Ministry of National Education, Youth and Sports

National Center for Educational Research and Development

Evaluation Teacher's Guide

Physics

October 1999

Ministry of National Education,
Youth & Sports
National Center for Educational Research
and Development

EVALUATION: **TEACHER'S GUIDE**
MATERIAL: **PHYSICS**

October 1999

INTRODUCTION

A self-evident tenet of curricula design is that such projects must encompass all the essential curricula elements, that is, the objectives, the contents, and teaching strategies and evaluation. Since the new published curricula did not initially include any evaluation, an evaluation system based upon continuous testing had to be added later, starting at the Basic Education level (excluding the Secondary cycle). However, upon trying out that system, a diversity of problems arose which drove a large majority of teachers to give up on it.

This reality led the Center for Educational Research and Development to take up a new challenge at the beginning of Year Two of the three-year period allowed for introducing the new programs i.e. eight out of the twelve years structured within the new educative system. It seems illogical and unacceptable to proceed to the implementation of new curricula while holding on to a traditional evaluation system exclusively devoted to memorizing information, in total disregard of a considerable part of the objectives introduced by the new curricula. To bridge the gap, a new commission has been charged with the task of developing the relevant evaluation system, as well as designing evaluation sheets, based on ideas and recommendations obtained during the teachers training sessions of summer 1999. Moreover, it is proposed that the sheets in their final form be distributed to all the schools at the beginning of the school year.

At this stage, we should particularly draw the teachers' attention to the difference between grading assessment and evaluation. Assessment focuses on the grade itself, which represents in this case the only indicator to appraise the student's achievement. Evaluation, on the other hand, goes beyond the grade which becomes only one of many elements taken into account to gauge the acquisition of the skills aimed at in the lesson and the wider scope of the subject being handled. Additionally, evaluation even examines attitudes relevant to certain situations.

Therefore it is of utmost importance to consider teaching and evaluation as two inseparable complementary entities to the extent that evaluation becomes an essential aspect of the learning/teaching process. It is of course essential that the

teacher be fully aware of the required skills – and that he informs the student of them – in order to select relevant work techniques for us in the teaching plan.

The teacher may resort to a series of techniques in order to evaluate the learning of the student. For example: direct knowledge is often gauged through an Objective Test while progress in the acquisition of competencies is evaluated through application, analysis and matching. We can thus say that evaluation is a comprehensive operation, which requires the use of various types of precision and estimation procedures. Furthermore, this operation is not limited to the grade, but involves numerous activities, which help the teacher appraise the student's work. Nevertheless, evaluation does not necessarily depend on pen-and-paper tests, but rather on the execution of definite tasks and activities as well as the observation of conducts. After collecting information through the evaluation of the student's work, the teacher will make use of it to reach two goals: on the one hand, to reassess continuously the teaching operation in order to improve it; and on the other, to make the student aware of his strengths and of his weaknesses.
We can point out that the introduction of such an evaluation system is a significant step forward in the development of our new curricula. It does not merely assess information – despite the importance of such information – but goes beyond that to use information and invest it for further building knowledge and attaining the required competencies.

Finally let us bear in mind that we do not claim that our work is perfect, which is why we urge all institutions and teachers, after trying out this evaluation system, to provide us with their opinions and comments which will be used for further reexamination and evaluation of the system.

President, Center for Educational Research and Development
Nemer FRAYHA

Summary

Material : Physics

EVALUATION: ***TEACHER'S GUIDE***

MATERIAL: ***PHYSICS***

Cycle 3 of basic Education and Secondary Cycle

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As mentioned in the document called common trunk, the domains of competencies, required for the same matter, are approximately the same for different cycles.
In physics, we have kept in 1st and 2nd years of secondary cycle the same domains as those listed in the document of evaluation in 7th and 8th grades of basic education with a supplementary domain titled «**Exploitation of a diagram**».

In this document, the teacher will find:

A- An explanation text of each domain, the essential points constituting it and the criteria of grouping the competencies in domains.

B- An example on the concept underlying all the domains according to the choice of the teacher.

C- The domains of competencies and the competencies to evaluate, in 7th and 8th grades of Basic Education, followed by two examples of situations of evaluation of one competency in each domain. This is to allow the teacher of secondary classes to know what the students have done.

D- The domains of competencies and the competencies to evaluate, in the 1st and 2nd secondary years, followed by two examples of situations of evaluation of one competency in each domain. This is to allow the teacher of the 7th and 8th to know what the student should acquire in the secondary level.

E- The domains of competencies and the competencies to evaluate in the second year secondary, Humanities, followed by two examples of situations of evaluation of one competency in each domain.

A- Explanation of the domains

The list of competencies and the domains of competencies is a work sheet. Complementary explanations are necessary to put it into application.
The explanations of a certain domain are generally the same transversally (for different fields), and longitudinally (for different cycles in the same field of study). They show the weight given to each domain and the elements that we look for when we are evaluating a competency of this domain. The students should know these explanations.

1. Application of knowledge

This domain doesn't involve the direct application of knowledge, like "apply the relation of Coulomb's law to calculate the force of interaction between two electrical charges" or "calculate the voltage between the terminals of a resistor, given its resistance and the current flowing through it.

