This is a Class 1 exam

Lebanon Evangelical School for Boys and Girls

Lebanon Evangelical School

for Boys and Girls — Loueizeh - Baabda

Stage Exam 05

12MAY2023

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 (7points)

Mechanical Energy

Figure 1 represents a track ABO formed of a horizontal rough rail of length $\mathbf{AB = 4m}$ and a frictionless inclined rail of length $\mathbf{BO = 3.9m}$ making an angle $\boldsymbol{\alpha = 30°}$ with respect to the horizontal .
A solid (S), taken a particle of mass $\mathbf{m = 0.4Kg}$, is launched at A with a horizontal velocity of magnitude $\mathbf{V_A = 10m/s}$.

Given:

- The horizontal plane passing through A and B is taken as a gravitational potential energy reference.
- The magnitude of the gravitational acceleration is $\mathbf{g = 10m/s^2}$.
- The force of friction between AB and (S) opposes its motion and assumed constant of magnitude $\mathbf{f = 1.8N}$.

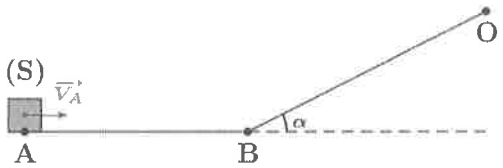


Figure 1

1. Motion between A and B

1. Calculate at A:
   (a) the kinetic energy.
   (b) the gravitational potential energy.
   (c) the mechanical energy.
2. Show that the speed of (S) at B is $\mathbf{V_B = 8m/s}$.

2. Motion between B and O

1. Is the mechanical energy of the system [(S) ; Earth] conserved between B and O ? Justify.
2. Determine the speed of (S) at the position O.

Exercise2 (6points)

Various Forms of Energy

Read carefully the following text then answer the questions below:
"Our forefathers had only that energy of their muscles to use. Today, we use the energy of falling water, that of the Sun, or that of the atom...". Certain bodies possess one form of energy that is function of their speed, other possess a form of energy due to their position in space.." But the most interesting is the energy of flowing water (torrent) or that of lake at a high attitude. Water is forced to fall, from a height of a few hundreds of meters, into a definite path ; at the end of its run, it is able to turn the blades of the shaft of a turbine that runs an alternator thus producing electricity.."
Questions:

1. In order to do work, man needs muscular energy. What is the source of this energy ?

2. (a) Pick up two statements from the text, one denoting kinetic energy and another denoting gravitational potential energy.
   (b) The combination of these two forms of energy gives another energy. Name this energy.
3. The water in a lake is **100m** above the turbine-alternator system and its rate of flow is $\mathbf{25 \times 10^4 Kg/s}$.
   (a) What are the different forms of energy existing between the water in the lake and the output of the alternator ?
   (b) Calculate the average energy **E** received by the turbine in one second.
   (c) **40%** of **E** is converted into electric energy $\mathbf{E_e}$. Calculate $\mathbf{E_e}$. Take $\mathbf{g = 10m/s^2}$.
4. Indicate for each of these energies mentioned in the text, whether or not this energy is polluting.

Exercise3 **(7points)**

Sources of Energy

In 1973, during the petroleum crisis, the price of a barrel of crude oil increased suddenly, eyes were then wide open on the problems of our dependence on petroleum. The suspects causing the above crisis were: cars, heaters, and the production of electric energy by power plants using fossil fuels. Thirty years later, the world is more depending on petroleum . In addition to its cost, this growing consumption of petroleum products gave rise to the problem of the polluting gases released into the atmosphere and the problem of the expected exhaust of the resources. There are, however, other sources of energy like wind, natural gas,coal, that is accused of being more polluting, sunlight whose exploitation are still very expensive and not easy to harness. Today, nuclear energy is partially used in the production of electric energy whereas we note a timid appearance of electric vehicles.

1. Classify the sources of energy mentioned in the text into renewable and non-renewable.
2. Two sources of non-polluting energy are mentioned in the text. Name these two sources and give the name of a third one.
3. Draw, from the text, the three reasons for which we have to limit our consumption of petroleum.
4. A solution is suggested in the text to limit the consumption of petroleum in transportation. Specify this solution.
5. Give the name of two possible fields of applications of the solar energy.
6. The combustion of the petroleum products releases some gases into atmosphere.
   (a) Name two of these gases.
   (b) One of the released gases is responsible for the global warming. Name this gas and specify the name of the corresponding effect.

GOOD LUCK

SE05/2022 2023/Physics/12SE SOLUTION

Exercise 1

AB = 4m (frictional) BO = 3.9m $\alpha = 30^\circ$ m = 0.4Kg $V_A = 10 m/s$

$g = 10 m/s^2$

$f = 1.8N$

1. Motion between A and B

1) a) $K.E_A = \frac{1}{2} m V_A^2$

$= \frac{1}{2}(0.4)(10)^2$

$= 20J$

$\boxed{K.E_A = 20J}$

b) $G.P.E_A = 0J$ ($h_A = 0m$)

c) $M.E_A = K.E_A + G.P.E_A$

$= 20 + 0$

$= 20J$

$\boxed{M.E_A = 20J}$

2) $\Delta M.E = -f_r \times AB$

$M.E_B - M.E_A = -f_r \times AB$

$(K.E_B + G.P.E_B) - (K.E_A + G.P.E_A) = -f_r \times AB$

$\frac{1}{2} m V_B^2 - 20 = -1.8 \times 4$

$\frac{1}{2}(0.4) V_B^2 = 12.8$

$V_B^2 = 64$

$V_B = 8 m/s$

2. i) Yes due to the absence of friction.

2) $M.E_B = M.E_0$

$K.E_B + G.P.E_B = K.E_0 + G.P.E_0$ $\quad h_0 = B_0 \sin\alpha'$

$\frac{1}{2} m V_B^2 = \frac{1}{2} m V_0^2 + mgh_0$

$0.5(0.4)(8)^2 = 0.5(0.2)V_0^2 + 0.5(10)(3.9 \times \sin 30)$

$12.8 = 0.1V_0^2 + 9.75$

$3.05 = 0.1V_0^2$

$V_0^2 = 30.5$

$V_0 \simeq 5.5 \text{ m/s}$

Exercise 2

1) The muscular force that is necessary for man is found in food.

2) a) K.E: some bodies possess a form of energy that is a function of their speed

G.P.E: other bodies possess a form of energy depending on their positions

b) M.E

3) a) The energy in the lake is stored in the form of potential energy during its fall it is transformed from G.P.E to K.E then at the level of turbine from K.E to electrical

mgh

b) $E = 25 \times 10^4 \times 10 \times 100$

$= 10^7 \times 25 \text{ J}$

c) $E_e = 40\% E = 0.4 \times 25 \times 10^7 = 10^8 \text{ J}$

4) Non-polluting: Muscular, potential energy, Kinetic, Solar & electrical
polluting: Fuel (fossil) energy.

Exercise 3

1) Renewable: wind and Sun
Non-Renewable: petrol, the coal, and natural gas.

2) Non-polluting: wind and Sun & waves

3) Rejection of pollutants into the atmosphere. The depletion of reserve. The cost.

4) Use electric cars.

5) Solar energy ⟶ thermal energy (Solar Heaters)
Solar energy ⟶ electric energy (photovoltaic cell)

6) a) CO_2, sulfur oxide
b) CO_2 when ejected into atmosphere produces the greenhouse effect that is responsible for the global warming.