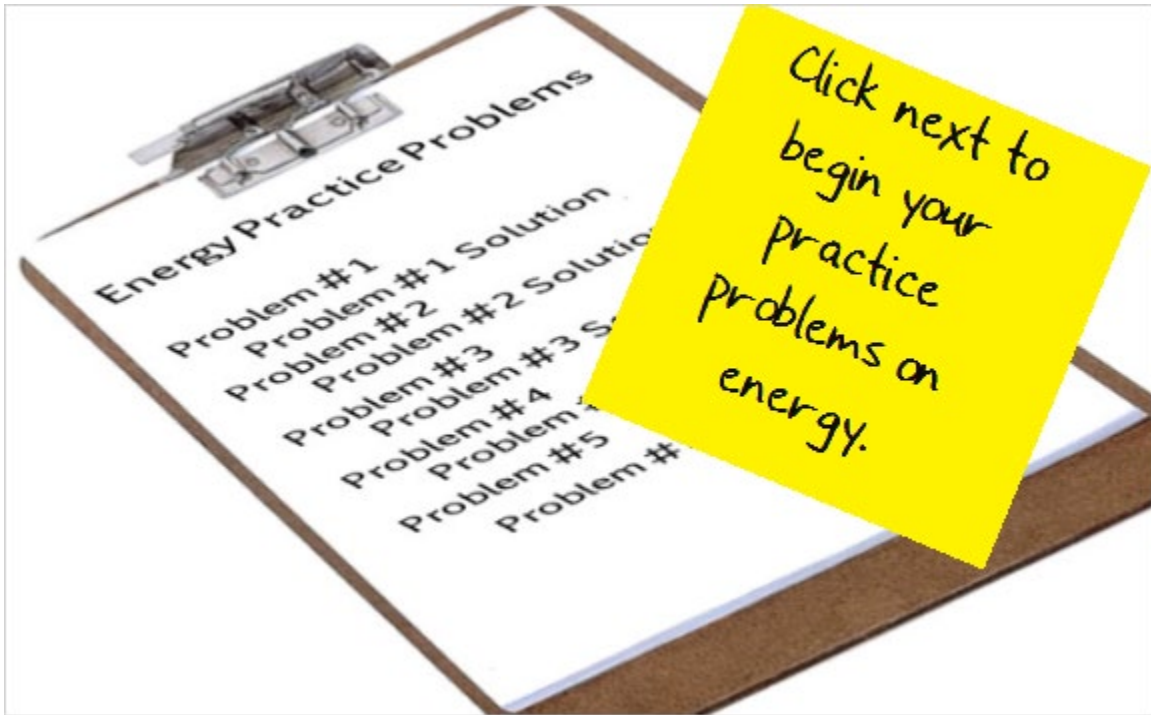


Module 4: Energy
Topic 2 Content: Energy Transformations Practice Solutions




Introduction

Module 4: Energy

Topic 2 Content: Energy Transformations Practice Solutions

DIRECTIONS: Solve the problem below. Make sure that you work out the problem, then type in your answer in the blank provided. Click submit after entering your answer.



Enter your answer here:

A 6 kg bowling ball is lifted from a shelf 1 meter high to a shelf 1.6 meters high. What is the change in potential energy of the bowling ball?

Problem 1

A 6 kg bowling ball is lifted from a shelf 1 meter high to a shelf 1.6 meters high. What is the change in potential energy of the bowling ball?

Module 4: Energy

Topic 2 Content: Energy Transformations Practice Solutions

Problem 1

Remember, you can click the magnifying glass to zoom images.

$\Delta PE = PE - PE_0$
 $PE = mgh$
 $m = 6.0 \text{ kg}$
 $g = 9.8 \frac{\text{m}}{\text{s}^2}$
 $h_0 = 1.0 \text{ m}$
 $h = 1.6 \text{ m}$

$PE_0 = mgh_0$
 $PE_0 = (6)(9.8)(1) = 58.8 \text{ J}$

$PE = mgh$
 $PE = (6)(9.8)(1.6) = 94.1 \text{ J}$

$\Delta PE = PE - PE_0 = 94.1 - 58.8$
 $\Delta PE = 35.3 \text{ J}$

$\Delta PE = mg \Delta h$
 $\Delta PE = mg(h - h_0)$
 $\Delta PE = (6)(9.8)(1.6 - 1.0) = 35.3 \text{ J}$

To find the change in potential energy, you need to subtract the initial potential energy from the final potential energy. Potential energy is equal to mgh . The mass is 6.0 kilograms, the gravitational acceleration is 9.8 meters per second squared. The initial height is 1.0 and the final height is 1.6 meters.

