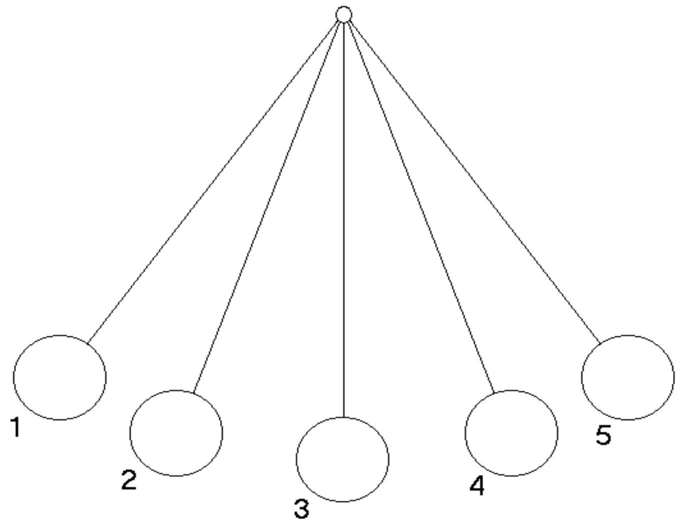
At what point is the <u>potential</u> energy the highest for a pendulum?



A) Potential energy is unrelated to height

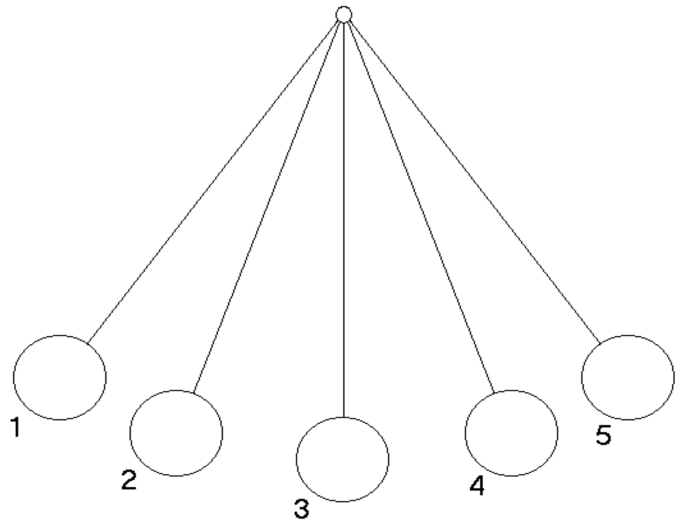
B) At the end of its path (1 & 5)

C) At the middle of its path (2 & 4)

D) At the bottom of its path (3)

E) Potential energy is constant

At what point is the potential energy the highest for a pendulum?



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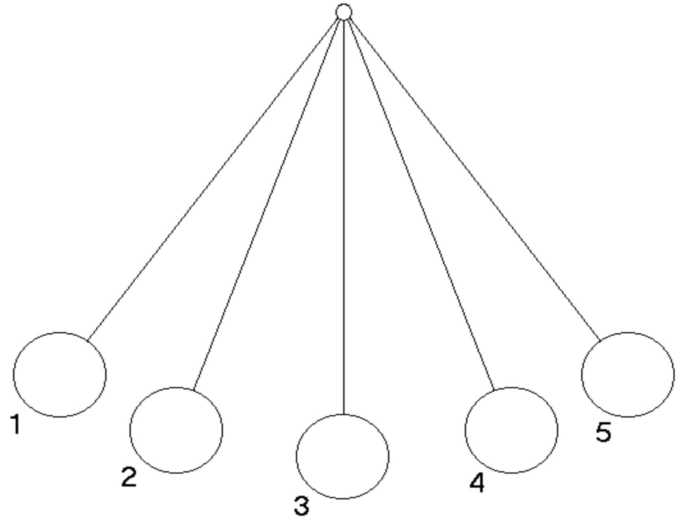
E) Potential energy is constant

At what point is the <u>kinetic</u> energy the highest for a pendulum?



