Worksheet 1
"Caves and human"

Exercise 1.

Write proper cave types.

Keywords: tectonic caves, reef caves, gypsum caves, erosion caves, volcanic caves

………………………… in Poland occur mainly in Nida Basin

Salt mines are examples of …………………………

………………………… are places explored by divers

………………………… are formed in the forms of solidified lava

………………………… are formed as a result of tectonic movements

Exercise 2.

Look at the reaction below that is responsible for karst processes and then answer the questions.

$CaCo_3$+ … + H_2O <==> Ca $(HCO_3)_2$

Name the compound missing from the chemical reaction

…………………………………………………………………..

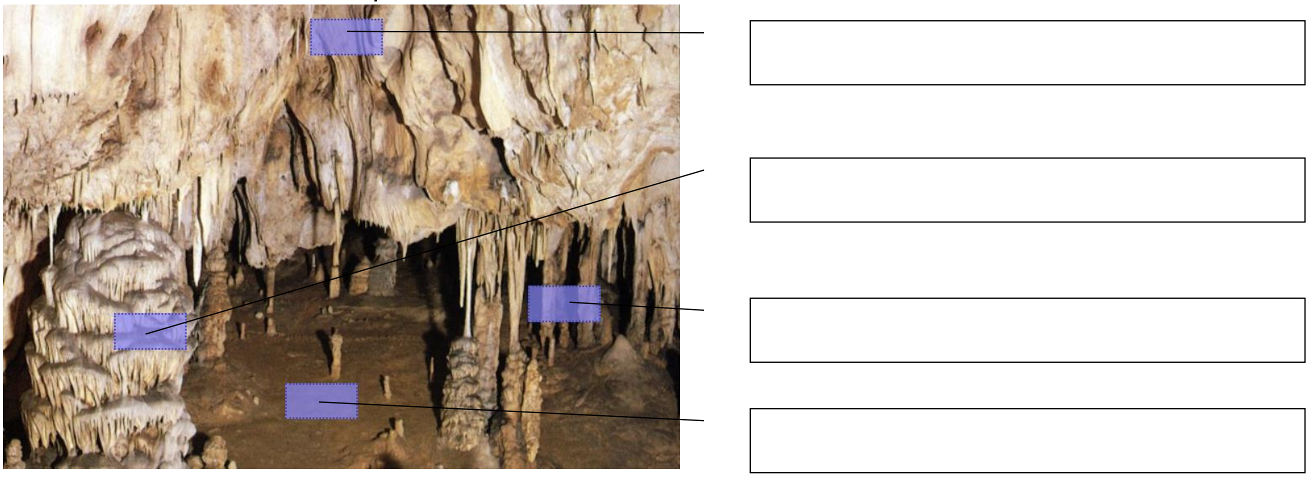
What are the names of the other chemical compounds in the reaction?

……………………………………………………………………………………………………

……………………………………………………………………………………………………

Exercise 3.

Give the forms shown in the picture the correct names.



Projekt EDU-ARCTIC 2: od badań polarnych do naukowej pasji - innowacyjna edukacja przyrodnicza w Polsce i Norwegii otrzymał dofinansowanie w wysokości ok. 240 000 EUR z Islandii, Liechtensteinu i Norwegii w ramach funduszy EOG. Celem projektu EDU-ARCTIC 2 jest: poszerzenie wiedzy o przyrodzie, geografii, zasobach naturalnych, specyfice politycznej dotyczącej regionów polarnych oraz zwiększenie świadomości w zakresie zagadnień środowiskowych i zmian klimatu, zwiększenie zainteresowania kontynuowaniem edukacji i kariery STEM dzięki zwiększeniu wiedzy o badaniach naukowych i ich miejscu we współczesnym świecie; przybliżenie młodym ludziom możliwości kariery naukowej; wprowadzenie innowacyjnych narzędzi i efektywnych metod nauczania przedmiotów ścisłych w szkołach.

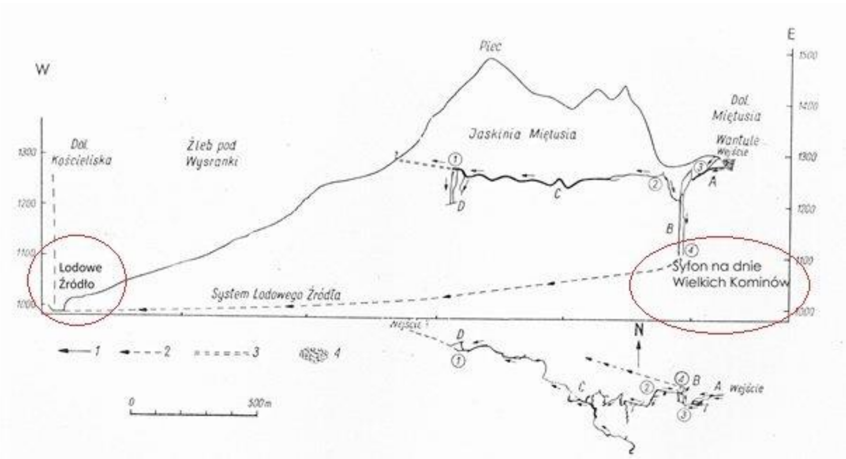
Keywords: stalactites, stalagmites, stalagnates, rock pillar

Exercise 4.

Look at the paintings below and then indicate where they came from.
Keywords: **A.** Cueva de las Manos, Santa Cruz, Argentina, **B.** Kakadu National Park, Australia, **C.** Lascaux, France, **D.** Leang Bulu Sipong, Celebes, Indonesia, **E.** Altamira, Spain

Exercise 5.

