Module 2.
Topic 2.2.1. Examples and plans of thematic and interdisciplinary lessons using the interactive learning toolkit “Climate box"

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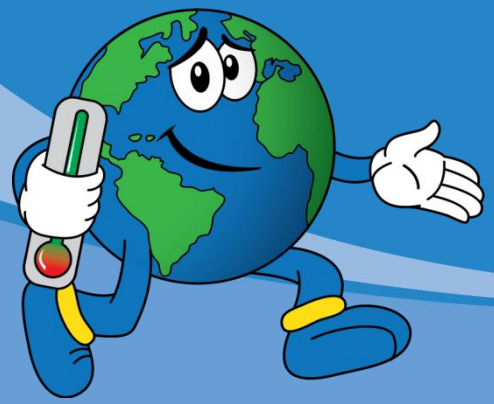

The Science Class
"Can the building not lose energy in vain?"

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I. Today's lesson "Can the building not lose energy in vain?"

II. The purpose of this lesson:

Raise students' awareness of the importance of thermal insulation for building energy efficiency and reducing the impact of buildings on climate change.

III. Planned tasks:

- Determine the impact of building energy loss on climate change.
- Discuss the causes of energy loss in buildings.
- Introduce the concepts of "thermal insulation", "passive house".
- Conduct an experiment demonstrating the thermal insulation properties of different materials.
- Discuss the thermal insulation properties of the yurts – nomad's tent in Central Asia.

IV. Type and form of the lesson:

Combined lesson; discussion and experiment

V. Equipment:

- Experiment set: 5 glasses, 5 ice cubes, cotton wool, felt, aluminum foil, cardboard.
- Materials "Climate box".
- Poster "Climate Change. CO_2NSERVE! CO_2MBAT! CO_2OPERATE!"

VI. Course of the lesson:

1. Organisational aspect.	
The teacher's action	**The students' action**
The teacher divides students into 3 groups.	Students are seated in 3 groups.
2. Checking homework.	
The teacher invites students to discuss written answers prepared at home to the question: "Can other energy sources take the place of fossil energy resources?". The teacher moves around the class and takes part in the discussion.	Students discuss prepared written answers within groups.

VI. Course of the lesson:

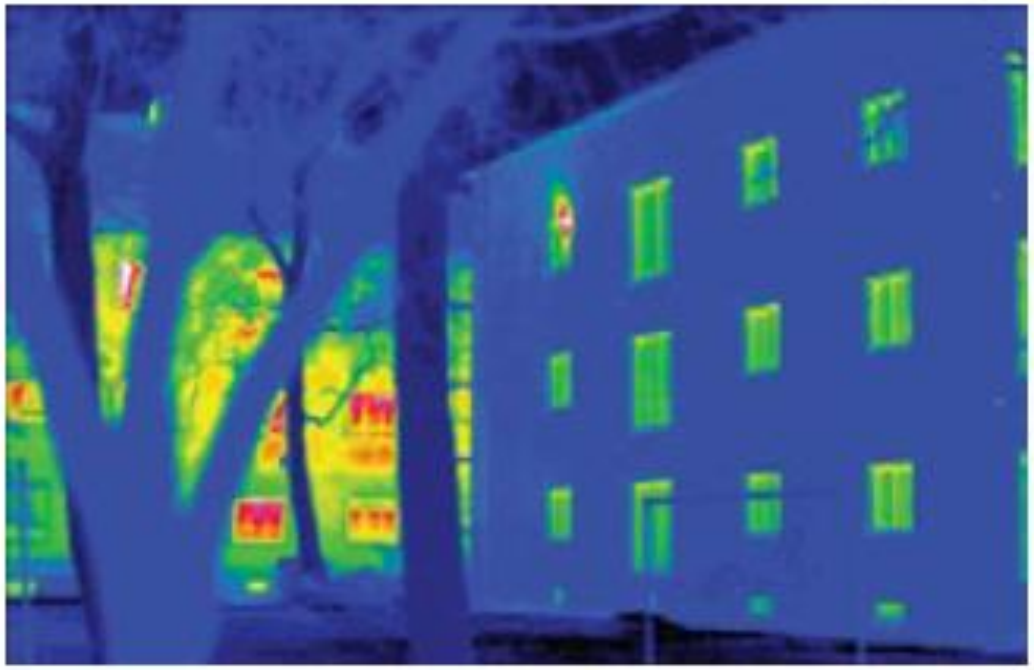
3. Actualization of knowledge.

