30 min.
9. Put the lemons into the simmering pumpkin mash.
10. Simmer the jam for ca. 20 min, until lemons become soft.
11. Smooth the jam with an electric blender, simmer for 2-3 min. and pour carefully into 0,5 l jars.

## ART AND TECHNOLOGIES

### Jam labels







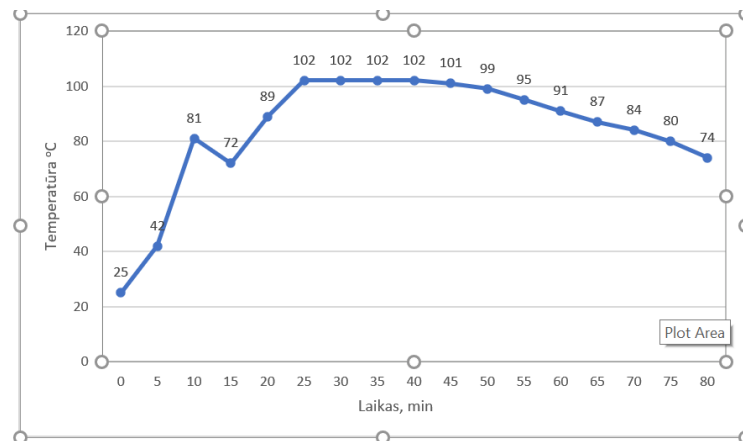
## PHYSICS

### Tasks:

While making the jam, use proper devices to measure jam temperature, mass, boiling time and volume. After getting the necessary data, draw jam temperature alteration diagrams, calculate jam density, amount of consumed energy, its cost and amount of evaporated liquid. In accordance with physics terms and observed processes, name the phenomena

### Pumpkin and Cranberry jam

#### 1. Jam temperature alteration diagram



#### 2. Jam density:

$$m = 646 \text{ g}$$

$$V = 500 \text{ cm}^3$$

$$\rho = m/V$$

$$\rho = 1,292 \text{ g/cm}^3 = 1292 \text{ kg/m}^3$$

#### 3. Amount of consumed energy:

$$P = 6500 \text{ W}$$

$$t = 1,3 \text{ h}$$

$$A = E = P \cdot t$$

$$A = E = 8450 \text{ Wh} = 8,45 \text{ kWh}$$

#### 4. Energy cost:

$$1 \text{ kWh} = 0,189 \text{ eur}$$

$$K = 1,597 \text{ eur}$$

#### 5. “Where did the jam disappear?”

Mass of products used for making the jam - 2000 g:

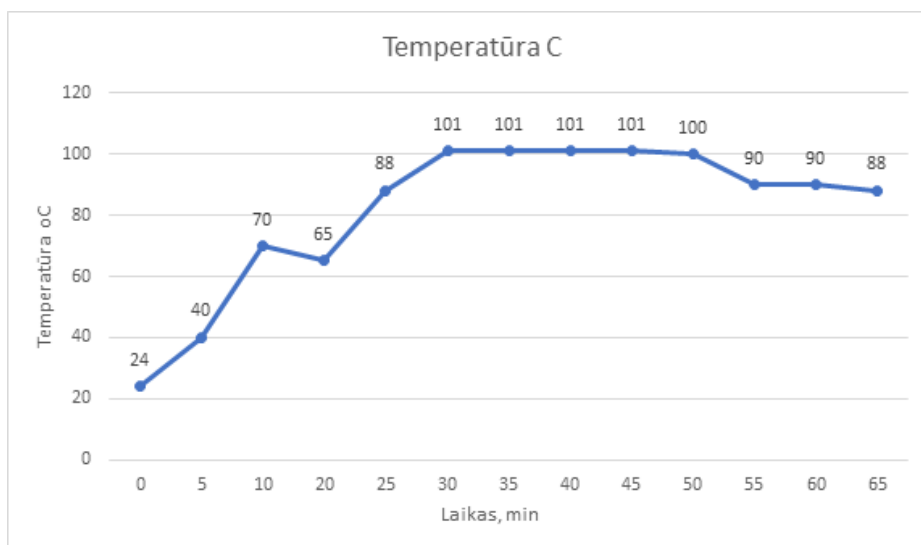
- a) 600 g pumpkin,
- b) 600 g cranberries,
- c) 600 g sugar
- d) 200 g water.

