**Lesson Plan 1**

**Author / Teacher:** *Ana Maria Nicolescu*

**Course / Subject:**  *Protecting the nature*

**Level** (ISCED, difficulty)**:** *ISCED: 6, medium*

**Theme:** *Sustainable Development*

**Prerequisite skills or knowledge** (connect to prior lesson): *Students must have basic knowledge about green energy and the importance of protecting nature through conscious and committed actions.*

**Time required for pre-class activity:** *1h*

**Time required for in-class activity:** *2h*

**Time required for post-class activity:** *1h*

Story, canvas, challenges for student (optional, motivational):

*Data collected from students help us to see how familiar they are with the 17 goals and the concept of sustainable development in general. It also helps us measure students' interest in protecting nature, as well as their attitude towards green energy. After going through the theoretical materials and after the class discussions, the students will become more aware of the importance of the previous concepts.*

1. **Student’s new material (before class)**

Please see:

General intro:

<https://sdgs.un.org/goals>

Green energy:

<https://www.youtube.com/watch?v=Ms--0d7Oh0s>

Protecting the nature:

<https://www.youtube.com/watch?v=RzJPvMo9QNw>

1. **In-class activities**
2. Discussion of theoretical aspects related to sustainable development and green energy, focusing on the benefits they bring to nature and people.
3. Group play: Sustainable Development Quiz (Ideal Game Creator)
4. Discussion game results, playing in forum.
5. Homework:
   1. To re-read the theoretical aspects, if they gave wrong answers to the questions;
   2. Answer how to verify one of randomly assigned questions.
6. **Post-class activities**

Homework: Each student will have to choose one of the 17 goals to reinterpret through a drawing.

1. **Evaluation and Assessment**

Feedback on results, grades for answers.

**Lesson Plan 2**

**Author / Teacher:** *Adriana Gabriela Schiopu*

**Course / Subject:** *Construction of materials structure according to the elements in the composition*

**Level** (ISCED, difficulty)**:** *ISCED: 6, medium*

**Theme:** *Engineering of materials*

**Prerequisite skills or knowledge** (connect to prior lesson): *Students must have basic knowledge about* *the crystal and molecular structures and how build any kind of crystal or molecular structure*.

**Time required for pre-class activity:** *1h*

**Time required for in-class activity:** *2h*

**Time required for post-class activity:** *1h*

Story, canvas, challenges for student (optional, motivational):

*Data collected from students help us to see how familiar they are with 7 crystallographic systems,* *atomic boundaries,* *kind of cell structures. After going through the theoretical materials and after the class discussions, the students will become more aware of the importance of the previous concepts.*

* + 1. **Student’s new material (before class)**

Please see:

The 7 Crystal Systems:

<https://www.youtube.com/watch?v=11Ng8CJNE7Y>

Crystallography:

<https://www.youtube.com/watch?v=WuclTFbINq4>

Unit Cell Chemistry Simple Cubic, Body Centered Cubic, Face Centered Cubic Crystal Lattice Structure

<https://www.youtube.com/watch?v=HCWwRh5CXYU>

* + 1. **In-class activities**

1. Discussion of theoretical aspects related to crystal structure, unit cell,
2. Group play: Determination of crystal structure Quiz (Ideal Game Creator)
3. Discussion game results, playing in forum.
4. Homework:
   1. To re-read the theoretical aspects, if they gave wrong answers to the questions;
   2. Answer how to verify one of randomly assigned questions.
5. **Post-class activities**

Homework: Each student will have to choose one crystal structure and reinterpret through a drawing.

1. **Evaluation and Assessment**

Feedback on results, grades for answers.

