ME 274: Basic Mechanics II
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Quiz #7

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

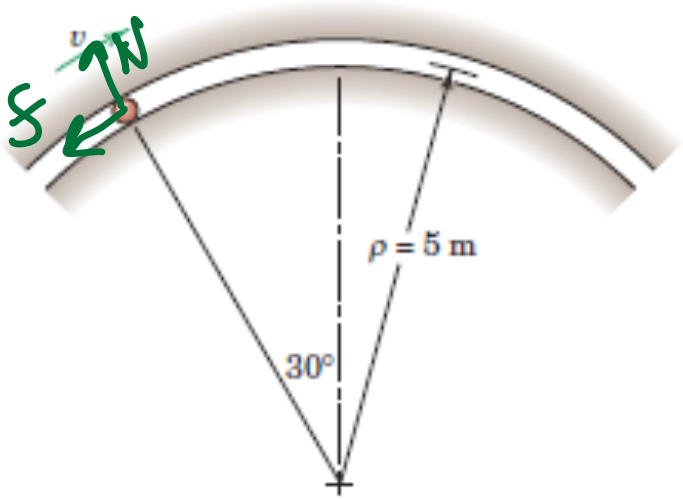
By Charles M. Krousgrill, Jeffrey F. Rhoads

What method?

$\vec{a} = \dot{v}\hat{e}_t + \frac{v^2}{\rho}\hat{e}_n$

- A) Newton's Law
- B) Work-Energy
- C) LIM
- D) AIM

3/49 The 0.1-kg particle has a speed $v = 10$ m/s as it passes the 30° position shown. The coefficient of kinetic friction between the particle and the vertical-plane track is $\mu_k = 0.20$. Determine the magnitude of the total force exerted by the track on the particle. What is the deceleration of the particle?



Problem 3/49

N : looking at one moment in time

W-E

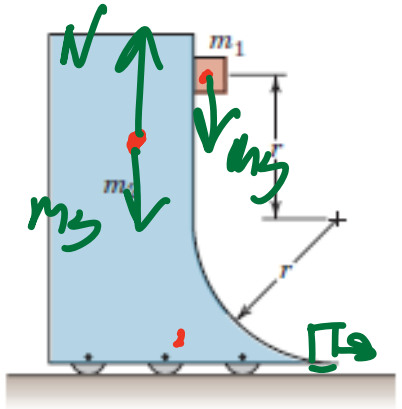
LIM

A+M

What method?

- A) Newton's Law
- B) Work-Energy
- C) LIM
- D) AIM

3/185 The slider of mass m_1 is released from rest in the position shown and then slides down the right side of the contoured body of mass m_2. For the conditions $m_1 = 0.50$ kg, $m_2 = 3$ kg, and $r = 0.25$ m, determine the absolute velocities of both masses at the instant of separation. Neglect friction.



Problem 3/185

N: will not find velocity

W-E: $U_{1-2}^{nc} = 0$

LIM: LM_x, conserved
LM_y, no

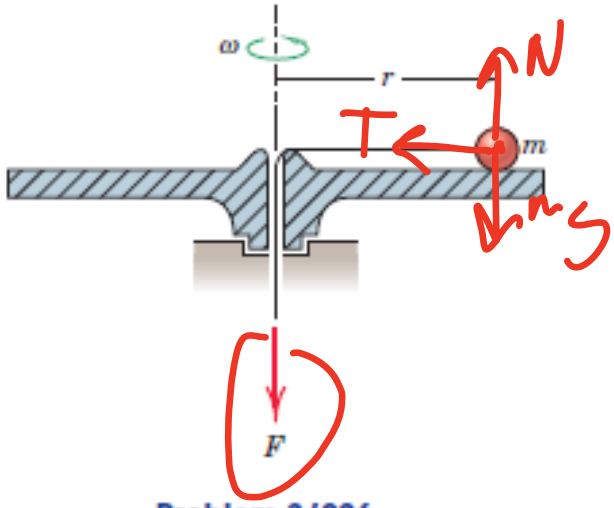
AIM: no rotation involved

include both m_1 & m_2 in system

What method?

- ~~A) Newton's Law~~
- B) Work-Energy
- ~~C) LIM~~ : no s/c LM not conserved
- D) AIM

3/226 The small particle of mass m and its restraining cord are spinning with an angular velocity ω on the horizontal surface of a smooth disk, shown in section. As the force F is slightly relaxed, r increases and ω changes. Determine the rate of change of ω with respect to r and show that the work done by F during a movement dr equals the change in kinetic energy of the particle.