Mass of the ready jam - 1292 g

Evaporated liquids - 708 g

### Pumpkin and Lemon jam

#### 1. Jam temperature alteration diagram



#### 2. Jam density :

$$m = 562 \text{ g}$$

$$V = 500 \text{ cm}^3$$

$$\rho = m/V$$

$$\rho = 1,124 \text{ g/cm}^3 = 1124 \text{ kg/m}^3$$

#### 3. Amount of consumed energy:

$$P = 6500W$$

$$t = 1,12 \text{ h}$$

$$A = E = P * t$$

$$A = E = 7280 \text{ Wh} = 7,45\text{kWh}$$

**4. Energy cost :**

$$1\text{kWh} = 0,189 \text{ eur}$$

$$K = 1,408\text{eur}$$

**5. “Where did the jam disappear?”**

Mass of products used for making the jam – 2000 g:

600 g pumpkin,

600 g lemons,

600 g sugar,

200 g water.

Mass of the ready jam – 1124 g

Evaporated liquids - 876 g

**6. Physical phenomena that proceeded while making the jam:**

- a) diffusion,
- b) change of substances physical state,
- c) expansion of thermal bodies,
- d) convection,
- e) thermal movement,
- e) thermal conductivity,
- f) thermal radiation.

## **BIOLOGY**

**Aim:**

Using sources of information and jam recipes, do the integrated biology, mathematics and IT tasks in order to evaluate nutritional and energy value of different jams.

**Task:**

List the components of different jams and their nutritional composition (100 g of the product). Evaluate amount of nutritional and fibrous materials and vitamins according to the recommended daily norm.

### Pumpkin

Maistinė medžiaga, 100 gramų produkto	Kiekis	% dienos normos
Kalorijos	26 Kcal	1%
Angliavandeniai	6.50 g	5%
Baltymai	1.0 g	2%
Riebalai	0.1 g	0.5%
Cholesterolis	0 mg	0%
Maistinės skaidulos	0.5 g	2%
Vitaminai		
Folio rūgštis	16 mcg	4%
Niacinas	0.600 mg	4%
Pantoteno rūgštis	0.298 mg	6%
Vitaminas B6	0.061 mg	5%
Riboflavin	0.110 mg	8.5%
Tiaminas	0.050 mg	4%
Vitaminas A	7384 IU	246%
Vitaminas C	9.0 mg	15%
Vitaminas E	1.06 mg	7%
Vitaminas K	1.1 mcg	1%
Elektrolitai		
Natris	1 mg	0.5%

### Conclusions:

- The main component of pumpkin are carbohydrates
- Pumpkin abounds in vitamins A, C, E and riboflavin
- Pumpkin has 0,5 g /in 100 g/ fibrous material

### Cranberry ( 100 g of the product)



Maistinė medžiaga	Kiekis	% dienos normos
Kalorijos	46 Kcal	2.3%
Angliavandeniai	12.2 g	9%
Baltymai	0.4 g	1%
Viso riebalų	0.13 g	<1%
Cholesterolis	0 mg	0%
Maistinės skaidulos	4.6 g	12%
Vitaminai		
Folio rūgštis	1 µg	<1%
Niacinas	0.101 mg	1%
Pantoteno rūgštis	0.295 mg	6%
Vitaminas B6	0.057 mg	4%
Riboflavinai	0.020 mg	2%
Tiaminas	0.012 mg	1%
Vitaminas A	60 IU	2%
Vitaminas C	13.3 mg	22%
Vitaminas E	1.20 mg	8%
Vitaminas K	5.1 µg	4%

### Conclusions:

- The main component of cranberries are carbohydrates 12,2 g.
- Cranberries abound in vitamins C, E and pantothenic acid.
- Cranberries have 4,6 g /in 100 g/ fibrous material.

