This is a Class 1 exam

Lebanon Evangelical School for Boys and Girls

Lighting the fires that burn for eternity

Loueizeh - Baabda

Lebanon Evangelical School

for Boys and Girls Loueizeh - Baabda

Mock Exams : Pt2

13, 14, 15 JUN2022

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

Subject :	Physics
Class :	12SE
Teacher :	Mr. Ali Moukalled
Duration :	1 hour

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 (6.5points)

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 $^{40}_{18}\mathbf{Ar}$.

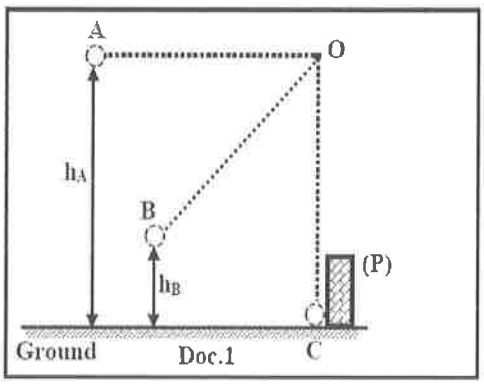
1. Define radioactivity.
2. Indicate the composition (number of protons and number of neutrons) of potassium-40.
3. One of the decay equations of potassium-40 is: $^{40}_{19}\mathbf{K} \longrightarrow {}^{40}_{18}\mathbf{Ar} + {}^{A}_{Z}\mathbf{X}$
   Calculate **Z** and **A** indicating the used laws.
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 2 (7.5points)

Bouncing of a Ball

Consider a ball taken as a particle **(S)** of mass $\mathbf{m = 100g}$. **(S)** is suspended from the lower end of an inextensible massless string, of length **1m**, whose upper end is attached to a fixed point **O**. The system **[(S) – String]** is shifted from its equilibrium position by an angle of **90°**, and then **(S)** is released from rest from point **A** of height $\mathbf{h_A = 1m}$ above the ground. **(S)** reaches the ground at point **C** (Doc.1).
Air resistance is neglected during the motion of **(S)**. The aim of this exercise is to study whether **(S)** is suitable for a certain sports game.
Take:

- the horizontal plane containing **C** as a reference level for the gravitational potential energy of the system **[(S) – Earth]**;
- $\mathbf{g = 10m/s^2}$.



Doc.1

1. Calculate the kinetic energy $\mathbf{K.E_A}$ of **(S)** at **A**.
2. Calculate the gravitational potential energy $\mathbf{G.P.E_A}$ of the system **[(S) – String – Earth]** at **A**.

3. Show that the mechanical energy $\mathbf{M.E_A}$ of the system **[(S) – String – Earth]** at **A** is $\mathbf{M.E_A = 1J}$.
4. The mechanical energy of the system **[(S) – String – Earth]** is conserved during the motion of **(S)** from **A** to **C**. Why?
5. As **(S)** reaches the ground at point **C**, it collides with a plate **(P)** fixed at the ground. During this collision the system **[(S) – String – Earth]** loses **55%** of its mechanical energy, and then **(S)** bounces back and attains a new maximum height $\mathbf{h_B}$.
   (a) Calculate the mechanical energy of the system **[(S) – String – Earth]** after the collision with the plate **(P)**.
   (b) Deduce that $\mathbf{h_B = 0.45m}$.
6. Calculate the ratio $\frac{h_B}{h_A}$.
7. The ball **(S)** is suitable to be used in a certain sports game if the bouncing ratio is $\mathbf{r = \frac{h_B}{h_A} = 0.54}$. Deduce whether **(S)** is suitable for this game.