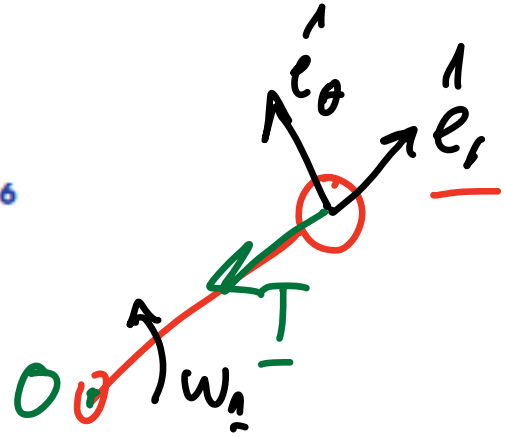
Problem 3/226

W-E: $U_{12}^{nc} = \int F\,ds$

$= F(R_2 - R_1)$

AIM: $\vec{M}_O = 0$

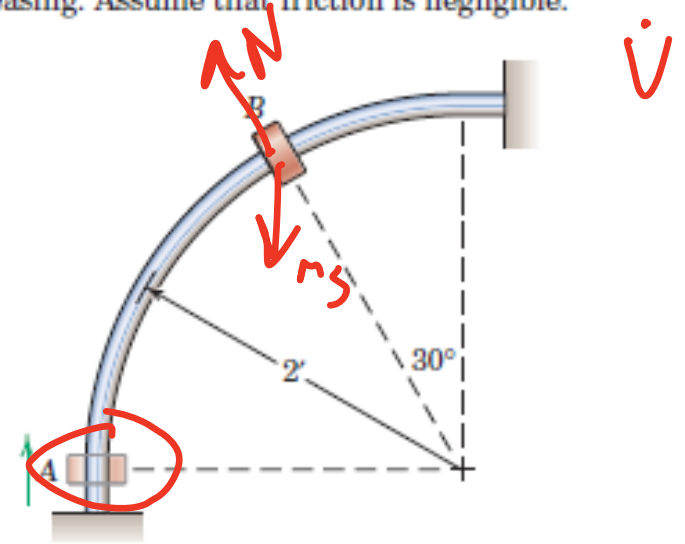
$\vec{H}_{O1} = \vec{H}_{O2}$



What method?

- A) Newton's Law
- B) Work-Energy
- C) LIM
- D) AIM

3/48 A 2-lb slider is propelled upward at A along the fixed curved bar which lies in a vertical plane. If the slider is observed to have a speed of 10 ft/sec as it passes position B, determine (a) the magnitude N of the force exerted by the fixed rod on the slider and (b) the rate at which the speed of the slider is decreasing. Assume that friction is negligible.



Problem 3/48

- only looking at time B
- $\vec{a}$ and F

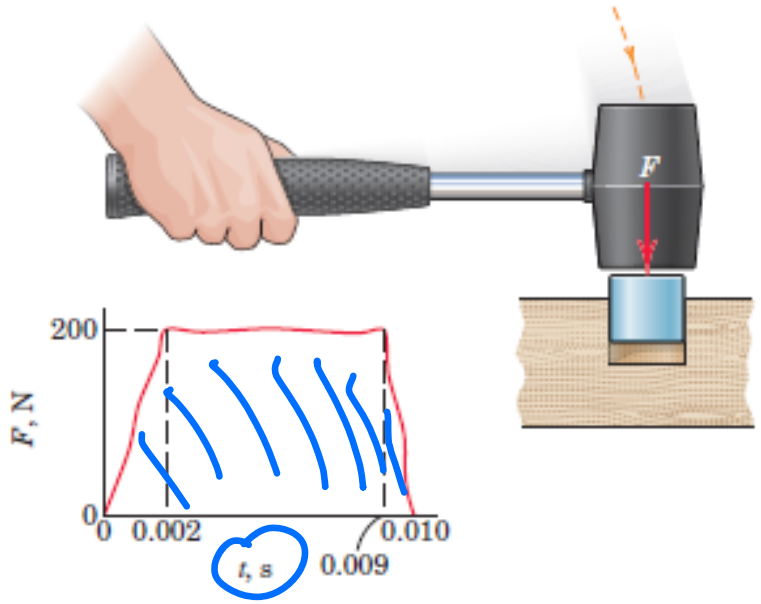
What method?

