Cici Zhu
Lab: AP Physics C Mechanics Review Sheet
04/27/2026

Ch 7 - Energy and Energy Transfer

Background/Summary:

Energy is energy is the scalar quantity representing a system's capacity to do work, measured in joules. Energy cannot be created or destroyed, only transformed and transferred. It exists primarily as kinetic or potential energy.

Energy transfer is the process of converting energy from one form to another. In **conservation of energy**, energy can be transferred without loss, often shifting between kinetic and potential forms while the total mechanical energy remains constant.

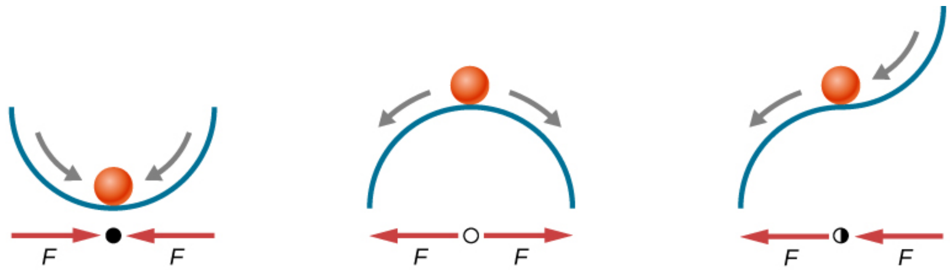
Important key points:

- Energy is a scalar quantity, measured in Joules (J)
- Energy doesn't disappear, it moves, transferred, or dissipated
- Conservative forces: energy stays in
  mechanical forms (KE + PE); no energy lost
  [gravity, springs]
- Non-conservative forces: energy is transformed into thermal/internal energy
  [friction]
- Use energy to solve problems if the motion is messy but start/end is clear!

Vocabulary:

- Kinetic Energy (KE): energy of motion
- Potential Energy (PE): stored energy due to position/height
  - Gravitational Potential Energy: energy due to height
  - Elastic Potential Energy: energy stored in a spring
- Mechanical Energy: total sum of KE + PE
- Work: energy transferred by a force acting over a distance
- Power: rate of energy transfer, measure in watts (W)

- Work-Energy Theorem: net work equals change in kinetic energy
- Conservation of Energy: total energy remains constant in an isolated system
- Equilibrium Point: where net force = 0
    - Stable Equilibrium: minimum potential energy
    - Unstable Equilibrium: maximum potential energy



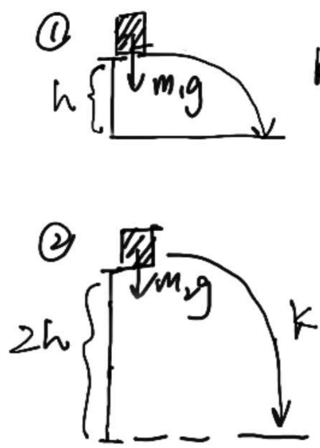
(a) Stable equilibrium point (b) Unstable equilibrium point (c) Unstable equilibrium point

Formulae:

Kinetic Energy	$KE=\frac{1}{2}mv^2$
Gravitational Potential Energy (Earth)	$PE=mgh$
Elastic Potential Energy	$PE=\frac{1}{2}kx^2$
Total Mechanical Energy	$E=KE+PE$
Work (constant F)	$W=F\cdot d=Fd\cos\theta$
Work (variable F)	$W=\int F\cdot dr$
Work Energy Theorem	$W_{net}=\Delta KE$
Conservation of Energy	$KE_i+PE_i=KE_f+PE_f$
Force from Potential Energy	$F=\frac{-dU}{dx}$
Power	$P=\frac{W}{t}$
Instantaneous Power	$P_{ins}=Fv$

Problems in order of difficulty (Easy, Medium, Hard):

1. A person drops a pebble of mass m_1 from a height h, and it hits the floor with kinetic energy K. The person drops another pebble of mass m_2 from a height of 2h, and it hits the floor with the same kinetic energy K. How do the masses of the pebbles compare?