**Lesson Plan 3**

**Author / Teacher:** *Adriana Gabriela Schiopu*

**Course / Subject:** *Determination of materials behavior*

**Level** (ISCED, difficulty)**:** *ISCED: 6, medium*

**Theme:** *Engineering of materials*

**Prerequisite skills or knowledge** (connect to prior lesson): *Students must have basic knowledge about* *the properties of materials: ferrous alloys (steels, cast irons), nonferrous alloys, ceramic materials (oxides, nitrides, carbides), polymer materials (PVC, PET, PE).*

**Time required for pre-class activity:** *1h*

**Time required for in-class activity:** *2h*

**Time required for post-class activity:** *1h*

Story, canvas, challenges for student (optional, motivational):

*Data collected from students help us to see how familiar they are with are mechanicals properties: hardness, resilience, resistance at traction, elongation a with technological properties: hardening, weldability (calculus of equivalent carbon).*

*After going through the theoretical materials and after the class discussions, the students will become more aware of the importance of the previous concepts.*

* + - 1. **Student’s new material (before class)**

Please see:

What materials and objects are made of?

<https://www.youtube.com/watch?v=B8EQCS5ZGwg>

Materials properties.

<https://www.youtube.com/watch?v=340MmuY_osY>

Sorting materials into groups:

<https://www.youtube.com/watch?v=og9Gyhzm_XA>

* + - 1. **In-class activities**

1. Discussion of theoretical aspects related to class of materials and properties
2. Group play: Determination of materials behavior Quiz (Ideal Game Creator)
3. Discussion game results, playing in forum.
4. Homework:
   1. To re-read the theoretical aspects, if they gave wrong answers to the questions;
   2. Answer how to verify one of randomly assigned questions.
      1. **Post-class activities**

Homework: Each student will have to choose one property and reinterpret through a drawing.

* + 1. **Evaluation and Assessment**

Feedback on results, grades for answers.

**Lesson Plan 4**

**Author / Teacher:** *Adriana Gabriela Schiopu*

**Course / Subject:** *Microscopic analysis of ferrous alloys*

**Level** (ISCED, difficulty)**:** *ISCED: 6, medium*

**Theme:** *Engineering of materials*

**Prerequisite skills or knowledge** (connect to prior lesson): *Students must have basic knowledge about* *the solidification, phase transformation, ferrous alloys, structure, classification of alloys and microscopic analysis techniques.*

**Time required for pre-class activity:** *1h*

**Time required for in-class activity:** *2h*

**Time required for post-class activity:** *1h*

Story, canvas, challenges for student (optional, motivational):

*Data collected from students help us to see how familiar they are with ferrous alloys, solidification, phase transformation, metallographic structure. After going through the theoretical materials and after the class discussions, the students will become more aware of the importance of the previous concepts.*

* + 1. **Student’s new material (before class)**

Please see:

Ferrous and non-ferrous alloys:

<https://www.youtube.com/watch?v=IiBgHQ5D-3Y>

The different phase of steel:

<https://www.youtube.com/watch?v=-YIGjX-jcMo>

Microscopic technique:

<https://www.youtube.com/watch?v=UuHofNW40Yw>

* + 1. **In-class activities**

1. Discussion of theoretical aspects related to structure and ferrous alloys;
2. Group play: Microscopic analysis of ferrous alloys Quiz (Ideal Game Creator)
3. Discussion game results, playing in forum.
4. Homework:
   1. To re-read the theoretical aspects, if they gave wrong answers to the questions;
   2. Answer how to verify one of randomly assigned questions.
      * 1. **Post-class activities**

Homework: Each student will have to choose one class of ferrous alloy and reinterpret the structure through a drawing.

* + - 1. **Evaluation and Assessment**

Feedback on results, grades for answers.

**Lesson Plan 5**

**Author / Teacher:** *Viorel Nicolae*

**Course / Subject:** *Vehicles manufacturing Automotive manufacturing*

**Level** (ISCED, difficulty)**:** *ISCED: 6, medium*

**Theme:** *Automotive manufacturing*

**Prerequisite skills or knowledge** (connect to prior lesson): *Students must have basic knowledge about* *the main processing operations running in a vehicle manufacturing factory*.

