Date:- Jan 13, 2025

TENDER HEART HIGH SCHOOL, SEC-33B, CHD.

Subject- Physics

CLASS-IX (Work Power Energy)

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Conversion of one form of energy into other form:→

* [Mechanical Energy ⟶ Sum of P.E and K.E]

⇒ **Mechanical energy to Electrical Energy:→** Electrical generator,

⇒ **Electrical energy to Mechanical Energy:→** Electric motor, Electric fan, Electric Iron, Washing machine, Mixer grinder etc.

⇒ **Electrical energy to heat Energy:→** heater, oven, geyser, toaster etc.

⇒ **Heat Energy to Electrical Energy:→** thermocouple.

⇒ **Electrical energy to Sound Energy:→** Electric bell.

⇒ **Sound Energy to Electrical Energy:→** Microphone.

⇒ **Electrical Energy to Chemical Energy:→** While charging a battery.

⇒ **Chemical Energy to Electrical Energy:→** When current is drawn from the cell.

⇒ **Chemical Energy to light Energy:→** A Burning candle, A burning wick of a kerosene lamp.

⇒ Light Energy to Chemical Energy :→ A process of photosynthesis.

⇒ Electrical Energy to light Energy :→ Electric bulb.

⇒ Light Energy to electrical Energy :→ Solarcell, photocell.

⇒ Heat Energy to Mechanical Energy :→ Steam Engine.

⇒ Chemical Energy to heat Energy :→ Lighted Candle, Steam Engine.

⇒ Chemical Energy to Mechanical Energy :→ Automobiles.

⇒ Electric energy to magnetic Energy :→ Electromagnet.

⇒ Nuclear Energy to Electrical Energy :→ Nuclear Reactor.

⇒ Mechanical Energy to heat Energy :→ moving parts of a machine get heated due to friction, then a part of mechanical energy is changes into heat energy.

——— α ——— α ——— α ——— α ——— α ———

⇒ Ch-2 [Work, Power and Energy]

2(C) Conservation of Energy

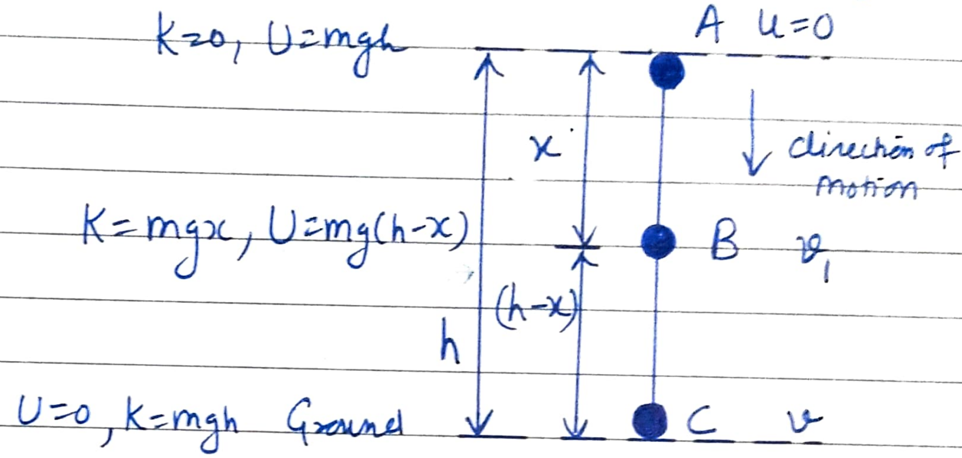
* Principle of Conservation of Energy :→

It states that energy can neither be created nor be destroyed. It can only be transformed from one form to another. i.e if there is only an interchange between the potential energy and kinetic energy, the total mechanical energy (K.E + P.E) remains Constant.

i.e $K + U =$ Constant

here K – K.E
U – P.E

⇒ <u>Theoratical Verification of $K + U =$ Constant</u> [In absence of frictional forces]



let a body of m be falling freely under gravity from height h above the ground i.e from position; A

So, <u>At position A, (at a height h above the ground)</u>;

$u = 0$ (Initial velocity) (body at rest)

K.E, $K = 0$

P.E, $U = mgh$

So Total Energy $= K + U = 0 + mgh = mgh$ —— ①

When the body has fallen through a distance; x then at <u>Position B</u> :→

$u = 0$, $S = x$, $a = g$ (acceleration due to gravity)

Using $v^2 - u^2 = 2as$

$(v = v_1)$ $v_1^2 - 0^2 = 2 \times g \times x = 2gx$

$v_1^2 = 2gx$ —— (2)

So K.E at B $= \frac{1}{2}mv_1^2 = \frac{1}{2}m \times 2gx = mgx$

at position B, ht. of body is $(h-x)$

So $P.E, U = mg(h-x) = mgh - mgx$

So Total Energy $= K+U = \cancel{mgx} + mgh - \cancel{mgx}$

$= mgh$ ——— (3)

