ASSESSMENT OF THE QUALITIES OF TEACHING EXPERIMENTS WHICH ILLUSTRATE THE GREENHOUSE EFFECT

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Abstract. The contemporary state strategy for education in Bulgaria focuses natural science education on forming and developing individuals with strong understanding of ecology. In the context of educational strategy, the school subject "Chemistry and Environment" is taught from 7th to 12th grade. A review of the curriculum in the relevant textbooks indicates an absence of experimental activity related to the global environmental problems. A step in this direction is this paper which presents some of the selected and developed teaching experiments for illustration one of the global environmental problems – the intensification of the greenhouse effect on Earth. The qualities of the teaching experiments are examined through an expert assessment and in a representative sample of students in the 9th grade in experimental education conditions. For the purposes of the survey, two students' groups are formed – control and experimental. They are chosen at random by two independent samples of students (40 in each group) with similar results incoming testing for ecological culture. The cognitive performances of students are established by outgoing testing for ecological culture. The data show that the developed teaching experiments provide good conditions to enrich students' ecological culture and they can be used effectively in secondary school chemistry education.

Keywords: teaching chemical experiment, greenhouse effect, environmental education, ecological culture

Introduction

The problems related with environment pollution (intensification of the greenhouse effect, damage to the ozone layer, formation of acid rain, smog, etc.) are the focus of experts' attention from different scientific areas (Bliznakov & Mitov, 2001; Deriabo & Iasvin, 1996; Heinz & Reinhart, 1991). Solving these global problems is possible only if there are significant changes in social evolution towards maintaining harmony between man, society and nature (Anastas et al., 2009; Fabian, 1987; Firor, 1990).

In this connection the formation of ecological culture of the adolescents is one of the main objectives of education. The achievement of this objective is in the base for optimization of the relationships between man and environment, as the ecological culture is a permanent part of the spirituality and the common culture of personality (Salz & Figueroa, 2009; Taylor et al., 2009).

To enrich the students' ecological culture are used the possibilities of educational content on the natural school subjects and the methodical system of organization forms, methods and means of teaching (Anastas et al., 2009; Angelacheva & Gergova, 2011; 2013; Gergova & Angelacheva, 2008; Pak, 2012). The leading method in studying chemistry is the teaching experiment which allows close supervision and learning of objects from the environment. It can be used for increasing of the students' ecological preparation by learning the impact of chemical substances on the environment, chemical methods for its protection and recovery, presence of substances in nature, biological importance, toxic effect, etc. (Angelacheva, 2006; 2014a).

There is a great number of authors who describe and suggest good ideas about teaching experiments which illustrate the global environmental problems (see, for example Kiselev, 2004; Nazarenko & Luchinina, 1993; Rakoczi & Ivanyi, 1999 – 2000; Mak, 1997, etc.). The elaborations of these authors deserve special attention because they focuse on the technique of experiments' demonstration – materials, methods, apparatus, procedures. Some of authors put emphasis not only on technique but also on methodology of conducting the experiment, i.e. objectives of the experiment, place in educational content, analyze, explanation. However, none of authors has studied the effectiveness of the developed chemical experiments in Science education. That is why the task of this work is to find the answer to research question:

What is the influence of teaching experiments connected with the global environmental problems on the cognitive results of students with an emphasis on their ecological culture in science education?

The outlined problem directs to the objectives of this paper: (1) to select and to develop teaching experiments which can be used for illustration one of the global environmental problems – the intensification of the greenhouse effect on Earth; (2) to investigate experimentally the appropriateness of the proposed teaching experiments for enrichment the ecological culture of students in secondary school chemistry education.

The expectation of the educational experiments' approbation is for a positive influence on the process of learning with an emphasis on the system of ecological knowledge, skills and attitudes of the students towards the environment.

Methodology

To reach the objectives the following research methods as analysis of literature, the quantative content analysis of textbooks, expert evaluation, pedagogical

experiment, criterion testing are applied. The analysis of empirical results is carried out with statistical methods: Student's t-test, Mann-Whitney U-test (Arthur et al., 2012; Bizhkov & Kraevski, 2007; Cohen et al., 2011; Nasledov, 2012; Sidorenko, 2007). The calculations are carried out with the computer program SPSS (Manov, 2001; Nasledov, 2005).

In connection with the requirements to the teaching experiment in chemistry (Angelacheva, 2006; Chernobelskaia, 2000; Gendjova, 2008; Pak, 2012) are selected and designed experiments about the greenhouse effect (Angelacheva, 2013; Buchner et al., 1989; Rasool, 1973). For each of the experiments is created a worksheet in which is reflected the methodological consistency in conducting of the experiments (Appendix 2).

