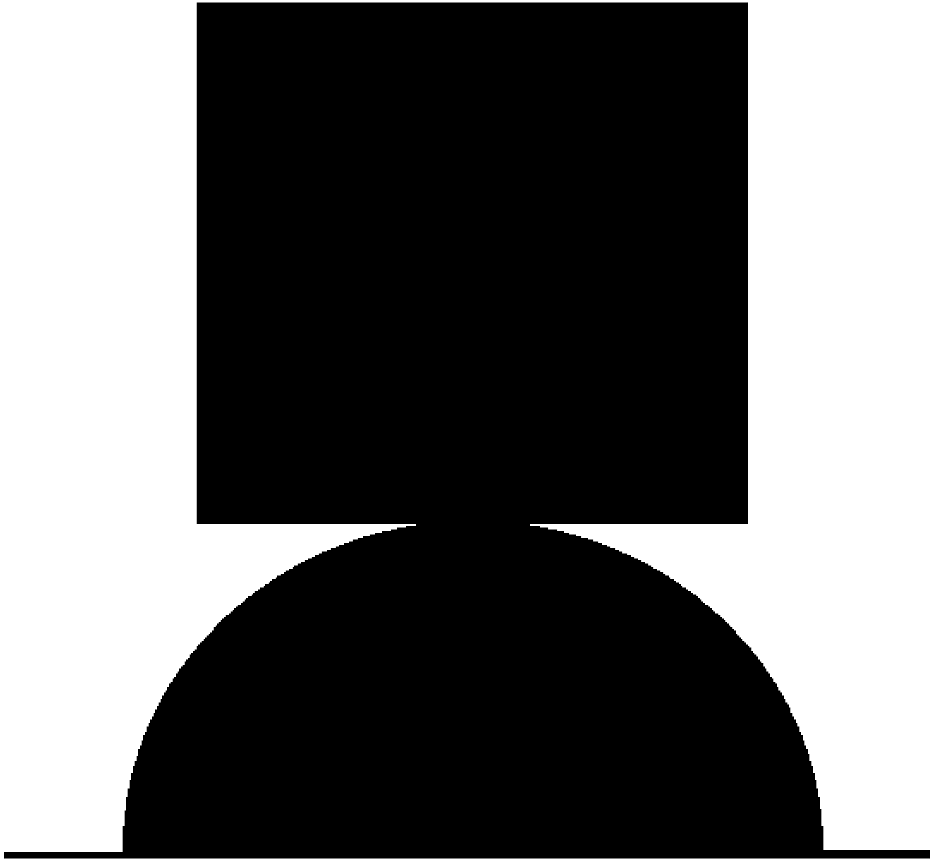
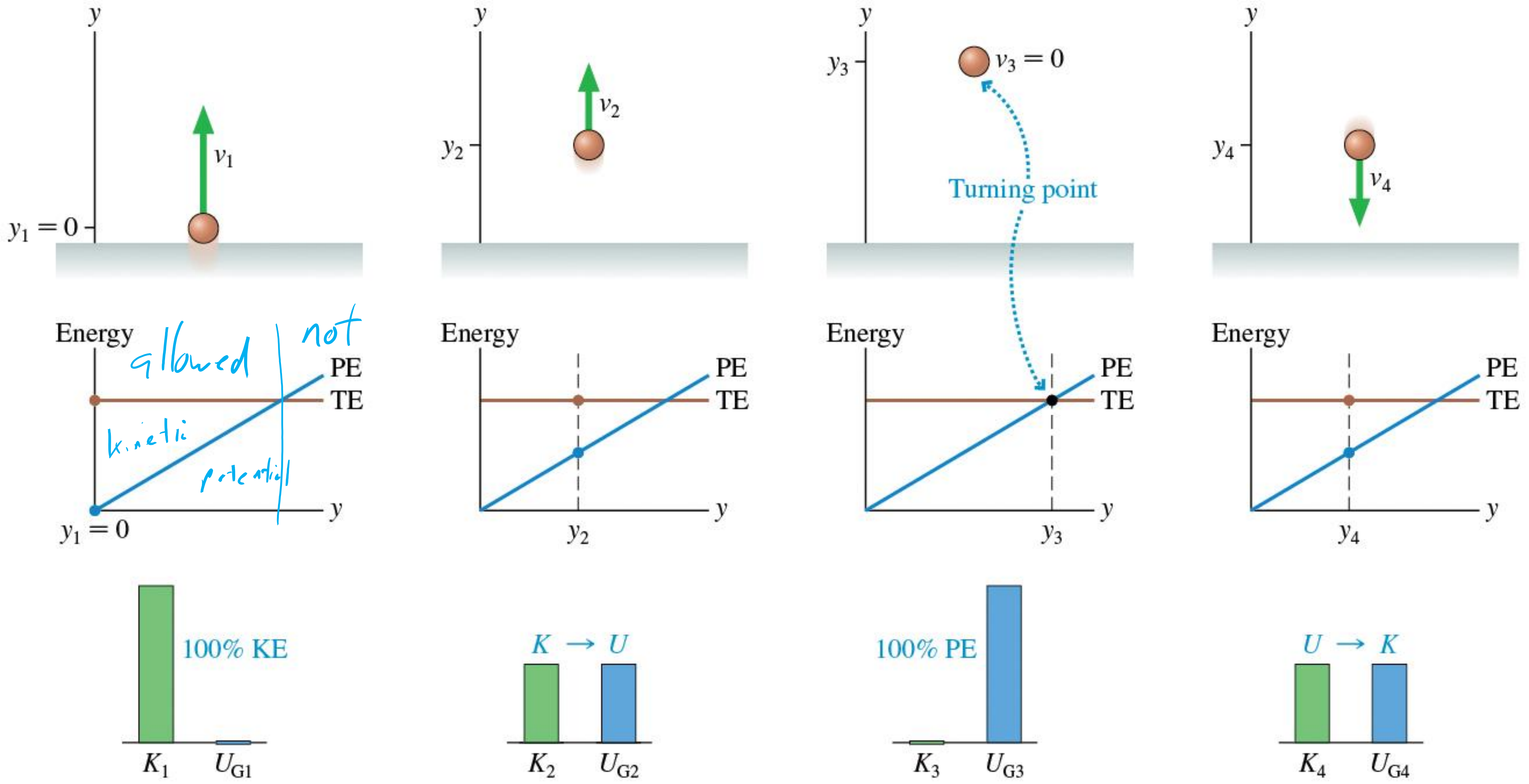
A cube sits on a hemisphere. Static friction is large.