A) Kinetic energy is unrelated to height

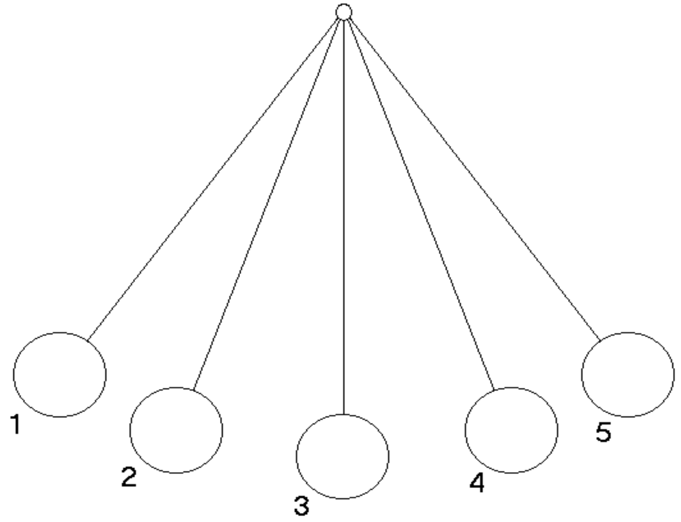
B) At the end of its path (1 & 5)

C) At the middle of its path (2 & 4)

D) At the bottom of its path (3)

E) Kinetic energy is constant

At what point is the kinetic energy the highest for a pendulum?



A) Kinetic energy is unrelated to height

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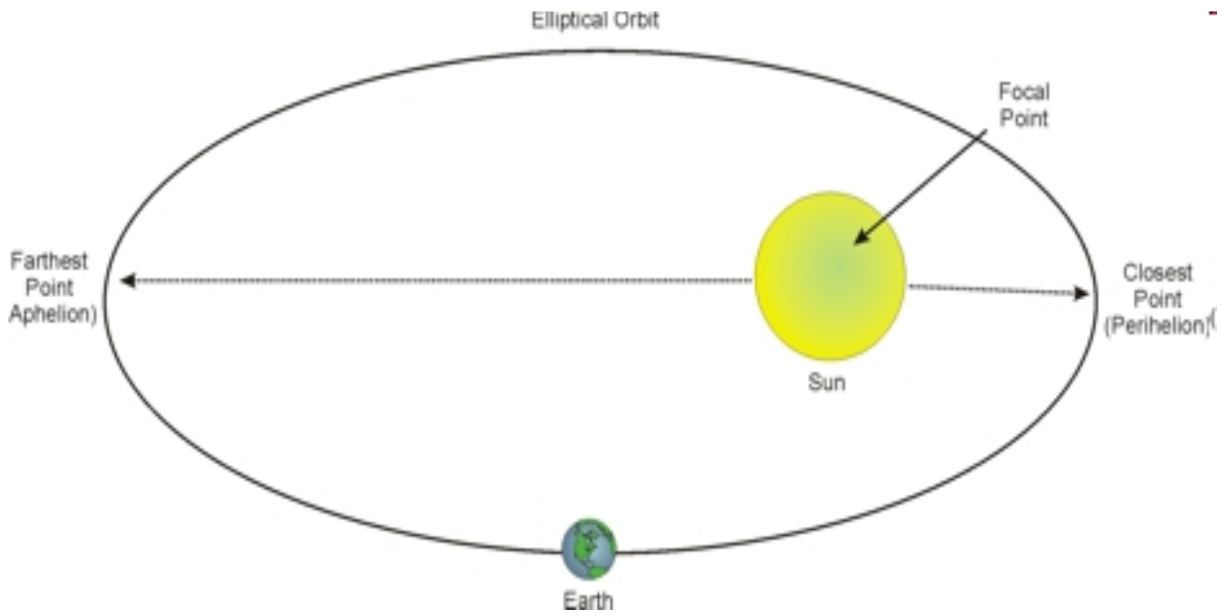
C) At the middle of its path (2 & 4)

D) At the bottom of its path (3)

E) Kinetic energy is constant

At what point is the potential energy the highest for an elliptical orbit?