The expert assessment of the qualities of proposed educational experiments is carried out by 26 experts (students – future teachers of chemistry). They perform experiments in laboratory conditions – in the course "Methodology and technique of teaching experiment in chemistry". The experts evaluate the qualities of the experiments on indicators which are necessary for determination of their methodological and technical characteristics (Table 1 in Appendix 1). It is used an evaluation scale: +1 – the experiment responds to the relevant indicator; 0 – the expert could not determine whether the experiment responds to the indicator; –1 – the experiment does not responds to the indicator.

The experiments with score under 10 points and which do not respond to the top ten indicators are with poor quality and may not be used for experimental activities in teaching chemistry. Experiments with 10 or 11 points which respond to the first ten indicators have good quality and can be used for illustration the learning process. Experiments assessed with 12 and 13 points are with very good quality and those with 14 and 15 points – with excellent quality.

From the proposed for evaluation experiments are selected only those that have very good and excellent quality. The other experiments are processed or eliminated (Angelacheva, 2013).

To establish the effectiveness of the developed teaching experiments for enrichment the ecological culture of students while studying the IVA group of the Periodic table (9^{th} grade) is carried out pedagogical experiment.

The experimental training is conducted with two groups of students on the following versions: version 1 ($\mathbf{V_1}$) – in this group of students the experiments are carried out as demonstration; version 2 ($\mathbf{V_2}$) – the students realize the experiments as laboratory. In version $\mathbf{V_2}$ the experiments are commented with an emphasis on the sources of air pollution with "greenhouse" gases, the consequences for the environment of enhancing the greenhouse effect, the ways to reduce the amount of "greenhouse" gases in the atmosphere, etc. Placing the focus of these accents in performance of the experiments can enrich the students' knowledge about the role of chemistry as a science and a school subject for achieving the sustainable development of society and the environment.

At random of the two groups are formed two independent samples of students (40 in each group) with similar academic achievements by solving the preliminary test "IVA group of the Periodic table and protection of the environment" (Angelacheva & Gergova, 2011). To establish the influence of the developed two versions of training on the students' cognitive results is used outgoing test (Appendix 3). It is constructed according to the selected criteria and indicators: (a) criterion of ecological knowledge with indicators volume and application of knowledge in different cognitive situations (subtest 1 – tasks from 1 to 5); (b) criterion of a developed attitude towards global environmental problems with indicators intensity and awareness of attitude (subtest 2 – tasks from 6 to 10). The bases for selection of the criteria and indicators are: (a) pedagogical researches that establish the existence of a logical link between the level of the students' environmental culture and the productivity of learning (Angelacheva, 2014b; Gergova & Angelacheva, 2008); (b) bibliographic reference, which allows to identify the main components of the ecological culture – ecological knowledge, skills and attitudes towards the environment (Deriabo & Iasvin, 1996; Pak, 2012; Salz & Figueroa 2009).

Results and discussion

The need to experimental verification of the formulated hypothesis places in the focus of statistical analysis the question: do the distributions of random variables **X** and **Y**, which characterize with numerical values the productivity of learning chemistry in both groups, differ?

The statistical hypotheses are: $\mathbf{H_0}$: the distributions of random variables **X** and **Y** in the groups trained in both variants are not significantly differ; $\mathbf{H_A}$: between the distributions of random variables **X** and **Y** in the groups trained in both variants there is a significant difference.

The verification of the statistical hypotheses is carried out on the basis of the data for students' marks from outgoing test. The mark is formed as a sum total of certain number of points for each true solved task (Appendix 3). The data from outgoing test (Table 1) shows better results of students who learned under version $\mathbf{V_2}$.

The distributions of random variables **X** and **Y** that characterize the productivity of learning chemistry can be traced in Table 2 through typical for statistics variables.