★ $U_g \to K$.

$\therefore \begin{cases} K = m_1 g h. \\ K = m_2 g (2h). \end{cases}$

$\therefore m_1 g h = m_2 g (2h)$

$\therefore \boxed{m_1 = 2m_2}$

2. (a) What is the average power consumption in watts of an appliance that uses 5.00kW*h of energy per day? (b) How many joules of energy does this appliance consume in a year?

a). $P = \frac{W}{t} = \frac{5.00\,kWh}{24h} = 0.208\,kW$

$\therefore 0.208\,kW = \boxed{208W.}$

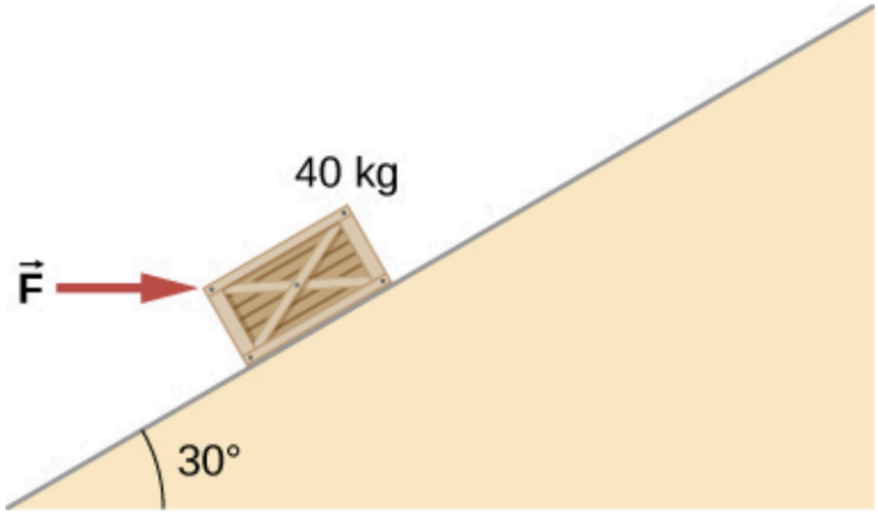
b). $5.00\,kWh/day \times 365 = 1825\,kwh$

$\because 1\,kWh = 3.6 \times 10^6\,J.$

$\therefore 1825\,kwh \times 3.6 \times 10^6$

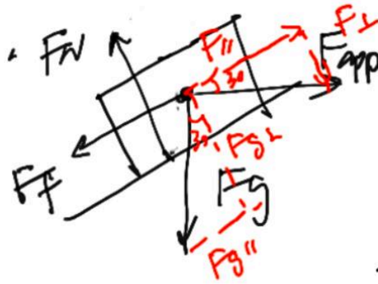
$= \boxed{6.57 \times 10^9\,J}$

3. Shown below is a 40-kg crate that is pushed at constant velocity a distance 8.0 m along a 30-degree incline by the horizontal force F. The coefficient of kinetic friction between the crate and the incline is μ=0.40. Calculate the work done by the applied force.



$\mu_k = 0.40$.

a).



* friction force: opp. to motion!

∵ constant velocity

∴ $\Sigma F = ma = 0$

horizontal: $F_\perp - F_f - F_g{}_{\parallel} = 0$

∴ $\cos 30 F_{app} - \mu_k N - mg\sin 30° = 0$

∴ $\cos 30 F_{app} - (0.4)N - (40)(9.8)\sin 30° = 0$

where to find N?

Vertical: $\Sigma F = ma = 0$.

∴ $F_N = F_{g\perp} + F_{app\perp}$

∴ $F_N = \cos 30° mg + F_{app}\sin 30°$

∴ $F_{app}\cos 30 = (40)(9.8)\sin 30° + (0.4)\cdot(\cos 30 mg + F_{app}\sin 30)$

∴ $F_{app} = 3.8 \times 10^2 N$