8/24/22 Intro Lecture

1) Intro of personnel

2) Navigate to course web page

3) Syllabus

   a) schedule
   b) required work
   c) grading

4) HW1 due Sept. 7 posted on HW page

   userid: 4222
   pwd: classical

5) Use of computational tools

6) History of energy concepts

Physics 1: Work → motion → KE

Work-KE thm:

1D motion subject to force F

$$a = \frac{dv}{dt} = \frac{dv}{dx}\frac{dx}{dt} = v\frac{dv}{dx}$$

$$W_{12} = \int_1^2 F\,dx = \int_1^2 m\left(v\frac{dv}{dx}\right)dx = \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2$$

Q: how do we know $\frac{1}{2}mv^2$ is KE, + what does it mean?

17-18th century debate between Descartes, Leibniz + Newtonian schools

Would universe run down?

colliding particles

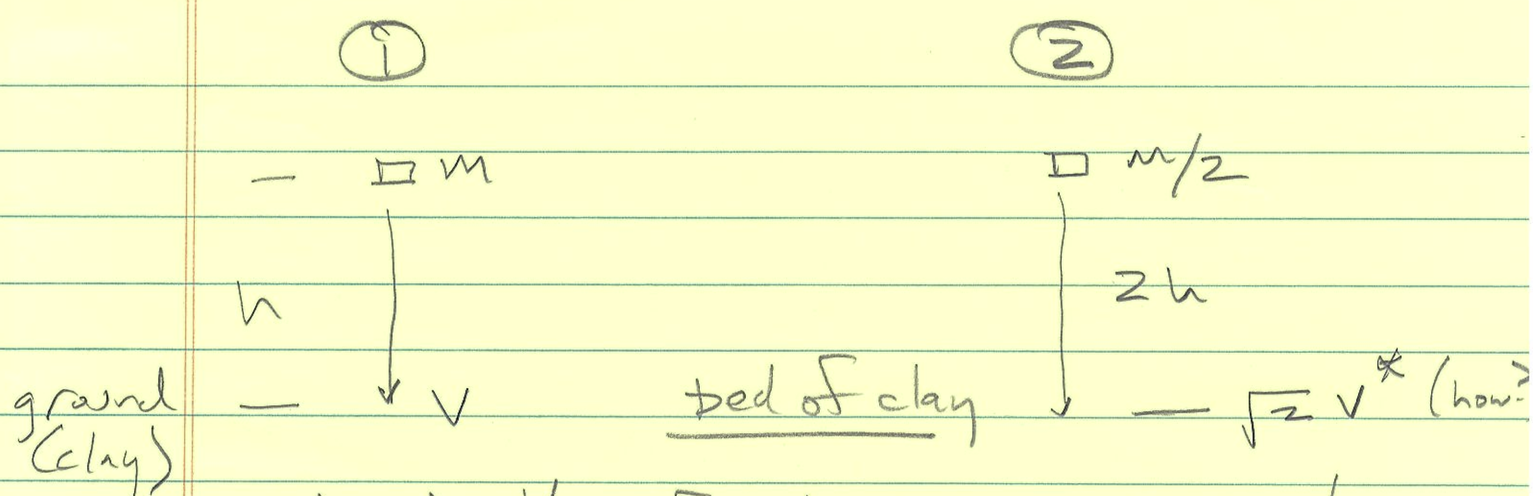
Descartes: no — God created it with a certain amount of motion, and this motion must remain. Measure of motion — vis viva (living force)

(D): universe consists of matter in collision. Must be that something is conserved in collision — mv

e.g. 2 billiard balls.

Leibniz: This can't be whole story — what about 2 balls of clay hitting + sticking. Proposed another quantity mv^2, suggested that missing vis viva went into particles of clay.

1722 Experiments 's Gravesande early 18th c.



but depth of dent was same!

* we know $mgh = \frac{1}{2}mv^2 \Rightarrow v = \sqrt{2gh}$

'sGravesande! mv doesn't work to explain experiment

$$m_1 v_1 = mv \qquad m_2 v_2 = \frac{m}{2}\sqrt{2}\,v$$

$$m_1 v_1 \neq m_2 v_2 \qquad \text{why?}$$

'sG: mv^2 works better

$$m_2 v_2^2 = \frac{m}{2} 2v^2 = mv^2$$

$\Longrightarrow$ notions of conservation of energy, momentum very unclear until 19th century. idea of heat, potential energy comes still later.

Laplace determinism ~ 1815