The competencies of this domain should be evaluated in new complex situations and / or in situations similar to those already seen in the class. The application of a law should take place in a situation where many laws can be valid. The student chooses one of them as the only convenient knowledge that solves the problem. The elements that should appear in these competencies include the following:

a- Extract, from a scientific document, the essential information concerning the physical quantities related to electricity (current, voltage, power, energy, ...), to waves (frequency, period, amplitude, wavelength, ...) and to mechanics (position, velocity, acceleration, force, ...).

b- Analyze the given: sort out the essential information and leave the superfluous information. It is necessary to determine that, in the same situation, an information is essential to answer a certain question and superfluous to answer a second question. In a situation of reflection and refraction of light, the refractive index is an essential information to calculate the angle of refraction and superfluous information to determine the angle of reflection.

c- Is the student able to identify the physical quantities of the situation and to relate them to his relevant knowledge?

d- Mobilize and apply knowledge confined to physics (in electricity, in waves, in mechanics). Once this relation is accomplished, is the student able to choose the relevant knowledge (law, definition, unit,...)? If yes, is he able to apply the chosen law?

e- Mobilize and apply knowledge non confined to physics (calculation, scale, circular functions, graphs, vectors,...).

f- Verify the relevance of the result: physical sciences describe situations identical to those of the real life. Are the obtained results practical? Is there any illogical answer:

negative mass, speed greater than that of light, mass of Earth in grams...? Is the order of magnitude of the physical quantities respected?

2. Exploitation of a diagram

In this domain, the competencies to evaluate are related to the learning objectives such as:

a- Plot a diagram.
b- Give the physical significance of the abscissa and of the ordinate.
c- Chose the convenient scale.
d- Determine graphically the point of functioning of an electric device.
e- Extract, from a diagram, the characteristics of a device.
f- Use the measured data to find the values of other physical quantities.

3. Realization of an experimental protocol

In this domain, the student should be able to perform an experiment. The interest of this domain, once the student leaves school, lies applying the characteristics of an apparatus in order to obtain good functioning. The student should notably follow the following steps:

a- Read the plan of an experiment.
b- Choose and use the appropriate materials (stroboscope, source of direct current, loud-speaker, microphone, L.F.G., air table, capacitor, resistors, oscilloscope, diodes, operational amplifier).
c- Build the set-up of an experiment (from or without a sketch).
d- Abide by the safety rules (for persons and for installations).
e- Take data and validate the result.
f- Answer the questions.
g- Write a report illustrated by clear figures.

4. Explanation of physical phenomenon related to daily life

To explain a scientific phenomenon, the student must follow, as in the domain "**Application of knowledge**", the different steps of the scientific process:

- **Observation**: the student examines the phenomenon, which can be a constructed or natural fact in order to collect information.
- **Analysis of information**: the student should sort out the essential information from the superfluous information according to his prior knowledge. In other words, he should identify the physical quantities related to the situation.
- **Elaboration of a model**: this phase is relatively difficult. It is easier and more practical to the student to choose a model and to justify this choice than to elaborate a new model.
- **Mobilization of knowledge** belonging to physics and other field in order to solve the problem. This phase is related to the autonomy of the decision. The student has to decide which knowledge he wants to mobilize, how to organize it and how to use it in the goal to answer the question.

5. Mastering communication

The competencies of this domain do not appear separately from the competencies of other domains. In each competency, there is in physics: figures, diagrams, tables, oral and / or written expressions, symbols,.... The teacher decides, each time, the part he wants to include in the competencies of this domain. He can use his own observation or a part of the global mark to evaluate the communication.

B- Same concept in different domains

Consider the concept of electric voltage.

1. In the **application of knowledge**, the voltage can be introduced in the following situation:
   Between two points A and B, where the voltage is 20 V, there is branched, in series, a resistor of resistance R = 6 Ω and an ammeter of resistance 1 Ω. A second resistor of resistance x is branched in parallel to the ammeter. This latter reads 2 A. Calculate:
   a- the voltage across R.
   b- the value of x.

2. In domain of **exploitation of a diagram**, it is possible to give a situation similar to that described later (see domain of exploitation of diagram, example 1, page ...).

3. In the domain of **realization of an experimental protocol**, the teacher can ask about the experimental verification of Ohm's law for a generator (by distribution of a lab sheet).

4. In the domain of **explanation of physical phenomenon related to daily life**, it is possible to propose the following situation:
   You have, in your house, two heaters, each functioning normally with a voltage of 110 V. The Electricity Company decides to change the voltage from 110 to 220 V. Propose a solution allowing the functioning of the same heaters under 220 V. Is there any difference between their functioning before and after the change in the voltage?

C- 7th grade of Basic Education Physics

C_1- Domains and competencies

Domains of competencies	Competencies
Applying knowledge	♦ Apply information related to the three phases of matter (solid, liquid, gaseous), to heat (temperature, change of phase, expansion), to electricity (conductor, insulator, potential difference, association of lamps and cells, electric safety, interaction coil – magnet).
	♦ Identify grouping of lamps and cells, conductors and insulators, a phase change.
	♦ Relate current to voltage, temperature and phase change.
	♦ Distinguish between closely related physical quantities (mass and density, manometer and barometer, heat and temperature, voltage and current, magnet and coil traversed by electric current).
Realization of An experimental Protocol.	♦ Determine experimentally the density of a solid body or a liquid.
	♦ Measure the pressure of a gas.
	♦ Build an electric circuit in order to light series and parallel lamps, to adapt cells to lamps.
	♦ Construct an electromagnet and an electric motor.
Explanation of physical phenomena related to Daily life	♦ Explain (pressure of a gas, different modes of heat transmission, rotation of an electric motor).
	♦ Interpret (diffusion, solid and liquid compressibility, change in phase, expansion).
	♦ Justify (the use of fuses in the electric appliances , the way of branching lamps in Christmas tree light and in lustre, …).
Mastering Communication	♦ Use the appropriate scientific vocabulary.
	♦ Use different modes of representation: oral, written, diagrams, tables, graphics…

C_2- Examples of evaluation of competencies in 7^{th} grade of Basic Education.