### Lemon (100 g of the product)

Maistinės medžiagos, 100 gramų produkto	Kiekis	% dienos normos
Kalorijos	29 Kcal	1.5%
Angliavandeniai	9.32 g	7%
Baltymai	1.10 g	2%
Viso riebalų	0.30 g	1%
Cholesterolis	0 mg	0%
Maistinės skaidulos	2.80 g	7%
Vitaminai		
Folio rūgštis	11 µg	3%
Niacinas	0.100 mg	1%
Pantoteno rūgštis	0.190 mg	4%
Vitaminas B6	0.080 mg	6%
Riboflavin	0.020 mg	1.5%
Tiaminas	0.040 mg	3.5%
Vitaminas C	53 mg	88%
Vitaminas A	22 IU	1%
Vitaminas E	0.15 mg	1%
Elektrolitai		
Natris	2 mg	0%
Kalis	138 mg	3%
Mineralai		
Kalcis	26 mg	3%
Varis	37 µg	4%
Geležis	0.60 mg	7.5%
Magnis	8 mg	2%
Manganas	0.030 mg	1%
Cinkas	0.06 mg	0.5%

### Išvados:

- The main component of lemons are carbohydrates 9,32 g.
- Lemons abound in vitamins C, B6, pantothenic acid and iron.
- Lemons have 2,8 g /in 100 g/ fibrous material.

Sugar

Kalorijos	395 kcal
Vanduo	0.1 ml
Baltymai	0 g
Angliavandeniai	99.8 g
Maistinės skaidulos	0 g
Cukrus, viso	99.8 g
Cukrus, natūralus	0 g
Riebalai	0 g
Sotieji riebalai	0 g
Poli-nesotieji riebalai	0 g
Omega-3 riebalai	0 g
Omega-6 riebalai	-
Mono-nesotieji riebalai	0 g
Cholesterolis	0 mg
Druska	0 g

Cinnamon (2,6 g)

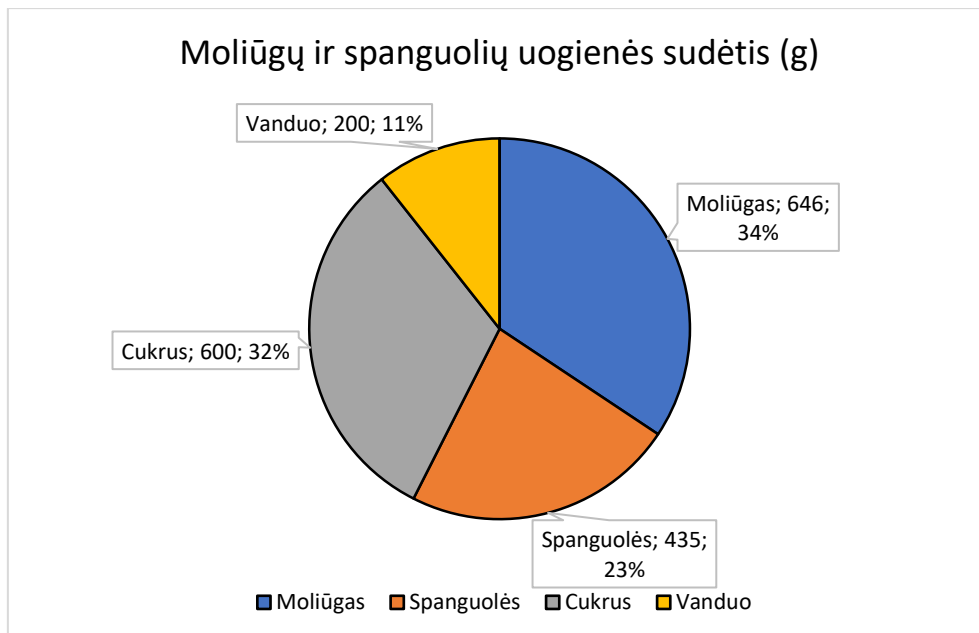
<u>Elementas:</u>	<u>Kiekis:</u>
Kalorijos	6.4 kcal
Vanduo	0.3 ml
Baltymai	0.1 g
Angliavandeniai	2.1 g
Maistinės skaidulos	1.4 g
Cukrus, viso	0.1 g
Cukrus, natūralus	0 g
Riebalai	0 g
Sotieji riebalai	0 g
Poli-nesotieji riebalai	0 g
Omega-3 riebalai	0 g
Omega-6 riebalai	0 g
Mono-nesotieji riebalai	0 g
Cholesterolis	0 mg
Druska	0 g