**Time required for pre-class activity:** *1h*

**Time required for in-class activity:** *2h*

**Time required for post-class activity:** *1h*

Story, canvas, challenges for student (optional, motivational):

*Data collected from students help us to see how familiar they are with the main aspects of the processing operations running in a vehicle manufacturing factory. After going through the theoretical materials and after the class discussions, the students will become more aware of the importance of the previous concepts.*

* + 1. **Student’s new material (before class)**

Please see:

Crankshaft manufacturing:

<https://www.youtube.com/watch?v=MRlnwacph3I>

Plane grinding:

<https://www.youtube.com/watch?v=CsTbWAu0k-o>

Engine block manufacturing

<https://www.youtube.com/watch?v=hJkwUVSpNPw>

Piston manufacturing

<https://www.youtube.com/watch?v=oteRRECMeSo>

* + 1. **In-class activities**

1. Discussion of theoretical aspects related to process manufacturing of vehicles
2. Group play: Solving the quiz related to vehicle manufacturing process (Ideal Game Creator)
3. Discussion game results, playing in forum.
4. Homework:
   1. To re-read the theoretical aspects, if they gave wrong answers to the questions;
   2. Answer how to verify one of randomly assigned questions.
      1. **Post-class activities**

Homework: Each student will have to choose one manufacturing process and to establish the proper succession of the operations.

* + 1. **Evaluation and Assessment**

Feedback on results, grades for answers.

**Lesson Plan 6**

**Author / Teacher:** *Viorel Nicolae*

**Course / Subject:** *Solving crisis situations*

**Level** (ISCED, difficulty)**:** *ISCED: 6, medium*

**Theme:** *Sustainable development*

**Prerequisite skills or knowledge** (connect to prior lesson): *Students must have basic knowledge about* *the main threats that can endanger the activity of an enterprise*.

**Time required for pre-class activity:** *1h*

**Time required for in-class activity:** *2h*

**Time required for post-class activity:** *1h*

Story, canvas, challenges for student (optional, motivational):

*Data collected from students help us to see how familiar they are with the main aspects of the threats that can endanger the activity of an enterprise. After going through the theoretical materials and after the class discussions, the students will become more aware of the importance of the previous concepts.*

1. **Student’s new material (before class)**

Please see:

What to do after the earthquake:

<https://www.youtube.com/watch?v=SmklQjGAr20>

What to do after the flood:

<https://www.youtube.com/watch?v=GjrRinJgBp4>

Reducing the risk of landslides:

<https://www.youtube.com/watch?v=zl6EwTrJxCc>

1. **In-class activities**
2. Discussion of theoretical aspects related to crisis situation that could affect the company’s activities
3. Group play: Solving the quiz related to solving crisis situations (Ideal Game Creator)
4. Discussion game results, playing in forum.
5. Homework:
   1. To re-read the theoretical aspects, if they gave wrong answers to the questions;
   2. Answer how to verify one of randomly assigned questions.
      1. **Post-class activities**

Homework: Each student will have to choose one crisis situation and to analyze every detail of it.

* + 1. **Evaluation and Assessment**

Feedback on results, grades for answers.

**Lesson Plan 7**

**Author / Teacher:** *Viorel Nicolae*

**Course / Subject:** *Solutions for quality problems*

**Level** (ISCED, difficulty)**:** *ISCED: 6, medium*

**Theme:** *Manufacturing*

**Prerequisite skills or knowledge** (connect to prior lesson): *Students must have basic knowledge about* *the quality issues that appear in the activity of an enterprise*.