Domain 1: Application of knowledge

Example 1

Relate each of the following sentences to the convenient term:

Instrument to measure mass	Mass
Force of attraction exerted by Earth on an object	Balance
Instrument to measure weight	Dynamometer
Quantity of matter in an object	Weight

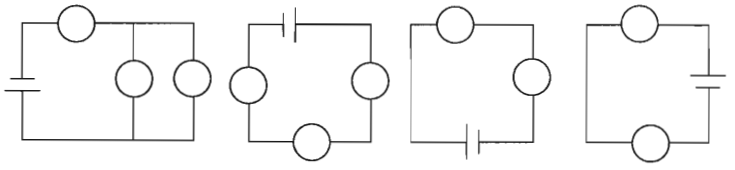
Example 2

	air	copper	dry wood	human body	glass	silver	cartoon	salt water	mercury
Conductor									
Insulator									

Complete the table above by writing (X) in the convenient case.

Example 3

In which diagrams, are the ammeters conveniently branched?



Domain 2: Realization of an experimental protocol.

Sheet to be distributed

Example 1

Competency to evaluate: Measure the density of a solid.

Materials:

- Copper plate
- Graduated glass tube
- Balance
- Masses box.

Experimental process:

- Verify the horizontality of the two pans of the balance.
- Measure the mass of the plate.
- Pour water in the graduated glass tube
- Note precisely the water level.
- Immerse the copper plate in water.
- Find out the volume of the plate.

Questions :

- Draw figures showing the steps of the experiment.
- Determine the density of copper.

Example 2

Competency to evaluate: Measure the volume of a solid by immersion.

Materials:

- Graduated glass tube of 100 ml containing 25 ml of water.
- Solid body non- soluble in water.

Manipulation

- Note the volume V_1 of water in the tube.
- Introduce the solid into the tube.
- Note the new level V_2 of the liquid.
- Calculate the volume of the solid.
- Lower the solid gently into the tube to avoid spillage.

Questions

a- Write a report illustrated with figures.

b- Why should the body be insoluble in water?

Domain 3: Explanation of physical phenomenon related to daily life

Competency to evaluate: Justify the use of fuses in electric circuits.

Example 1

On a multi-plug of maximum current 10 A, there are branched, at the same time, an electric motor in which a current of 6 A flows, an electric iron that can support a maximum current of 5 A and a radio functioning with a current of 2 A. What will happen? Explain.

Example 2

A radio, functioning with a current of 3 A, is branched to the sector in series, successively with:

a- A fuse of 2 A.
b- A fuse of 5 A.

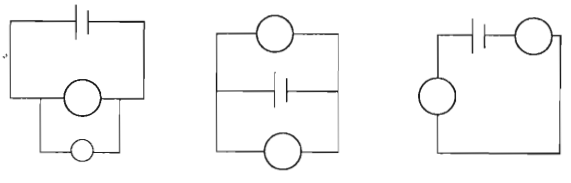
Explain what should happen in each case and give a conclusion.

Domain 4: Mastering communication.

Competency to evaluate: use a figure as a mode of representation

Example 1

a- In each of the following figures, say if the lamps are branched in series or in parallel.



b- What happens in each circuit if one of the lamps is grid?

Example 2

Draw a diagram showing the installation of your lamp torch.

C- 8th grade of Basic Education Physics

C_3- Domains and competencies

Domains of competencies	Competencies
Applying knowledge	♦ Apply information related to mechanics (motion, trajectory, rotation of Earth, force…), to energy (work, kinetic energy, potential energy, sources and forms of energy, conservation of energy), to the propagation of light (principle of rectilinear propagation of light, luminous ray and beams, law of reflection relative to angles)
	♦ Identify (characteristics of waves, sound emitters and receivers, physiological qualities of sound, electromagnetic waves, luminous beams).
	♦ Relate (work and energy, kinetic and potential energies, power and energy).
	♦ Distinguish between physical quantities closely related (translation and rotation, forces at a distance and contact forces, work and fatigue, transverse and longitudinal waves).
Realization of An experimental protocol.	♦ Measure (a force, period of a vibratory motion,…).
	♦ Establish experimentally the relation between weight and mass
	♦ Determine experimentally the factors on which the kinetic energy depends.
	♦ Obtain experimentally the dispersion of white light.
	♦ Verify (the rectilinear propagation of light, the law of reflection of light,…).
Explanation of physical phenomena Related to daily life	♦ Explain (apparent motion of the Sun, and of the Moon, transfer and conservation of energy, wave and energy transfer, propagation of wave, formation of images given by plane mirrors,…).
	♦ Interpret (the phenomenon of echo, the diffusion and the dispersion of light,…).
	♦ Analyze (the rest and the motion, effect of friction, reflection of light,…).
Mastering Communication	♦ Use the appropriate scientific vocabulary.
	♦ Use different modes of representation: oral, written, diagrams, tables, graphics…

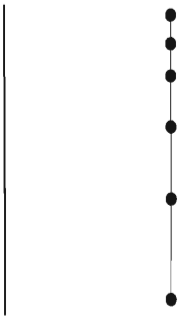
C_4- Examples of evaluation of competencies for 8^{th} grade of Basic Education.

Domain 1: Application of knowledge

Example 1

The adjacent figure shows the photography of the fall of a ping –pong ball taken each 0.02 s. Figure 3.

a) Is the motion uniform? Why?
b) Calculate the average speed between the first two positions, then between the two last positions. Give a conclusion.



Example 2

Sami carries a tennis ball (B), of mass M in his hand:

a- What is the form of energy that the ball (B) possess?
b- Sami drops the ball, does the potential energy of (B) increase or decrease?
c- Is it the same for its kinetic energy?

Domain 2: Realization of an experimental protocol.

Competency to evaluate: Verify the principle of rectilinear propagation of light.

Example 1

You dispose the following objects : a candle, two pieces of cardboard, supports. Realize an experimental protocol to verify the principle of rectilinear propagation of light.

Competency to evaluate: Realize the dispersion of light.