Water 500 g

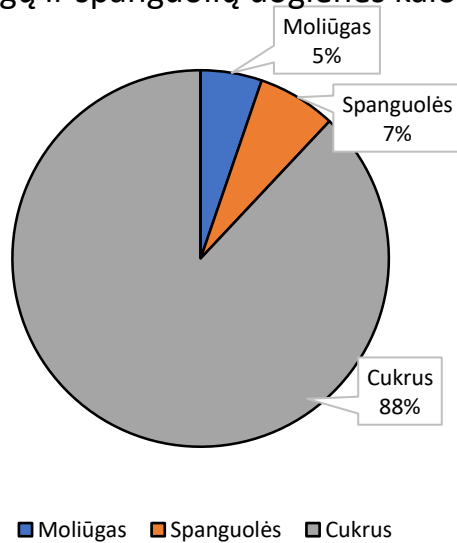
## MATHEMATICS AND IT

**Task:** Calculate the nutritional value of different types of jam in kilocalories, compare them and prove which components give the jam the highest energy value. Present your calculations in the form of tables and diagrams.

Moliūgų ir spanguolių uogienė			
Ingridientai	Svoris (g)	Kcal ingridiente	Kcal 100 gramų ingridiento
Moliūgas	646	136	21
Spanguolės	435	174	40
Cukrus	600	2274	379
Vanduo	200	0	0
Maltas cinamonas	0	0	0
Iš viso	1881	2584	137

