. PHYSICS .
Class: Grade 12 SE.
Teacher: Fouad Yehya.

First Exercise: (7 pts.) The Earth is in danger

Read carefully

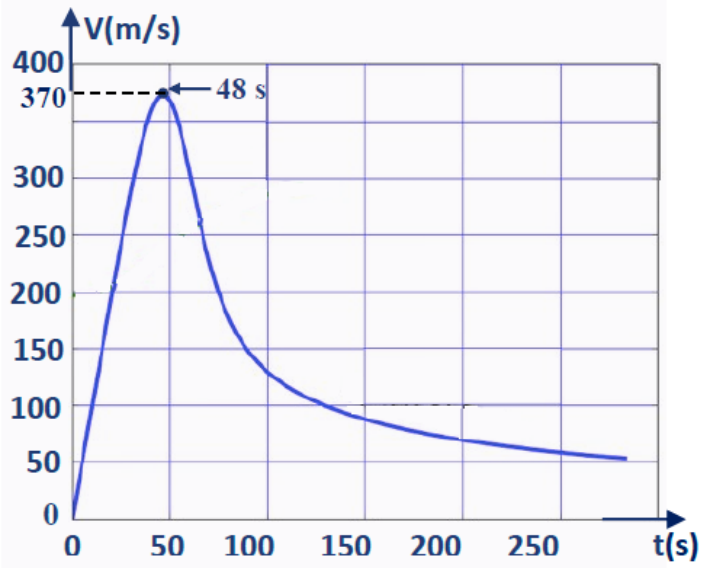
"Human activities lead to serious pollution problems that affect air, water and soil. These effects can be progressive or violent, regional or global. This pollution attacks our planet_ the Earth and manifests itself in various forms: gases and exhaust fumes from cars and factories affect atmosphere.
Wastes, garbage, cans, plastic bottles and dead animals thrown to rivers, lakes and seas are the main cause of water pollution. Chemical fertilizers and pesticides used in agriculture contribute to the pollution of soil and air. In brief, human health is in danger. The seriousness of the situation that is due to greedy and uncontrolled activities of man requires urgent solution…"

1) Pollutants are of two types.
- **1-1)** Define each type of pollutant (1 pt.)-
- **1-2)** pick from the text an example of each Type. (1 pt.)

2) Pick from the text two human activities responsible for pollution of the environment. (1 pt.)
3) "Smog" is a brown thick layer that can be seen over Beirut. Explain the reason behind that (½ pt.)
4) The temperature of the earth is expected to rise by 3^{o} C by the end of this century. Explain the reason behind that. (1 pt.)
5) Name one harmful effect of each of air pollution and water pollution. (1 pt.)
6) Suggest a way to limit each of air, soil and water pollution. (1 ½ pt.)

Second Exercise: Felix Jump (7 pts)

On October 14, 2012, Felix Baumgartner broke the speed of sound reaching a maximum speed of 370 m/s. Felix climbed to 39000 m in a helium-filled balloon, and then he jumped back towards ground. Felix's entire trip back to earth lasted 9 minutes and 3 seconds.
The aim of this exercise is to study the motion of Felix before opening his parachute. This motion is composed of two phases: the first one during the time interval [0 ; 48 s] and the second one during [48 s ; 260 s].
The graph of the adjacent figure shows the variation of the speed of Felix during [0;260s] as a function of time.



Given:
Mass of Felix and his equipment: m = 110 kg.
The height of Felix relative to ground is 32155 m at t = 48 s.
We suppose that the gravitational acceleration g is constant during the whole journey; g = 10 N/kg.
The ground is taken as a reference level for gravitational potential energy.

1) Refer to the text to indicate height from which Felix jumped, and the duration of his whole
journey.

2)

2-1) Use the graph to calculate the kinetic energy of Felix at $t_o = 0$ and at t = 48 s.
2-2) Determine the gravitational potential energy of the system (Felix ; Earth) at $t_o = 0$ and at t = 48 s.
2-3) Deduce the mechanical energy of the system (Felix ; Earth) at $t_o = 0$ and at t = 48 s.

3)

3-1) Calculate the variation in the mechanical energy of the system (Felix ; Earth) during the time interval [0 ; 48 s].
3-2) Deduce the work done by air resistance f during [0 ; 48 s] knowing that $\Delta E_m = W(f)$.
3-3) Deduce whether air resistance is neglected during [0 ; 48 s].

4)

4.1. Refer to the figure to prove that the mechanical energy of the system (Felix ; Earth) decreases during the time interval [48 s ; 260 s].
4.2. Indicate the energy transformation that takes place during the time interval [48 s ; 260 s].