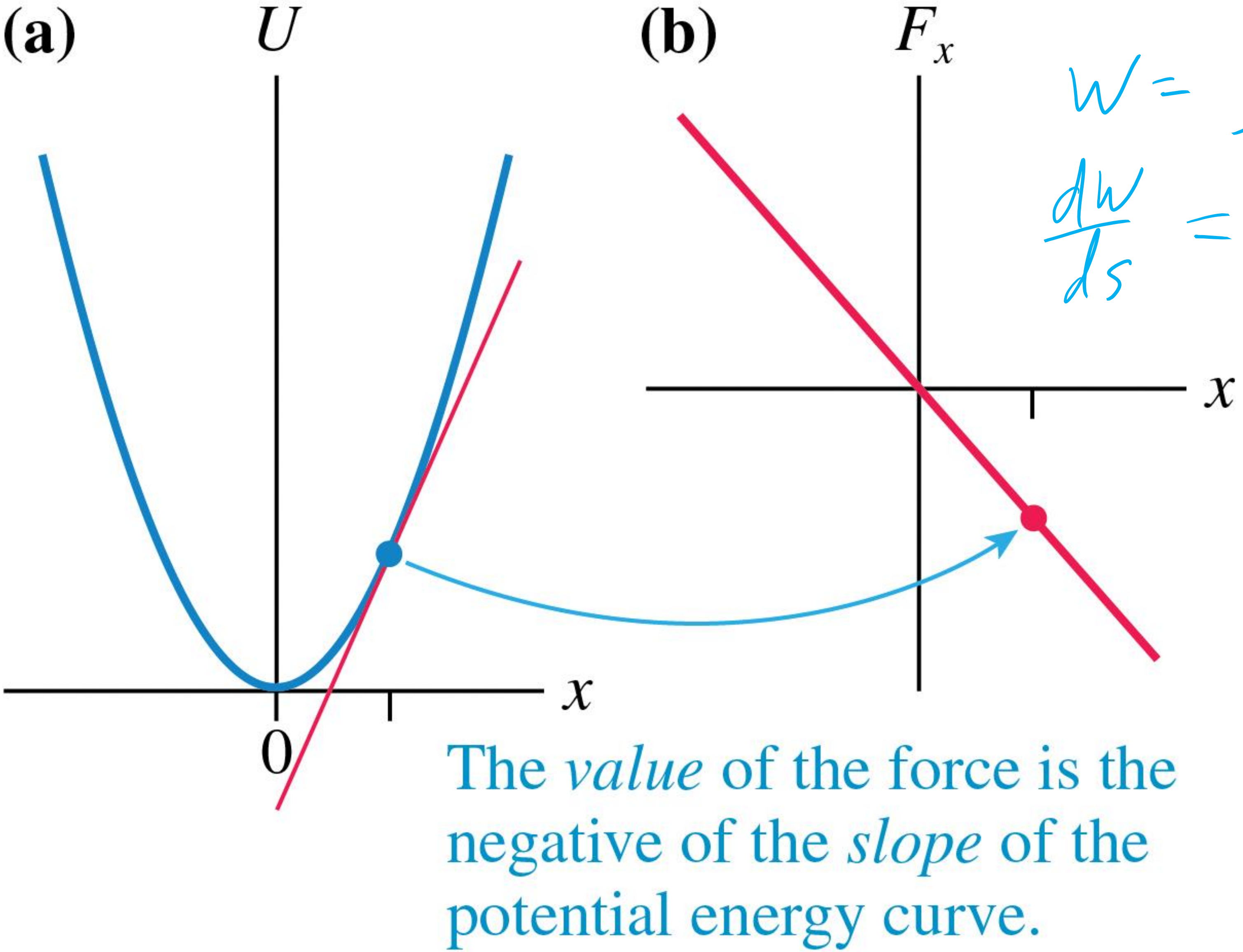
Is this cube stable if tipped slightly?