Example 2

Try to make a rain-bow with a projector and a black slide having a hole.

Domain 3: Explanation of physical phenomenon related to daily life.

Competency to evaluate: Explain the effects of the energy carried by sound.

Example 1

When a shell explodes close to a house, the glass windows of the house are broken even if the fragments of the shell don't strike them. Explain.

Example 2

An opera singer performs in a closed hall. An empty glass placed on the table in front of the star breaks. Explain.

Domain 4: Mastering communication

Competency to evaluate: Use different modes of representation.

Example 1
Represent the phases of the Moon during one cycle (lunation).

Example 2
Write a report about the experiment of the rainbow mentioned above under Realization of an experimental protocol.

D- 1st year secondary Physics

D_1- Domains and competencies

Domains of competencies	Competencies
Applying knowledge	♦ Apply information related to electricity (Coulomb's law, laws of voltage and of currents, law of functioning of a resistor, a generator and a receiver), to the rectilinear motion (Newton's laws).
	♦ Identify (the nature of an electric device according to its law of functioning, a uniform rectilinear motion, a uniformly accelerated rectilinear motion).
	♦ Determine (the equivalent resistance of many resistors, the characteristics of a rectilinear motion, the characteristics of a wave,…).
	♦ Compare (reflection and refraction of mechanical and electromagnetic waves, electrostatic and gravitational interaction, current and voltage,…).
Exploitation of a diagram.	♦ Exploit I-V characteristic of resistor, generator and receiver.
	♦ Determine graphically the point of functioning of an electric circuit.
	♦ Exploit periodic diagrams (periodic voltage visualized on the screen of an oscilloscope, diagram of a transverse wave).
	♦ Collect, from a recording on air table, the characteristics of a rectilinear motion (uniform and uniformly accelerated without initial velocity).
Realization of an experimental Protocol.	♦ Set up (a simple electric circuit containing elements in series and in parallel, the reflection and the refraction of mechanical waves on a ripple tank, a recording on an air table of a rectilinear translation motion).
	♦ Take experimental data to plot the I-V characteristic of an electric device.
	♦ Verify experimentally the laws of reflection and refraction of light, Newton's laws in case of rectilinear motion, …).
	♦ Determine experimentally the characteristics of the image of a real object given by a plane mirror or a converging lens.

Domains of competencies	Competencies
Explanation of physical Phenomena related to Daily life	♦ Explain the physical phenomena related to electrical charge (electrification,…), to waves (reflection, refraction), to optics (the formation of the images of a real object given by plane mirrors, lenses, eye and magnifier).
	♦ Interpret (the electric current, Joule's effect, the phenomenon of echo,…
	♦ Analyze the rest and the rectilinear motion of a system.
Mastering Communication	♦ Use an appropriate scientific vocabulary.
	♦ Use different modes of representation: orally, written, diagrams, tables, graphics,…
	♦ Write clearly and concisely

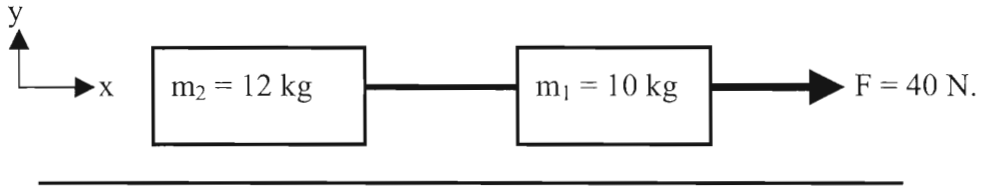
D_2- Examples of evaluation of competencies for 1st year secondary

Domain 1: Applying knowledge

Competency to evaluate: Apply Newton's laws on a system in rectilinear motion.

Example 1

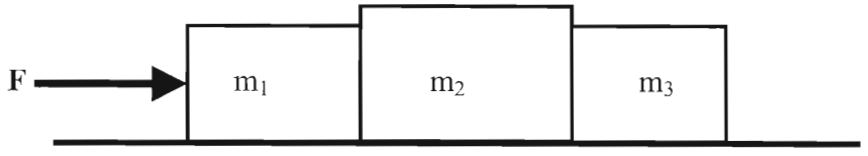
A mass-less cable connects two boxes having respectively the masses of 12 kg and of 10 kg to each other. The whole system is placed on a horizontal table without friction. A person exerts a horizontal force F_p of 40 N on the box of 10 kg (see figure).



Determine the acceleration of each box and the tension in the cable.

Example 2

Three blocs, put on a horizontal surface without friction, are in contact with each other (see figure). A force F is applied on the bloc n١ ؛ (of mass m_1).



1.Determine, in terms of m_1, m_2 and m_3:

a- The acceleration of the whole system.
b- The resultant force applied on each bloc.
c- The force exerted by each bloc on the adjacent one.

2. If $m_1 = m_2 = m_3 = 10$ kg and F = 100 N, give the numerical values of the answers of the questions a-, b- and c-.

Domain 3: Exploitation of a diagram

Competency to evaluate: exploit the I-V characteristics of a cell and of a resistor.

Example 1

To determine experimentally the I-V characteristics of a cell already in use, we have taken the following readings of an ammeter and of a voltmeter branched in parallel across the cell:

U (en V)	*4,25*	*3,85*	*3,45*	*3,00*	*2,60*	*2,05*	*1,30*	*0,35*
I (en mA)	*0*	*50*	*100*	*150*	*200*	*250*	*310*	*390*

a- Plot the I-V characteristic of this cell. Deduce its electromotive force and its internal resistance in the region of linear function.

b- This cell feeds an incandescent lamp. The indications of the ammeter and those of the voltmeter branched now in parallel between the terminals of the lamp are given in the following table:

U (en V)	*0,20*	*0,76*	*1,70*	*2,60*	*3,75*	*5,20*
I (en mA)	*100*	*150*	*200*	*250*	*300*	*350*

Plot the I-V characteristic of this lamp and determine the point of functioning when fed by the preceding cell.