To calculate the initial potential energy, you multiply mass by gravity by initial height and obtain a value of 58.8 Joules.

To calculate the final potential energy you multiply mass by gravity by final height and obtain a value of 94.1 Joules.

Subtracting these, you find that the change in potential energy is equal to 35.3 Joules.

You also could have solved this problem by recognizing that the change in potential energy can be calculated using the change in height.

The change in potential energy equals mass times the acceleration of gravity times the change in height. Substituting and solving, you find again that the change in potential energy is equal to 35.3 Joules.

Problem 1 Solution

To find the change in potential energy, you need to subtract the initial potential energy from the final potential energy. Potential energy is equal to mgh . The mass is six point zero kilograms, the gravitational acceleration is nine point eight meters per second squared. The initial height is one point zero meters and the final height is one point six meters.

To calculate the initial potential energy, you multiply mass by gravity by initial height and obtain a value of fifty eight point eight Joules.

To calculate the final potential energy you multiply mass by gravity by final height and obtain a value of ninety four point one Joules.

Subtracting these, you find that the change in potential energy is equal to thirty five point three Joules.

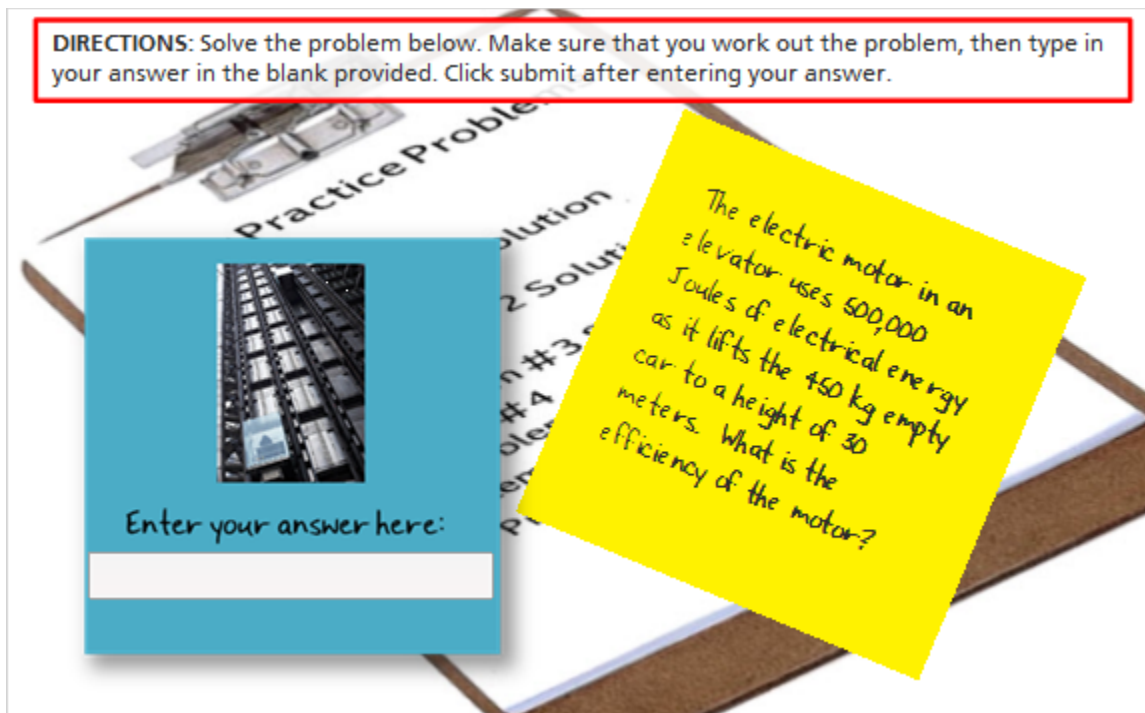
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The change in potential energy equals mass times the acceleration of gravity times the change in height. Substituting and solving, you find again that the change in potential energy is equal to thirty five point three Joules.

Module 4: Energy

Topic 2 Content: Energy Transformations Practice Solutions

DIRECTIONS: Solve the problem below. Make sure that you work out the problem, then type in your answer in the blank provided. Click submit after entering your answer.



The electric motor in an elevator uses 500,000 Joules of electrical energy as it lifts the 450 kg empty car to a height of 30 meters. What is the efficiency of the motor?

Enter your answer here:

Problem 2

The electric motor in an elevator uses 500,000 Joules of electrical energy as it lifts the 450 kg empty car to a height of 30 meters. What is the efficiency of the motor?

