ME 274: Basic Mechanics II
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Quiz #6

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Questions from Prof. James Gibert and Information adapted from “DYNAMICS: A Lecturebook”

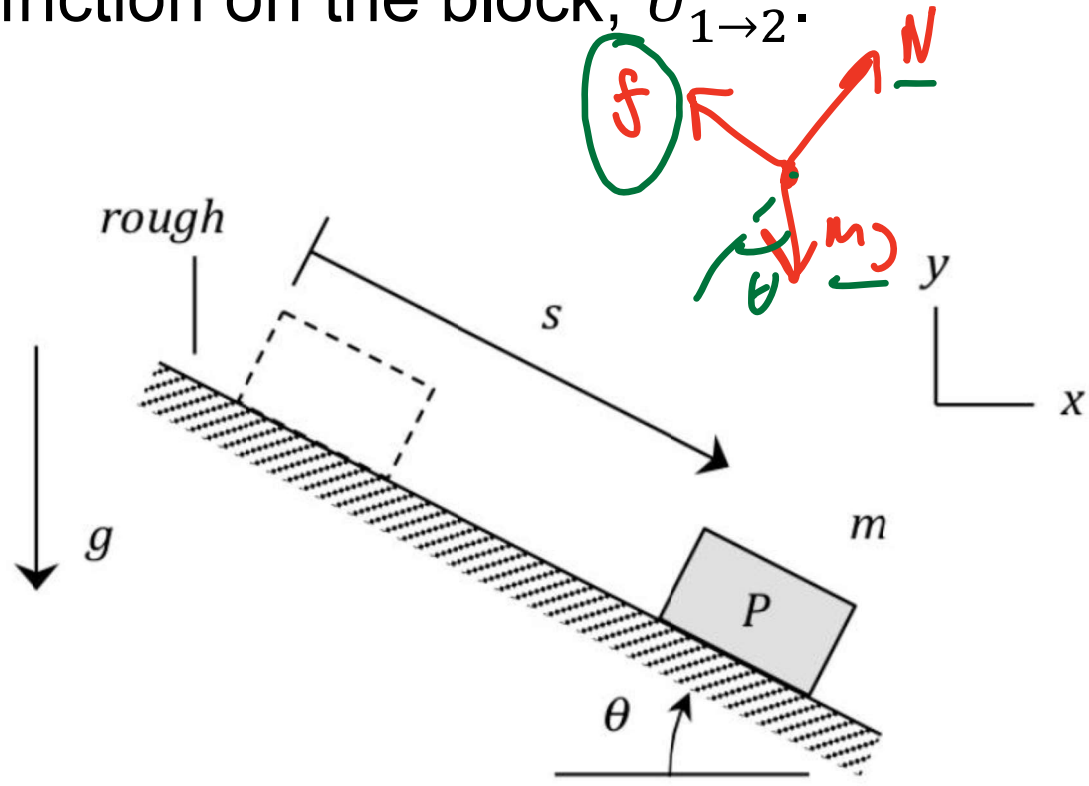
By Charles M. Krousgrill, Jeffrey F. Rhoads