Table 1. Test results in groups trained in versions V_1 and V_2

Number of tasks solved	V1 (subtest 1), frequency	V1 (subtest 2), frequency	V2 (subtest 1), frequency	V2 (subtest 2), frequency
1	3	5	-	2
2	8	11	5	4
3	18	15	6	10
4	7	6	20	17
5	4	3	9	7

Table 2. Summarized results from statistical analysis

Statistical variables	V1, subtest 1	V2, subtest 1	V1, subtest 2	V2, subtest 2
Number of respondents (n)	40	40	40	40
Mean arithmetic values (x)	3.03	3.83	2.78	3.58
Variance (s2)	1.10	0.87	1.2	1.12
Standard deviation (s)	1.05	0.93	1.10	1.06
Fisher's F-criterion H0: s12 = s22 HA: s12 ≠ s22	F0.01;39/39 = 1.81; Femp = 1.26 Femp < F0.01;39/39 H0 is taken		F0.01;39/39 = 1.81; Femp = 1.07 Femp < F0.01;39/39 H0 is taken	
Student's t-test H0: μ1 = μ2 HA: μ1 ≠ μ2	t0.01/78 = 2.64; temp = 3.61 temp > t0.01/78 H0 is rejected		t0.01/78 = 2.64; temp = 3.34 temp > t0.01/78 H0 is rejected	
Mann-Whitney U-test H0: |u| < uα HA: |u| ≥ uα	Ucr = 2, p ≤ 0.05; Uemp = 7 Uemp > Ucr H0 is rejected		Ucr = 4, p ≤ 0.05; Uemp = 12 Uemp >Ucr H0 is rejected	

Fisher's F-criterion

At a confidence level of $\boldsymbol{\alpha} = 0.01$ and sample size $\mathbf{n_1} = \mathbf{n_2} = 40$ the difference between the variances in groups $\mathbf{V_1}$ and $\mathbf{V_2}$ is not statistically significant. The condition for equal dispersion of the studied groups is satisfied and the Student's t-test can be applied.

Student's t-test

Through this statistical method are exmined the distributions of random variables in groups $\mathbf{V_1}$ and $\mathbf{V_2}$ in independent samples with an equal sample size $\mathbf{n_1} = \mathbf{n_2} = 40$ and a confidence level of $\boldsymbol{\alpha} = 0.01$.

The higher empirical values of the criterion $\mathbf{t_{emp}}$ than its critical value $\mathbf{t_{0.01/78}}$ give a reason to accept the hypothesis $\mathbf{H_A}$: for both subtests the mean arithmetic values in groups trained in both versions differ significantly. The results of students who learned under version $\mathbf{V_2}$ are better than those of the students who learned under version $\mathbf{V_1}$. Consequently the realization of laboratory chemical experiments related to the greenhouse effect in studying the IVA group of the Periodic table (version $\mathbf{V_2}$) has a positive influence on the productivity of learning chemistry as measured by the selected criteria and indicators. The established difference between the distributions of random variables **X** and **Y** which characterize the productivity of learning activity in the studied groups is confirmed by the Mann-Whitney **U**-test.

Mann-Whitney U-test

Applying **U**-test is obtained $\mathbf{U_{emp}} > \mathbf{U_{cr}}$, i.e. the hypothesis $\mathbf{H_0}$ is rejected. The statistical analysis confirms the alternative hypothesis $\mathbf{H_A}$: the average arithmetic means of the

two groups differ substantially. Statistically significant difference can be explained by the positive influence of the proposed teaching experiments on the students' cognitive performances that reflect students' ecological knowledge and skills and attitudes towards the environment.

The quantitative and qualitative analysis of the data shows that students trained in version $\mathbf{V}_2$, demonstrate better results than students trained in version $\mathbf{V}_1$ on the selected criteria. This confirms the hypothesis about the effectiveness of the developed teaching experiments for increasing the environmental culture of students.

The reliability of the cognitive results of students trained in version $\mathbf{V}_2$ is measured through a retest (Table 3).

Table 3. Results from outgoing test and retest of experimental group V_2

Statistical variables	Test, subtest 1	Retest, subtest 1	Test, subtest 2	Retest, subtest 2
Number of respondents (n)	40	40	40	40
Mean arithmetic values (x)	3,83	3,65	3,58	3,44
Variance (s2)	0,87	1,05	1,12	1,26
Standard deviation (s)	0,93	1,02	1,06	1,12

The results from the outgoing test and the retest show similar values of the statistical parameters. There is no statistically significant difference between the data from the test and the retest which confirms the expectation of lasting effect of the proposed teaching experiments on the cognitive results of the tested students.

Conclusions

On the basis of the quantitative and qualitative analysis of the emirical results it can be claimed that in the context of the designed chemical experiments the hypothesis of the research is confirmed and its objectives are carried out. The organized training in version $\mathbf{V}_2$ has positively influence on the productivity of learning which is measured by criteria of the ecological culture.