Module 4: Energy
Topic 2 Content: Energy Transformations Practice Solutions

Problem 2 Solution

$Energy\ in = 500,000\ J$

$Energy\ out = \Delta PE = mg\Delta h$

$Energy\ out = (450)(9.8)(30) = 132,300\ J$

$Efficiency = \frac{Energy\ out}{Energy\ in} = \frac{132,300}{500,000} = 0.265$

$Efficiency = 26.5\%$

To solve this efficiency problem, you need to know the energy input and the energy output of the process. You see that 500,00 Joules of electrical energy were used by the motor. This is the energy input. The energy output is the potential energy change of the elevator car, which is equal to its mass times the acceleration of gravity times the change in height. You calculate the energy output to be 132,300 Joules.

Now you can use your efficiency equation to calculate the efficiency: 132,300 divided by 500,000 results in an efficiency of 26.5%.

Problem 2 Solution

To solve this efficiency problem, you need to know the energy input and the energy output of the process. You see that five hundred thousand Joules of electrical energy were used by the motor. This is the energy input. The energy output is the potential energy change of the elevator car which is equal to its mass times the acceleration of gravity times the change in height. You calculate the energy output to be one hundred thirty two thousand three hundred Joules.

Now you can use your efficiency equation to calculate the efficiency. One hundred thirty two thousand three hundred divided by five hundred thousand results in an efficiency of twenty six point five percent.

Module 4: Energy

Topic 2 Content: Energy Transformations Practice Solutions

DIRECTIONS: Solve the problem below. Make sure that you work out the problem, then type in your answer in the blank provided. Click submit after entering your answer.

Practice Problem

2 Solution

#3

#4

er

2

What is the kinetic energy of a 55 kg cheetah running at 31.2 m/s?

Enter your answer here:

Problem 3

What is the kinetic energy of a 55 kg cheetah running at 31.2 m/s?

Module 4: Energy
Topic 2 Content: Energy Transformations Practice Solutions

Problem 3 Solution

$$KE = \frac{1}{2}mv^2$$
$$m = 55 \text{ kg}$$
$$v = 31.2 \frac{\text{m}}{\text{s}}$$
$$KE = \frac{1}{2}(55)(31.2^2) = 26,800 \text{ J}$$

Kinetic energy is equal to one half mass times speed squared. The mass is 55 kilograms and the speed is 31.2 meters per second. Substituting and solving you see that the kinetic energy is equal to 26,800 Joules.

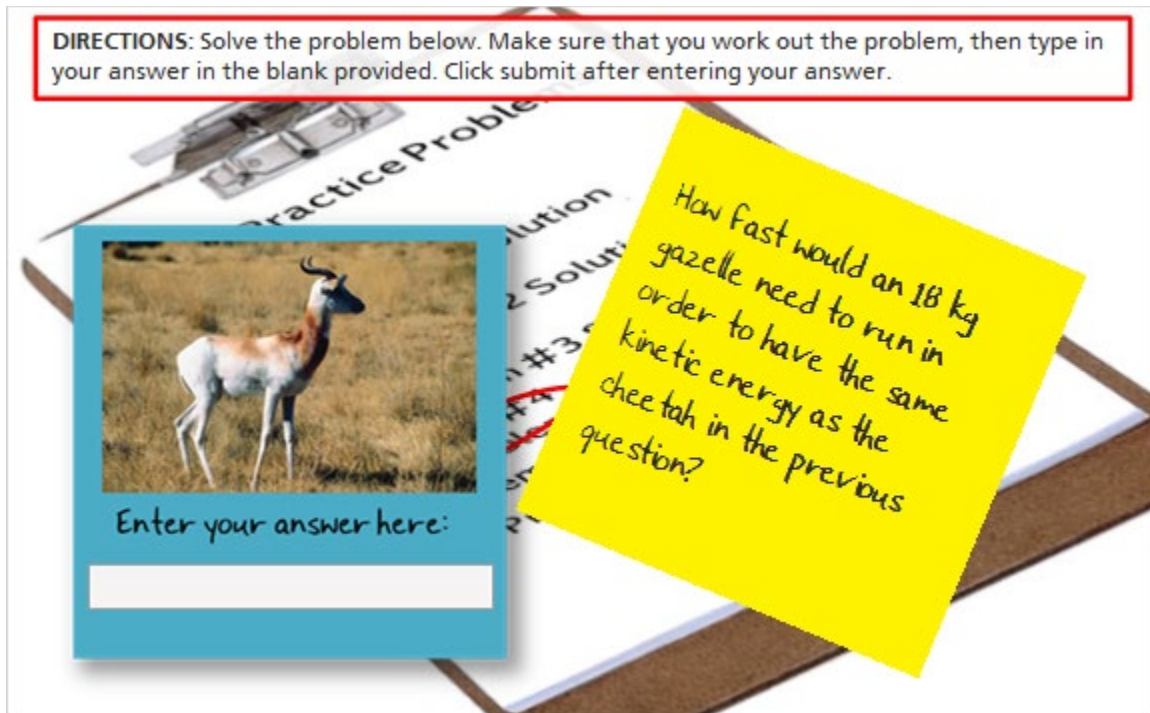
Problem 3 Solution

Kinetic energy is equal to one half mass times speed squared. The mass is 55 kilograms and the speed is 31.2 meters per second. Substituting and solving you see that the kinetic energy is equal to 26,800 Joules.