The teacher's action	The students' action
The teacher writes the word "Thermal Conductivity" on the blackboard, and below it schematically shows the location of molecules in a solid, liquid, and gas (see the example below). The teacher names the 1st group of students as "solid", the 2nd group as "liquid", the 3rd group as "gas". The teacher suggests students imagining themselves as molecules and place themselves in groups in a certain way. Each group gets a ball. Teacher asks: "So, each group represents one of the states of matter. Imagine that the ball is energy. You (molecules) transfer energy to each other, keeping the structure in the group." Teacher asks after a while: "In what state of matter is it easier to transfer energy? What is thermal conductivity?".  gas liquid solid	Students of group 1 ("solid") sit close or join hands. Students of group 2 ("liquid") are located at some distance from each other. Students of group 3 ("gas") are randomly assigned in the study room. After getting the ball, students within the group pass it in chain order. Students are not allowed to change their location. Students keep on speaking until they form a conclusion: "Energy is more easily transmitted in a solid state. Thermal conductivity is the ability of a body to transfer energy from one molecule to another."

VI. Course of the lesson:

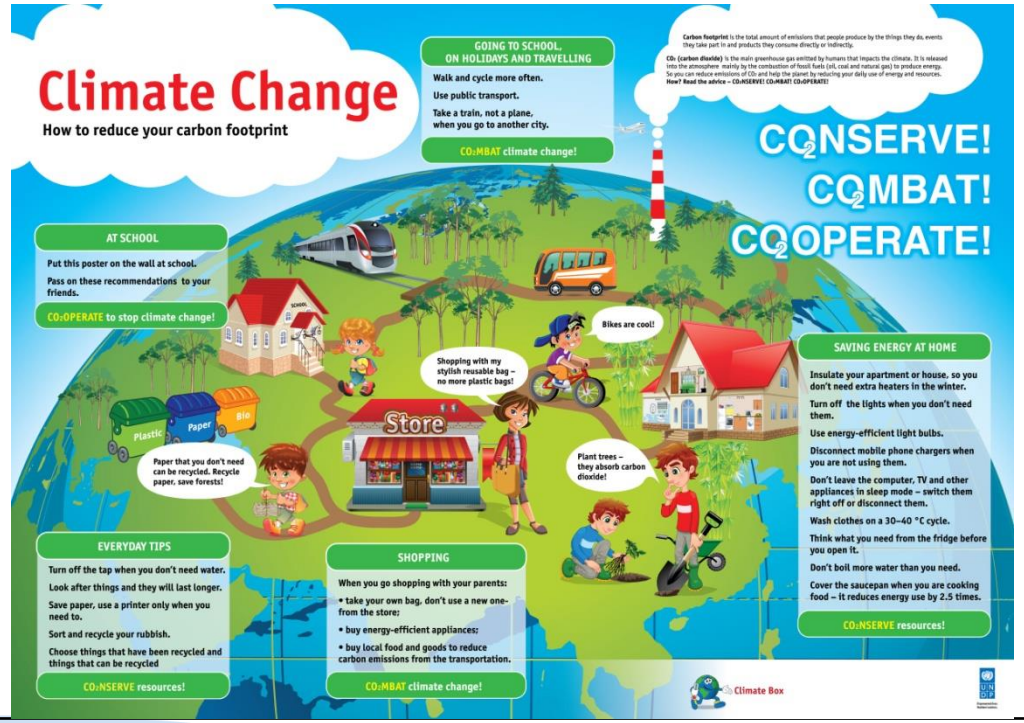
4. Lesson plan. Questions to study (based on the textbook).
1. Why should we keep the house warm?
2. Causes of heat loss. Thermal insulation.
3. The study of insulating properties of materials.

Fig. 3.2.13. An infrared picture shows how effective the heat insulation of a passive house (right) can be in comparison with a conventional house (left).



VI. Course of the lesson:

5. The main part.

Question 1. **Why should we keep the house warm?**	Materials from the "Climate Box": **Poster**
The teacher tells students about the problem of climate change and the relation between the production and consumption of heat energy and the increasing average temperature on the planet. The teacher writes on the blackboard: "About 30% of the heat energy produced in Kazakhstan is spent on heating our houses." A teacher shows students a poster "Climate Change. CO_2NSERVE! CO_2MBAT! CO_2OPERATE!" from the "Climate Box" textbook. The teacher suggests groups reviewing the poster and formulate an answer to the question: "Why should we keep the house warm?".	Poster "Climate Change. CO_2NSERVE! CO_2MBAT! CO_2OPERATE!" 