A) Potential energy is unrelated to satellite motion

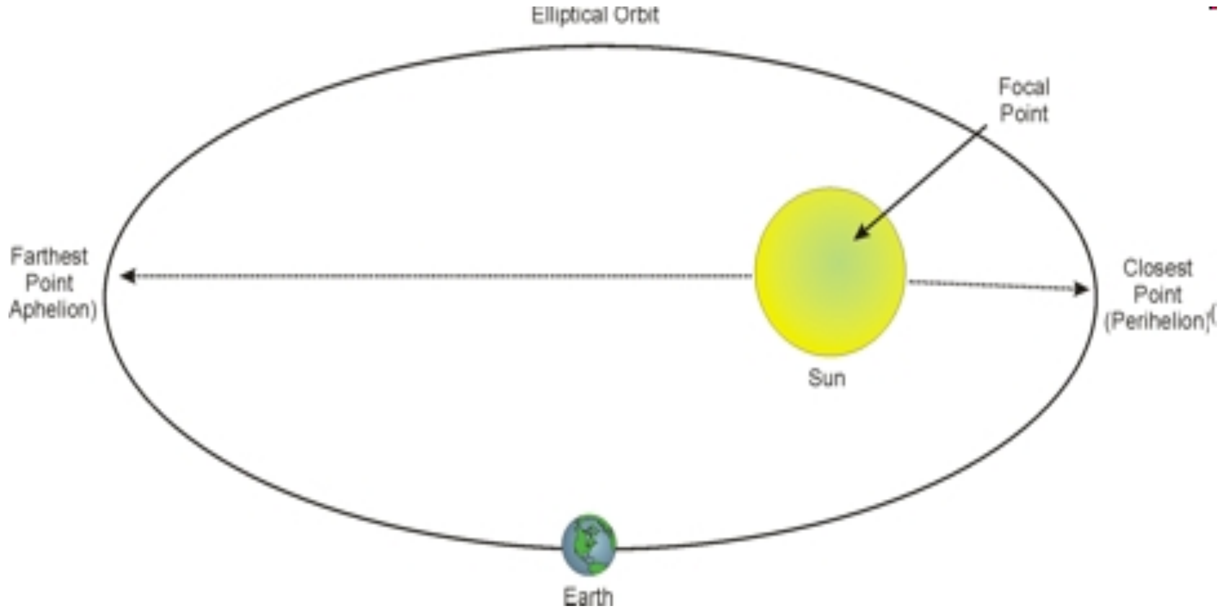
B) At the closest point of its path (Penthelion)

C) At the middle of its path

D) At the farthest point of its path (Aphelion)

E) Potential energy is constant

At what point is the potential energy the highest for an elliptical orbit?



A) Potential energy is unrelated to satellite motion

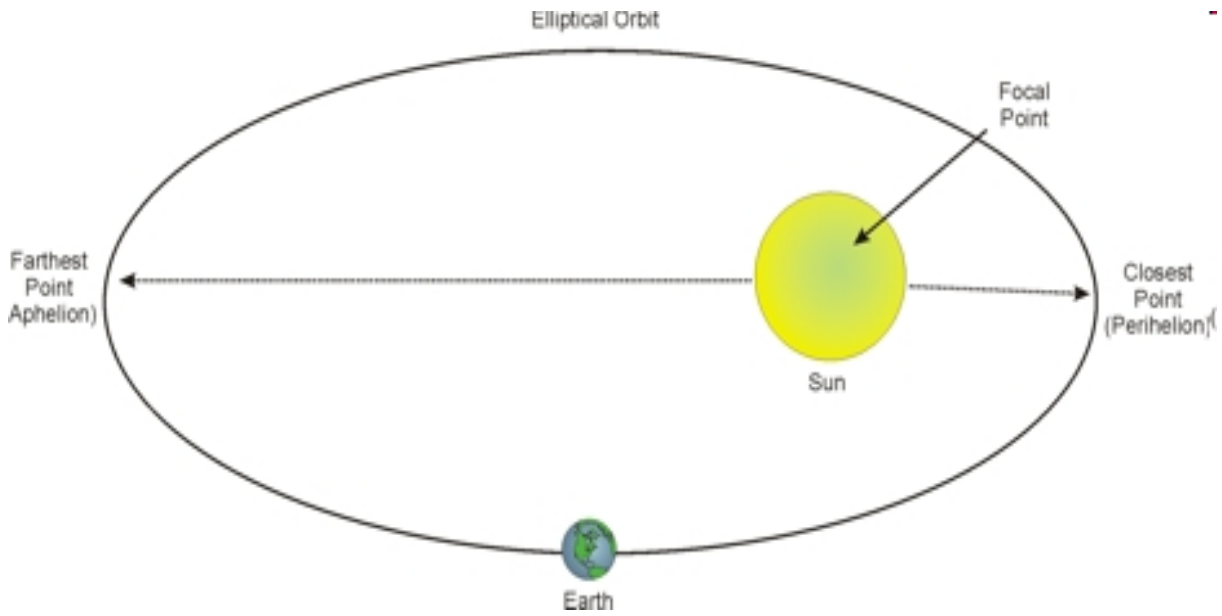
B) At the closest point of its path (Penthelion)