Example 2

The I- V characteristic of a cell is rectilinear. Its maximum voltage is of 22.5 V and its internal resistance is 12 Ω. A resistor of resistance 57 Ω is connected to the terminals of this cell.

a- Plot, in the same system of ordinates (I in abscissa, V in ordinates) the I-V characteristic of the cell and that of thew resistor.

b- Determine, from the two graphs, the coordinates of the point of functioning of the circuit.

c- Find, by calculation, the previous results.

Domain 4: Realization of an experimental protocol

Example 1.

Competency to evaluate: Verify experimentally the laws of reflection and of refraction of light.

Experimental protocol to be distributed

Objectives:

- Verify the laws of reflection of light.
- Verify the laws of refraction of light.

Materials:

- 12 V lamp in a box having a small slit.
- Graduated disc.
- Rectangular plane mirror which can be placed vertically.
- Glass cylinder.

Manipulation

- Build up the setup to verify the laws of reflection.
- Give the angle of incidence 5 values and measure, each time, the corresponding angle of reflection.
- Build up the considered setup to verify the laws of refraction.
- Start to increase, from zero, the angle of incidence i_1, 10 values and measure, each time, the corresponding angle of refraction i_2.
- Find the minimum angle of incidence for which a ray of light passing from glass to water undergoes a total internal reflection.

Questions

i- Write a report with figures showing the path of luminous rays.
ii- Compare the angles of incidence and of reflection. Conclude.
iii- Calculate the refractive index of glass.
iv- Plot, on a graph paper, the graph of variations of sine i_1 in terms of sine i_2.

Example 2

Verify the laws of reflection and refraction of mechanical waves on the surface of the water of a ripple tank.
Write a report illustrated by clear figures.

Domain 5: Explanation of physical phenomena related to daily life

Competency to evaluate: Explain the phenomenon of electrification by contact.

Example 1

The charged extremity of a glass rod already rubbed on a piece of silk is put in contact with the metallic sphere of an electroscope initially neutral.

a- Explain what happens.

b- What happens if the charged rod is now removed away from the electroscope?

Example 2

The metallic sphere of an electrostatic pendulum is negatively charged. It is suspended by means of an insulator wire so that it lies halfway between two metallic plates P_1 and P_2. When the wire is deviated for a certain reason, its length is sufficient to put the sphere in contact with the one or the other plate. Explain what will happen if the two plates P_1 and P_2 are respectively connected to the positive and the negative terminals of a cell.

D_3- Domains and competencies

Domains of competencies	Competencies
Applying knowledge	♦ Apply information related to waves (superposition of waves, characteristics of sound waves,…). to mechanics (Newton's laws, mechanical energy, rotation dynamics). to thermodynamics (perfect gases, kinetic theory of gases, zeroth law and first law of thermodynamics,…). to electromagnetism (electromagnetic force,…). to electronics (diodes, transistors, operational amplifier).
	♦ Identify (sound emitters and receivers, charging and discharging of a capacitor,…).
	♦ Determine (physiological qualities of sound, the characteristics of standing waves, the characteristics of a plane motion,…).
	♦ Compare (loud-speaker and microphone, superposition of mechanical waves of same frequencies and of slightly different frequencies, roles of transistor and an operational amplifier in linear and saturated modes,…).
Exploitation of a diagram	♦ Read the periodic diagram resulting from the superposition of two sinusoidal waves.
	♦ Exploit diagrams related to mechanics (trajectory of a charged particle in a uniform electrical and magnetic fields).
	♦ Determine graphically (the threshold of junction and Zener diodes, the amplifying factor and the saturation of an operational amplifier).
	♦ Collect, from a recording on an air table, the characteristics of a plane motion (satellite and projectile).
Realization of an experimental Protocol	♦ Measure the frequency of a periodic phenomenon by a stroboscope.
	♦ Visualize, on the screen of an oscilloscope, the phenomenon of beats and the charging and the discharging of a capacitor.
	♦ Realize (a recording on an air table of a plane motion, a setup to trace the I – V characteristic of a diode, the inverted and non-inverted amplifying circuits with operational amplifier).
	♦ Determine experimentally the characteristics (of the electromagnetic force, the magnetic field between Helmholtz coils,…).

Domains of competencies	Competencies
Explanation of physical Phenomena Related to daily life	♦ Explain (the strobocopy, the beats, the emission and reception of sound, the doping, the charging and discharging of a capacitor, the rectifying of an alternating current, the amplification of voltage).
	♦ Interpret (the formation of interference fringes, the standing waves, Doppler's effect, the role of a diode and a transistor,…).
	♦ Analyze (the conservation of mechanical energy, the reciprocal conversion of mechanical energy into electrical energy, the different efficiencies of a heat engine,…).
Mastering Communication	♦ Use an appropriate scientific vocabulary.
	♦ Use different modes of representation: orally, written, diagrams, tables, graphics,…
	♦ Write clearly and concisely

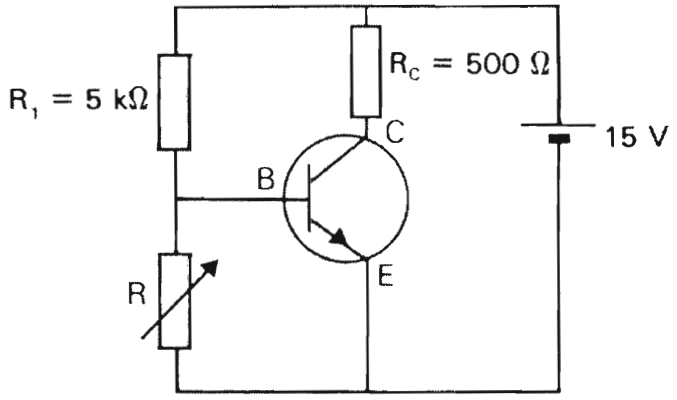
D_4- Examples of evaluation of competencies in 2nd year secondary

