

Professional Reflection-Oriented Focus on Inquiry-based Learning and Education through Science

PROFILES IBSE Teaching/Learning Materials – Student activities

Compiled by the PROFILES Working Group of the Masaryk University, Czech Republic



Carbon – nature of life

A Module for IBSE

Instruction: **Science** (especially **Chemistry and Biology**)

Grades: **5th to 9th**

Abstract

The essence of this module is to show students that carbon is the fundamental building block of living organisms. Students verify the presence of carbon in organic materials using simple experiments. Students become familiar with the composition of organic compounds. They look for a link between carbon, coal, and wood and burned dish in a pan. They draw conclusions about the importance of carbon. It is possible using simple experiments to present not only carbon but also hydrogen and oxygen in organic matter.

STUDENT ACTIVITIES:

Scenario:

➡ *Read the story and think about it:*

1 350 million years ago

It's warm, maybe hot and the air smells damp. Why not? We are in marshes and wetlands and there are huge Equisetaceae and Lycopodiophyta around us. The trees are not small at all. They have grown to 20 m, and some are probably 10 m more. The tree trunk has a diameter of more than 1 m. Giant dragonflies fly among the trees. If there was a man, he would be scared of a plane hurtling at him. This Meganeura has the wingspan of about 75 cm and the body length of about 250 cm. But it is no time to look at Meganeura. Suddenly, the wind rises and brings storm clouds. It starts thundering and becomes overcast. It starts pouring with rain. The water falls from the sky and the wind blows. It looks like a hurricane. Suddenly, trees start falling down. They fall into the swamp and start slowly sinking. Suddenly, the storm fades as quickly as it came.

Some 20 years ago in the coal region near the city of Ostrava

Coal miners work in a deep mine. They break off smaller and larger pieces. Suddenly they break off a piece with a nicely visible leaf. Where did it come from? Is this the magic of dwarves?



<http://cs.wikipedia.org/wiki/Soubor:Neuropteris.JPG>,

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Yesterday in our kitchen

I feel like eating something nice. What will I prepare? Maybe I like to have cocoa. I pour a little milk into a saucepan and heat it on an electric stove. Ring, ring. Who is calling? Well, Eva. "How are you?" We keep talking. Suddenly I smell burnt milk. I hang up and hurry to the kitchen. What a mess! When my mother comes home, she will tell me off - I have to wash everything quickly!

Problems and questions:

➡ *Carefully re-read the stories and write down the questions that occur to you:*

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....

➡ *If you have just no ideas try to answer following questions:*

- (a) Is it possible to find the piece of coal with a visible leaf? Which natural process is responsible for the things on the picture number one?
- (b) What was the appearance of the saucepan from the short story „Yesterday...”? To what colour has the milk changed? What was the reason for this change?
- (c) Is it possible to consider described experiments as an evidence of the presence of carbon in organic materials?
- (d) Is it possible to consider described experiments as an evidence of the presence of carbon in organic materials?
- (e) How is possible to prove the presence of oxygen in organic substances? What simple compound containing oxygen can help to prove it?

The following experiments help to answer questions:

Tasks and experimenting:

❖ Experiment 1: A Evidence of Carbon, Oxygen, Hydrogen in Paraffin

Equipment and chemicals: beaker, petri dish, lime water, paraffin wax candle, pliers

Procedure:

- ▶ Place a burning candle in a beaker.
- ▶ After a moment, cover this beaker using Petri dish.
- ▶ After the extinction of the candle, observe the sides of the beaker.
- ▶ Then remove the candle, pour lime water in a beaker, cover it and shake it.
- ▶ Write down observed changes, and explain them, if it is possible take the photos.

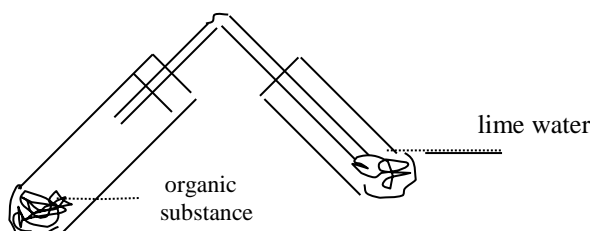
Worksheet	Evidence of Carbon, Oxygen, Hydrogen in Paraffin
Chemicals:	
Chemical equipment:	
<p>Observations:</p> <p>1. Describe what happened in the beaker when you cover it using Petri dish.</p> <p>2. Describe the appearance of the lime water before pouring into a beaker and after pouring into beaker with products of burning.</p> <p>3. Which substance was proved by this reaction?</p>	
<p>Conclusion:</p> <p>This reaction is able to demonstrate the presence of certain elements in paraffin. What elements are they?</p>	