With this work is added a new accents to the theory and practice of teaching chemistry in the following aspects: (a) there are developed worksheets which placed emphasis on methodology and technique of the proposed chemical experiments related to the greenhouse effect on Earth; (b) there are investigated experimentally the qualities of teaching experiments with a view to the possibilities of their application for enrichment the students' ecological culture in the course of teaching chemistry; (c) for the purposes of empirical research is designed a variant of criterion test that can effectively used for diagnostic of students' environmental knowledge and attitudes in studying the group IV-A Group of the Periodic table in 9th grade.

It should be noted that the selected and developed versions of teaching experiments for illustration the greenhouse effect do not exhaust the whole range

of opportunities to visualize the learning process in chemistry. It is necessary for each specific case to look for the most optimum option that not only develops the cognitive interests of the students but also enriches their ecological culture.

APPENDIX 1

Indicators for expert assessment of the experiments

Indicators for evaluation of the methodological characteristics of the experiments	Points		
1. An explicit objective of the experiment.	– 1	0	1
2. A logical connection between the experiment and the educational content.	– 1	0	1
3. An accurate description of the necessary for the experiment chemicals, glassware, apparatus.	– 1	0	1
4. An appropriate instructions for implementation and observation of the experiment.	– 1	0	1
5. An analysis of the experimental results and formulation of conclusions.	– 1	0	1
6. An opportunity for discussion in progress of the experimental activity of information about the consequences for the environment of enhancing the greenhouse effect, the ways to reduce the amount of "greenhouse" gases in the atmosphere, etc.	– 1	0	1
7. An opportunity for enrichment the students' ecological culture (the system of ecological knowledge, skills and attitudes of students towards the environment).	– 1	0	1
8. Increasing of the cognitive activity and independence of the students (examination of additional literary sources, implementation of other experiments on the topic, etc.).	– 1	0	1
Indicators for evaluation of the technical characteristics of the experiments			
9. Safety of the experiment.	– 1	0	1
10. Visibility of the phenomena and processes taking place.	– 1	0	1
11. A well selected quantitative correlation of the substances.	– 1	0	1
12. Appropriate concentration of the substances.	– 1	0	1
13. Appropriate conditions under which the experiment is performed.	– 1	0	1
14. Accessibility of the used substances and materials.	– 1	0	1
15. Simple experimental arrangement.	– 1	0	1

APPENDIX 2

Worksheet for the teaching experiment "Influence of carbon dioxide CO_2 on the greenhouse effect on Earth"

Purpose of the experiment: to compare the temperatures of the air and carbon dioxide **CO_2** upon reaching the dynamic temperature equilibrium of gases with the environment.

Place of the experiment in educational content: in studying the IVgroup of the Periodic table.

Necessary substances and materials: plastic bottle of mineral water (3l), thermometer, lamp with lamp shade and 100 W bulb, sodium bicarbonate **$NaHCO_3$** (baking soda), vinegar, flask with a volume of 500 cm^3, stopper which is fitted with a glass tube.

Experiment:

Version 1. The top of a dry plastic bottle of mineral water (3l) is cut off. A few centimeters from the bottom of the bottle, in its wall is pierced a thermometer (digital or mercury-in-glass). Over the bottle is placed a lamp with lamp shade and 100 W bulb. The air in the bottle is heated until the thermometer reading become constant, i.e. until the system reaches dynamic temperature equilibrium with the environment. The temperature of the air in the bottle is registered.

Then without shuffling the experimental arrangement the bottle is filled with carbon dioxide $\mathbf{CO_2}$. It is obtained as in the flask with a volume of 500 cm^3 is placed about 10 g sodium bicarbonate $\mathbf{NaHCO_3}$ and 250 cm^3 vinegar. The flask is closed with a stopper which is fitted with a glass tube. The end of the glass tube is placed in the plastic bottle. It is waited about 10 min to fill up the bottle with carbon dioxide $\mathbf{CO_2}$ (check with a lighted match).

The bottle with carbon dioxide $\mathbf{CO_2}$ is heated with the lamp while the thermometer reading become constant, i.e. until the system reaches second dynamic temperature equilibrium with the environment. The temperature of carbon dioxide $\mathbf{CO_2}$ in the bottle is registered.

Observations and reflections on the experiment: When filling the bottle with carbon dioxide $\mathbf{CO_2}$ is completed a fast increasing of the temperature is observed. For example in one of the measurements is recorded an air temperature 42.8°C and a temperature of carbon dioxide $\mathbf{CO_2}$ – 48.1°C. This is explained by the fact that 90% of the bulb light is in the infrared region and the carbon dioxide $\mathbf{CO_2}$ absorbs infrared waves.