Question #1

$U_{1\to2}^{nc} = \int -F\,ds = -\mu_k mg\cos\theta \, s$

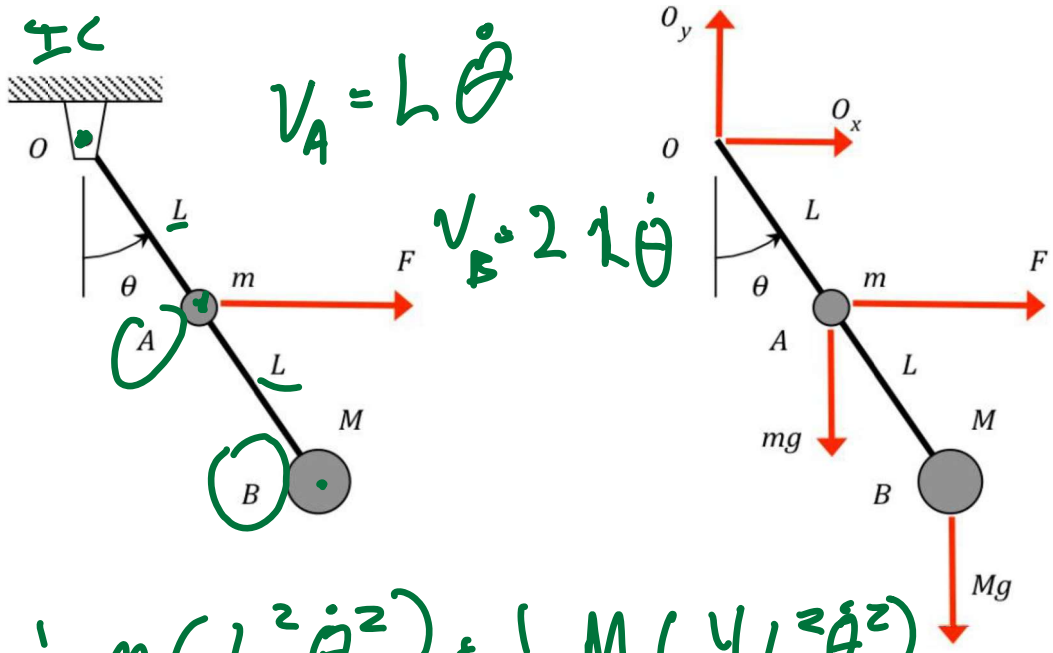
$N = mg\cos\theta$

- Block P slides a distance of s down a rough incline, where μ_s and μ_k are the static and kinetic coefficients of friction, respectively. Choose the response below that accurately describes the work done by friction on the block, $U_{1\to2}^{(f)}$.
  - (a) $U_{1\to2}^{(f)} = +\mu_s mgscos\theta$
  - (b) $U_{1\to2}^{(f)} = -\mu_k mgscos\theta$
  - (c) $U_{1\to2}^{(f)} = -\mu_s mgscos\theta$
  - (d) $U_{1\to2}^{(f)} = +\mu_s mgs$
  - (e) $U_{1\to2}^{(f)} = +\mu_k mgssin\theta$



Question #2

- Particles A and B (having masses of m and M, respectively) are attached to rigid bar OB (with the mass of OB being negligible). A constant, horizontal force F acts to the right on particle A. A FBD of the system made up of A, B and OB is also shown. For the system being released from rest when $\theta = 0$, it is desired to know the speed of particle B as a function of the angle θ. For the system shown, select the correct response below that represents the kinetic energy, T, of the system.
  - (a) $T = \frac{1}{2} m L^2 \dot{\theta}^2$
  - (b) $T = \frac{1}{2} M (2L)^2 \dot{\theta}^2$
  - (c) $T = \frac{1}{2}(m + M) L^2 \dot{\theta}^2$
  - (d) $T = \frac{1}{2}(m + 4M) L^2 \dot{\theta}^2$
  - (e) none of the above

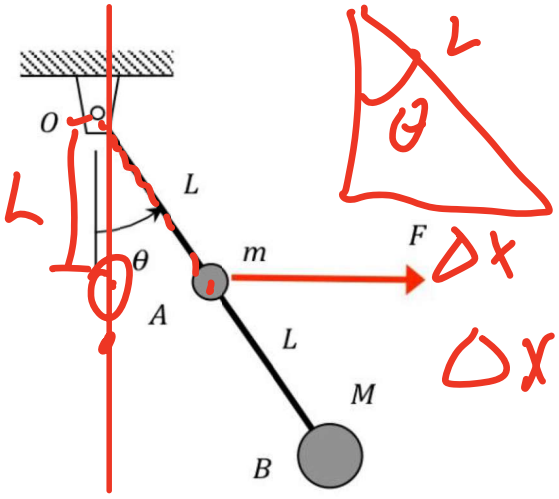


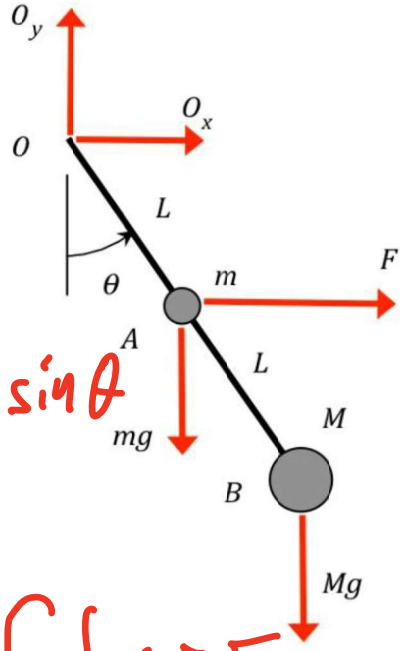
$T = \frac{1}{2} m V_A^2 + \frac{1}{2} M V_B^2 = \frac{1}{2} m (L^2 \dot{\theta}^2) + \frac{1}{2} M (4 L^2 \dot{\theta}^2)$
$= \frac{1}{2}(m + 4M) L^2 \dot{\theta}^2$

