Test for assessing teachers' assessment preferences in the area of Physics (Pérez de Landazábal, Varela & Alonso Tapia, 2011)

Indicate the degree in which you use the kinds of task next included for assessing your students' knowledge and competencies. Use the following scale:

Never 0.....1.....2.....3.....4.....5.....6 Habitually

1. Read the following text and answer the questions posed.

Georg Simon Ohm (1787-1854) was born in Bavaria. It was the son of a mechanic, and became a high-school teacher after working very hard, but he ambitioned to become a university professor. It was necessary to present an important research work to obtain a university appointment. So, Ohm, that was aware of the work of Volta, elected the new field of electricity supply. As he was poor and the equipment was very difficult to obtain, he had to manufacture it himself.

Ohm decided to apply some discoveries made by Fourier on the propagation of heat to the case of the flow of electricity through a wire, drawing analogies between the electric current flow and the heat transfer such as: If the heat spreads more quickly between two points as grater are both, the difference of temperature between them, and the thermal conductivity of the material that connects them, in the same way the flow of electric current will depend on the difference of potential between two points and the electrical conductivity of the wire used. In his research he used a set of Volta batteries and a galvanometer as the one designed by Ampere.

The relationship between voltage, intensity and resistance, and the factors on which the resistance of a metallic conductor depends, were the discoveries that Ohm published in a paper entitled: "The Galvanic circuit mathematically investigated. In this text, Ohm introduces the idea that the intensity of current flow is directly proportional to voltage and inversely proportional to the resistance of the conductor. Furthermore, the resistance of the conductor depends on the nature of the material (resistivity) and on its geometrical characteristics (length and section).

I. Asimov. *Biographical Encyclopedia of Science and Technology*. Alliance Dictionaries.

a) Explain the meaning of the following words:

- Propagation of heat
- Thermal conductivity
- Volta Battery
- Directly proportional
- Inversely proportional

b) To understand that you correctly understand the text, do answer the following questions:

- What determines the speed of heat transfer in a material?
- With which other concept does the text relate the concept "*difference of potential between two points"?*
- To what variables does the expression in the text "as greater are" refers?

c) Summarize briefly the main ideas of the text-

d) What strategy did Ohm use in order to establish the functioning of an electrical conductor?

2. Different amounts of potassium chlorate are weighted and then heated. Once the reaction is completed, the resulting potassium chloride is weighted. The reaction equation is:

$$2KClO_3 \rightarrow 2KCl + 3\,O_2$$

The results obtained after conducting three experiments are shown in the table.

Mass of reactive (g)	Mass of solid product (g)	Mass of oxygen produced (g)
5	3,0	
10	6,1	
15	9,1	

Complete the table, taking into account that the law of conservation of mass must be satisfied. Verify that the amount of oxygen produced is in a fixed ratio with respect to the original amount of potassium chlorate.

3. What is the difference between a physical and a chemical change? Give examples of both processes.

4. The objective is to study the stoichiometry of the reaction:

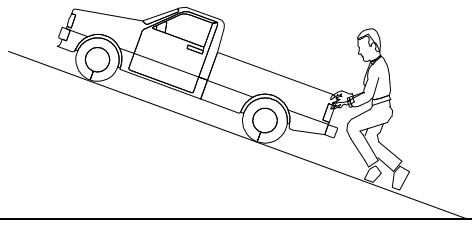
$$Pb(NO_3)\ 2KI \rightarrow PbI_2 + KNO_3$$

in which appears a yellow precipitate of lead iodide (II).

1) After preparing a solution of nitrate of lead (II) with a concentration of 18g/l, 20 ml of this solution are poured in a beaker.
2) In a similar way, it is prepared a solution of potassium iodide with a concentration of 9 g/l. Then, 40 ml of this solution are poured into the beaker containing lead nitrate (II), what produces a yellow precipitate.
3) If you heat the beaker containing the precipitate and the solution, without allowing it to boil, and allowed it to cool slowly, it can be observed that the precipitate reappears in the form of bright yellow flakes. This phenomenon is known as "golden rain".
4) When cooled, the precipitate is filtered. Then, the filter with the solid product is heated in a ceramic capsule (without burning the filter paper) until all the water evaporates. Finally, the obtained solid is weighed.
   - What is the amount of mass of lead nitrate (II) existing in the 20 ml of solution?
   - What is -in moles- the amount of nitrate lead (II)
   - What is the amount of mass of potassium iodide contained in the 40 ml of solution?
   - What is -in moles- the amount of potassium iodide?
   - What is the amount of mass of lead iodide (II) obtained?
   - What is -in moles- the amount of lead iodide (II) obtained?
5) Do data conform to the stoichiometry of the reaction?

5. A car with a mass of 1000 kg moves at 72 km/h. It brakes, stopping after 15 seconds.
   - How much force do their brakes exert?
   - What would be the strength of the brakes if it had stopped after travelling for 100 m?