**Time required for pre-class activity:** *1h*

**Time required for in-class activity:** *2h*

**Time required for post-class activity:** *1h*

Story, canvas, challenges for student (optional, motivational):

*Data collected from students help us to see how familiar they are with the main aspects of the quality issues that appear in the activity of an enterprise. After going through the theoretical materials and after the class discussions, the students will become more aware of the importance of the previous concepts.*

* + 1. **Student’s new material (before class)**

Please see:

Quality documents:

<https://www.youtube.com/watch?v=0qKJ71iMHN4>

Separate sequential and parallel operations:

<https://www.youtube.com/watch?v=6LFBZL7RfRY>

Tips to achieve zero defects quality:

<https://www.youtube.com/watch?v=6LFBZL7RfRY>

* + 1. **In-class activities**

1. Discussion of theoretical aspects related to quality problems that could affect the company’s activities
2. Group play: Solving the quiz related to solutions to quality problems (Ideal Game Creator)
3. Discussion game results, playing in forum.
4. Homework:
   1. To re-read the theoretical aspects, if they gave wrong answers to the questions;
   2. Answer how to verify one of randomly assigned questions.
      1. **Post-class activities**

Homework: Each student will have to choose one quality problem and to analyze every detail of it.

* + 1. **Evaluation and Assessment**

Feedback on results, grades for answers.

**Lesson Plan 8**

**Author / Teacher:** *Alexandru Dan TOMA*

**Course / Subject:** *Differences between leadership and management within an organization*

**Level** (ISCED, difficulty)**:** *ISCED: 6, medium*

**Theme:** *Human Resources Management*

**Prerequisite skills or knowledge** (connect to prior lesson): *Students must have basic knowledge about what are the leader skills and respectively the manager skills in order to rule an organization as well as possible. Also, they must have knowledge about the relation between* *the leadership and the management and about ways to improve this relation in order to optimally use the human resources of an organization.*

**Time required for pre-class activity:** *1h*

**Time required for in-class activity:** *2h*

**Time required for post-class activity:** *1h*

Story, canvas, challenges for student (optional, motivational):

*Data collected from students help us to see how familiar they are with the requirements to become a capable leader or manager,* *the concepts of leadership and management of an organization and the methods to optimally use its human resources. After going through the theoretical materials and after the class discussions, the students will become more aware of the importance of the previous concepts.*

* + - 1. **Student’s new material (before class)**

Please see:

Leadership explained

<https://www.youtube.com/watch?v=V3VYtT4Fw2g>

The definition of Management

<https://www.youtube.com/watch?v=H58V2Z0CBaA>

Differences between Leadership and Management

<https://www.youtube.com/watch?v=mhkLc0HEtR0>

* + - 1. **In-class activities**

1. Discussion of theoretical aspects related to the leader and the manager of an organization and their concerns about human resources.
2. Group play: Leader versus Manager - Quiz Game (Ideal Game Creator)
3. Discussion game results, playing in forum.
4. Homework:
   1. To re-read the theoretical aspects, if the students gave wrong answers to the questions;
   2. Answer how to verify one of randomly assigned questions.
5. **Post-class activities**

Homework: Each student will apply the notions learned to a possible scenario of a crisis situation that may occur within a company as: strikes, salary or staff reductions, national or global economic crisis, bankruptcy, natural disasters, etc.

1. **Evaluation and Assessment**

Feedback on results, grades for answers.

**Lesson Plan 9**

**Author / Teacher:** *Alexandru Dan TOMA*

**Course / Subject:** *Abraham Maslow`s Theory of the Hierarchy of Needs or the Pyramid of Needs*

**Level** (ISCED, difficulty)**:** *ISCED: 6, medium*

**Theme:** *Human Resources Management*

**Prerequisite skills or knowledge** (connect to prior lesson): *Students must have basic knowledge about human needs* *as they are classified in the Theory of the Hierarchy of Needs or the Pyramid of Needs elaborated by Abraham Maslow. According to this theory, the students must know to group the human needs in the ascending order of their importance to the individual and also to specify what type they are:* ***E****xistential,* ***R****elational or* ***G****row (personal development) needs. This classification is known as the* ***ERG*** *code of the Pyramid of Needs.*