C) At the middle of its path

D) **At the farthest point of its path (Aphelion)**

E) Potential energy is constant

At what point is the <u>kinetic</u> energy the highest for an elliptical orbit?



A) Kinetic energy is unrelated to orbits

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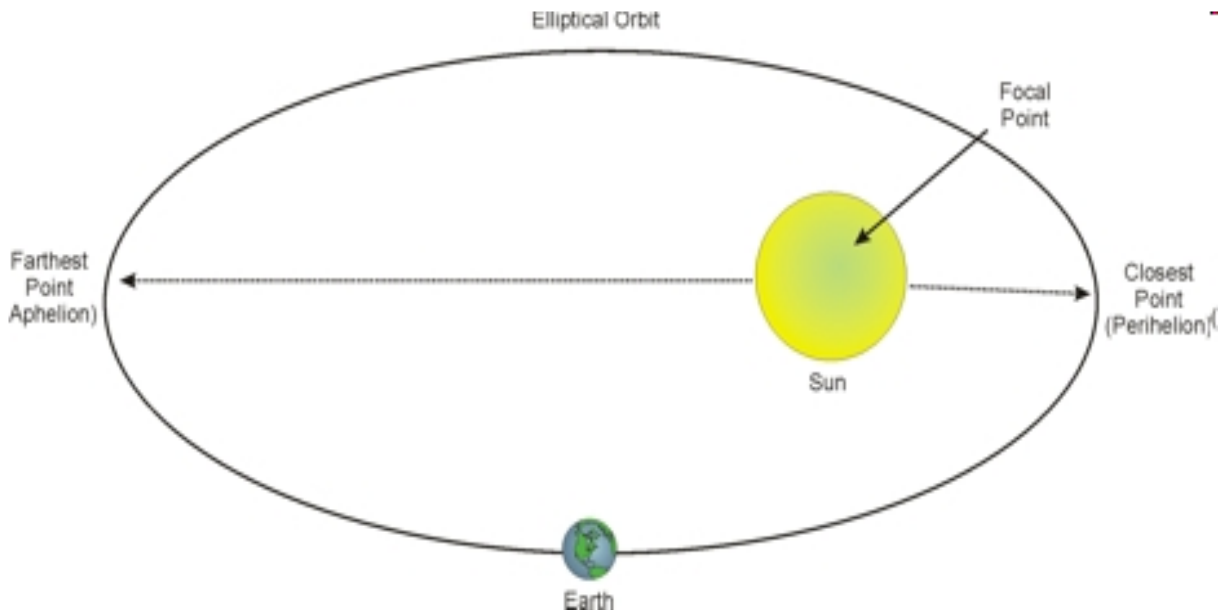
E) Kinetic energy is constant

At what point is the kinetic energy the highest for an elliptical orbit?