Domain 1: Applying knowledge

Competency to evaluate: Apply knowledge related to electronics

Example 1

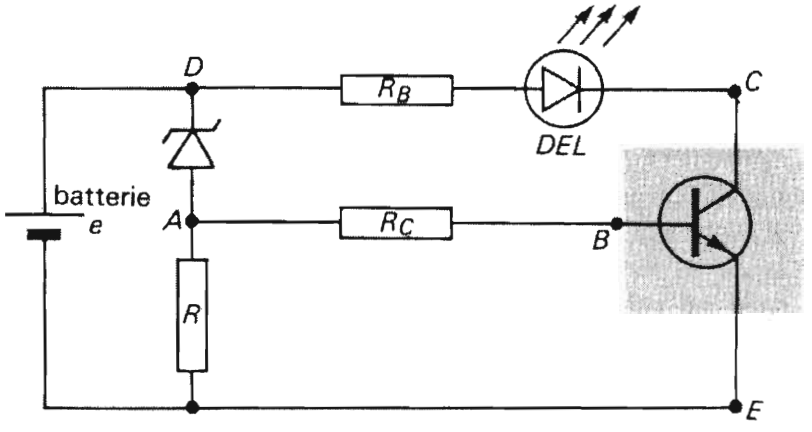
The transistor, in the figure below, has a current gain $\beta = 125$. The base – emitter junction is ideal and the threshold is 0.7 V.



a- Knowing that the current base is $I_B = 0.16$ mA. Determine the values of I_C, U_{CE} and the value of R.
b- Determine the maximum value of R for which the transistor remains blocked.
c- Find the maximum value of R if we want to limit the current I_B to 1 mA. Show that the transistor is now saturated.

Example 2

The circuit below contains a transistor T, of current gain $\beta = 100$, for which the threshold of the base-emitter junction is 0.7 V.
The Zener diode, considered as ideal, has a Zener voltage of 10.5 V. The characteristics of the DEL are: $U_{max} = 1.8$ V and $I_{max} = 50$ mA.
A cell of negligible internal resistance and of electromotive force e is connected to the points D and E. Given $R_B = 4$ kΩ, $R_C = 250$ Ω and R = 500 Ω.



a- Show that if e < 10.5 V, the transistor is blocked.
b- e > 10.5 V. Express successively U_{AE}, U_{AB}, I_B and I_C in terms of e.
c- For what value of e, the transistor is passing? For what value of e, a current of 20 mA traverses the DEL?
d- Explain qualitatively the role of R_C.

Domain 2: Exploitation of a diagram

Competency to evaluate: exploit a diagram of a plane motion on an air table.

Example 1

The figure below represents the real recording, on an air table, of the positions taken by a projectile at regular intervals of time τ.

a- Represent the velocity vectors of the projectile at instants: 3, 4, 5, 10, 11, 12, 15, 16 and 17.
b- Represent the components $\mathbf{v}_x$ and $\mathbf{v}_y$ of the velocity vectors $\mathbf{v}_4$, $\mathbf{v}_{11}$ and $\mathbf{v}_{16}$. What can you say about $\mathbf{v}_x$?
c- Represent the acceleration vectors of the projectile at the instants. Conclude.

Example 2

A puck of 650-g mass is connected to a fixed support O by means of an inextensible massless wire. The recordings of the motion of its center of inertia, on a horizontal air table, each 60 ms are shown on the figure below.

a- Determine the form of the trajectory of the puck.

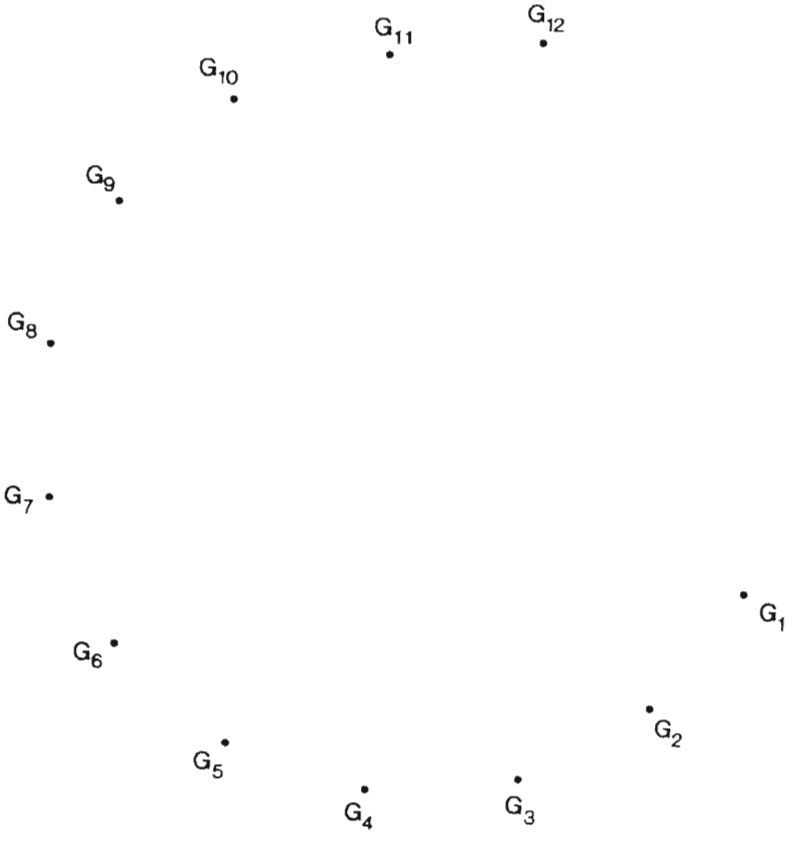
b- Represent the velocity vectors $\mathbf{v}_6$, $\mathbf{v}_7$, $\mathbf{v}_8$, $\mathbf{v}_9$ and $\mathbf{v}_{10}$.