**Time required for pre-class activity:** *1h*

**Time required for in-class activity:** *2h*

**Time required for post-class activity:** *1h*

Story, canvas, challenges for student (optional, motivational):

*Data collected from students help us to see how familiar they are with the human needs arranged and coded in* *the ascending order of their importance to the individual, as they are classified in the Theory of the* *Hierarchy of Needs or the Pyramid of Needs elaborated by Abraham Maslow. After going through the theoretical materials and after the class discussions, the students will become more aware of the importance of the previous concepts.*

* + 1. **Student’s new material (before class)**

Please see:

Abraham Maslow`s Hierarchy of Needs explained

<https://www.youtube.com/watch?v=y1WdqcONLHY>

Motivation Theory - Maslow`s Hierarchy of Needs (business level)

<https://www.youtube.com/watch?v=3St5OoLYTJ0>

Motivation – Contemporary Theories (Maslow`s Hierarchy of Needs for 21th Century)

<https://www.youtube.com/watch?v=UUCpQsS_aGs>

* + 1. **In-class activities**

1. Discussion of theoretical aspects related to strong point of Maslow's theory, which is the principle of hierarchy of human needs related to their importance to the individual. It expresses that a higher-level need does not arise as motivation unless the lower one has been satisfied. If in the meantime the satisfaction of a need from a lower level is in danger, it becomes dominant again. So, Abraham Maslow developed a motivational theory explaining how individuals progress through the hierarchy of human needs.
2. Group play: Maslow's Pyramid of Human Needs – Build a Bridge Game / Crane Game (Ideal Game Creator)
3. Discussion game results, playing in forum.
4. Homework:
   1. To re-read the theoretical aspects, if the students gave wrong answers to the questions;
   2. Answer how to verify one of randomly assigned questions.
      * 1. **Post-class activities**

Homework: Each student will apply the notions learned to a possible scenario of a crisis situation that may occur within the professional life of an individual (employee of an organization) as: strikes, salary or staff reductions, national or global economic crisis, bankruptcy, etc.

* + - 1. **Evaluation and Assessment**

Feedback on results, grades for answers.

**Lesson Plan 10**

**Author / Teacher:** *Alexandru Dan TOMA*

**Course / Subject:*****Types of Energy***

**Level** (ISCED, difficulty)**:** *ISCED: 6, medium*

**Theme:** *General* *Physics and Chemistry*

**Prerequisite skills or knowledge** (connect to prior lesson): *Students must have basic knowledge about the main types of energy involved in various physical and chemical phenomenon, both encountered in natural events and in everyday life.*

**Time required for pre-class activity:** *1h*

**Time required for in-class activity:** *2h*

**Time required for post-class activity:** *1h*

Story, canvas, challenges for student (optional, motivational):

*Data collected from students help us to see how familiar they are with* *the main types of energy defined in general courses of Physics and Chemistry and what is their capacity to recognize the type of energy involved in various phenomenon. After going through the theoretical materials and after the class discussions, the students will become more aware of the importance of the previous concepts.*

* + 1. **Student’s new material (before class)**

Please see:

Types of energy overview (Energy in Physics)

<https://www.youtube.com/watch?v=yLeoRtb5jxI>

What is chemical energy? (Energy in Chemistry)

<https://www.youtube.com/watch?v=hFmKIpXceqY>

10 forms of energy (Energy in Physics and Chemistry)

<https://www.youtube.com/watch?v=E3MnZ-bj1Iw>

* + 1. **In-class activities**

1. Discussion of theoretical aspects related to definitions and classification of the main types of energy defined in general courses of Physics and Chemistry. Discussion of practical aspects related to what type of energy/types of energies is/are involved in various physical and chemical phenomenon.
2. Group play: Types of Energy - Quiz Game / Raining Words Game (Ideal Game Creator)
3. Discussion game results, playing in forum.
4. Homework:
   1. To re-read the theoretical aspects, if the students gave wrong answers to the questions;
   2. Answer how to verify one of randomly assigned questions.
      1. **Post-class activities**

Homework: Each student will will apply the notions learned to specify what type of energy is involved in 10 physical or chemical phenomenon personally encountered in natural events and in everyday life.