Chapter 10 – Interactions and Potential Energy

- Potential energy and conservation of energy
- Energy bar charts and energy diagrams
- Relationship between force and potential energy
- Conservative and nonconservative forces


y
$y_1 = 0$
v_1
y_2
v_2
y_3
$v_3 = 0$
Turning point
y_4
v_4
Energy
allowed
not
kinetic
potential
PE
TE
y
$y_1 = 0$
y_2
y_3
y_4
100% KE
$K \rightarrow U$
100% PE
$U \rightarrow K$
K_1
U_{G1}
K_2
U_{G2}
K_3
U_{G3}
K_4
U_{G4}



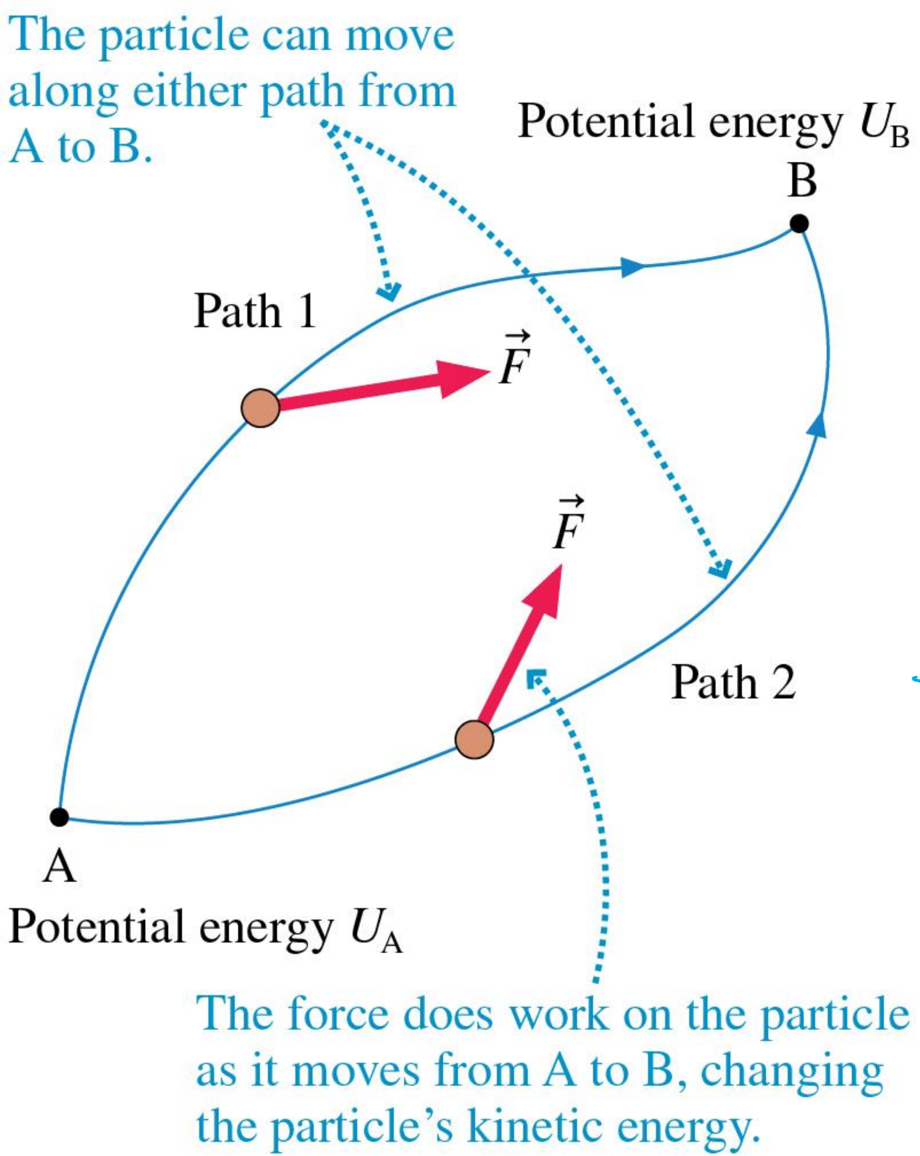
$$W = \int \vec{F} \cdot d\vec{s}$$

$$\frac{dW}{ds} = \vec{F} \; ?$$

$$F_{sp\ on\ me} = -F_{me\ on\ sp}$$

$$= -\frac{dW}{ds}$$

$$F_{sp} = -\frac{dU}{ds}$$



Nonconservative if

$F(\vec{v})$ (except Lorentz force)