The temperature of carbon dioxide $\mathbf{CO_2}$ is reserved for about 10 min then is reduced to the air temperature. The reason for this is that carbon dioxide $\mathbf{CO_2}$ is gradually leaves the bottle and it is filled with air.

Conclusions: When increasing the concentration of the "greenhouse" gases (carbon dioxide $\mathbf{CO_2}$, water vapor $\mathbf{H_2O}$, methane $\mathbf{CH_4}$, ozone $\mathbf{O_3}$, nitrogen oxides, etc.) the atmosphere becomes more permeable for the short (ultraviolet) wavelengths of sunshine and less permeable to the long (infrared) wavelengths of the Earth's thermal radiation. This leads to intensification of the greenhouse effect and to changes in the modes of heat and water balance of the planet, to adverse changes in the conditions for the existence and development of organisms.

Comments:

– The upper part of the bottle may not be cuts to keep longer the carbon dioxide $\mathbf{CO_2}$ in it.

– When filling the bottle with carbon dioxide $\mathbf{CO_2}$ must be careful not to fall in it solution or foam. This can happen if in the flask are placed large quantities of baking soda or vinegar.

– When performing the experiment should not be allowed direct sunshine and air flow.

– The active part of the thermometer can be overshadowed to not directly heated by the lamp.

– To obtain carbon dioxide **CO_2** are suitable and other substances – sodium carbonate **Na_2CO_3**, potassium carbonate **K_2CO_3**, calcium carbonate **$CaCO_3$** (marble, chalk) which is treated with different acids (hydrochloric acid **HCl**, sulphuric acid **H_2SO_4**, nitric acid, **HNO_3**, tartaric or citric acid).

Version 2. Two plastic bottles of mineral water with a capacity of 3l are filled with air and carbon dioxide **CO_2**. At the bottom of the bottles are pierced thermometers for reporting temperature change of the gases. Above each of the bottles is placed a lamp. The gases are heated to a constant value of the thermometers reading. The temperatures of the air and **CO_2** is registered and compared.

Version 3. In the real greenhouse effect participate water, soil, living organisms, etc. which absorb solar energy and radiate back some of that energy. The participation of the environmental components in the greenhouse effect can be demonstrated by using colored paper. It should be thin with negligible heat capacity to require some time to heat. The matt black paper is best but on the other hand the green paper resembles the nature. The paper should be large enough so that it covers all the radiation that enters in the bottle.

Two thermometers are placed at the same distance (10 cm) from the lamp. The one thermometer is left open and the other is placed in a tightly closed with a stopper test tube. Through the stopper is thrust a thermometer. Advance in the test tube is placed a thin green paper which clings to the inner walls of the tube and covers the thermometer. The thermometer readings are recorded and compared at appropriate intervals (for example 1 min). At the beginning of the experiment the reading of the thermometer left open is rising fast and the reading of the thermometer in the tube almost did not change. This is explained by the fact that the heating of the glass tube needs more time.

After about 5 min is determined a significant difference in the readings of the thermometers – at the thermometer outdoor is recorded temperature 29.6°C; at the thermometer overshadowed by the green paper in the tube – 37.8°C.

APPENDIX 3

Test "Greenhouse effect"

Task 1. In what line are referred substances that are **persistent components of the air**? Point it out.

A. CH_4, O_2, H_2; (0 pts)
B. N_2, O_2, Ar; (1 pt)
C. SO_2, N_2, O_2; (0 pts)
D. NO, NO_2, CO; (0 pts)
E. O_2, H_2O (water vapor), **NH_3**. (0 pts)

Task 2. In what line are given substances that are **variable components of the air** and have **"greenhouse" properties**? Point it out.

A. H_2O (water vapor), **CO_2, CH_4**; (1 pt)
B. H_2O (water vapor), **NO, O_2**; (0 pts)

C. $\mathbf{O_3}$, $\mathbf{CH_4}$, $\mathbf{N_2}$; (0 pts)
D. $\mathbf{SO_2}$, **CO,** $\mathbf{O_2}$; (0 pts)
E. $\mathbf{CH_4}$, $\mathbf{H_2O}$ (water vapor), $\mathbf{N_2}$. (0 pts)

Task 3. Natural sources of **carbon dioxide** $\mathbf{CO_2}$ in the environment are:
A. volcanic activity; (1.5 pts)
B. photosynthesis; (0 pts)
C. dissolution of carbon dioxide $\mathbf{CO_2}$ in surface waters; (0 pts)
D. decay of organic substances; (1.5 pts)
E. respiration of organisms. (1.5 pts)
Circle the letters of the correct answers.

