



Title of the STEAM Unit: Bridges

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RELATED SUBJECTS	GRADE RECOMMENDATIONS	TOTAL ACTIVITY TIME	LEARNING OBJECTIVES DURING THE LESSON SUBJECT-SPECIFIC COMPETENCIES	LEARNING OBJECTIVES AFTER THE LESSON
science (physics), technology, mathematics, mechanical engineering, art (class)	Age 12 / grade 6	540min = 10x45min lessons at school (Properties of liquids and gases) and + one week at home (probably 90 minutes of group work), then 2x45minutes presentation at school.	Teamwork, cooperative designing, constructing, inter-disciplinarity understanding	To understand the importance of the relation between school subjects and real-life scenarios

OVERVIEW: TOPIC & PURPOSE

Pupils are to:

Design a hydraulic machine that takes advantage of the fact that fluids are incompressible.

Understand that the pressure is the same in all places, therefore it moves the least stable parts.

By using syringes and tubes, create a hydraulic machine that you will be presented.

Work with the concepts of incompressibility and spillability.



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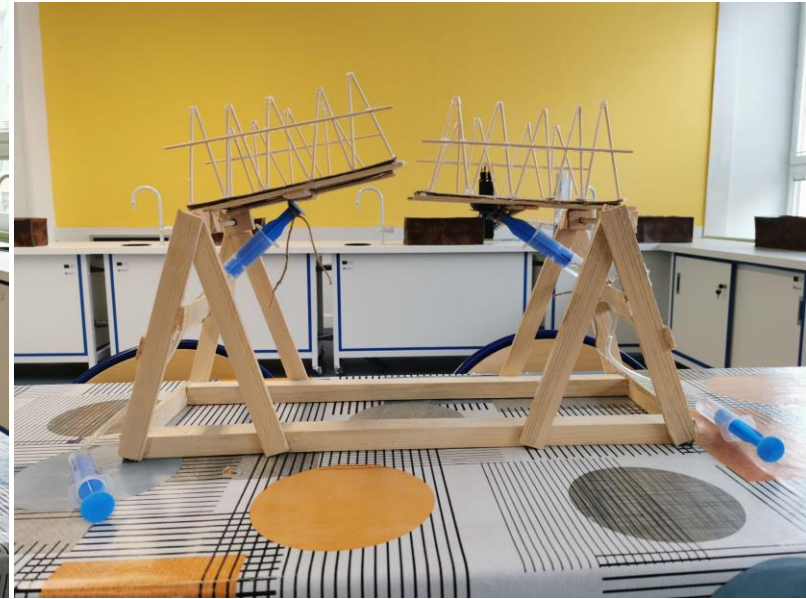
STEAM Connect Material Collection

Multimedia (informatics) – find an application for Lego that evaluates what this model/aid consists of (it exists, but unfortunately, it is not free of charge)

Art and informatics – record a video, or edit it, re-edit it.

Art – draw a model/diagram of how hydraulic pressure will work, floor plan, elevation, side elevation, how it works

Evaluation criteria – functionality, aesthetics, originality, technical complexity of the construction, practical use + presentation itself





ACTIVITY PREREQUISITES

Content knowledge needed for the activity

STEAM ELEMENTS

ELEMENT 1: context presentation	How to build lifting bridges? How to do it with hydraulics?
ELEMENT 2: creative design	Invent, design and build a hydraulic machine that takes advantage of the fact that liquids are incompressible.
ELEMENT 3: emotional and social learning	Agree upon a strategy, appreciate progressive ideas of peers, be able to fill each other in.