$\frac{dF}{dt} \neq 0$

Good → if 1-D

Team Up Questions

$$U(s) = A\, s^4$$

① $F = -\frac{dU}{ds}$

② $W = \Delta U$

③ $E = K + U(x=2) \rightarrow 0 + U(x=?)$

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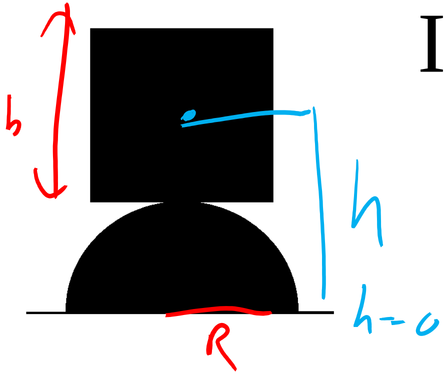
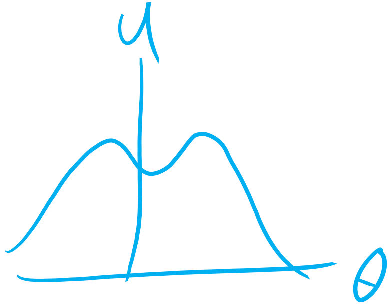


$$U = mgh$$

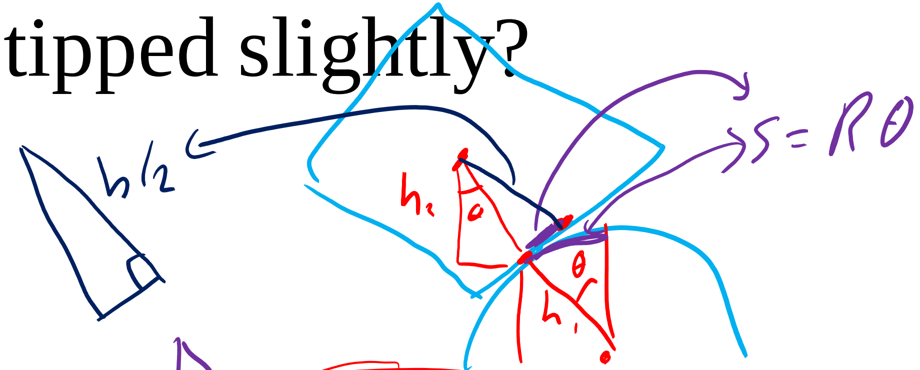


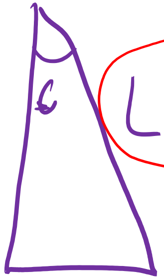
$$h_1 + h_2 = ?$$

$$h_1 = R\cos\theta$$

$$h_2 = L\cos\theta = \sqrt{\left(\frac{b}{2}\right)^2 + (R\theta)^2}\,\cos\theta$$

$$U = mg\cos\theta\left(R + \sqrt{\left(\frac{b}{2}\right)^2 + (R\theta)^2}\right)$$

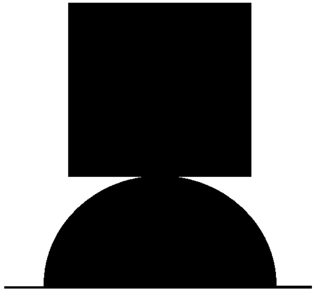




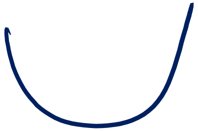
$$L = \sqrt{\left(\frac{b}{2}\right)^2 + (R\theta)^2}$$

A cube sits on a hemisphere. Static friction is large.

Is this cube stable if tipped slightly?



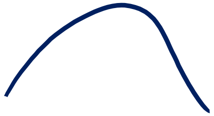
$$U = mg\cos\theta\left(R + \sqrt{\left(\tfrac{b}{2}\right)^2 + (R\theta)^2}\right)$$



? stable

$$\theta \ll 1 \rightarrow \cos\theta \simeq 1 - \theta^2/2$$

$$(1+\theta)^n \simeq 1 + \theta n$$



? unstable

$$U \sim K + A\,\theta^2$$

$A > 0 \rightarrow$ stable

$A < 0 \rightarrow$ unstable