Question #3

$U_{12}^{F} = \int F\,ds$

- Same problem as in Question 2. Choose the correct response below that represents the work done by the force F, $U_{1\to2}^{(F)}$,in moving bar OB to an arbitrary angle of $\theta > 0$.
  - (a) $U_{1\to2}^{(F)} = 0$
  - (b) $U_{1\to2}^{(F)} = FLsin(\theta)$
  - (c) $U_{1\to2}^{(F)} = -FLsin(\theta)$
  - (d) $U_{1\to2}^{(F)} = FLcos(\theta)$
  - (e) None of the above





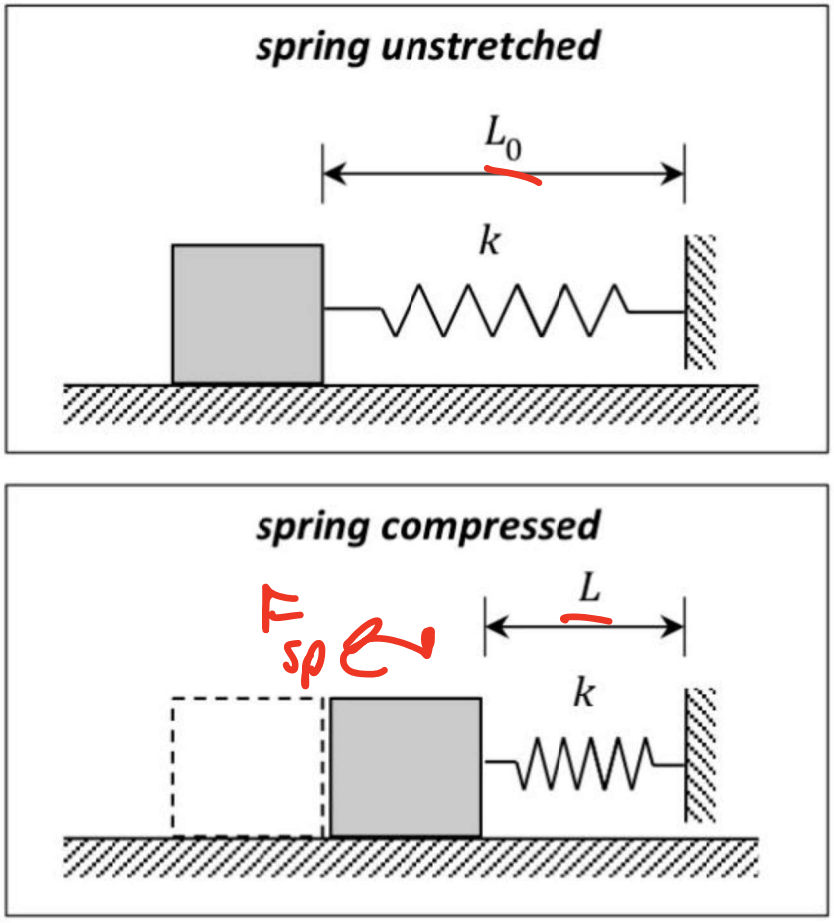
$\Delta x = L\sin\theta$

$U_{12}^{F} = \int F\,ds = \int F_x\,dx + \int F_y\,dy = F\int dx = F\Delta x$

$U_{12}^{F} = FL\sin\theta$

Question #4

- A spring of stiffness k and with an unstretched length of L_0 has been compressed to the point that the spring has a length of L, where $L < L_0$. Choose the response below that accurately describes the potential energy, V, of the spring in this compressed state.
  - (a) $V = 0$
  - (b) $V = -\frac{1}{2}kL^2$
  - (c) $V = +\frac{1}{2}kL^2$
  - (d) $V = +\frac{1}{2}k(L - L_o)^2$
  - (e) None of the above



$V = \frac{1}{2}k(L - L_0)^2$

$(L_0 - L)^2$

Question #5

$$U_{1\to 2}^{nc} = \int \vec{F} \cdot d\vec{s} = \int F_x dx + \int F_y dy$$

- What is the definition that best describe of work done on an object by a constant force?
  - (a) force times displacement
  - (b) force times displacement where the force and displacement are in the same direction
  - (c) force times velocity
  - (d) force times duration in time
  - (e) none of the above