LESSONS 9-12

Appendix No.1. Story

Imagine that you live in 2060. This is a potential pessimistic scenario of the future, in which most of today's threatening forecasts have become true.

This is an excerpt from the publication in 2060:

Lessons No. 9-12. Appendix No. 2. Questions for the discussion

Cycle 3. Idea of sustainable development - challenge for science and engineering

Lesson 9-12

Questions for discussion:

- What is this story about? Do you think that it is realistic? Why?
- How can you explain the concept „terraform"?
- According to the story, what kind of problems do Earth inhabitants face in 2060?

Mention the most important 5 problems which are related to the factors:
- food,
- climate,
- nature,
- soil,
- waste.

Slide *Lessons No. 9 -12. Appendix No. 3*

Cycle 3. Idea of sustainable development - challenge for science and engineering

Lesson 9-12

Task 1.
Imagine being a team that traveled to Mars. Your mission is to create an artificial **biosphere** where other people's expeditions could stay in the future for a longer time. Create an idea and prepare a biosphere project where you will grow plants taken from the Earth. Select one or more conditions for the task to complete:

- plants must grow "supervised" by remotely controlled microcontroller systems;
- In the biosphere as many plants as possible might be planted. It is recommended to create a modular system/ structure of the selected capacities printed by a 3D printer and to use it creatively while solving an engineering problem;
- Create ecological / economical packages to bring various products to Mars which will be needed for astronauts. Packages should be adaptable for multiple use and be environmentally friendly.

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Slide *Lessons No. 9 -12. Appendix No. 4*

Cycle 3. Idea of sustainable development - challenge for science and engineering

Lesson 9-12

Task 2

Imagine being an engineer team that works in the Earth in 2060 and has to deal with a variety of problems. On the basis of the story you have read, select one or more of the issues you will try to tackle creatively when applying your knowledge / skills. Select one or more conditions for the task to complete:

· In a large city with a high population and architecture density it is necessary to produce as many good quality food crops as possible. Create an idea and prepare a project how to grow crops using a variety of building spaces for plant cultivation; the creation of various mobile structures, constructions;
· Create an idea and prepare a project to reduce pollution of air / water by using plants and other things (might be created by yourself).

Appendix No.5. Worksheet 1

Task 1

Imagine that you are a team which came to Mars. Your mission is to create an artificial biosphere where other people's expeditions could stay in the future for a longer time. Create an idea and prepare a Mars biosphere project where you will sow and grow plants brought from the Earth. Select one or more conditions for the task to complete:

• plants must grow "supervised" by remotely controlled microcontroller systems;

• in the biosphere as many plants as possible must be planted. It is recommended to create a modular system/ structure of the selected capacities printed by the 3D printer and to use it creatively while solving an engineering problem;

• create ecological / economical packages to bring various products to Mars which will be needed for astronauts. Packages should be adaptable for multiple use and be environmentally friendly.

Task 2

Imagine being an engineer team which works in the Earth in 2060 and has to deal with a variety of problems. Regarding the story you have read, select one or more of the issues you will try to tackle creatively when applying your knowledge / skills. Select one or more conditions for the task to complete:

- in a big city, where the density of people and buildings is very high, you need to grow food plants of as good quality as possible. Create an idea and prepare a project to grow crops using various building spaces for plant cultivation; the creation of various mobile structures and constructions;
- create an idea and prepare a project to reduce pollution of air / water by using plants and other means (use your imagination).

Appendix No 6. Worksheet 2

Work planning

Planning	Completed
Stages/ steps of the project 1. 2. 3. 4. 5.	

Usefulness of the project and its relation with the environment		
Criteria	Planning	Completed
Problem (describe the problem you are going to solve. Why?)		
Goal of the project/ possibilities of use (*how can your project be useful for people, future perspectives)*		
Project implementation costs (*human resources/ funding/ time costs, etc.)*		
Project presentation/ dissemination/ advertising		
Team building		
How many members will be in your team? What are their functions?		
What will be the most important responsibilities and activities of the team members ?		
How will responsibilities be shared, help provided if there is a need?		

Appendix No.7. Presentation of creative engineering projects

Time for the project's presentation:.....min.

1. Problem.
2. Project's idea.
3. Visualization/ presenting of the project (sketches,models, photos, videos, etc.).
4. Resources of the project:

Materials	Cost of a unit	Number of units	Expenses (in total)

Design expenditures	Design	Required time	Expenses (in total_

Production expenditures	Cost of a unit	Number of units	Required time	Expenses (in total)

5. Solution of a problem/, advantages of an idea/ project.
6. Possible applications of an idea/ project (multifunctionality; examples of application and others).
7. Design/ advertising of a project (presentation, video advertisement, flyers, poster and others).
8. How did you succeed working as a team?
9. What were the responsibilities/ functions/ activities of your team members?
10. Was it difficult to distribute the tasks? Why?
11. Did all team members succeed in performing their tasks? Why?
12. Did you manage to accomplish the project as it had been planned? If not, what was changed and why?

Appendix No.8. (Self) assessment of creative engineering projects

Group's name:	Assessment (points)						Remarks
	0	1	2	3	4	5	
Identifying the problem							
Originality of an idea							
Clarity of visualization							
Effectiveness of using project resources							
Usefulness of a project							
Design/ advertising							
Other							
Points in total:							

Group's name:	Assessment (points)						Remarks
	0	1	2	3	4	5	
Identifying the problem							
Originality of an idea							
Clarity of visualization							
Effectiveness of using project resources							
Usefulness of a project							
Design/ advertising							
Other							
Points in total:							

Group's name:	Assessment (points)						Remarks
	0	1	2	3	4	5	
Identifying the problem							
Originality of an idea							
Clarity of visualization							
Effectiveness of using project resources							
Usefulness of a project							
Design/ advertising							
Other							
Points in total:							

Group's name:	Assessment (points)						Remarks
	0	1	2	3	4	5	
Identifying the problem							
Originality of an idea							
Clarity of visualization							
Effectiveness of using project resources							
Usefulness of a project							
Design/ advertising							
Other							
Points in total:							