STEAM SUBJECT ELEMENTS

STEAM SUBJECTS	SCIENCE	TECHNOLOGY	ENGINEERING	ARTS	MATHEMATICS
<p style="text-align: center;">SHORT INTRODUCTION TO RELATED SUBJECT ELEMENTS</p>	<p>Invent of a hydraulic machine that takes advantage of the fact that fluids are incompressible . Understanding that the pressure is the same in all places, therefore it moves the least stable parts. Use syringes and tubes, create a hydraulic machine that will be presented. Work with the Developing concepts of incompressibili</p>	<p>Design a presentation of the model of the hydraulic machine in some presentation software (PowerPoint, Canva, ...), which will explain this model.</p> <p>Create a short 1-minute video about working on the created model of hydraulic machine and inserting it into the presentation.</p>	<p>Invent, design and build a hydraulic machine that takes advantage of the fact that liquids are incompressible.</p> <p>Construct a model of a lifting bridge.</p>	<p style="text-align: center;">Draw a model/diagram of how hydraulic pressure would work, floor plan, elevation, side elevation, how it works.</p>	<p>Calculate the volume of air/fluid in syringes and the volume of compressed air, measure the time of stroke, unit conversions ... (this is the content of grade 6 in both mathematics and physics).</p>





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SYLLABUS

LESSONS	SUBJECTS	TOPIC OF THE UNIT	LEARNING OBJECTIVES DURING THE LESSON: SUBJECT SPECIFIC COMPETENCIES	LEARNING OBJECTIVES AFTER THE LESSON: STEAM COMPETENCIES
1	Science	Hydraulics, pressure in liquids.	To develop knowledge on pressure of liquids.	Be able to understand the pressure of liquids Explain the principles of a hydraulic device.
2	Mathematics	Volume, various units of volume.	To develop knowledge on volume, transfer of units of volume.	Be able to understand and apply the transfer of units of volume.
3	Science	Technical principles of hydraulic devices, practical creation of hydraulic devices.	To build the hydraulic bridge from the technical point of view.	Be able to create a functional hydraulic device.





4	Art	Artistic design of hydraulic devices.	To build the hydraulic bridge from the visual artistic point of view.	Be able to create an artistic design of hydraulic device.
5	Team Homework on project	Artistic design of hydraulic devices.	To build the hydraulic bridge from the visual artistic point of view.	Be able to create an artistic design of hydraulic device.
6	Science	Presentation of created models of hydraulic bridges.	To develop presentation skills.	Be able to present a created model with its functionalities.

INSTRUCTIONAL PLAN BY LESSON

LESSON 1 Science (90 min) Hydraulics, pressure in liquids

TIME PLAN	TEACHING & LEARNING ACTIVITIES	MATERIALS	LEARNING OBJECTIVES
INTRODUCTION (15 minutes)	Detecting pupils' preconceptions about pressure and pressure in liquids detecting pupils' preconceptions about	whiteboard, software for conceptual mapping	Pupils will be able to conceptualize and present their preconceptions about pressure, pressure in liquids and understanding of principles of hydraulics.





	principles of hydraulics and knowledge about hydraulic devices.		
LEARNING ACTIVITIES (60 minutes)	Measuring with hoses and syringes how the hydraulics work.	worksheets made by teacher, syringes of various volumes, tubing and water	Pupils will be able to understand how hydraulics devices work.
WRAP-UP & EVALUATION (15 minutes)	Presentation of the measurement results.	interactive board/white board	Pupils will be able to explain the principles of hydraulic device.

LESSON 2 Math (90 min) Volume, various units of volume

TIME PLAN	TEACHING & LEARNING ACTIVITIES	MATERIALS	LEARNING OBJECTIVES
INTRODUCTION (10 minutes)	Detecting pupils' preconceptions about different volume units.	whiteboard or interactive board	Pupils will be able to conceptualize and present their preconceptions about units of volume of liquids and solids.
LEARNING ACTIVITIES (65 minutes)	Comparison of units of liquids and solids.	worksheets made by teacher	Pupils will be able to understand and apply the





			principles of transfer of units of volume.
WRAP-UP & EVALUATION (15 minutes)	Solving the transformations of volume units in the worksheet.	worksheets made by teacher	Pupils will be able to understand and apply the principles of transfer of units of volume.