Module 4: Energy

Topic 2 Content: Energy Transformations Practice Solutions

DIRECTIONS: Solve the problem below. Make sure that you work out the problem, then type in your answer in the blank provided. Click submit after entering your answer.



How fast would an 18 kg gazelle need to run in order to have the same kinetic energy as the cheetah in the previous question?

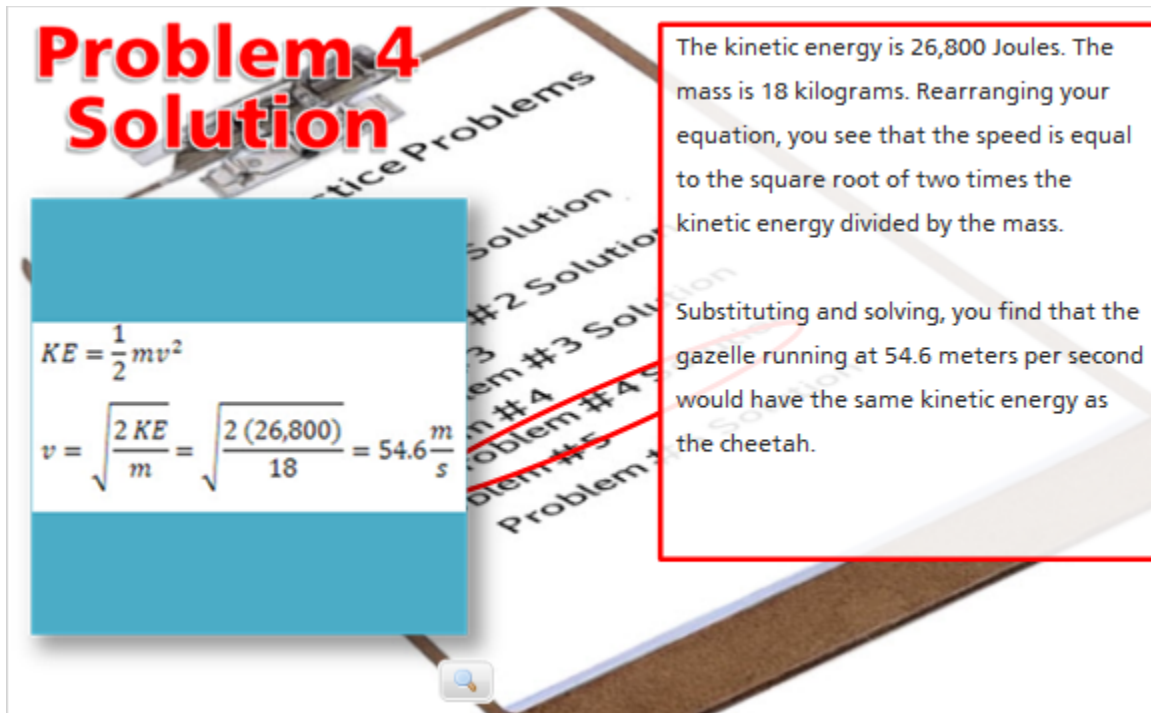
Enter your answer here:

Problem 4

How fast would an 18 kg gazelle need to run in order to have the same kinetic energy as the cheetah in the previous question?

Module 4: Energy

Topic 2 Content: Energy Transformations Practice Solutions



Problem 4 Solution

$$KE = \frac{1}{2}mv^2$$
$$v = \sqrt{\frac{2KE}{m}} = \sqrt{\frac{2(26,800)}{18}} = 54.6 \frac{m}{s}$$

The kinetic energy is 26,800 Joules. The mass is 18 kilograms. Rearranging your equation, you see that the speed is equal to the square root of two times the kinetic energy divided by the mass.

Substituting and solving, you find that the gazelle running at 54.6 meters per second would have the same kinetic energy as the cheetah.

