

Chapter 6: Work and Kinetic Energy

m = mass $g = 9.8 \text{ m/s}$

F = Weight (N) $F = m \cdot g$

s = distance $K_E = \text{Kinetic Energy}$

W = Workdone

Power = P (Watts) $x = \cos$
 $y = \sin$

1 km = 1000m 1kg = 1000g

$\Delta K = K_f - K_i$ Friction = always negative

$g = -9.8$ (decreasing) $g = 9.8$ (normal)

$a = g$ (gravitational acceleration) $\Theta = \text{Angle between } F \text{ and } s$

$\parallel$ = Component of F parallel to dl v = velocity

$W = (\int_{P_2 \text{ to } P_1}) F \cdot dl$ $W = F \parallel dl$

$W = (\int_{P_2 \text{ to } P_1}) F \cdot \cos\Theta \cdot dl$ $W = F \cdot s$ (Joules)

$P_{av} = \Delta W / \Delta t$ $P = \lim_{\Delta t \rightarrow 0} (\Delta W / \Delta t) = dW / dt$

$V_f = V_i^2 + 2 \cdot a \cdot s$ $P = (W/t)$

Constant Speed : ($a = 0$) F = force
 $P = F \cdot v$

Friction (opposite) = $\cos(180^\circ)$

$W_x = F (\cos\Theta) \cdot s$ $W_y = F (\sin\Theta) \cdot s$

$a = (V_f^2 - V_i^2) / (2 \cdot s)$

$F_s = (1/2) \cdot m \cdot V_f^2 - (1/2) \cdot m \cdot V_i^2$

$W_{grav} = m \cdot g \cdot h$ $P = (W/t)$

$K_E = (1/2) \cdot m \cdot V^2$ $P_E = m \cdot g \cdot h$

Chapter 7: Potential Energy, Energy Conservation

Potential Energy = U , $\Delta K = -\Delta U_{grav}$
 P_E

K = Kinetic Energy R = Radius

$s = y_f - y_i$ $U_{grav} = m \cdot g \cdot y$

$\Delta s = \Delta x_i + \Delta y_j$ cm = circular motion

Chapter 7: Potential Energy, Energy Conservation (cont)

k = constant of spring

$P_E = (1/2) \cdot k \cdot x^2$

$W_{grav} = w \cdot \text{vector} \cdot \Delta s \cdot \text{vector}$ Diameter = $2 \cdot \text{Radius}$

W_f = Work Done by Friction if elastic...
 $K_E = P_E$

$W_{grav} = F \cdot s$ $W_{grav} = m \cdot g \cdot y_i - m \cdot g \cdot y_f$

$K_i + U_i = K_f + U_f$ $(1/2) \cdot m \cdot V_i^2 + m \cdot g \cdot y_i = (1/2) \cdot m \cdot V_f^2 + m \cdot g \cdot y_f$

if gravity does work.... $W_{total} = K_f - K_i$
 $E = K + U_{grav}$ $W_{total} = W_{grav} + W_{other}$

$W_{other} + U_i - U_f = K_f - K_i$ Work done on a spring
arrange to.... $W = (1/2) K_E \cdot X_f^2 - (1/2) K_E \cdot X_i^2$

$K_i + U_i + W_{other} = K_f + U_f$ Work done by a spring
 $W = (1/2) K_E \cdot X_i^2 - (1/2) K_E \cdot X_f^2$

$U_{cm} = m \cdot g \cdot R$ Elastic Potential Energy
 $U_{el} = (1/2) \cdot K_E \cdot x^2$

Work Done by Elastic Force

$W_{el} = (1/2) \cdot K_E \cdot x_i^2 - (1/2) \cdot K_E \cdot x_f^2$

if elastic force does work, and mechanical energy is conserved

$K_i + U_{el, i} = K_f + U_{el, f}$

Chapter 7: Potential Energy, Energy Conservation (cont)

Work Done by Friction: Law of Conservation of Energy

$W_f = -W_{fric}$ $\Delta K + \Delta U + \Delta U_{int} = 0$

$W_f = -(\mathbf{f} \cdot \mathbf{s})$

$W_f = \mu_k \cdot m \cdot g \cdot s$

$F = F_x + F_y + F_z$ $F_x = (1/2) \cdot K \cdot x^2$

$F_x(x) = -m \cdot g$

$F_y(y) = -m \cdot g$

$F_z(z) = -m \cdot g$

Chapter 8: Momentum, Impulse, Collisions

p = momentum J = Impulse

m = mass v = velocity

$P = m \cdot v$ (kg · m/s)

$F = dp / dt$ $J = \Sigma F (t_f - t_i)$

$J = \Sigma F \cdot \Delta t$

$J_y = (\int_{t_f \text{ to } t_i}) \Sigma F_y$ $J = (\int_{t_f \text{ to } t_i}) \Sigma F dt$

$J_y = (F_{av})_y (t_f - t_i)$ $J_x = (\int_{t_f \text{ to } t_i}) \Sigma F_x dt$

$J_y = P_{fy} - P_{iy}$ $J_x = (F_{av})_x (t_f - t_i)$

$J_y = (m \cdot V_{fy}) - (m \cdot V_{iy})$ $J_x = P_{fx} - P_{ix}$
 $J_x = (m \cdot V_{fx}) - (m \cdot V_{ix})$

$\Sigma F = (P_f - P_i) / (t_f - t_i)$ $J = F_{av}(t_f - t_i)$

$J = (P_f - P_i) = \{F\} : \text{Change in Momentum}$

$P = P_A + P_B = |P_A + P_B|$

Assuming m_1 and m_2 don't change

$m_1 \cdot v_1 + m_2 \cdot v_2 = \text{constant}$ $(P_1 + P_2)_i = (P_1 + P_2)_f$

$P_1 + P_2 = \text{constant}$ $P_i = P_f$

$V_f = (m_1 \cdot v_1 + m_2 \cdot v_2) / (m_1 + m_2)$



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Published 3rd November, 2021.
Last updated 3rd November, 2021.
Page 1 of 1.

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