# NYU Physics I

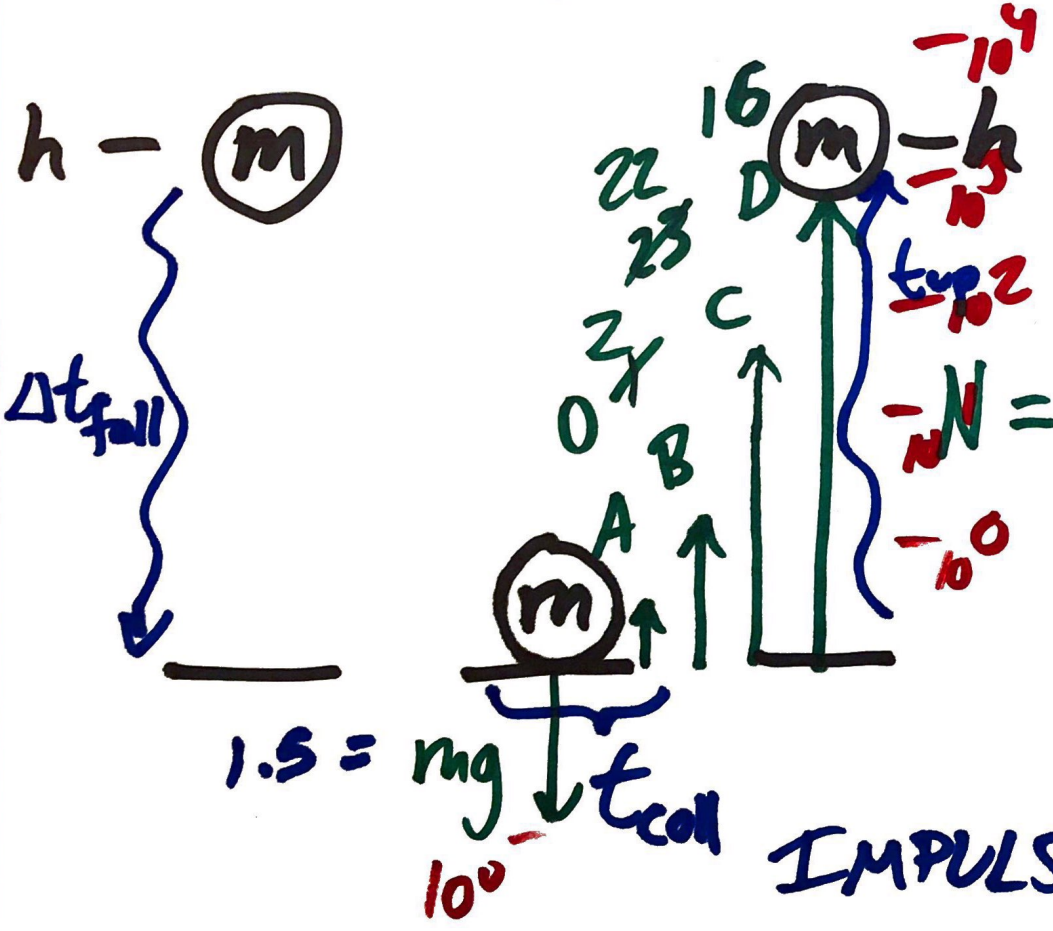
2018-10-11

- Exam 2 back
- Collect PS4 tomorrow
- Voter Reg!
- Physics in the News
  - → Soyuz
- Questions

→ impulse $\Delta \vec{p}$

→ elastic collisions

# bouncing ball




(perfectly elastic) $\Rightarrow$ KE conserved

$\vec{p}$ conserved

$\vec{p} \rightarrow \vec{F} \cdot t$

$kg\,m\,s^{-1} = kg\,m\,s^{-2} \cdot s$

IMPULSE: $\Delta p = \vec{F}_{avg} \cdot \Delta t$

$$F_{avg} = \frac{\Delta p}{\Delta t} \rightarrow \frac{m\Delta v}{\Delta t}$$

$$F = \frac{dp}{dt}$$

$$\Delta p = F_g \Delta t_{fall}$$

$p_i = 0$

$p_f = -mv$

$$(-2) -mv = F_g \Delta t_{fall} (-2)$$

$2mv$ ↓

$$F_g t_{fall}(-2) = (F_g + N) t_{coll}$$

$$F_g t_{fall}(-2) - F_g t_{coll} = N t_{coll}$$

$$N = \frac{F_g(2t_{fall} - t_{coll})}{t_{coll}} = -2F_g\left(\frac{t_{fall}}{t_{coll}} + \frac{1}{2}\right)$$

BIG

v↓ (m)  v↓ (m) ↑v

$$\Delta p = F \Delta t_{coll}$$

$$(F_g + N) t_{coll}$$

$p_i = -mv$

$p_f = mv$

$$mv - (-mv) = 2mv =$$

$$(F_g + N) t_{coll}$$

$t_{fall} = ?$

$x = x_0 + v_0 t + \frac{1}{2} a t_{fall}^2$

$0 = h - \frac{1}{2} g t_{fall}^2 \rightarrow t_{fall} = \sqrt{\frac{2h}{g}}$ $\sqrt{\frac{m}{m s^{-2}}}$

$= \sqrt{\frac{2 \cdot 1.5\,m}{10\,m s^{-2}}}$ $\sqrt{s^2} = s$ ✓

$= \sqrt{\frac{3}{10}} = 0.55\,s$

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$t_{coll} = ?$

air: $c_S = 345\,m/s$

$v_S = 3000\,m/s$

$t = \frac{dist}{vel} = \frac{5cm}{3000\,m/s} = \frac{5 \cdot 10^{-2}\,m}{3 \cdot 10^3\,m/s} = \frac{5}{3} \cdot 10^{-5}\,m\,s$

$\frac{5}{3} = 1.7$

$$N = 2mg\left(\frac{t_{fall}}{t_{roll}} + \frac{1}{2}\right)$$

$5 \cdot 10^{-1}$

$$= 2 \cdot 0.15\,kg \cdot 10\,ms^{-2}\left(\frac{0.5}{10^{-5}} + \frac{1}{2}\right)$$

$10^{-5} = 10^{4}$

$$= 0.3 \cdot 5 \cdot 10^{5}$$

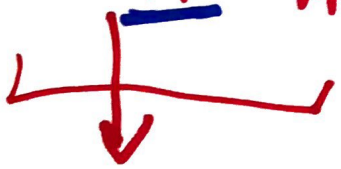
$$N = 2 \cdot 10^{5}\,kg\,m\,s^{-2}$$

$$F_g = mg = 0.15 \cdot 10 = 1.5\,kg\,ms^{-2} \uparrow 10^{5}$$

$\Delta p \rightarrow \Delta t_A \, F_A = F_B \, \Delta t_B$

$mv$

Impulse



(coll) (full)

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Work-Energy:

$W = \Delta KE$

$F \cdot d = \left(\frac{1}{2}mv^2\right)_f - \left(\frac{1}{2}mv^2\right)_i$