* + 1. **Evaluation and Assessment**

Feedback on results, grades for answers.

**Lesson Plan 11**

**Author / Teacher:** *Alexandru Dan TOMA*

**Course / Subject:*****Characteristics of the photon***

**Level** (ISCED, difficulty)**:** *ISCED: 6, medium*

**Theme:** *Quantum Physics*

**Prerequisite skills or knowledge** (connect to prior lesson): *Students must have basic knowledge about the Theory of Special Relativity and the* *Corpuscular Theory of Light, from which it follows the characteristics of the photon* *and their expressions as formulas.*

**Time required for pre-class activity:** *1h*

**Time required for in-class activity:** *2h*

**Time required for post-class activity:** *1h*

Story, canvas, challenges for student (optional, motivational):

*Data collected from students help us to see how familiar they are with the main notions about the corpuscular nature of light and the characteristics of the corpuscle of light, named photon. After going through the theoretical materials and after the class discussions, the students will become more aware of the importance of the previous concepts.*

* + 1. **Student’s new material (before class)**

Please see:

Theory of Special Relativity

<https://www.youtube.com/watch?v=UHj2b6lZA-U>

Corpuscular Theory of Light

<https://www.youtube.com/watch?v=3T8T7u2-aVY>

Characteristics of the photon

<https://www.youtube.com/watch?v=pnh6HK77EXA>

* + 1. **In-class activities**

1. Discussion of theoretical aspects related to the Theory of Special Relativity, elaborated by Albert Einstein, and the Corpuscular Theory of Light, elaborated by Max Plank and completed by Albert Einstein, from which it follows the characteristics of the photon (speed in vacuum, speed in a transparent material environment, wavelength, energy, impulse, motion mass, rest mass, electric charge) and their expressions as formulas.
2. Group play:Characteristics of the photon - Memory Game (Ideal Game Creator)
3. Discussion game results, playing in forum.
4. Homework:
   1. To re-read the theoretical aspects, if the students gave wrong answers to the questions;
   2. Answer how to verify one of randomly assigned questions.
      1. **Post-class activities**

Homework: Each student will apply the notions learned to define the characteristics of the photon and to specify their expressions asformulas.

* + 1. **Evaluation and Assessment**

Feedback on results, grades for answers.

**Lesson Plan 12**

**Author / Teacher:** *Alexandru Dan TOMA*

**Course / Subject:*****Corpuscular nature of light***

**Level** (ISCED, difficulty)**:** *ISCED: 6, medium*

**Theme:** *Quantum Physics*

**Prerequisite skills or knowledge** (connect to prior lesson): *Students must have basic knowledge about the Corpuscular Theory of Light and the physical phenomena involving the corpuscular nature of light, as distribution of the spectral intensity of the thermal radiation, external photoelectric effect and Compton effect.*

**Time required for pre-class activity:** *1h*

**Time required for in-class activity:** *2h*

**Time required for post-class activity:** *1h*

Story, canvas, challenges for student (optional, motivational):

*Data collected from students help us to see how familiar they are with the main notions about the corpuscular nature of light and the physical phenomena in which this aspect is manifested. After going through the theoretical materials and after the class discussions, the students will become more aware of the importance of the previous concepts.*

* + 1. **Student’s new material (before class)**

Please see:

Corpuscular Theory of Light

<https://www.youtube.com/watch?v=3T8T7u2-aVY>

Plank`s distribution of the spectral intensity of the thermal radiation

https://www.youtube.com/watch?v=7hxYGaegxAM

Einstein`s photoelectric equation

<https://www.youtube.com/watch?v=O0wchw_Mi30>

External photoelectric effect – Experimental Demonstration

<https://www.youtube.com/watch?v=UHj2b6lZA-U>

What is Compton Scattering?