- A) Newton's Law
- B) Work-Energy
- C) LIM
- D) AIM

$\int F\,dt$

V_2

3/173 The rubber mallet is used to drive a cylindrical plug into the wood member. If the impact force varies with time as shown in the plot, determine the magnitude of the linear impulse delivered by the mallet to the plug.

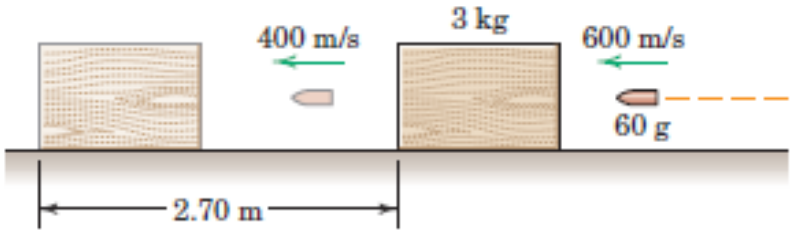


Problem 3/173

What method?

- A) Newton's Law
- B) Work-Energy
- C) LIM
- D) AIM

3/178 A 60-g bullet is fired horizontally with a velocity $v_1 = 600$ m/s into the 3-kg block of soft wood initially at rest on the horizontal surface. The bullet emerges from the block with the velocity $v_2 = 400$ m/s, and the block is observed to slide a distance of 2.70 m before coming to rest. Determine the coefficient of kinetic friction μ_k between the block and the supporting surface.



Problem 3/178

· inputs use LIM

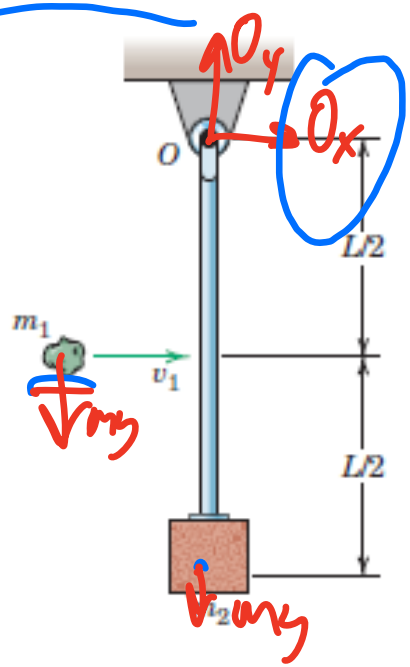
· use W-E for sliding block

What method?

- A) Newton's Law
- B) Work-Energy
- C) LIM
- D) AIM

$\sum M_O = 0$

3/222 A wad of clay of mass m_1 with an initial horizontal velocity v_1 hits and adheres to the massless rigid bar which supports the body of mass m_2, which can be assumed to be a particle. The pendulum assembly is freely pivoted at O and is initially stationary. Determine the angular velocity $\dot{\theta}$ of the combined body just after impact. Why is linear momentum of the system not conserved?



Problem 3/222

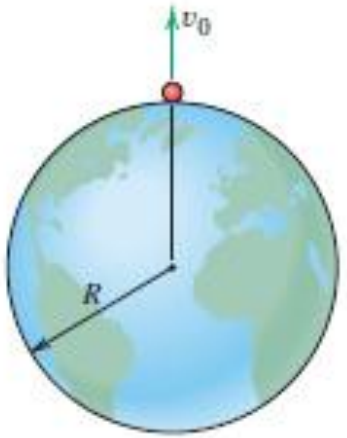
$\sum F$

$\sum M_O$

What method?

- A) Newton's Law
- B) Work-Energy
- C) LIM
- D) AIM

3/122 A projectile is launched from the north pole with an initial vertical velocity v_0. What value of v_0 will result in a maximum altitude of $R/2$? Neglect aerodynamic drag and use $g = 9.825$ m/s^2 as the surface-level acceleration due to gravity.

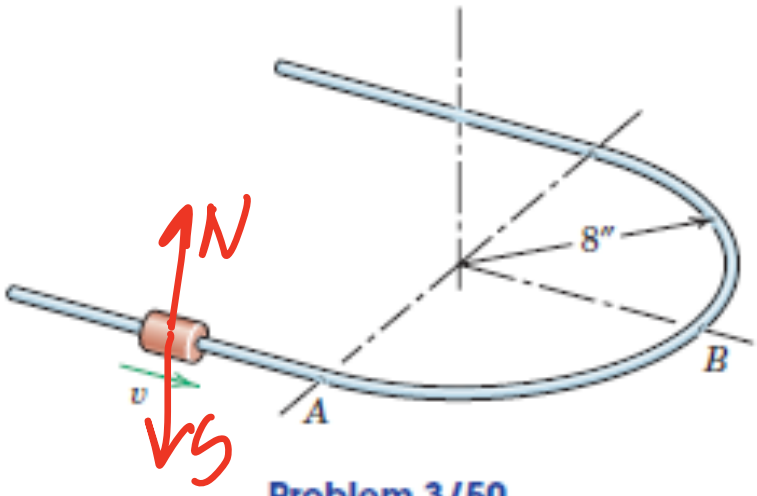


Problem 3/122

What method?