A) Kinetic energy is unrelated to orbits

B) At the closest point of its path (Penthelion)

C) At the middle of its path

D) At the farthest point of its path (Aphelion)

E) Kinetic energy is constant

CONSERVATIVE VS. NONCONSERVATIVE FORCES

Work done against gravity does *not* depend on the path taken

Forces for which work done doesn't depend on path but only on initial and final positions are called **conservative forces**

I.e. gravitational, elastic (spring), electric

CONSERVATIVE VS. NONCONSERVATIVE FORCES

Nonconservative forces *do* depend on the path

I.e. friction, air resistance, tension, push or pull

Add or remove energy from the system

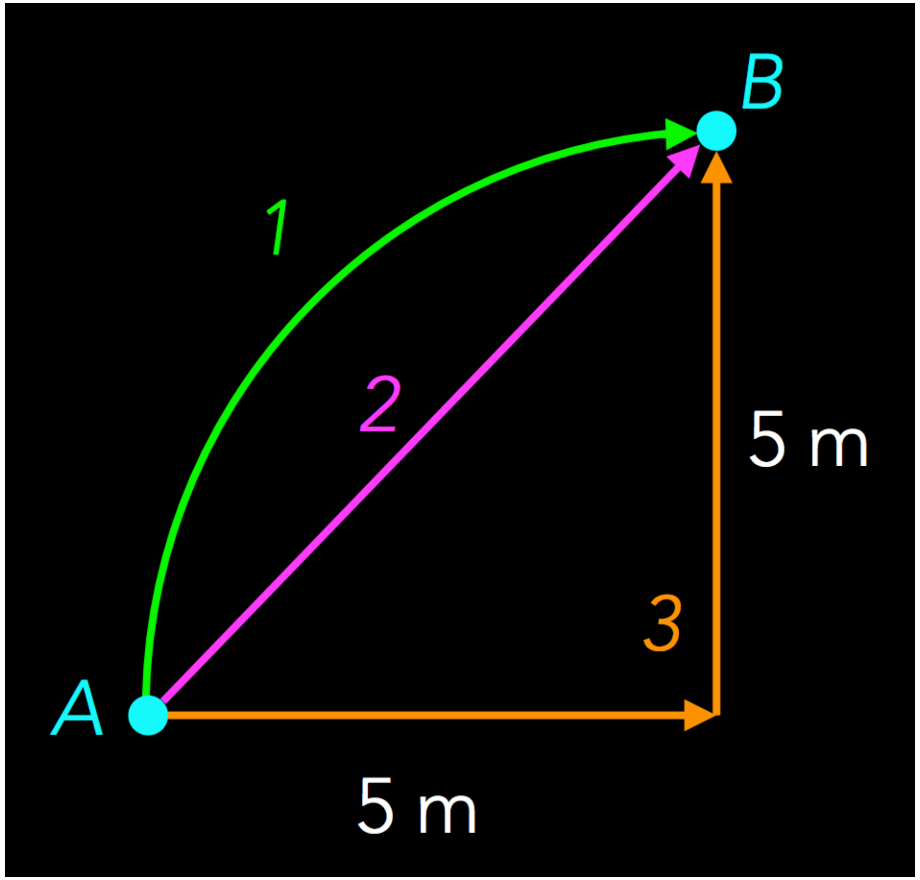
FRICTION

50N of friction act on a box that is dragged across the floor from A to B. How much work is done by friction along the three paths shown to the right?

1: (.5 xπx 5m) x -50N = -393 J

2: (5$\sqrt{}$5m) x -50N = -354 J

3: 10m x -50 N = -500 J



CONSERVATIVE FORCES AND PE

Potential energy is the energy associated with position or configuration

Only makes sense if it can be stated uniquely for a given point

Can't be done with nonconservative forces

Potential energy can be defined only for a conservative force

WORK-ENERGY THEOREM REVISITED

$W_{net} = W_C + W_{NC}$

$W_{net} = \Delta KE$

$W_C = -\Delta PE$

$W_{NC} = \Delta KE + \Delta PE$

Note: make sure to include <u>every</u> force acting on a system

CONSERVATION OF MECHANICAL ENERGY

What if there are no nonconservative forces acting on the system?