<https://www.youtube.com/watch?v=rGy7nsC8O_Y>

Compton effect – Experimental Demonstration

<https://www.youtube.com/watch?v=vvDy2aA4eVU>

* + 1. **In-class activities** 
       1. Discussion of theoretical aspects related to the Corpuscular Theory of Light, elaborated by Max Plank and completed by Albert Einstein, and the physical phenomena involving the corpuscular nature of light as: distribution of the spectral intensity of the thermal radiation, external photoelectric effect and Compton effect. Discussion of experimental aspects related to these phenomena, the laws that govern them and their expressions as formulas.
       2. Group play:Corpuscular nature of light - Memory Game (Ideal Game Creator)
       3. Discussion game results, playing in forum.

d) Homework:

1. To re-read the theoretical aspects, if the students gave wrong answers to the questions;
2. Answer how to verify one of randomly assigned questions.
   * 1. **Post-class activities**

Homework: Each student will apply the notions learned to define the 3 studied physical phenomena involving the corpuscular nature of light and to specify the laws that govern them and their expressions as formulas.

* + 1. **Evaluation and Assessment**

Feedback on results, grades for answers.

**Lesson Plan 13**

**Author / Teacher:** *Alexandru Dan TOMA*

**Course / Subject:*****Undulating nature of microparticles***

**Level** (ISCED, difficulty)**:** *ISCED: 6, medium*

**Theme:** *Quantum Physics*

**Prerequisite skills or knowledge** (connect to prior lesson): *Students must have basic knowledge about* *the hypotheses and physical phenomena involving the undulating nature of microparticles, as* *de Broglie`s hypothesis, Davisson & Germer experiment on electron diffraction on single crystal atomic lattices, Bragg`s law related to this experiment and Heisenberg's uncertainty principle for an atomic particle.*

**Time required for pre-class activity:** *1h*

**Time required for in-class activity:** *2h*

**Time required for post-class activity:** *1h*

Story, canvas, challenges for student (optional, motivational):

*Data collected from students help us to see how familiar they are with the main notions about the undulating nature of microparticles and the physical phenomena in which this aspect is manifested. After going through the theoretical materials and after the class discussions, the students will become more aware of the importance of the previous concepts.*

**1. Student’s new material (before class)**

Please see:

Louis de Broglie`s hypothesis

<https://www.youtube.com/watch?v=n-tM6y_1lkU>

Davisson & Germer experiment – Verification of the de Broglie`s hypothesis

<https://www.youtube.com/watch?v=Ho7K27B_Uu8>

Bragg`s law related to Davisson & Germer experiment

<https://www.youtube.com/watch?v=uvHc9etFt-A>

Heisenberg's uncertainty principle

<https://www.youtube.com/watch?v=Fw6dI7cguCg>

**2.In-class activities**

1. Discussion of theoretical aspects related to the hypotheses and physical phenomena involving the undulating nature of microparticles, as: Louis de Broglie`s hypothesis, Davisson & Germer experiment on electron diffraction on single crystal atomic lattices, Bragg`s law related to this experiment and Heisenberg's uncertainty principle for an atomic particle. Discussion of experimental aspects related to these phenomena, the laws that govern them and their expressions as formulas.
2. Group play:Undulating nature of microparticles - Memory Game (Ideal Game Creator)
3. Discussion game results, playing in forum.
4. Homework:
   1. To re-read the theoretical aspects, if the students gave wrong answers to the questions;
   2. Answer how to verify one of randomly assigned questions.
      1. **Post-class activities**

Homework: Each student will apply the notions learned to define 3 studied physical phenomena involving the undulating nature of microparticles and to specify the laws that govern them and their expressions as formulas.

* + 1. **Evaluation and Assessment**

Feedback on results, grades for answers.