

LAB GROUP (6 MAXIMUM; GIVE FULL NAMES):

1. _____ 2. _____ 3. _____
4. _____ 5. _____ 6. _____

PENGUINS IN THE JUNGLE (or Monkey, Tiger, Lion) (Monster Race)

1. Calculate the output work when a penguin is moved from the bottom to the top of the ramp.
SHOW NECESSARY DATA CLEARLY.
SHOW METHOD CLEARLY, INCLUDING EQUATION AND UNITS.

2. If efficiency is assumed to be 75%, calculate the input work.
NO NEW DATA REQUIRED.
SHOW METHOD CLEARLY, INCLUDING EQUATION AND UNITS.

3. Calculate the effort force required to move a penguin up the ramp.
SHOW NECESSARY DATA CLEARLY.
SHOW METHOD CLEARLY, INCLUDING EQUATION AND UNITS.

Crazy Train

1. How much power is expended in flipping the track?
SHOW NECESSARY DATA CLEARLY.
SHOW METHOD CLEARLY, INCLUDING EQUATION AND UNITS.

2. One horsepower is approximately 750 watts. What is the horsepower of Choo Choo ?
NO NEW DATA REQUIRED.
SHOW METHOD CLEARLY, INCLUDING EQUATION AND UNITS.

Space Shuttle

What centripetal force should a dolphin feel at the midpoint of the bottom curve? Assuming no friction as a dolphin rolls down the ramp, its loss of potential energy equals its gain of kinetic energy. This fact allows you to determine the centripetal force, as shown in the derivation below:

$$PE_{\text{loss}} = KE_{\text{gain}} \qquad F = \frac{mv^2}{r} = \frac{m2gh}{r} \qquad m = \underline{\hspace{2cm}} \text{ kg}$$

$$mgh = \frac{1}{2}mv^2 \qquad \qquad \qquad h = \underline{\hspace{2cm}} \text{ m}$$

$$v^2 = 2gh \qquad \qquad \qquad r = \underline{\hspace{2cm}} \text{ m}$$

Use the equation derived above to find the centripetal force on the dolphin as it passes the black stripe on the lower curve. SHOW METHOD CLEARLY, INCLUDING EQUATION AND UNITS.

Monkey Tree

1. How much power is expended by one elevator lifting one animal one time?

SHOW NECESSARY DATA CLEARLY.

SHOW METHOD CLEARLY, INCLUDING EQUATION AND UNITS.

2. Considering that one elevator lifts an animal while the other travels downward empty, the machine essentially lifts one animal at a time continuously. How much work would be done if the machine were left on for one hour?

NO NEW DATA REQUIRED. Hint: since power = work/time, then work = power x time

SHOW METHOD CLEARLY, INCLUDING EQUATION AND UNITS.

BRAVE BIKERS (Dalmation Chase)

Assuming no friction as a biker travels down the ramp, its loss of potential energy equals its gain of kinetic energy. The derivation shown below uses this relationship to determine the biker's maximum speed at the bottom of the ramp. Find this speed.

SHOW NECESSARY DATA CLEARLY.

SHOW METHOD CLEARLY, INCLUDING EQUATION AND UNITS.

$$PE_{\text{loss}} = KE_{\text{gain}} \qquad mgh = \frac{1}{2}mv^2 \qquad v^2 = 2gh \qquad v = \sqrt{2gh}$$

ZG Climber

Match the items below with the numbered labels on the apparatus.

- _____ a. kinetic energy is transformed to gravitational potential energy
- _____ b. gravitational potential energy is transformed to kinetic energy and heat
- _____ c. work in the motor is transformed to kinetic energy
- _____ d. centripetal force is the greatest here
- _____ e. centripetal force is the least here