6. A man has had a breakdown, and to get to the workshop, he has to push the car to climb a small hill. Explain the energy transfers that take place between the man, who pushes, and the car that climbs the hill.



7. Jane is a 19 years old high jumper. Her recommended daily diet is 9,820 kJ. Her birthday, one of her friends takes her to dinner at a restaurant. Jane, who writes everything she eats per day, he knew - through the use of diet tables – that she had already reached 7,520 kJ of energy. Below is a table containing the amount of energy –estimated by Jane- of each of the dishes

Menu		Estimation of the energy provided by each plate, made by Joan (in kJ)
Soups	Tomato Soup	355
	Cream of mushroom	585
Meat	Chicken Mexican	960
	Caribbean Chicken	795
	Lamb chops	920
Salads	Potato Salad	750
	Cheese salad, pineapple and nuts	335
	Pasta Salad	480

Desserts	Apple and raspberry tart Cheesecake Strawberry tart	1.380 1.005 565
Shakes	Chocolate Vanilla	1.590 1.470

Jane wants that her menu provides her an amount of energy that neither exceeds the daily amount recommended for her in about 500 kJ, nor is below this figure. One possibility is to take the closed dinner menu the restaurant offers:

Tomato Soup / Caribbean Chicken / Strawberry tart

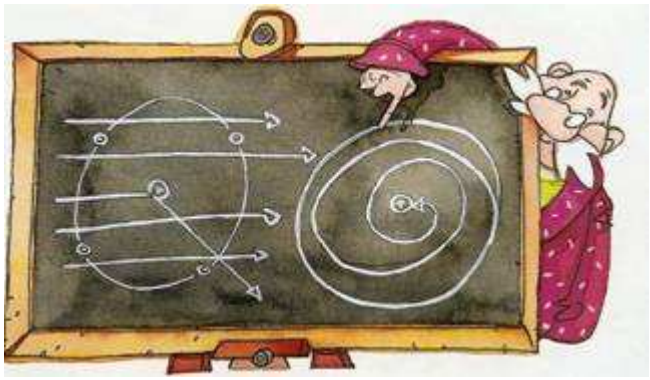
Find out whether this menu will allow Jane to stay, more or less, within the range of 500 KJ she has been recommended. Explain your answer as you make and write the calculations.

8. 1. Read the following text and answer the questions posed.

Now we can examine the question of how atoms, according to Dalton, are formed by elementary particles. The first right answer to this question was given in 1911 by Ernest Rutherford. He was studying the atomic structure of various atoms by bombarding them with positively charged very tiny particles moving at high speed (see the figure below). When observing the deflection experienced by the projectiles after passing through a piece of matter, Rutherford arrived at the conclusion that all atoms should have a very dense positively charged core, surrounded by a cloud of negative electric charge.

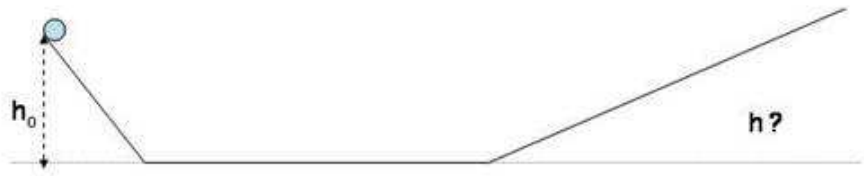
Despite the apparent simplicity of the atomic model of Rutherford, their understanding is far from being easy. In fact, according to classical physics, the negatively charged electrons, which revolve around the atomic nucleus, are doomed to lose its energy through a process of light emission, so that the atmosphere of electrons would end up sinking into the nucleus.

George Gamow. *El señor Tompkins durmiendo*. Fondo de Cultura Económica



- What kind of load did the bullets which with Rutherford bombarded the atoms have? Why did they deviate from their path
- Describe Rutherford's experiment
- Explain why their results could not be explained by Thomson's atomic model.
- Why is not stable the Rutherford's atomic model?
- What changes did Bohr introduce in such model?

9. Imagine the following problem, schematized in the figure: “In a mini-golf, a ball is released down a slope with virtually no friction. how high will the ball get up on the other side?". Design a little research to solve this problem following the experimental methodology.



Help: Remember the criteria you should consider:

1. Formulation of questions related to the ball movement, especially those having to do with the conditions of the problem or the kind of data necessary to solve it.
2. Formulation of the hypotheses that you are to test experimentally.
3. Experimental design and control of variables. It is not enough to design an experimental setup with laboratory equipment. You have to set the variables you will measure, those that you have to change, and those you have to control.
4. Data analysis: You should pay attention to the data tables and charts that you have to build to be able to reach some conclusion.
5. Contrasting the hypothesis in the light of data.