Problem 4 Solution

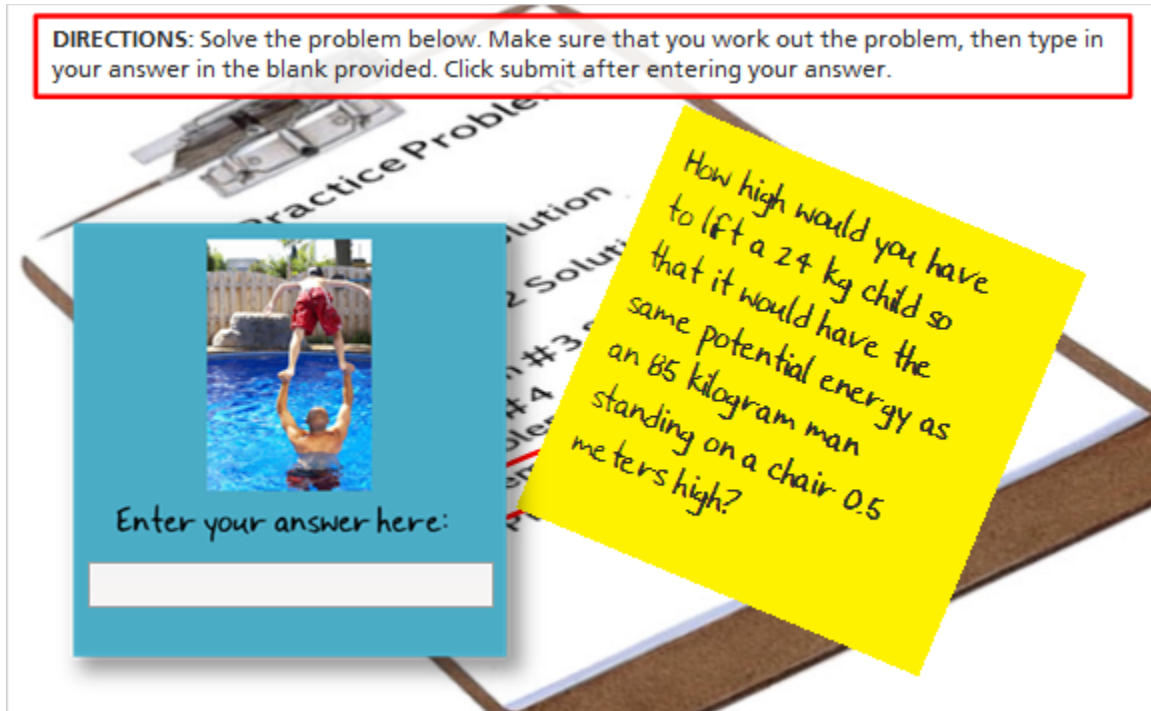
The kinetic energy is 26,800 Joules. The mass is 18 kilograms. Rearranging your equation, you see that the speed is equal to the square root of two times the kinetic energy divided by the mass.

Substituting and solving, you find that the gazelle running at 54.6 meters per second would have the same kinetic energy as the cheetah.

Module 4: Energy

Topic 2 Content: Energy Transformations Practice Solutions

DIRECTIONS: Solve the problem below. Make sure that you work out the problem, then type in your answer in the blank provided. Click submit after entering your answer.



Practice Problem

2 Solution

#3

#4

er

How high would you have to lift a 24 kg child so that it would have the same potential energy as an 85 kilogram man standing on a chair 0.5 meters high?

Enter your answer here:

Problem 5

A 950 kilogram elevator is lifted by an electric motor that delivers 14,000 Watts of power. How long does it take the elevator to rise 30 meters?

Module 4: Energy
Topic 2 Content: Energy Transformations Practice Solutions

Problem 5 Solution

$PE = mgh$
 $PE = (85)(9.8)(0.5)$
 $PE = 403.75 \text{ J}$

$PE = mgh$
 $h = \frac{PE}{mg} = \frac{403.75}{(25)(9.8)} = 1.65 \text{ m}$

The potential energy of the man can be calculated by multiplying his mass times the acceleration of gravity times his height. His potential energy calculates to be 403.75 joules.

For the child, you can rearrange the potential energy equation solving for height. You see that height equals potential energy divided by the product of mass and the gravitational acceleration.

Substituting and solving, you see that the child would need to be lifted to a height of 1.65 meters.

Problem 5 Solution

The potential energy of the man can be calculated by multiplying his mass times the acceleration of gravity times his height. His potential energy calculates to be 403.75 Joules.

For the child, you can rearrange the potential energy equation solving for height. You see that height equals potential energy divided by the product of mass and the gravitational acceleration.

Substituting and solving, you see that the child would need to be lifted to a height of 1.65 meters.