

Study Material for Chapter Work and Energy

- **Work:** Work is said to be done when force applied on a body displaces it in a certain direction
 - **Positive Work:** Work is said to be positive when force applied on a body displaces it in the direction of force
 - **Zero Work:** Work is said to be zero, when force applied on a body, doesn't displace it
 - **Negative Work:** Work is said to be negative, when force applied on a body displaces it in the opposite direction.
- **Energy:** Energy is the ability to do work.
- **1 Joule of work:** When a force of 1 N acts on an object and displaces it through 1 m; 1 Joule of work is said to be done.
 - **1 Joule of energy:** The energy required to do 1 Joule of work.
- **Kinetic Energy:** Energy possessed by a body by virtue of its motion.
- **Potential Energy:** Energy possessed by a body by virtue of its position or configuration.
- **Law of Conservation of Energy:** It states that energy can only be transformed from one form to another; it can neither be created nor destroyed. The total energy before and after the transformation is constant.
- **1 KWh:** The energy used in one hour at the rate of 1kW.
- **1 W:** It is the power of an engine doing work at the rate of 1 Joule per second.
- **Power:** Power is the rate of doing work or the rate of transfer of energy.

Some Questions on Work and Energy:-

1. **Why is it said that work done is equal to energy possessed by an object?**

It is said so because the amount of energy possessed by an object is equal to the amount of work done by the object when this energy is released. A body having energy can do work in the following ways:- 1) It can exert force on another object 2) It can displace an object. Eg: A raised axe held in air has potential energy. When it is left and allowed to fall on a log of wood, it can do work on the wood.

2. **Why does a blacksmith use a heavy hammer than the one used by a goldsmith.**

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A blacksmith uses a heavier hammer than the one used by a goldsmith because the heavier hammer has more mass hence will possess more kinetic energy. Moreover, $F = ma$; therefore; since the mass is more the force exerted by the hammer is also greater and more work will be done by the blacksmith's hammer. This is beneficial for the blacksmith as they deals with harder metals whereas goldsmith handles softer metals like gold.

3. Write about the energy transformations at Hydel Power House.

At a Hydel Power House, a dam is built on a river. Water stored behind the dam has potential energy. This water is allowed to fall from a great height to convert P.E to K.E. This K.E. is used to rotate huge turbines that are connected to electric generators for producing Electrical Energy.

Potential Energy \rightarrow Kinetic Energy \rightarrow Electrical Energy

4. Write about the energy transformations at Thermal Power House.

At a Thermal Power House, coal is burnt. The chemical energy in coal is changed into heat energy. This heat energy converts water into steam. This steam rotates turbines which change the heat energy into K.E. The turbines are connected to generators to produce Electrical Energy.

Chemical Energy \rightarrow Heat Energy \rightarrow Kinetic Energy \rightarrow Electrical energy

5. Write about the energy transformations in:

A) Electric Motor: Electric Energy \rightarrow Mechanical Energy

B) Electric Iron: Electric Energy \rightarrow Heat Energy

C) Electric Bulb: Electric Energy \rightarrow Heat & Light Energy

D) Radio : Electric Energy \rightarrow Kinetic Energy \rightarrow Sound Energy (Electric energy vibrates the diaphragm)

E) Steam Engine: Heat Energy \rightarrow Kinetic/Mechanical Energy

F) Car Engine: Chemical Energy \rightarrow Heat Energy \rightarrow Kinetic/Mechanical Energy

G) Cell/Battery : Chemical Energy \rightarrow Electric Energy

H) Gas Stove: Chemical Energy \rightarrow Heat & Light Energy

I) Solar Water Heater: Light Energy \rightarrow Heat Energy

J) Solar Cell: Light Energy \rightarrow Electric Energy

K) Generator: Mechanical Energy \rightarrow Electric Energy

L) Torch: Chemical Energy \rightarrow Electric Energy \rightarrow Light & Heat Energy

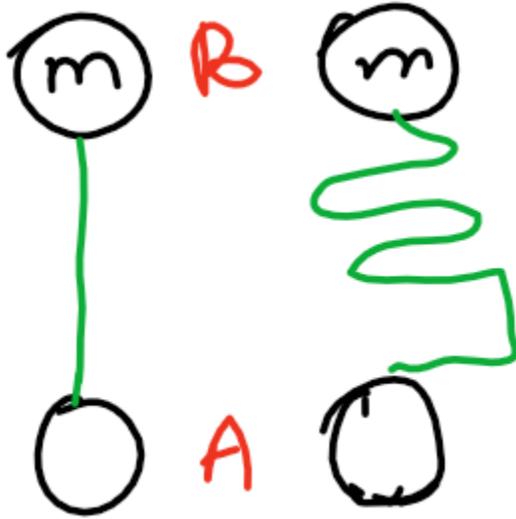
6. How does an object possessing energy do work?

A body possessing energy can exert a force on another object. During this process energy is transferred to the other object. By gaining energy, the object moves. Hence, work is done as there is force and displacement.

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7. Is Potential Energy path dependent?

No, Potential Energy is not path dependent. It is only dependent on the vertical distance between the initial position and the final position irrespective of the path traveled to reach the final position. As shown in the figure, two bodies of same base are start from A and travel different paths to reach B. But the PE of both is the same.



Prepared by Viraaam