<u>Third problem</u>: (6 pts.) Solar energy for the contribution of the settlement of electricity in Lebanon

Read carefully the following selection then answer the questions that follow.

« The development of alternative forms of energy constitutes one of the solutions considered to settle the problem of electricity in Lebanon. In this perspective, the Ministry of Energy and Water launched a media campaign to increase public awareness of using alternative forms of energy. This campaign puts an emphasis, in the first place, on the advantages of solar energy in heating water… The source of solar energy is free, inexhaustible, clean and respectful for the environment…
The rapid changes on the ecological and economic level, as the pollution of air in cities, the Global warming, the rise in the price of fuels, urge the governments to turn to alternative sources of energy. The ministry confirms that it is possible to reduce by 10% the demand of electricity for the needs of hot water, which is not a negligible percentage ».

L'orient Le jour (july 12th 2006)

<u>Questions:</u>

1) Specify the origin of the energy provided by the Sun.

2) Pick up, from the text, the statement showing that:

2-1) the Sun is a renewable source of energy.

2-2) the solar energy is non-polluting

3) The solar energy may be collected and converted into electric or thermal energy Give, for each of these transformations, the name of the corresponding energy converter.

4) Give the name of the main source of electric energy presently used in Lebanon.

5) The Ministry of Energy and Water talks about alternative energy sources to produce electricity.

5-1) Pick up, from the text, three reasons for which the turn to alternative sources of energy needed.

5-2) **Name** two non-polluting alternative energy sources that may be used in Lebanon.

Solution:

First Exercise: The earth is in danger		7 pts.
1-1	Biodegradable : Def Non-degradable pollutants: Def	½ ½
1-2	Bio degradable: Chemical fertilizers and pesticides used in agriculture Nondegradable: plastic bottles, cans	½ ½
2	Agriculture and industry.	½ + ½
3	"Smog" over Beirut is due to a mixture of carbon monoxide, organic compounds, and nitrogenous oxides produced by incomplete combustion of fossil fuel in cars and factories, and sulfur dioxides produced impurities in fuel.	½
4	The temperature of the earth is expected to rise by 3^o by the end of this century, due to the green house effect (global warming) caused by accumulation of carbon dioxide and other cases in air, which reduce the escape of radiation from the atmosphere.	1
5	Water pollution: death of fish and other aquatic life. Soil pollution: destroy crops.	1
6	Recycling of organic products, metals, and glass. Use filters for exhausts. Treating sewage water. Use different techniques in agriculture (maybe: organic fertilizers).	1 ½

Second Exercise Felix Jump		7 poiots
1	The height is 39 000 meters and the duration of his journey is 9 minutes and 3 seconds.	¼ ¼
2-1	$KE = ½ mv^2$ $KE_o = (0.5)(110)(0)^2 = 0$ J $KE = (0.5)(110)(370)^2 = 7529500$ J	½ ½ ½
2-2	GPE = m.g.h At t = 0 GPE_o = (110) (10) (39000) = 42 900 000 J. At t = 48 s GPE = (110) (10) (32155) = 35 370 500 J.	½ ¼ ¼
2-3	ME = KE + GPE At t = 0 ME_o = 0 + 42 900 000 = 42 900 000 J. At t = 48 s ME = 7 529 500 + 35 370 500 = 42 900 000 J.	½ ¼ ¼
3-1	$\Delta ME = ME - ME_o = 42900\,000 - 42900\,000 = 0$	½

3-2	$\Delta ME = 0 \rightarrow W(f) = 0$ so the work done by air resistance is zero.	½
3-3	The work done by air resistance is zero during [0 ; 48 s], then air resistance is neglected during this time interval.	½
4-1	During [48 s ; 260 s], the speed of Felix decreases and then his KE decreases. Also GPE of the system (Felix ; Earth) decreases since Felix's height decreases. ME = GPE + KE then decreases.	1
4-2	The loss in gravitational potential energy and kinetic energy is transformed into heat energy	½

Third Exercise: Solar energy for the contribution of the settlement of electricity in Lebanon		**(6 pts)**
1	Nuclear fusion reaction in the Sun.	(½ pt)
2-1	The solar energy is inexhaustible	(½ pt)
2-2	The solar energy is clean and respectful for the environment.	(½ pt)
3	From solar energy into electrical energy (solar cells) From solar energy into thermal energy (solar panels)	(¾ pt) (¾ pt)
4	Fuel .	(½ pt)
5-1	a) Pollution of air - global warming b) rise of price of fuel.	(1½ pt)
5-2	Wind energy Hydroelectric energy	(½ pt) (½ pt)