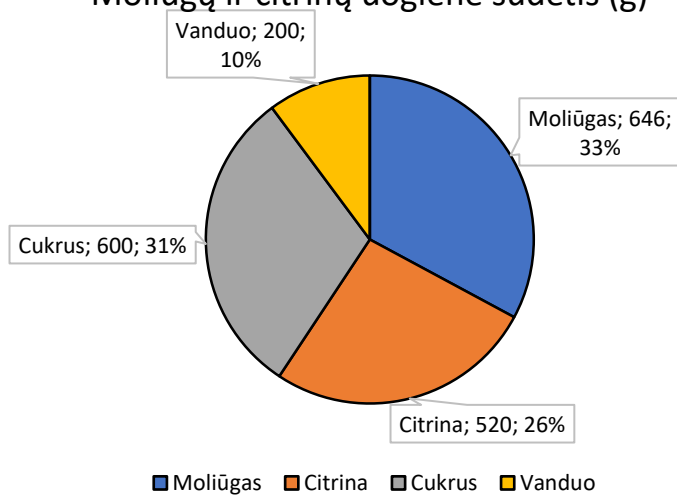


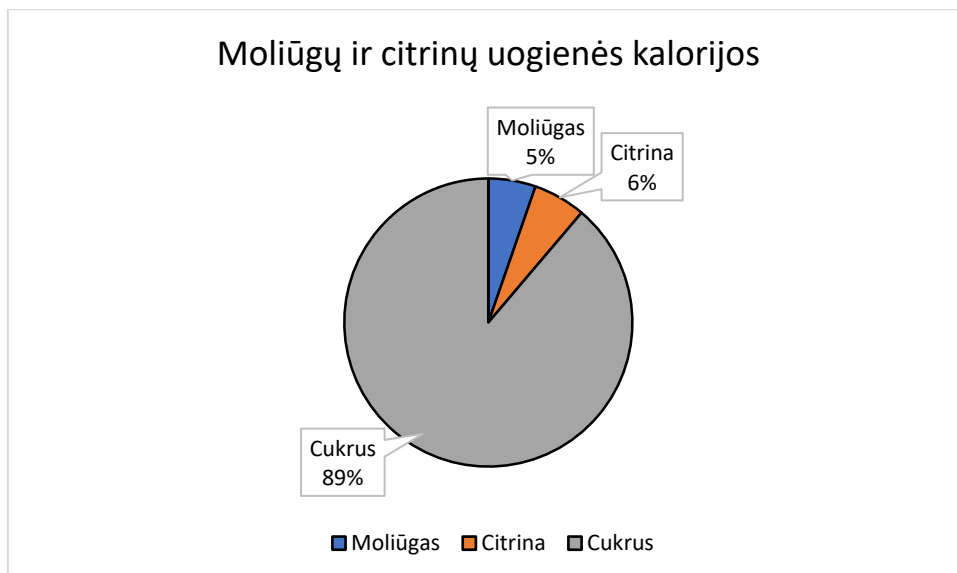
### Moliūgų ir spanguolių uogienės kalorijos



Moliūgų ir citrinų uogienė			
Ingridientai	Svoris (g)	Kcal ingridiente	Kcal 100 gramų ingridiento
Moliūgas	646	136	21
Citrina	520	151	29
Cukrus	600	2274	379
Vanduo	200	0	0
Maltas cinamonas	0	0	0
Iš viso	1966	2561	130

### Moliūgų ir citrinų uogienės sudėtis (g)

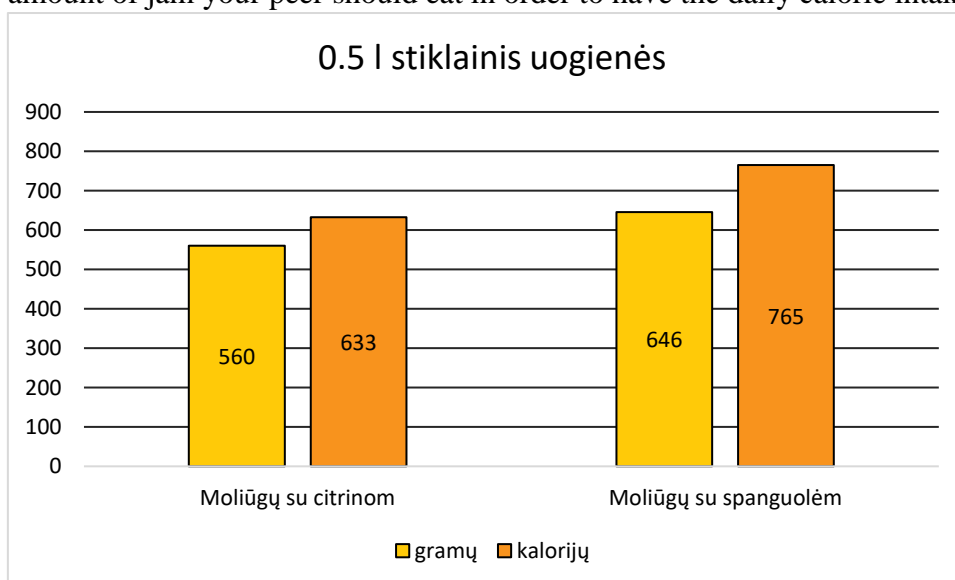




### Conclusions:

- Recipes of two types of jam differ in one component – lemons or cranberries, thus the nutritional and energy value depends on these two ingredients.
- Pumpkin and lemons promptly turned into the jam. It is heavier due to the greater amount of unevaporated water confined in the jelly.
- Pumpkin and lemon jam has less calories.
- The main energy material is sugar and cranberries and lemons.