c- Deduce the nature of the motion.

d- Represent, at G_7 and at G_9 respectively, the vectors $\Delta\mathbf{v}_7 = \mathbf{v}_8 - \mathbf{v}_6$ and $\Delta\mathbf{v}_9 = \mathbf{v}_{10} - \mathbf{v}_8$. What do the vectors $\Delta\mathbf{v}_7 / 2\tau$ and $\Delta\mathbf{v}_9 / 2\tau$?

e- What is the value of the normal acceleration? Justify your answer.

f- Determine the tension in the wire.



Domain 3: Realization of an experimental protocol

Example 1

Competency to evaluate: Measure experimentally the frequency of beats.
Materials:

- Two L.F.G.
- Oscilloscope.
- Loudspeaker.

Manipulation

- Build up the setup represented on the diagram.
- Adjust the 2 L.F.G. to the same frequency (1000 Hz for example).
- Keeping constant the frequency of one L.F.G., start to change very slowly the frequency of the second one until you obtain the phenomenon of beats.
- Measure the period of beats.

Questions

i- Knowing the period, determine the frequency of beats.
ii- Compare this value to those indicated by the two L.F.G.
iii- Conclude.
iv- Write a report with clear figures.

Example 2

Competency to evaluate: Realize the superposition of two sinusoidal waves of frequencies f and 2f.

Materials:

- Two L.F.G.
- Oscilloscope.

Manipulation

- Build up the setup represented on the diagram.
- Adjust the 2 L.F.G. to the sine signal.
- Choose 500 Hz as frequency of the first one and 1000 Hz for the second one.
- Add the two obtained curves visualized on the screen of the oscilloscope.
- Measure the period of resultant signal.

Questions

1. Calculate the frequency of the resultant signal. Conclude.
2. What do the two signals represent for the resultant one?
3. What is the difference between pure sound and complex sound?
4. Write a report illustrated by clear figures.

Domain 4: Explanation of physical phenomena related to daily life

Competency to evaluate: explain the emission of sound by the membrane of a loudspeaker.

Example 1

A loudspeaker is connected to the terminals of an L.F.G. delivering a sinusoidal voltage of frequency 100 Hz.
Interpret the sound emitted and determine its frequency.

Example 2

An L.F.G. feeds, at the same time, two loudspeakers 80 cm away from each other. Their membranes face each other. The L.F.G. delivers a sinusoidal voltage of frequency 850 Hz.
Explain the physical phenomenon that you detect when you displace, along the line separating the two loudspeakers, one of your ears (the second being closed).

E- 2nd year secondary – Humanities Series-Physics

E_1- Domains and competencies

Domains of competencies	Competencies
Applying knowledge	♦ Apply knowledge related to electric energy (production, transport, consumption).
	♦ Identify the characteristics of electromagnetic waves (micro-waves, R_x, infrared, ultraviolet, optical systems…) and sound waves (nature of sound, sound emitter and receiver, physiological qualities of sound, musical instruments).
Exploitation of a diagram	♦ Exploit the graphs u (t) and i (t) for DC and AC currents.
	♦ Read the diagrams related to electrical energy (word production of electric energy, standard electric circuit of a house, electricity in the car).
	♦ Determine graphically the physiological qualities of sound (pitch, loudness, timber).
Explanation of polluting and unhealthy effects of some physical phenomena	♦ Determine the polluting effects of thermal (coal and fuel) and nuclear electric power stations.
	♦ Explain the safety rules against the electricity dangers.
	♦ Use the electromagnetic radiation in medicine (UV, R_x, laser).
	♦ Analyze the auditory effects of unhealthy sound.
Mastering communication	♦ Write a report using the appropriate scientific vocabulary.
	♦ Use different modes of representation (oral, writing, figures, tables, …).

E_2- Examples of evaluation of competencies in second year secondary –Humanities

Domain 1: Application of knowledge

Competency to evaluate: Apply knowledge relative to sound waves

Example 1

Two persons pronounce the same vowel (O for example), but one much strong than the other. Between the following physical quantities, which ones are identical, for the two sounds, and which ones are different:

a- Speed of propagation
b- frequency
c- wavelength
d- amplitude
e- timber.

Justify your answer for each quantity.

Example 2

Two firecrackers produce when exploding a sound of sound level 85 dB. What is the sound level produced by the explosion of one firecracker? Give the name used to know the number of decibels of a sound?

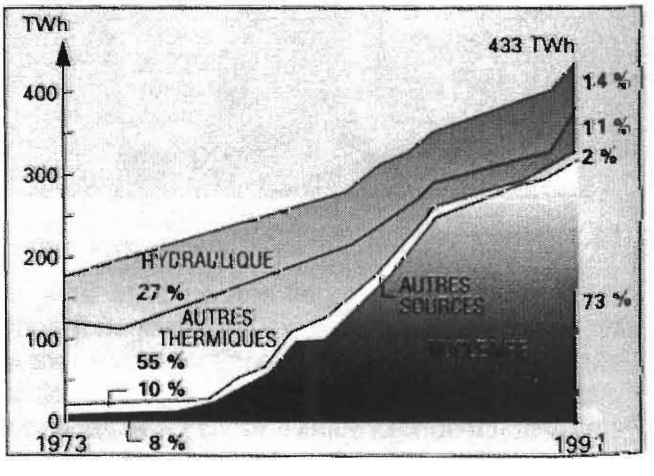
Domain 2: Exploitation of a diagram

Competency to evaluate: Exploit a diagram of production of electrical energy.