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❖ Experiment 2: Evidence of carbon in wood

Equipment and chemicals: 2 test tubes, plug with the hole, glass tube, wood shavings or sawdust, lime water, burner, laboratory stand, $\text{CuSO}_4 \cdot 0.5 \text{H}_2\text{O}$, swab

Schema of the apparatus



Procedure:

- ▶ Pour sawdust into about two thirds the height of the test tube and close it using stopper with a glass tube.
- ▶ According to the scheme assemble the apparatus and carefully pour lime water into a second test tube.
- ▶ Heat the mixture of solids and observe changes in both test tubes.
- ▶ Drops of liquid have formed on the walls of the tube with shavings. Gently wipe off them with a cotton swab, which is covered with anhydrous CuSO_4 .
- ▶ Write down observed changes, and explain them, if it is possible take the photos.

Worksheet	Evidence of carbon in wood
Chemicals:	
Chemical equipment:	
Observation: 1. Describe the appearance of the solid which will heat. 2. Describe the changes in the second test tube with lime water. Which substances this reactions is able to demonstrate? 3. Describe the appearance of anhydrous CuSO_4 before reaction and after reaction with liquid. 4. Which substance was proved by this reaction?	
Conclusion: This experiment is able to demonstrate the presence of certain elements in dry wood. What elements are these?	

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❖ Experiment 3: Evidence of carbon in organic materials

Equipment and chemicals: candle, sugar, flour, piece of plastic (cup), chemical pliers, porcelain shard (porcelain bowl), matches, 3 test tubes, burner, test tube holder

Procedure:

- ▶ Using the pliers grab the porcelain and insert it into the flame of candles.
- ▶ After removing the porcelain from the flame observe changes on its surface.
- ▶ Pour sugar, flour and a piece of plastic (only when the hood is available!) into individual test tubes.
- ▶ Hold gradually the test tubes into the holder and strongly heat in the flame of the burner.
- ▶ Observe changes in individual test tubes.

<i>Worksheet</i>	Evidence of carbon in organic materials
Chemicals:	
Chemical equipment:	
<p>Observation:</p> <ol style="list-style-type: none"> 1. What was the difference between porcelain before and after this experiment? For which element is this colour typical? 2. Explain what has proved by this reaction? 3. Describe appearance of substances in the test tubes before heating and after heating. 4. Which element was proved by this change? 	
<p>Conclusion:</p> <p>This reaction is able to demonstrate the presence of one element in organic substances. Which element is it?</p>	

Decision making:

Answers to questions:

► Briefly answer the questions that you are expressed at the beginning of your inquiry.

1.....

Answer:

2.....

Answer:

3.....

Answer:

4.....

Answer:

5.....

Answer:

(a) Is it possible to find the piece of coal with a visible leaf? Which natural process is responsible for the things on the picture number one?

Answer:

(b) What was the appearance of the saucepan from the short story „Yesterday...”? To what colour has the milk changed? What was the reason for this change?

Answer:

(c) Is it possible to consider described experiments as an evidence of the presence of carbon in organic materials?

Answer:

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(d) Is it possible to consider described experiments as an evidence of the presence of carbon in organic materials?

Answer:

(e) How is possible to prove the presence of oxygen in organic substances? What simple compound containing oxygen can help to prove it?

Answer:

Conclusions and recommendations to the stories:

- ➔ **In the left column of the table write down your suggestions and recommendations that in your opinion belongs to these stories. Discuss with classmates and teachers about your opinions. Corrections and additions write down in the right column.**

Worksheet: 1 350 million years ago		
	My opinion:	Correction and supplement after the discussion
1.		
2.		
3.		
4.		
5.		

Worksheet: Some 20 years ago in the coal region near the city of Ostrava		
	My opinion:	Correction and supplement after the discussion
1.		
2.		
3.		
4.		
5.		

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Worksheet: Yesterday in our kitchen		
	My opinion:	Correction and supplement after the discussion
1.		
2.		
3.		
4.		
5.		