Course Assistants (CAs) in TAM.

210/211/212/251

Wed night. emails instructions.

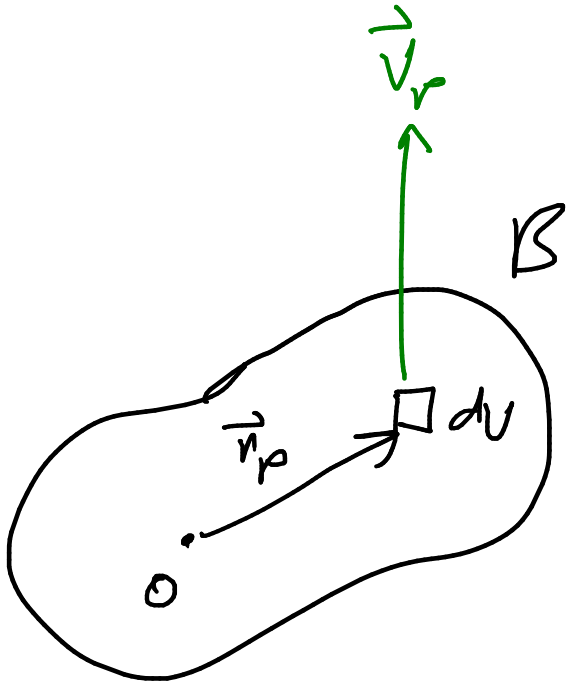
Energy

$$E = T + V$$

kinetic + potential

point mass: $T = \frac{1}{2} m v^2$

body: $T = \iiint_B \frac{1}{2} \rho v_p^2 \, dV$



rigid bodies:

$$T = \frac{1}{2} m v_c^2 + \frac{1}{2} I_c \omega^2$$

v_c = center of mass speed

trans KE

rotational KE

must be CM.

Special cases:

$T = \frac{1}{2} I_O \omega^2$ $\quad O$ = fixed point

$\rightarrow T = \frac{1}{2} I_M \omega^2$ $\quad M$ = inst. center

↑ rot KE

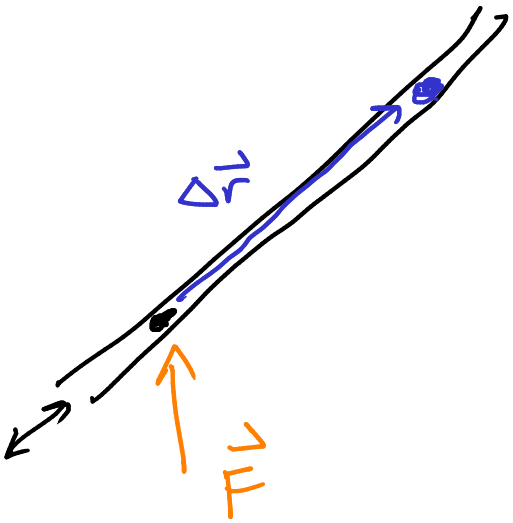
gravitational PE of RB = $V = mgh_c$

Work-energy principle: $W = \Delta E = E_f - E_i$

$$W = \int_{\vec{r}_0}^{\vec{r}_f} \vec{F} \cdot d\vec{r} = \int_{t_0}^{t_f} \vec{F} \cdot \vec{v}\, dt$$

↑ incremental work

↑ power



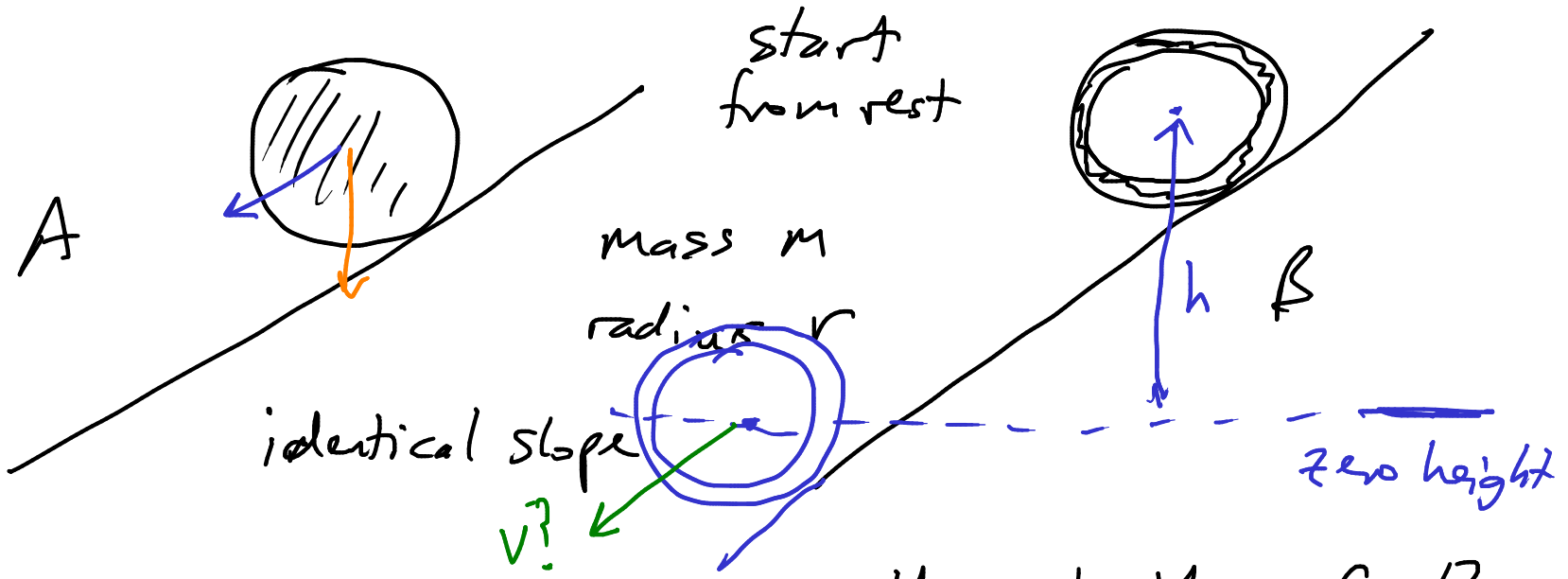
$$W = \vec{F} \cdot \Delta\vec{r}$$

if $\vec{F}(t) \Rightarrow$ $W = \int_{\vec{r}_0}^{\vec{r}_f} \vec{F} \cdot d\vec{r}$

$$\vec{v} = \frac{d}{dt}\vec{r} = \frac{d\vec{r}}{dt} \qquad d\vec{r} = \vec{v}\,dt$$

Ex

rolling w/o slip



Q: Which cylinder reaches the bottom first?

Drop height h, what is v?

W-E princ. → use PE for gravity, not work.

$$0 = E_f - E_i \Rightarrow E_f = E_i$$

$$T_f = V_i$$

hollow cyl has more R. KE

$$\frac{1}{2}mv_c^2 + \frac{1}{2}I_c\omega^2 = mgh$$

$v_c = \omega r$

$$(mr^2 + I_c)\omega^2 = 2mgh$$

A Solid

$$I_c = \frac{1}{2}mr^2$$

$$v_c = A.\ \sqrt{\frac{1}{2}gh}$$

B. $\sqrt{\frac{3}{4}gh}$

C. $\sqrt{gh}$

D. $\sqrt{\frac{4}{3}gh}$

E. $\sqrt{2gh}$

B hollow

$$I_c = mr^2$$

$$v_c = A.$$

C. $\sqrt{gh}$

E.

Who reaches the bottom first?