At position C :→ let v be the velocity when body reaches to ground then

$u=0, s=h, a=g$

Using; $v^2-u^2=2as$

$v^2-(0)^2 = 2\times g\times h = 2gh$

$\boxed{v^2=2gh}$ $\therefore$ K.E $= \frac{1}{2}mv^2 = \frac{1}{2}m\times 2gh$

$= mgh$

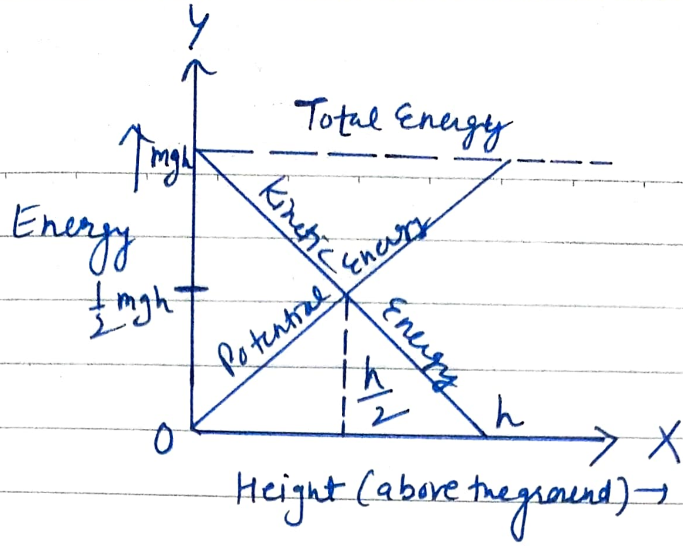
as P.E = 0 (at the ground)

So Total Energy $= K+U = mgh + 0 = mgh$ ——— (4)

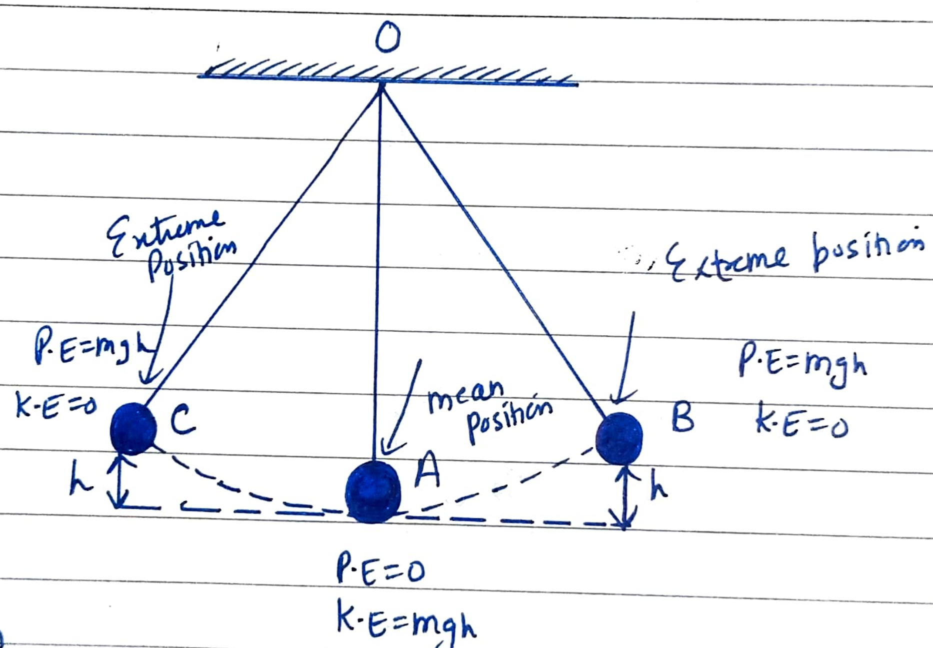
from Equations (1), (3) and (4) we note that Total mechanical energy remains constant at each point of motion.

Graphical representation of Conversion of mechanical energy in motion under gravity.

Position	P.E	K.E	T.E
At point A	mgh	zero	mgh
At point B	$\frac{1}{2}mgh$	$\frac{1}{2}mgh$	mgh
At point C	zero	mgh	mgh



⇒ Application of Principle of Conservation of simple pendulum :→



P.E of pendulum

let metallic bub be at position A, resting at mean position then P.E=0

At point B, where pendulum is displaced and then raised through height h then P.E of pendulum is increased by mgh

At point C, where pendulum is again raised by height h then P.E = mgh

K.E of pendulum :→

At point A; mean position; K.E = gh

At point B; K.E = 0 (at Extreme position)

At point C; K.E = 0 (" " ")

Teacher's Signature

So pendulum has K.E at only mean position and total mechanical energy remains constant throughout the swing.

Numericals Related to Simple Pendulum:→

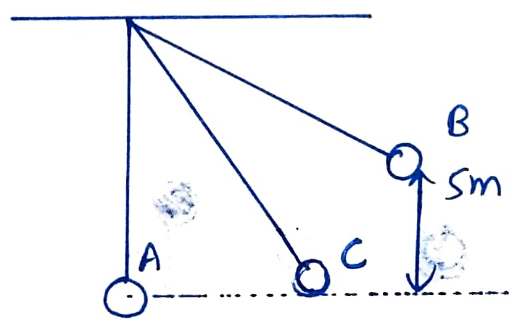
(1) A simple pendulum of mass 200g, It is displaced from the mean position 'A' to the extreme position 'B'. The P.E at position A is zero. At position B the bob is raised by 5m.

(a) What is the P.E of the pendulum at position B?

(b) find Total mechanical Energy at C?

(c) find bob speed at A when it is released from B.

[Take $g = 10 m/s^2$]



Solution: → (a) P.E at B is $mgh = \frac{200 \times 10 \times 5}{1000} = 10$ Joules

(b) Total mechanical Energy at C = ?

from the principle of Conservation of Energy;

Total Energy at C = total Energy at B

As at B, P.E = 10J but K.E = 0 (Extreme position)

So Total Energy at B = 10J + 0 = 10 Joules

(c)

↳ Speed of bob at A = ?

As at A (mean position); K.E = 10J as P.E = 0

($\because$ Total Energy = 10J)

So total mechanical Energy = K.E

$$10 = \frac{1}{2} m v^2$$

$$10 = \frac{1}{\cancel{2}} \times \frac{\cancel{200}}{1000} \times v^2$$

$$10 \times 10 = v^2$$

$$100 = v^2 \text{ or } \boxed{v = 10 m/s}$$