- $\Delta KE + \Delta PE = 0$
- $(KE_2 - KE_1) + (PE_2 - PE_1) = 0$
- $KE_2 + PE_2 = KE_1 + PE_1$

Total mechanical energy, *E*

- $E = KE + PE$
- $E_2 = E_1 =$ constant

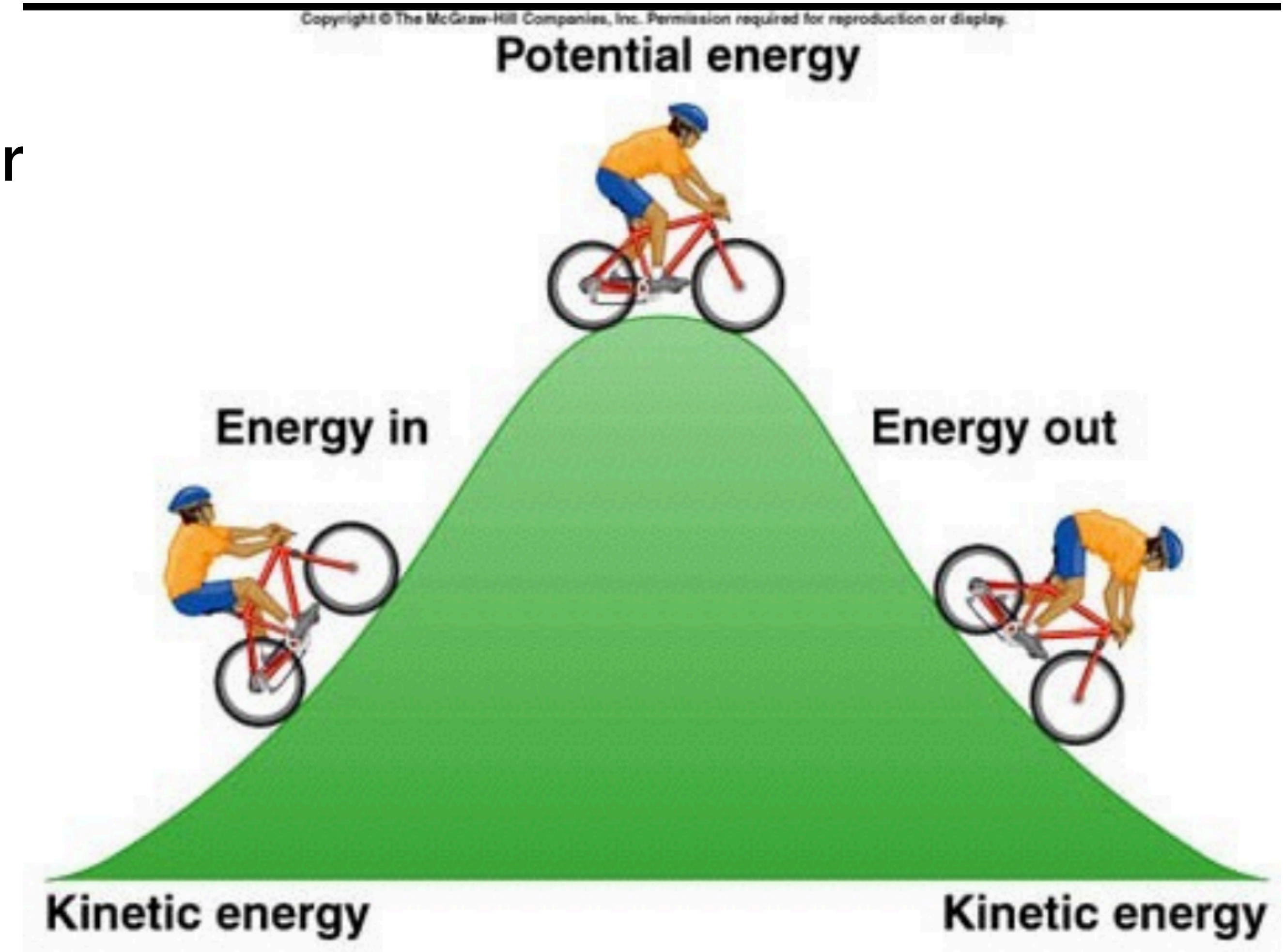
CONSERVATION OF MECHANICAL ENERGY

If only conservative forces are acting, the **total mechanical energy** of a system never changes. It stays constant: it is **conserved**

Conservative forces keep energy conserved: nonconservative forces add or remove energy from a system.