- A) Newton's Law
- B) Work-Energy
- C) LIM
- D) AIM

3/50 The 4-oz slider has a speed $v = 3$ ft/sec as it passes point A of the smooth guide, which lies in a horizontal plane. Determine the magnitude R of the force which the guide exerts on the slider (a) just before it passes point A of the guide and (b) as it passes point B.



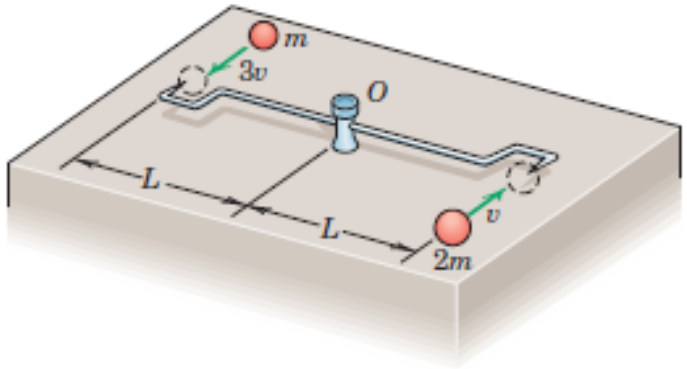
Problem 3/50

asks for forces at specific moments in time

What method?

- A) Newton's Law
- B) Work-Energy
- C) LIM
- D) AIM

3/220 The small spheres, which have the masses and initial velocities shown in the figure, strike and become attached to the spiked ends of the rod, which is freely pivoted at O and is initially at rest. Determine the angular velocity ω of the assembly after impact. Neglect the mass of the rod.



Problem 3/220

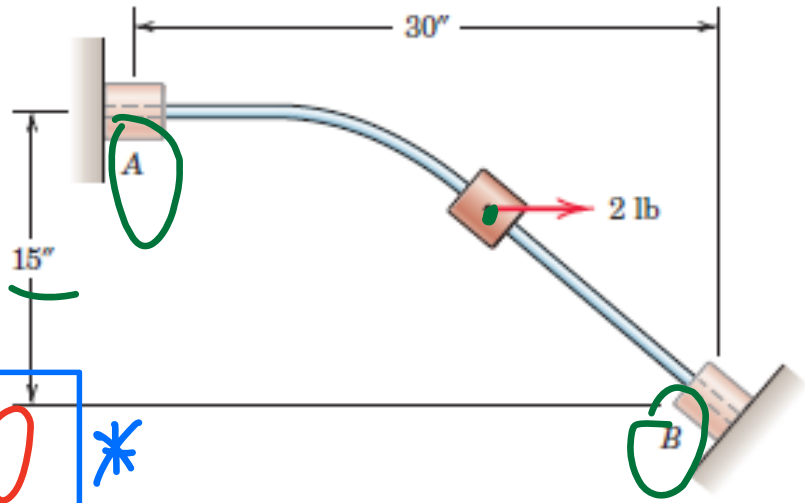
$\vec{M} = 0$

· impact throws out W-E

What method?

- A) Newton's Law
- B) Work-Energy
- C) LIM
- D) AIM

3/100 The 1.5-lb collar slides with negligible friction on the fixed rod in the vertical plane. If the collar starts from rest at A under the action of the constant 2-lb horizontal force, calculate its velocity v as it hits the stop at B.



Problem 3/100

given two moments in time

$U_{12}^{nc} = 0$ *

linear momentum not conserved

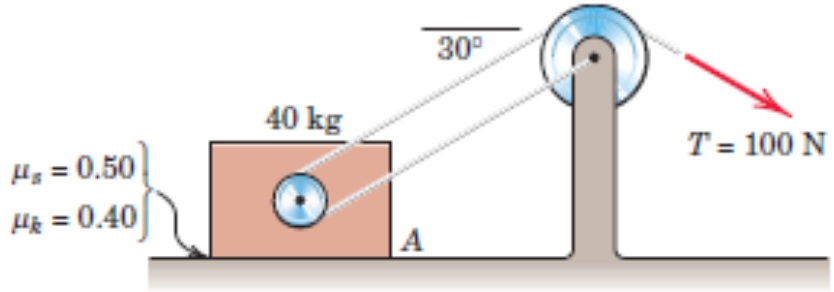
and angular momentum not conserved

What method?

asks for $\vec{a}$ at this specific moment

- A) Newton's Law
- B) Work-Energy
- C) LIM
- D) AIM

3/37 Compute the acceleration of block A for the instant depicted. Neglect the masses of the pulleys.