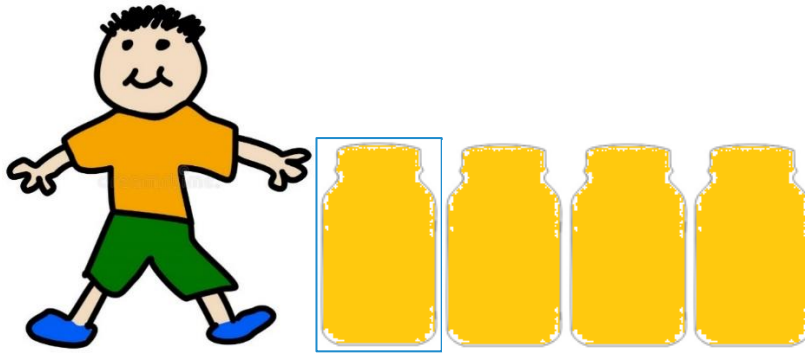
**Task:** Imagine you are locked in a jam larder and have nothing to eat but jam. Calculate the amount of jam your peer should eat in order to have the daily calorie intake.



### Pumpkin and lemon jam daily calorie intake

Daily calorie intake for a teenager boy is 2500 kcal, thus he should eat four 0,5 l jars of pumpkin and lemon jam.

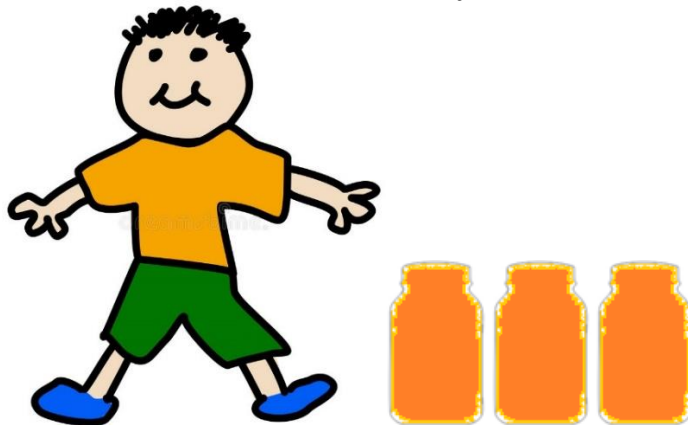




Daily calorie intake for a teenager girl is 2000 kcal, thus she should eat 3,25 jars of pumpkin and lemon jam..



#### **Pumpkin and cranberry jam daily calorie intake**



Daily calorie intake for a teenager girl is 2100 kcal thus she should eat 2,75 jars of pumpkin and cranberry jam.



### Conclusions:

Pumpkin and cranberry jam has slightly more calories thus you should eat smaller amount of it. Daily calorie intake for girls is less than for boys.

## CHEMISTRY

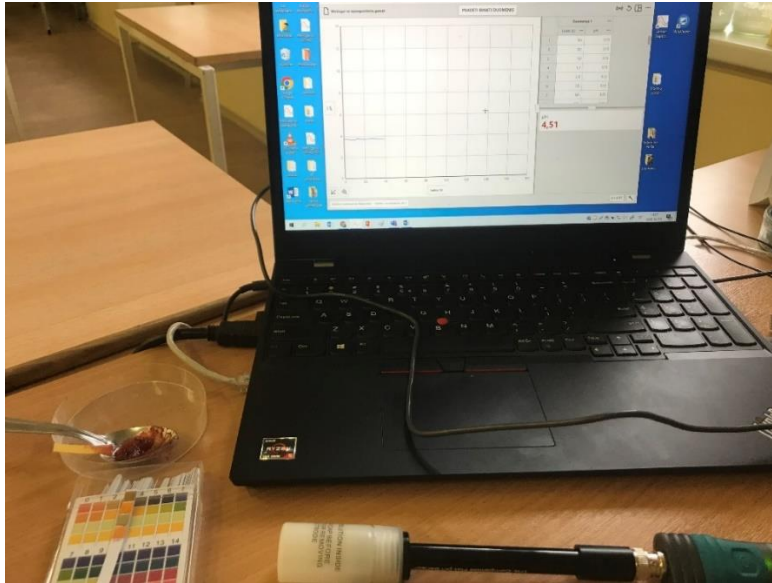
**Task:** Conduct research on how precisely your taste receptors evaluate sourness – which of two jams is more sour? Identify jam pH using universal indicator strips and Vernier sensor. Present your data in the form of tables and diagrams.