Task 4. Which of the following reasons for increasing the concentration of carbon dioxide $\mathbf{CO_2}$ in the atmosphere are **the result of human activity**. Circle the letters of the correct answers.
A. felling of forests, especially tropical; (1.5 pts)
B. road transport; (1.5 pts)
C. hot mineral springs; (0 pts)
D. precipitation of carbonates; (0 pts)
E. combustion of fossil fuels. (1.5 pts)

Task 5. Which of the following statements **are a reason for intensification the greenhouse effect** on Earth? Circle the letters of the correct answers.
A. Entry into the atmosphere of methane $\mathbf{CH_4}$, halogen derivatives of hydrocarbons, nitrogen oxides, which absorb infrared radiation from 50 to 100 times more powerful than carbon dioxide $\mathbf{CO_2}$. (1.5 pts)
B. Use of carbon dioxide $\mathbf{CO_2}$ for production of aerated drinks. (0 pts)
C. Increasing concentration of carbon dioxide $\mathbf{CO_2}$ into the atmosphere which absorbs in the infrared region. (1.5 pts)
D. Increasing the concentration of water vapour and ozone $\mathbf{O_3}$ in the atmosphere which absorb in the ultraviolet and infrared region. (1.5 pts)
E. Formation of acid rains and their impact on the natural resources of carbonates. (1.5 pts)

Task 6. What do you think is the **importance of the natural greenhouse effect**. Circle the letters of the correct answers.
A. maintains the ecological balance; (1.5 pts)
B. leads to drying of the marshes accompanied by intensive oxidation of peat; (0 pts)
C. creates an average annual temperature on Earth's surface about 17°C; (1.5 pts)
D. improves the combustion in the internal combustion engines; (0 pts)
E. provides the progress of carbon**,** nitrogen, oxygen and water cycles in nature. (1.5 pts)

Task 7. What do you think might be **the consequences on the environment** from intensification of the greenhouse effect? Circle the letter of the correct answer.
A. change the Earth's climate; (0 pts)
B. increasing the level of seas and oceans; (0 pts)
C. change of the conditions for existence and development of the living organisms

on Earth; (0 pts)

D. defrosting of the territories of Siberia and Northern Canada, which will lead to the release of new quantities of carbon dioxide CO_2 and methane CH_4 included in soil at low temperatures; (0 pts)

E. all of the above. (1 pt)

Task 8. Which of the following actions would you recommend as an effective measure **to reduce the amount of greenhouse gases** in the atmosphere? Circle the letters of the correct answers.

A. Organization of large-scale afforestation campaigns. (1.5 pts)

B. Increasing the efficiency of machines which use fossil fuels. (1.5 pts)

C. Development and implementation of solar and other renewable energy sources. (1.5 pts)

D. Usage of coal, oil, natural gas as energy sources. (0 pts)

E. Development of technologies waste carbon dioxide CO_2 absorbtion or connection with appropriate substances. (1.5 pts)

Task 9. What do you think would happen if **the carbon dioxide CO_2 leaves the Earth's atmosphere**? Circle the letters of the correct answers.

A. Life on Earth will disappear. (1.5 pts)

B. The synthesis of organic substances by plants will hamper. (1.5 pts)

C. The amount of acid rain will increase. (0 pts)

D. The forest fires will facilitate. (0 pts)

E. There will be no change. (0 pts)

Task 10. To what extent **you are agree** with the following statements? In table 1 point only one answer on each line out.

We need to know which human activities the most contribute for intensification the greenhouse effect.	**A.** I totally agree. (1.5 pts)	**B.** I agree.	**C.** I disagree.	**D.** I totally disagree.	**E.** I don't have a position on the matter.
We need to learn which technologies minimize emissions leading to intensification the greenhouse effect.	**A.** I totally agree. (1.5 pts)	**B.** I agree.	**C.** I disagree.	**D.** I totally disagree.	**E.** I don't have a position on the matter.
The statements for the reasons for increasing the greenhouse effect and the consequences of this for the environment must be based on scientific researches.	**A.** I totally agree. (1.5 pts)	**B.** I agree.	**C.** I disagree.	**D.** I totally disagree.	**E.** I don't have a position on the matter.

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