This is a Class 1 exam

Lebanon Evangelical School for Boys and Girls

Lebanon Evangelical School
for Boys and Girls Loueizeh - Baabda

Stage Exam 04

20-25JUN2025

Do NOT write in this box. Your MARK will be placed here.

Subject :	Physics
Class :	11SE
Teacher :	Mr. Ali Moukalled
Duration :	1 hour
You are to answer the questions to this exam on : Squared paper	

Your name :		*Time taken to complete exam*
Your Class :		
Exam Room :		
How many sheets, including cover sheet :		

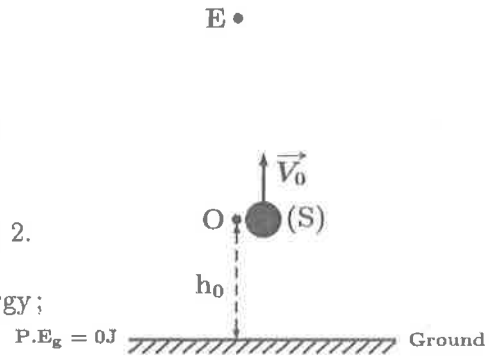
- Do not open this paper until the teacher in charge instructs you to do so.
- The most important thing to remember in taking an exam is NEVER PANIC.
- If you are caught cheating in this exam, you will be awarded zero for ALL exams that are taken on this day.

EXERCISE 1 (7 points)

Mechanical Energy

From a point **O** at a height $\mathbf{h_O}$ above the ground, a stone (S), considered as a particle of mass $\mathbf{m = 0.1kg}$, is launched vertically upwards with an initial velocity $\vec{V}_0$ as shown in document 1.
An appropriate device allows to register the gravitational potential energy $\mathbf{(P.E_g)}$ of the system (stone-Earth) and the kinetic energy **(K.E)** of the stone at the points O, A, B, C, D, and E during the upward motion of the stone. The results are tabulated in document 2.
Take:

- the ground as a reference level for gravitational potential energy;
- $\mathbf{g = 10m/s^2}$.



Doc.1

	O	A	B	C	D	E
$P.E_g(J)$	2	3	4	5	6	7
$K.E(J)$	5	4	3	2	1	0

Doc.2

1. Indicate the value of the gravitational potential energy of the system (stone-Earth) at O.
2. Deduce the initial height $\mathbf{h_0}$.
3. Determine the magnitude $\mathbf{V_0}$ of the velocity $\vec{V}_0$.
4. E is the highest point attained by (S). Justify.
5. Determine, relative to the ground, the maximum height reached by (S). Deduce the distance **OE**.
6. Calculate the mechanical energy of the system (stone-Earth) at the points O, C, and E. Conclude.
7. Deduce the speed of (S) as it hits the ground.

EXERCISE 2 (7points)

The age of the lunar rocks

The aim of this exercise is to determine the age of the lunar rocks brought back by the Apollo **XI** astronauts. A sample **(A)** of this rock is collected. This sample contains certain quantities of the radioactive isotopes, potassium-40 $^{40}_{19}\mathbf{K}$, as well as the product obtained by its disintegration, argon-40 $^{40}_{18}\mathbf{Ar}$.

1. Define radioactivity.
2. Indicate the composition (number of protons and number of neutrons) of potassium-40.
3. One of the decay equations of potassium-40 is: $^{40}_{19}\mathrm{K} \longrightarrow {}^{40}_{18}\mathrm{Ar} + {}^{A}_{Z}\mathrm{X}$
   Calculate **Z** and **A** indicating the used laws.

4. Indicate the name and the symbol of the emitted particle.
5. The half-life (period) of potassium-40 is: $\mathbf{T = 1.25 \times 10^9}$ years.
   (a) Define the half-life of a radioactive substance.
   (b) Given that $\mathbf{m_1 = \frac{1}{8} m_0}$, where $\mathbf{m_1}$ is the mass of potassium-40 found in sample **(A)** and $\mathbf{m_0}$ is the initial mass of potassium-40 present in sample **(A)** when it is formed at $\mathbf{t_0 = 0}$. Determine the age of this sample.

EXERCISE 3 **(6points)**

Hydroelectric Power Plant

Read carefully the below selection and then answer the questions:
Heat from the Sun turns water into water vapor thus forming clouds. The water vapor of the clouds turns into water as rains falls. Water stored in mountain lakes or behind dams is directed at the blades of huge turbines in order to produce electricity in hydroelectric power plants. Some countries like Norway have many natural lakes high in the mountains. In other countries rivers have to be dammed.

Questions

1. Pick out from the above selection:
   (a) the source of energy used in hydroelectric power plants;
   (b) the statement that shows the transformation of mechanical energy into electrical energy.
2. Name two sources of energy, one renewable and one non-renewable.
3. Electricity is a secondary source of energy. Why?
4. Some electric power plants in Lebanon are hydroelectric.
   (a) Name one of these power plants.
   (b) Write two advantages of hydroelectric power plants.
5. The efficiency of a hydroelectric power plant is: $\mathbf{r = \frac{\text{Furnished power}}{\text{Received power}} = 0.4}$. The output electric power of this power plant is **100MW**. Calculate the mechanical power received by this power plant.

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Exercise 1

1) $\boxed{G.P.E_0 = 2J}$ (from table) (1)

2) $G.P.E_0 = 2$

$mgh_0 = 2$

$h_0 = \frac{2}{mg} = \frac{2}{0.1 \times 10}$ (1)

$\boxed{h_0 = 2m}$

3) $K.E_0 = \frac{1}{2} m V_0^2$

$5 = \frac{1}{2}(0.1) V_0^2$

$\frac{5}{0.05} = V_0^2 \Rightarrow \boxed{V_0 = 10 m/s}$ (1)

4) (S) reaches maximum height when $V = 0$, $K.E_f = 0J$ (1)

so E maximum height

5) $G.PE = 7nJ$

$mgh_f = 7$

$\Rightarrow h_f = 7m$

$\Delta E = h_f - h_0$ (2)

$= 7 - 2$

$= 5m$

6) $ME_0 = 7J$ $ME_f = 7J$ $M.E_f = 7J$

ME conserved $\Rightarrow$ No friction (1)

Exercise 2

1) Radioactivity: spontaneous transformation of a nucleus into one another with the emission of radioactive radiation. (1)

2) ✍ Z = number of protons = 19
N = number of neutrons = A − Z = 21 (1)

3) Due to Soddy's law
$4_0 = 4_0 + A$ & $19 = 18 + Z$
$A = 0$ $Z = 1$ (1)

4) Name: positron (1)
Symbol $^{0}_{1}e$

5) 5.1) Half-life is the time needed for a radioactive sample to get half-decayed. (1)

5.2) $m_0 \longrightarrow m_1 = \frac{m_0}{2}$ (1)

$$m_0 \xrightarrow{T} \frac{m_0}{2} \xrightarrow{T} \frac{m_0}{4} \xrightarrow{T} \frac{m_0}{8}$$

$t = 3T$
$= 3(1.25 \times 10^9)$
$= 3.84 \times 10^9$ years (1)

Exercise 3

1) a) Falling water (1)
   b) Water stored in mountain → produce electricity (1)

2) Renewable: Sun - wind - waves
   Non-renewable: Nuclear Fuel - Fossil Fuels (1)

3) Electricity is generated from a primary source (1)

4) a) Markba - Nahr Ibrahim (0.5)

   b) - Water non-polluting
   - Water is renewable
   - Water is inexpensive (1)

5) $0.4 = \frac{100}{P_{Mech}} \Rightarrow P_{Mech} = 250\ MW$ (0.5) (0.5)