VI. Course of the lesson:

Question 2. 2. Causes of heat loss. Thermal insulation.	Materials from the "Climate Box": 3.2.3 Sustainable building. Passive and active houses.
The teacher draws a schematic image of the house on the blackboard. It should include the following elements: roof, airhole, pipe, walls, windows, basement. Element names are not signed. The teacher draws 3 arrows pointing up (from the roof, airhole, pipe), and 3 arrows pointing down (from the wall, window, basement). Near the arrows, the teacher writes down the percentage of heat loss calculated for Kazakhstan: roof – 11%, airhole - 22%, pipe - 15%, wall - 18%, windows - 25%, basement - 9%. The teacher suggests the groups making a list of elements of the house that take part in losing heat. After all the elements are named, the teacher explains the meaning of the terms "Thermal Insulation" and "Passive House".	"Theoretically, the heating of a passive house is due to the heat released by the people living in it and household appliances. Not only are the walls insulated, but also the floor, ceiling, loft, basement... even the concrete foundation. It is important to control the design that doesn't have so - called "cold bridges", - the details and lintels, seemingly small, but which sometimes cause cooling of buildings that are generally well insulated. By using such technologies, you can reduce heat loss by almost 20 times! Carefully thought out design of windows: sealed glazing unit, the glass is equipped with a window sheet that lets light and heat inside, but reflects them from the inside. The largest windows face the sunny side." Students are reading the material from the "Climate Box". Discussion.

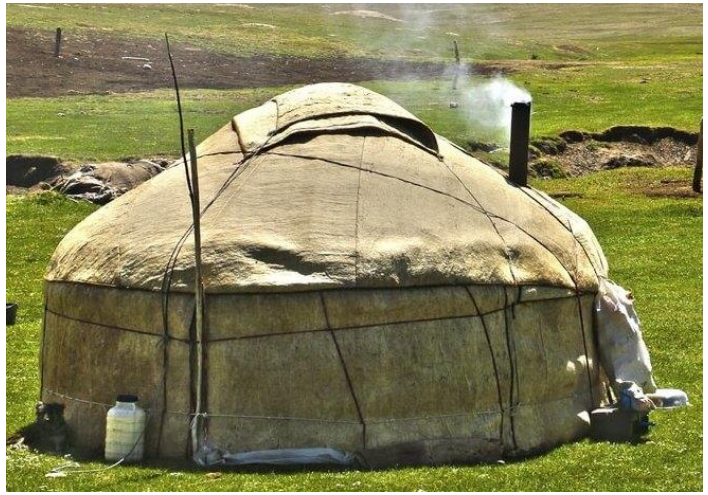
VI. Course of the lesson:

Question 3. Research of thermal insulation properties of materials.	Materials from the "Climate Box": 3.2.3 Sustainable building. Passive and active houses. 3.4. How can I help the planet? Reducing your carbon footprint. "Indoor air temperature and thermal acceptability"
The teacher suggests the groups studying the thermal insulation properties of materials. They are given the following instructions: • We have 5 glasses. Leave 1 glass at that. • Wrap 2 glasses with 0.5 cm thick cotton wool. • Wrap 3 glasses with 1 cm thick cotton wool. • Wrap the 4th glass with 1 cm thick felt. • Wrap the 5th glass with aluminum foil. • Put one ice cube in each glass. Take a picture of the ice in each glass. Cover the glasses with pieces of cardboard. Turn on the timer on your phone. Watch the ice melt in the glasses. Record the ice state every 3 minutes. Formulate an answer to the question: "What factors prevent ice from melting?". After discussing the results of the experiment, the teacher suggests students recalling examples of using thermal insulation in the past (yurt, peasant's log hut, Russian oven).	"Not everyone uses cars or even a full set of household appliances. It's a matter of lifestyle. But all people need housing. Therefore, the idea of building the most energy-efficient house has always been actually present. Both peasant's log hut and tents of nomadic peoples were built taking into account popular knowledge, even if it was not explained scientifically. The Russian oven was a very good example of energy efficiency, which is now just an object of fairy-tale films. The thick walls kept the heat quite well, the chimney with lintels allowed us to take all the heat from the smoke." Students are reading the material from the "Climate Box". Discussion of the photos showing the heat loss of houses.

VII. Solve a situational problem to fix the material.

Dana's family goes to the ethno-village, which is located near the city of Nur-Sultan. The ethano-village revealed the way of life of Kazakhs during the nomadic lifestyle. The main attraction is a yurt, which is decorated in the national style.
Dana's Dad: "Daughter, just fancy, we will soon see a real yurt! How do you think the structure and materials of the yurt helped to withstand heavy frost in winter and heat in summer?
For a thoughtful answer you will get ice cream!

Help Dana get ice cream ☺



VII. Solve a situational problem to fix the material.

- The yurt was made of wood and felt, and there was a hole on top for lighting and smoke escape. On cold days, this hole was closed, and the yurt turned into a perfectly insulated house.
- Felt is a porous material that provides a stable temperature inside the yurt.
- Felt could additionally insulate the walls in heavy frost.

VIII. Lesson summary (reflection).

The teacher asks students to answer a question:
"What can you do to prevent the house from losing the heat?".

IX. Sources of images used in the lesson

http://www.myshared.ru/

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