EXERCISE 3 (6points)

Solar Snake

The Swedish architect Mans Tham had brilliant idea to cover roads with photovoltaic panels (solar cells). The concept was adopted at Montpellier, Belgium, and Lebanon.
The concept "solar snake" is huge umbrella composed of photovoltaic panels that is placed over roads or highways. This solar snake, in addition to produce electric energy, reduces water pollution, noise and fine particles .....
Belgium was the first country to express its interest in this revolutionary concept and to adopt it. The first solar snake was built above the ultra-fast train line (TGV).... The solar snake was also installed on the parking of Montpellier airport.
In Lebanon, a similar project was carried out over the river that runs through Beirut. This gigantic umbrella of 325 meter long and 32 meter width gives shadow to the running water, avoiding it from evaporating.

1. The text mentioned photovoltaic panels.
   (a) Indicate the forms of energy received and furnished by these panels.
   (b) Name the source of energy that supplied these panels. Is it nonrenewable or renewable?
   (c) Name another converter that receives the same form of energy to produce thermal energy.
2. Pick out from the text of document 1:
   (a) the advantages of covering roads with photovoltaic panels;
   (b) the advantage of covering river runs through Beirut by a solar snake.
3. Currently, the solar panels project in Beirut consists of 3600 photovoltaic panels that produce an electric power of **1MW**.
   At the end of the project, photovoltaic panels are expected to generate an electric power of **10MW** to supply 10000 residents in Beirut. Determine:
   (a) the number of residents benefiting from the production of electric power of **1MW**;
   (b) the number of photovoltaic panels that should be installed to generate **10MW**.
4. The solar snake was constructed in Beirut to reduce the usage of fossil fuels in producing electricity. Name two non-polluting sources used to produce electricity in Lebanon.

GOOD LUCK

Mocks P+2/20212022/ Physics/12SE "Solution"

Exercise 1

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

2) number of protons = Z = 19
number of neutrons = N = A - Z
= 40 - 19
= 21 (0.5)

3) Due to Soddy's law
$40 = 40 + A \Rightarrow A = 0$
$19 = 18 + Z \Rightarrow Z = +1$ (1)

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

5) a) half-life: time after which half of the radioactive substance is disintegrated (1)

b) $\frac{m_i}{m_f} = 2^n = 2^3 \Rightarrow n = 3$ (2)
$t = nT = 3T = 3(1.25 \times 10^9)$
$= 3.84 \times 10^9$ years

~~Exz~~

Exercise 2

$m = 100g = 0.1\ kg$ $\quad g = 10\ m/s^2$
$h_A = 1m$

1) $K.E_A = \frac{1}{2} m V_A^2 = 0J$ (1)
2) $G.P.E_A = mgh_A = 0.1 \times 10 \times 1 = 1J$ (1)
3) $M.E_A = K.E_A + G.P.E_A$
$= 0 + 1$ (1)
$= 1J$
4) Due to the absence of friction (0.5)

(1)

5) a) $M.E_C = 0.45\,(1)$
$= 0.45\,J$ ✓ (1)

b) $M.E_B = M.E_C$
$M.E_B = K.E_B + G.P.E_B$
$0.45 = 0 + mgh_B$
$0.45 = 0.1 \times 10 \times h_B$ ✓ (1)
$0.45 = 1 \times h_B$
$h_B = 0.45\,m$

6) $\frac{h_B}{h_A} = \frac{0.45}{1} = 0.45$ ✓ (1)

7) Since $r = \frac{h_B}{h_A} = 0.54 \neq \frac{h_B}{h_A} = 0.45$ ✓ (1)
So the Ball is not suitable

Exercise 3

1) a) Solar Energy / Radiant. Furnished energy: electrical energy ✓ 0.5
b) Source: Sun ✓ 0.5
Renewable energy
c) Solar Panel ✓ 0.5

2) a) Reduce the pollution of water, noise and fine particles. ✓ (1)
b) Avoid evaporation of water from the River. ✓ 0.5

3) a) Number of Residents $= \frac{10\,000 \times 1}{10}$ Panels $= 1000$ Residents ✓ (1) ✓ (1)
b) $10\,MW = \frac{10 \times 3600}{1} = 36\,000$ ✓ (1)

4) water and wind ✓ 0.5 ✓ 0.5