MOVEMENT OF ENERGY

Energy cannot be created or destroyed, just shuffled around



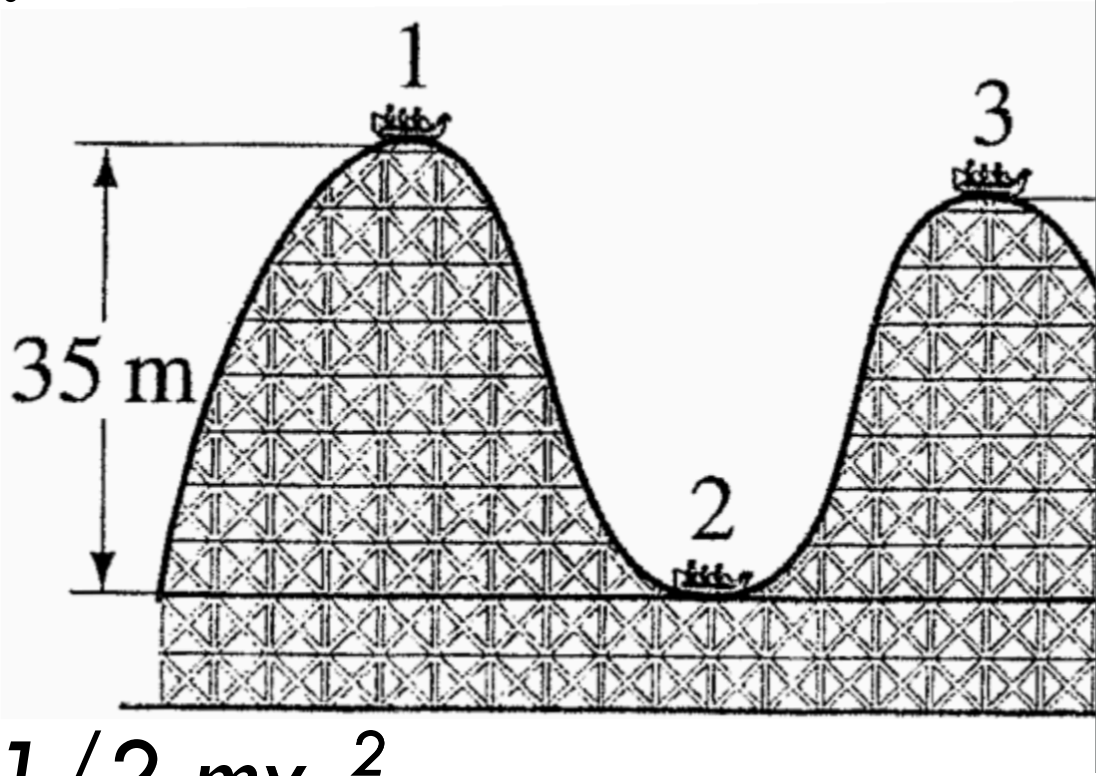
ENERGY SKATE PARK

TURN TO YOUR NEIGHBOR/GROUP OF 3 AND EXPLAIN THE DIFFERENCES BETWEEN CONSERVATIVE AND NONCONSERVATIVE FORCES, USING EXAMPLES

ROLLER COASTER PHYSICS

A rollercoaster car flies along at 25 m/s before dropping down a 35 m hill.

What will be the speed of the car at the bottom of the hill?



$\frac{1}{2} mv_1^2 + mgh_1 =$

$\frac{1}{2} mv_2^2 + mgh_2$

$mgh_2 = 0$, m's cancel out!

