Announcements

- CompDay 3 due tonight!
- Homework 4 due on Monday!
- Read through 5.3 for Friday
- Responses: `rembold-class.ddns.net`

MECHANICS

With great potential. . .

Today's Objectives

- To interpret stability from potential energy curves
- To understand when and where we can use potential energies and where we need to use work
- To be able to calculate energies and forces in spherical coordinates
- To remind ourselves how basic collisions work

Q1

Suppose an object is free to move in one dimension and has its potential energy given by:

$$U(x) = Ax^2 + (A - B)x^3$$

Under what conditions would the particle be stable at the point $x = 0$?

A) When $A > B$

B) When $A > 0$

C) The particle is not even in equilibrium at $x = 0$

D) This is an equilibrium point, but it will never be stable

Q2

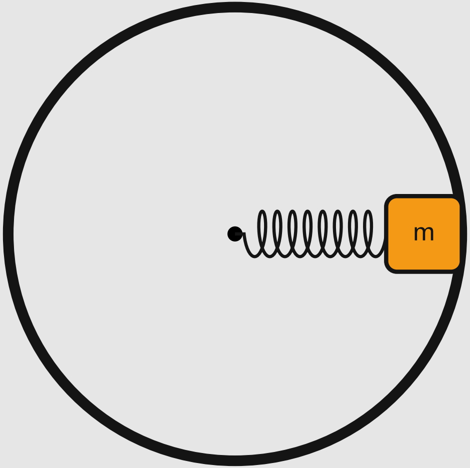
A block goes around the frictionless loop of radius R to the right. A very weak spring of spring constant k is attached to the block, such that, despite being stretched distance Δx and pulling on the block, the block stays in contact with the track. If the block starts from rest at the horizontal position, which expression best describes its velocity at the bottom of the loop?

A) $\sqrt{2gR}$

B) $\sqrt{2gR} + \frac{1}{2}k(\Delta x)^2$

C) $\sqrt{2gR - \frac{k}{2m}(\Delta x)^2}$

D) $\sqrt{2gR + \frac{k}{2m}(\Delta x)^2}$



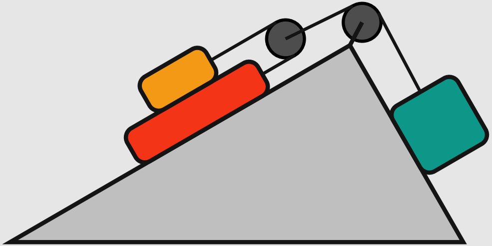
Q3

The below system has frictionless surfaces, perfect pulleys, and massless strings. Would energy be conserved in the system of the 3 blocks?

A) Of course!

B) No, not here

C) It would depend on the masses



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Q4

A particular force is given by

$$\vec{\boldsymbol{F}} = -\frac{\alpha}{r^5}\hat{\mathbf{r}}$$

where α is a positive constant. Is the force conservative?

A) Yes

B) No

Q5

A mass m moves in a circular orbit about the origin in the field of an attractive force with potential given by

$$U(r) = kr^4$$

Which of the following statements would be correct about the kinetic energy of the mass?

A) $T = \frac{U}{2}$
B) $T = U$
C) $T = 2U$
D) $T = 4U$

Q6

A particle of mass m and speed v_1 collides with a particle of mass $2m$ at rest. The collision is perfectly inelastic, so the particles move off together afterwards. What fraction of the initial energy is lost in the collision?

A) $\frac{1}{2}$

B) $\frac{1}{4}$

C) $\frac{2}{3}$

D) None of the above