LESSON 3 Science (90 min) To build the hydraulic bridge from the technical point of view

TIME PLAN	TEACHING & LEARNING ACTIVITIES	MATERIALS	LEARNING OBJECTIVES
INTRODUCTION (10 minutes)	Pre-activity dialogues between the teacher and groups of pupils.		Pupils will be able to acknowledge the necessary tools for the construction of the model.
LEARNING ACTIVITIES (65 minutes)	Designing/constructing a functional hydraulic bridge.	worksheet made by teacher syringes of various volumes, tubing and water, other tools as suggested by the pupils (skewers, Lego, glue gun, cardboard, paper, etc.)	Pupils will be able to build the hydraulic bridge from a technical point of view.
WRAP-UP & EVALUATION (15 minutes)	Reflexive dialogues between the teacher and groups of pupils.		Pupils will be able to check and test the functionality of the constructed hydraulic bridge.

LESSON 4 Art (90 min)

TIME PLAN	TEACHING & LEARNING ACTIVITIES	MATERIALS	LEARNING OBJECTIVES
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INTRODUCTION (10 minutes)	Pre-activity dialogues between the teacher and groups of pupils.		Pupils will be able to agree as a group on a draft of the artistic design of the bridge.
LEARNING ACTIVITIES (65 minutes)	Building the hydraulic bridge from the visual artistic point of view.	paper, cardboard, paints of various kinds, glitter, glue, or natural materials according to the pupils' design	Pupils will be able to create a pre-final artistic design of hydraulic bridge.
WRAP-UP & EVALUATION (15 minutes)	Reflexive dialogues between the teacher and groups of pupils		Pupils will be able to reflect on their work and check/revise the pre-final artistic design of hydraulic bridge.

LESSON 5 Team Homework on project (90 min)

TIME PLAN	TEACHING & LEARNING ACTIVITIES	MATERIALS	LEARNING OBJECTIVES
INTRODUCTION (10 minutes)	Pre-activity dialogues between members of the group.		Pupils will be able to agree as a group on the artistic design of the bridge according to previous revision.
LEARNING ACTIVITIES (70 minutes)	Continuous construction of the hydraulic bridge from the visual artistic point of view.	paper, cardboard, paints of various kinds, glitter, glue, or natural materials according to the pupils' design	Pupils will be able to create a final artistic design of the hydraulic bridge.
WRAP-UP & EVALUATION (10 minutes)	Reflective dialogues between the teacher and groups of pupils.		Pupils will be able to reflect on their work and check on the finalization of artistic design of hydraulic bridge.





LESSON 6 Science (90 min)

TIME PLAN	TEACHING & LEARNING ACTIVITIES	MATERIALS	LEARNING OBJECTIVES
INTRODUCTION (5 minutes)	Greeting and instructing the pupils by the teacher at the final presentation of the completed models.		Pupils will be able to understand key principles of the presentation procedure.
LEARNING ACTIVITIES (75 minutes)	Presentation of created models of hydraulic bridges.	A constructed model of the hydraulic bridge of each student group	Pupils will be able to present key information about the model created with its functionalities.
WRAP-UP & EVALUATION (10 minutes)	Final evaluation of the presented models by the teacher and pupils.	worksheet for scoring models made by pupils	Pupils will be able to co-evaluate the most interesting and creative models.

EVALUATION PLAN BY LESSON

LESSON	EVALUATION CRITERIA	EVALUATION METHOD
1	Do pupils understand the notion and phenomenon of pressure? (Is It is the same in different places?)	Dialogue between the teacher and pupils.
2	Do pupils understand the relationship between the units of volume (liters and cubic)?	Explaining the relationship between different units of volume to each other.
3	Are pupils able to create a functional model of hydraulics device?	Practical testing of constructed models by groups.





4	Are pupils able to artistically design a constructed hydraulic model?	Checking the pre-final stage of the artistic design of the models according to revision and criteria of creativity and originality.
5	Are pupils able to artistically design a constructed hydraulic model?	Checking the finalization of the artistic design of the models according to revision and criteria of creativity and originality.
6	Are the pupils able to present key notions of their constructed model of a bridge in a convincing and interesting way?	Observation, self-evaluation and co-evaluation of groups / pupils comparing products, peer-review of presentation materials.

NOTES

ACTIVITY SHEETS TO BE LINKED

EVALUATION MATERIALS TO BE LINKED

REFERENCES / SUPPORTING MATERIALS TO BE LINKED