Example 1

The adjacent figure shows the production of electrical energy in a country between 1973 and 1991.

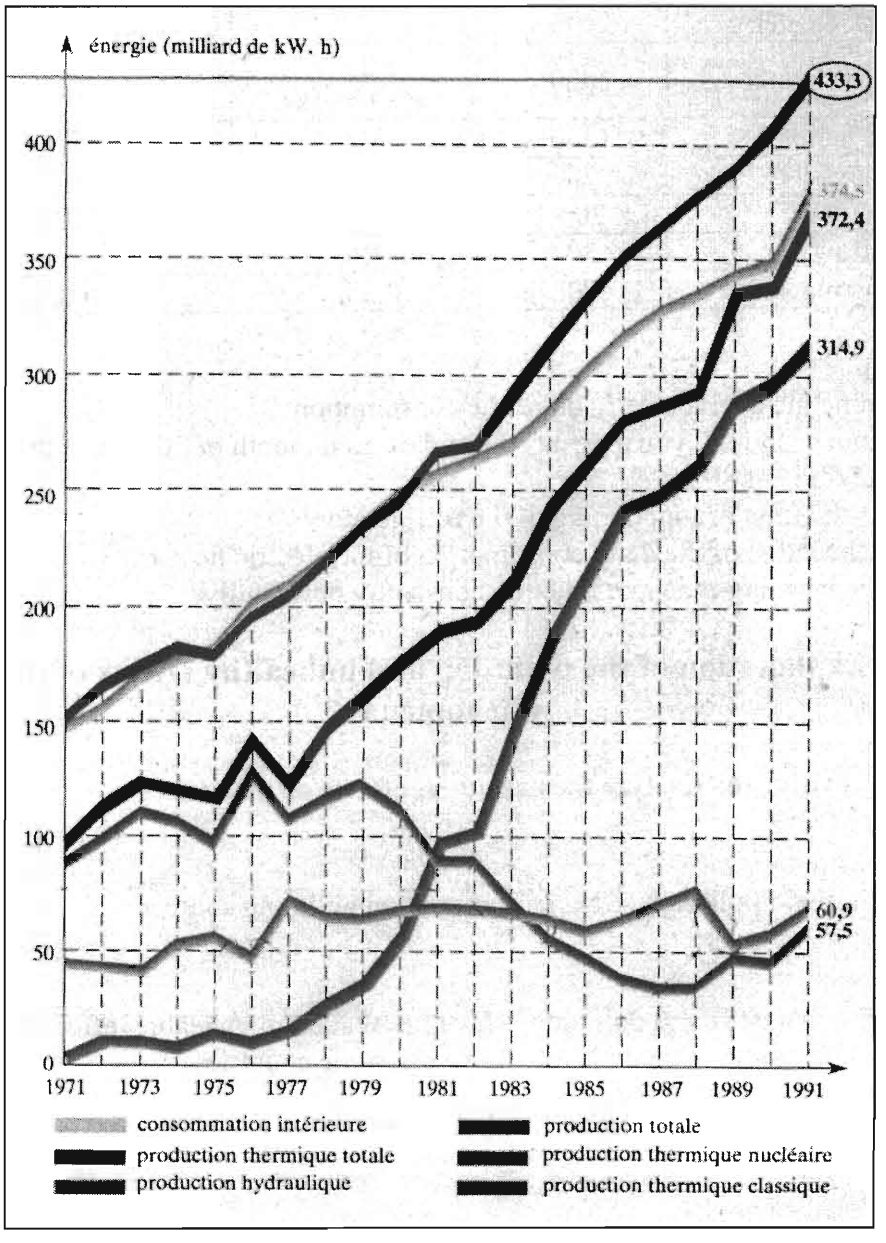
a- Compare the evolution of the production of electric energy by the nuclear and the thermal power stations.
b- Explain the consequences of this evolution.



Example 2

The diagrams of the document below represent the production and the consumption of the electric energy.

1. Which production has continued to increase? Which production remains approximately constant? Justify your answer.
2. What is the cause of each decrease in the production?
3. What are the power stations, which compensate this decrease?
4. Give, in percentage, the increase of the consumption between
   a- 1990 – 1991.
   b- 1971 and 1991.



Example 3

Apparatus	Power (W)	Average time of daily functioning	Average daily consumption in kW.h
Washing machine	2400	75 min.	1,1
dishwasher	3000	78 min.	1,6
Electric iron	1000	0,3 h	0,3
Vacuum cleaner	1400	0,5 h	0,5
Electric stove	2500	1,5 h	3,75
micro-wave	900	0,5 h	0,45
Refrigerator	200		1,45
Freezer	200		1,4
Water-heater	2000		3
Electric heater	2000	5 h / j for 30 weeks	5,7
15 lamps	1200	3 h	3,6
Television	70	3 h	0,21
Hi-Fi chain	200	2 h	0,4
Video-tape	30	1 h	0,03
Sewing machine	70	0,5 h.	0,035

Questions

a- Determine the average daily domestic consumption.
b- How much should you pay at the end of each month of 30 days if the price of each kW.h is of 80 L.P.?
c- What is the time of functioning of the refrigerator?
d- Verify the value of the daily consumption of the electric heater.
e- Does the washing-machine function constantly powerfully?

Domain 3: Explanation of the polluting and unhealthy effects of the physical phenomena

Competency to evaluate: Analyze the hazardous effects on the ear.

Example 1

Explain the term «sound pollution ». Name some sound polluting sources.

Example 2

How do you fight against sound pollution? Have the Walkman unhealthy effects? Give the order of magnitude of the maximum sound level allowed in some countries.