This is a Class 1 exam

Lebanon Evangelical School
for Boys and Girls
Loueizeh - Baabda

Stage Exam 04

12FEB2024

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

Subject :	Physics
Class :	11SE
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 (7points)

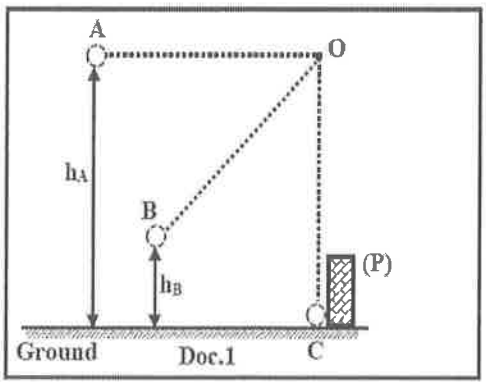
Bouncing of a Ball

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 $\mathbf{1m}$, whose upper end is attached to a fixed point O. The system [(S) − String] is shifted from its equilibrium position by an angle of $\mathbf{90°}$, 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 2 (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 rain 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: $r = \frac{\text{Furnished power}}{\text{Received power}} = 0.4$. The output electric power of this power plant is 100MW. Calculate the mechanical power received by this power plant.

EXERCISE 3 **(7points)**

Radioactivity

1. The Radium isotope $^{226}_{88}\mathbf{Ra}$, of period (or half-life) $\mathbf{T}$, is an alpha $\boldsymbol{\alpha}$ emitter.
   (a) Define radioactivity.
   (b) What is meant by an isotope of an element?
   (c) The $\boldsymbol{\alpha}$ radiation indicates a nuclide. Name this nuclide.
   (d) Define the period of a radioactive substance.
2. The radio-nuclide $^{226}_{88}\mathbf{Ra}$ decays into radon $\mathbf{Rn}$ according to the equation :

$$^{226}_{88}\mathbf{Ra} \longrightarrow \ldots\ldots\ldots + {}^{A}_{86}\mathbf{Rn}$$

   (a) Complete the equation and specify the used law.
   (b) A sample of $^{226}_{88}\mathbf{Ra}$ has a mass $\mathbf{m_0 = 8\ g}$ at the instant $\mathbf{t = 0}$. Find the mass of radium remaining at the instant $\mathbf{t = 4T}$.
3. The $\boldsymbol{\alpha}$ decay is generally accompanied with the emission of another radiation.
   (a) Identify this radiation (Name and nature)?
   (b) This radiation is dangerous. Why?

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Exercise 1

1. $K.E_A = \frac{1}{2} m V_A^2 = 0J$

$\boxed{K.E_A = 0J}$ (1)

2. $G.P.E_A = mgh_A$

$= 0.1 \times 10 \times 1$

$= 1J$

$\boxed{G.P.E_A = 1J}$ (1)

3. $M.E_A = K.E_A + G.P.E_A$

$= 0 + 1$

$= 1J$

$\boxed{M.E_A = 1J}$ (1)

4. The air resistance is neglected (1)

5. a) The remaining M.E just after collision is

$M.E' = 0.45 \times 1 = 0.45J$ (0.5)

b) $M.E' = K.E' + G.P.E'$

$0.45 = 0 + mgh'$ (0.5)

$0.45 = 0.1 \times 10 \times h'$

$\boxed{h' = 0.45m}$ (1)

6. $r = \frac{h_A'}{h} \Rightarrow r = \frac{0.45}{1} = 0.45$ (1)

7. No Since $r \neq 0.54$

Exercise 2

1. a) Falling water (0.5)
   b) Water stored in mountain → electricity (0.5)
2. Renewable source: Sun - Wind - Waves - Tides - Geothermal energy sources (1)
   Non-Renewable source: Nuclear fuel - Fossil fuels.
3. Because the electricity is generated from a primary energy source (1)
4. a) Markba - Nahr Ibrahim (0.5)
   b) - Water is a non-polluting energy source (1)
   - Water is a renewable source of energy
   - Water is an inexpensive energy source
5. $r = \frac{\text{Furnished power}}{\text{Received power}} = 0.4$ (1.5)

$$0.4 = \frac{100\,MW}{P_{rec}} \Rightarrow P_{rec} = 250\,MW$$

Exercise 3

1. b) Isotopes are atoms that have same atomic number (Z) (1)
   but different mass number (A)
   b) Helium nucleus $^{4}_{2}He$ (1)
   a) Radioactivity: Is the spontaneous emission of a Radioactive nucleus to become more stable (1)
   d) Half-life: Is the time needed for a radioactive sample to get half-decayed (1)
2. a) $^{226}_{88}Ra \longrightarrow {}^{4}_{2}He + {}^{A}_{86}Rn$

   Due to Soddy's law (1)

   $226 = 4 + A$

   $\boxed{A = 222}$

b) $m_0 = 8$

$$m_{rem} = \frac{m_0}{2^n} = \frac{m_0}{2^4} = \frac{8}{16} = 0.5\,g$$ (1)

3) a) X: electromagnetic Radiation (0.5)

b) It has high penetrating power (0.5)