

CCT Weekly- Science Practice

Work -Energy Theorem

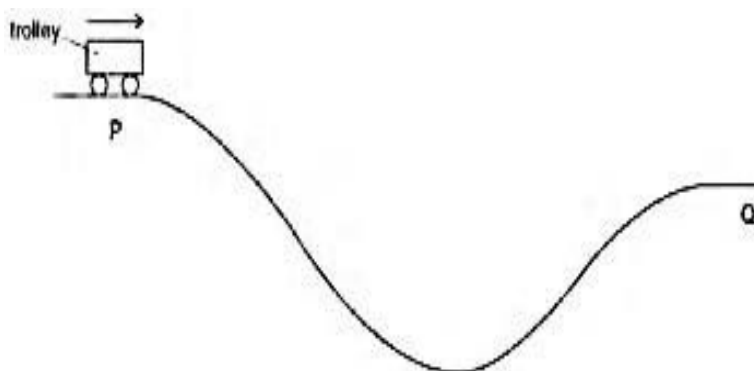
When an object, of mass m , is placed under the influence of gravitational force of earth (a conservative force) and some work is done upon the object by an external force, there will be a change in the total mechanical energy of the object. If only internal forces are doing work, there is no change in total mechanical energy (gravitational force between the mass and the earth are internal forces); it is said to be *conserved*. Thus, according to work energy theorem:

Initial Mechanical Energy + Work done by external forces (work done by against conservative force) = Final Mechanical Energy

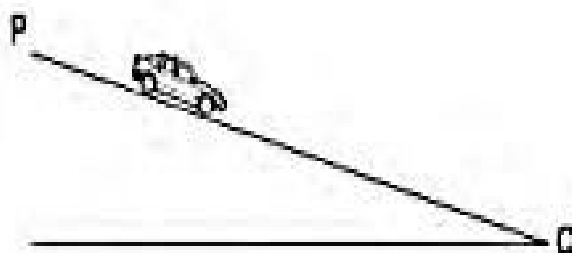
The work done by external forces can be a positive or a negative work. Whether the work is positive or negative, depends upon the angle between the force and the direction of motion.

Questions -

1. A trolley runs from P to Q along a track. At Q its potential energy is 50 kJ less than at P. At P, the kinetic energy of the trolley is 5 kJ. Between P and Q the work the trolley does against friction is 10 kJ. What is the kinetic energy of the trolley at Q?



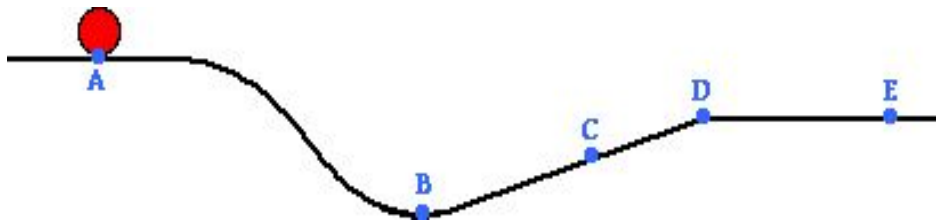
- a) 35 kJ
 - b) 45 kJ
 - c) 55 kJ
 - d) 65 kJ
2. A car driver adjusts the pressure on a car's brakes so that the car travels at constant speed down a hill from P to Q. The magnitude of the change in the car's kinetic energy is ΔE_k . The magnitude of the change in its gravitational potential energy is ΔE_p . Which statement is correct when the car reaches Q?



- a) $\Delta E_k > \Delta E_p$
- b) $\Delta E_k = \Delta E_p$
- c) $\Delta E_p > \Delta E_k > 0$
- d) $\Delta E_k = 0$

3. An object weighing 10 N is dropped from a height of 4 meters above the ground. When it has fallen freely through a distance of 1 meter, its total mechanical energy with respect to the ground is
- a) 2.5 J
 - b) 10 J
 - c) 30 J
 - d) 40 J

Use the following diagram to answer question 4 and 5:



4. The object will have a minimum gravitational potential energy at which of the following point(s)?
- a) A
 - b) B
 - c) C
 - d) D and E
5. The object's kinetic energy at point C is less than its kinetic energy at which of the following point(s)?
- a) A only
 - b) A, D and E
 - c) B only
 - d) D and E

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Answer Key:-

1. b) 45 kJ

$$PE_P + KE_P + \text{Work done against friction} = PE_Q + KE_Q$$

$$PE_Q = 50 \text{ kJ}$$

$$KE_P = 5 \text{ kJ}$$

$$\text{Work done against friction} = -10 \text{ kJ}$$

$$50 + 5 - 10 = KE_Q$$

$$KE_Q = 45 \text{ kJ}$$

2. d) $\Delta E_k = 0$ since car is travelling at a constant speed from P to Q.

3. d) 40 J as ME = PE at the top = $mgh = 10 \times 4 = 40 \text{ J}$.

4. b) B because $h = 0$.

5. c) B only because KE is maximum at B due to maximum velocity at B.

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