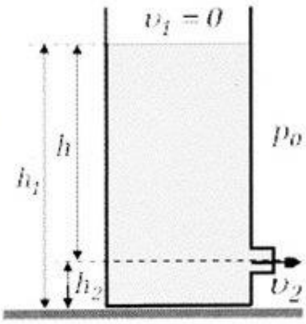
The outflow surface of Lodowe Źródło is at an elevation of 975 m above sea level.At low water level, the siphon level in the Wielkie Kominy is at 990 m above sea level, and the discharge rate is 200 l/s.



Bernoulli's law applies to the calculation of flows.

$$\frac{\rho \cdot v_1^2}{2} + \rho \cdot g \cdot h_1 + p_0 = \frac{\rho \cdot v_2^2}{2} + \rho \cdot g \cdot h_2 + p_0$$

$$\rho \cdot g \cdot h_1 = \frac{\rho \cdot v_2^2}{2} + \rho \cdot g \cdot h_2$$



Key:

V_1 - flow velocity at the upper surface of the reservoir (fall velocity)

V_2 - outflow velocity

P_0 - atmospheric pressure

p - liquid density

h - height difference between the liquid surface in the reservoir and the discharge axis

h_1 - height of liquid surface

h_2 - height of the drain axis

After assuming that the level in the vessel is constant, that the pressure at the inflow and outflow is the same and constant, as well as that the density of the fluid is constant and that the fluid is perfect (flow resistance is not considered), Bernoulli's law takes a form called Torricelli's law. This equation will be useful for further calculations.

We assume that at low tide the water level in a vessel - a glacier mill, a cave chimney - is constant. We neglect the flow resistance at the section between the bottom of the well (outflow) and the spring. Then the outflow velocity is:

Torricelli's law

$$v_2 = \sqrt{2 \cdot g \cdot h}$$

Key:

v_2 – outflow velocity [m/s]

g – standard gravity 9,81 m/s^2

h - the difference in elevation between the top level of the water in well and the level of the outlet

Assuming that the outflow follows Torricelli's law, the outflow velocity for a low water level is:

$V = (2 \times 9.81 \times 15)^{1/2} = 17.16$ m/s

***Question**: Let us now return to the Lodowe Źródło. We know that at low water level, the discharge velocity is about 17.16 m/s. What will be the outflow volume if the water level in the Wielkie Kominy is kept at 50 m above the level from the above calculation? First calculate the outflow velocity for the new elevation. Then, knowing that an outflow velocity of 17.16 m/s gives a discharge of 200 l/s, calculate the new discharge using the ratio: v1:200l/s=v2:x.*

Enter your answer below.

Exercise 6.

What will be the discharge for the fill level of the entire chimneys? First, find out the level difference between the bottom of the siphons and the outflow of Lodowe Źródło. Then add the minimum height (15 m), next calculate the velocity of the outflow using Torricelli's law, and the discharge using proportions (the same as in the previous exercise).

Enter your answer below.

Exercise 7.

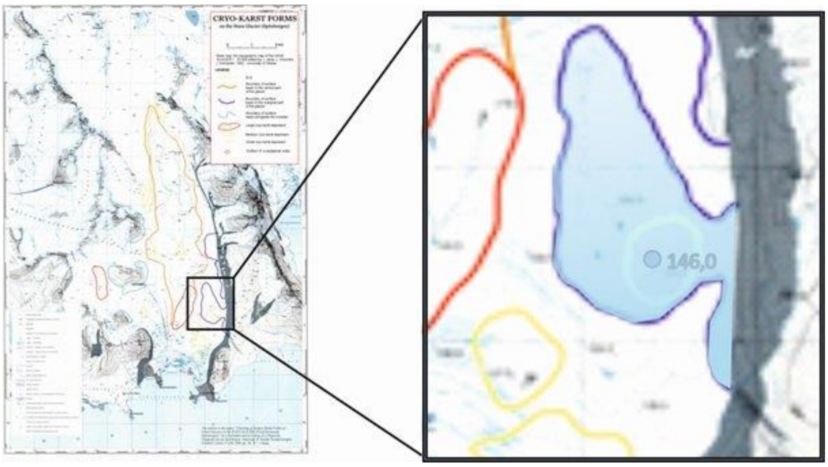
To what height will the Wielkie Kominy be filled if the discharge from Lodowe Źródło is 450 l/s? In this exercise, you must use the ratio used earlier and then solve the equation derived from Torricelli's law.

Exercise 8.

The depression on Hans Glacier is drained by a glacier mill, the edge of which is 146.0 m above sea level. Observations of the snow cover have shown that the mass balance is zero at the surface, meaning that the same amount of ice is added and lost in one year. Measurement of the snow cover at the end of the accumulation period showed that there was 1.30 m of compacted snow on the ice with a density of 350 kg/m^3, and 1.75 m of wind-compacted snow above it with a density of 200 kg/m^3. The area of the depression on a 1:25,000 scale map is 16.55 cm^2.

HINT:

- Remember that 1 cm on a 1:25 000 scale map is 250 m in the field.
- So the area of 1 cm^2 on the map is equal to 250 x 250 = 62,500 m^2 in the field.
- Then calculate the real area of the depression by multiplying the area on the map x 62500.



Question: *Calculate how many m^3 of water drained from the depression during the ablation period (we assume that the thickness and type of snow cover across the depression were the same).*

Exercise 9.

Assuming that the cross-section of the channels draining water from the bottom of the well at sea level is 1 m^2, calculate how long it would take for the entire volume of water from the melting snow to run off if the well were filled to the edge.