**Hypothesis:** Pumpkin and lemon jam is more sour.

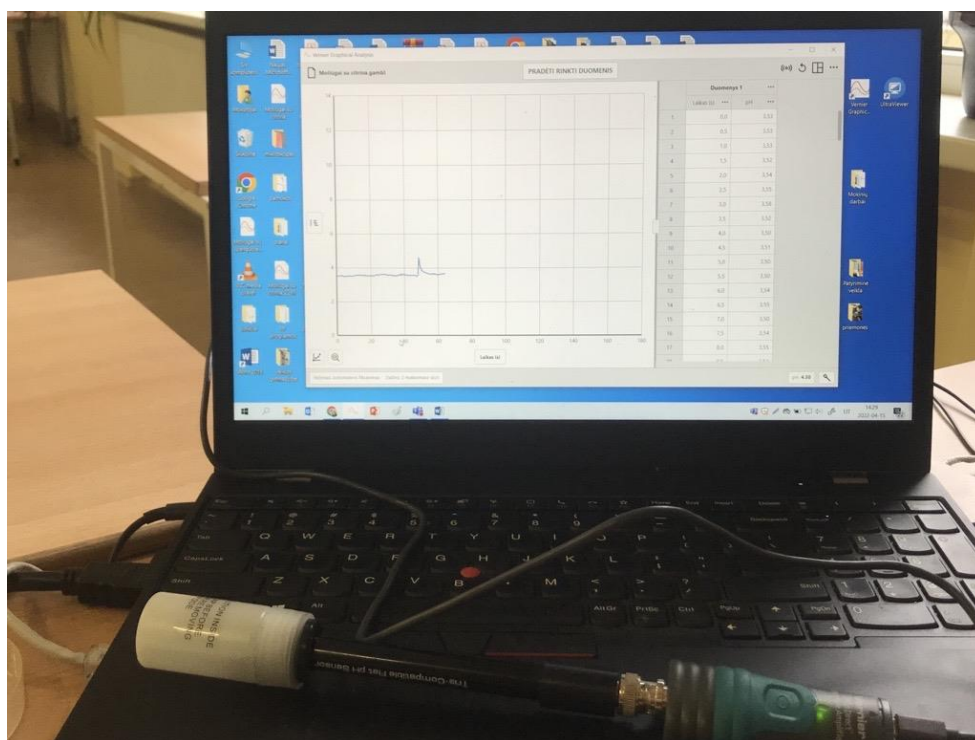
Indications of the universal indicator strips are nor precise: strips in two different jams show faint pink colour which corresponds to 3-4 pH value.



Vernier pH sensor indications:



Pumpkin and cranberry jam has pH 4 according to universal indicator indications and pH 3,73 according to Vernier pH sensor indications.



Pumpkin and lemon jam has pH 3 according to universal indicator indications and pH 3,5 according to Vernier pH sensor indications.

**Conclusions:** Hypothesis is correct: while tasting we decided that pumpkin and lemon jam is more sour. It was proved by the universal indicator and Vernier pH sensor indications. Pumpkin and cranberry jam pH is 3,7-4; pumpkin and lemon jam pH is 3-3,5.

## GEOGRAPHY

**Task:** Search for information about lemons, pumpkins and cranberries specifying the place of origin, range and conditions of growth, especial features. Present some interesting facts about the fruit or berry in the form of IT app.

- **Lemon:** [CITRINA – Plakatas \(canva.com\)](#)
- **Pumpkin:** [Moliūgas \(canva.com\)](#)
- **Cranberry:** [Spanguolės – Plakatas \(canva.com\)](#)

## CONCLUSIONS AND REFLECTION

Students made pumpkin and lemon jam and pumpkin and cranberry jam and defined their nutritional and energy values. In the course of technological processes students observed physical phenomena and carried out temperature, mass, volume, time, pH measurements and calculations. Students used IT tools and design skills for data analysis and visual presentation of the results. In their research activities students experienced success and joy of learning. Having made jam according to national recipes, students decided to try options with different fruit. Students gained practical cooking skills.