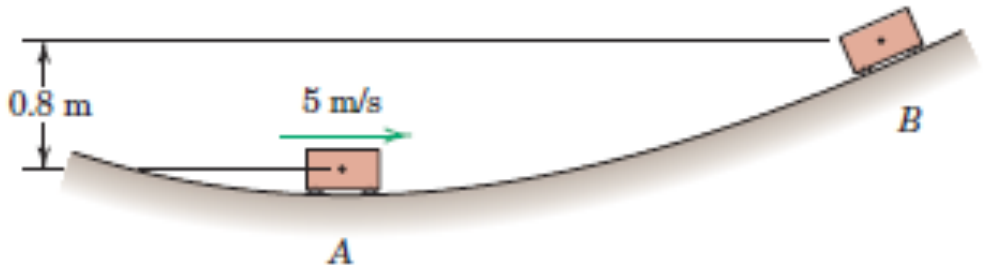


Problem 3/37

What method?

- A) Newton's Law
- B) Work-Energy
- C) LIM
- D) AIM

3/98 The small body has a speed $v_A = 5$ m/s at point A. Neglecting friction, determine its speed v_B at point B after it has risen 0.8 m. Is knowledge of the shape of the track necessary?



Problem 3/98

$\cdot V_{1_2}^{nc} = 0$

· LIM no good b/c $\int F dt \neq 0$

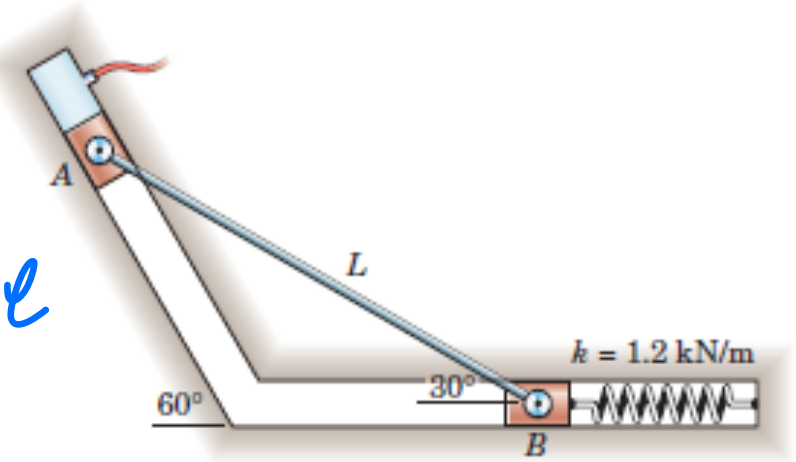
AIM no good b/c $\int \vec{M}_O dt \neq 0$

↳ and nothing is rotating

What method?

- A) Newton's Law
- B) Work-Energy
- C) LIM
- D) AIM

3/130 The two 0.2-kg sliders A and B are connected by a light rigid bar of length $L = 0.5$ m. If the system is released from rest while in the position shown with the spring undeformed, determine the maximum compression δ of the spring. Note the presence of a constant 0.14-MPa air pressure acting on one 500-mm^2 side of slider A. Neglect friction. The motion occurs in a vertical plane.



Problem 3/130

- springs are involved
- 2 moments in time

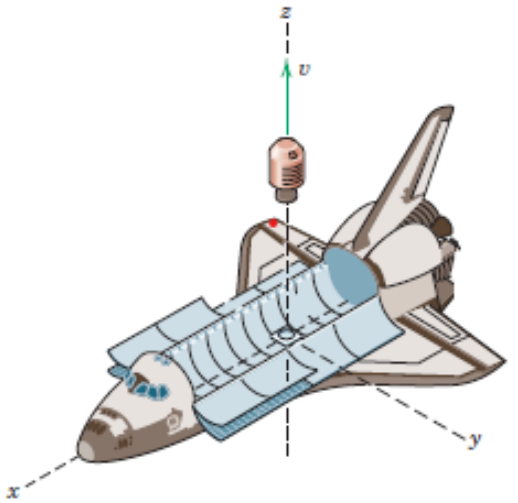
$$U'^{2}_{nc} = 0$$

What method?