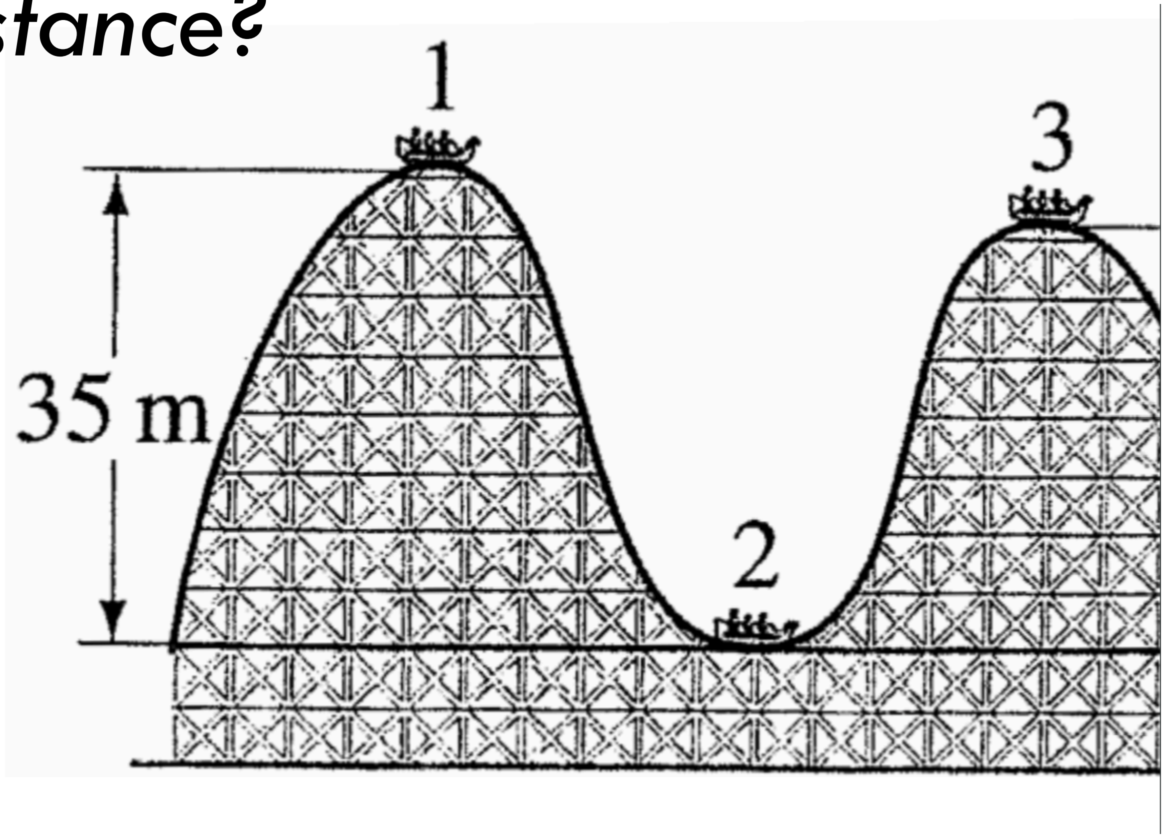
.5 (25 m/s) ^2 + 9.8 x 35= 1/2 mv_2^2

$v_2 = 36$ m/s

ROLLER COASTER PHYSICS

$v_2 = 36\ m/s$

What is the maximum height of the second hill the car could make it up without assistance?



$\frac{1}{2}\ m{v_2}^2 + mgh_2 =$

$\frac{1}{2}\ m{v_{max}}^2 + mgh_{max}$

$\frac{1}{2}\ m{v_{max}}^2 = 0,\ mgh_2 = 0$

$\frac{1}{2}\ m{v_2}^2 = mgh_{max}$

$(.5\ (36m/s)^\wedge 2)\ /\ 9.8 = h_{max}$

$h_{max} = 66\ m$

POTENTIAL ENERGY → WORK

You want to hammer in a nail on a bookcase, but you don't have a hammer! You decide to drop your physics textbook onto the nail instead. If you drop your 5 kg textbook from 2 m high, ideally how much work does the textbook do on the nail?

$-PE_g = W_g = mgh = 5 \text{ kg} \times 9.8 \times 2\text{m} = 98\text{J}$

Ideally all of the potential energy is

transferred to doing work.