- A) Newton's Law
- B) Work-Energy
- C) LIM
- D) AIM

· all forces are internal forces

3/193 The space shuttle launches an 800-kg satellite by ejecting it from the cargo bay as shown. The ejection mechanism is activated and is in contact with the satellite for 4 s to give it a velocity of 0.3 m/s in the z-direction relative to the shuttle. The mass of the shuttle is 90 Mg. Determine the component of velocity v_f of the shuttle in the minus z-direction resulting from the ejection. Also find the time average F_{av} of the ejection force.

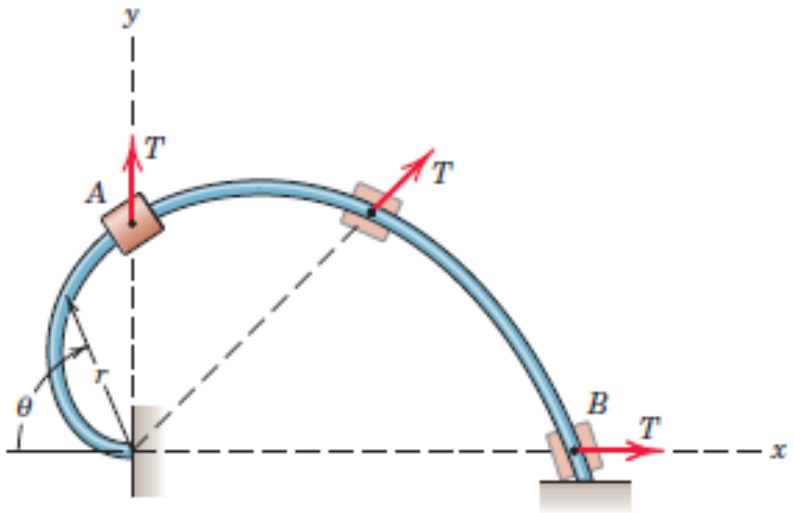


Problem 3/193

What method?

- A) Newton's Law
- B) Work-Energy
- C) LIM
- D) AIM

3/126 The 0.5-kg collar slides with negligible friction along the fixed spiral rod, which lies in the vertical plane. The rod has the shape of the spiral $r = 0.3\theta$, where r is in meters and θ is in radians. The collar is released from rest at A and slides to B under the action of a constant radial force $T = 10$ N. Calculate the velocity v of the slider as it reaches B.



Problem 3/126

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

might be tough but you can do it

LIM & AIM no good b/c $\int F\,dt \neq 0$ and $\int \vec{M}_O\,dt \neq 0$

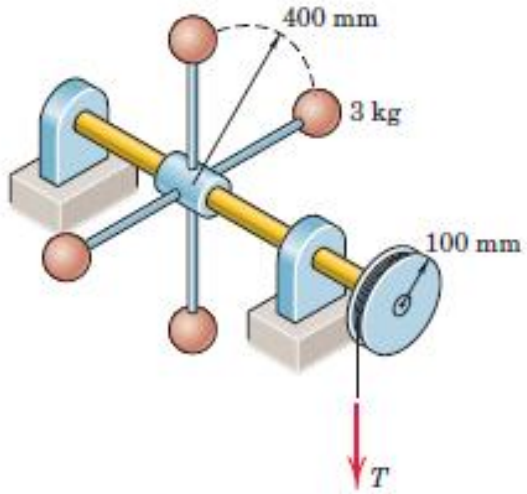
What method?

- A) Newton's Law
- B) Work-Energy
- C) LIM
- D) AIM

use $\int \dot{H}_O \, dt$

· no other equation gets you this

3/223 The assembly starts from rest and reaches an angular speed of 150 rev/min under the action of a 20-N force T applied to the string for t seconds. Determine t. Neglect friction and all masses except those of the four 3-kg spheres, which may be treated as particles.



Problem 3/223

What method?

- A) Newton's Law
- B) Work-Energy
- C) LIM
- D) AIM

A 75-kg man stands on a spring scale in an elevator. During the first 3 seconds of motion from rest, the tension T in the hoisting cable is 8300 N. Find the reading R of the scale in newtons during this interval and the upward velocity v of the elevator at the end of the 3 seconds. The total mass of the elevator, man, and scale is 750 kg.

- asks for forces!
but at one moment in time