Work and Energy

Oct 29 - 7:17 PM

Work and Energy

Force = push or pull

Work = force*distance (//)

Force x distance => Newton*Meter => kg m/s^2 *m => kg m^2/s^2 =>Joule => J

Oct 29 - 1:24 PM

Sample 1: How much work is done lifting a 5 N weight 3m vertically?

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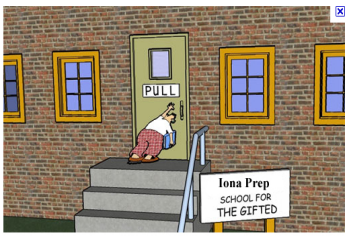

Sample 2: How much work is done by that student who is 0.8 m tall pushing on the door with a force of 20 N ?

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Sample 3: How much work is done by a student who carries his computer which has a mass of 1.3 kilograms a horizontal distance of 5 meters?

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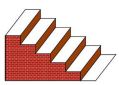
Sample 4: How much work does the student do if he carries the computer up a flight of stairs which has a vertical rise of 7.2 m ?



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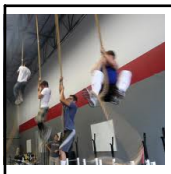

Two students climb vertical ropes in the gym. Each of them has a mass of 70 kilograms. Lou climbs 10 m in 8 seconds. Brendan climbs 10 m in 18 seconds.
(A) Who did more work?
(B) Who is the better athlete -- (able to work faster)?

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$$\text{Power} = \frac{\text{Work}}{\text{Time}}$$

Joule/Second = Watt

Nov 3 - 7:20 AM

John's mass is 80 kilograms. He climbs a rope until his feet are 8 meters above the gym floor. It took him 15 seconds.

(A) How much work did he do?
(B) How much power did he develop?

Nov 1-11:14 AM

Potential Energy
The ability to do work which a system has because of its condition or the relative position of its parts.
Equal to the amount of work done setting up the conditions.

Nov 28 - 9:11 AM

A 0.18 kg ball falls 2.5 m. How much work does the force of gravity do on the ball?

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Two students climb vertical ropes in the gym. Each of them has a mass of 70 kilograms. Lou climbs 10 m in 8 seconds. Brendan climbs 10 m in 18 seconds.

How much POWER does each of them develop?

Nov 3 - 7:22 AM

An elevator lifts a total mass of 1.1x10^3 kg a distance of 40 m in 12.5 s. How much power is used by the elevator motor?

Oct 29 - 7:43 PM

Kinetic Energy:
The ability to do work which an object has because of its motion.

Equal to the amount of work expended in accelerating the object from rest up to its speed.

KE = 1/2 mv^2

Oct 29 - 1:34 PM

Sample 1: What is the kinetic energy of a 2.1 kilogram mass moving at 5.2 m/s?

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Sample 2 A bullet having a mass of 8.2 grams is moving at 100 m/s.
(A) Calculate its kinetic energy.
(B) If the barrel of the gun was 0.5 m long, calculate the average force exerted by the expanding gasses.

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A 105 g hockey puck is sliding acorss the ice. A player exerts a constant 4.5 N force over a distance of 0.15 m. If the force was in the directic the puck was originally moving, how much did th kinetic energy of the puck change?

Oct 29 - 7:31 PM

A rock climber wears a 7.5 kg backpack while scaling a cliff. After 30. minutes, the climber is 8 m above the starting point.
(A) How much work does the climber do on the backpack?
(B) If the climber had a mass of 75 kilograms, ho much work did he do lifting himself and the backpack?

Oct 29 - 7:36 PM

Example:
How much work is done by a man having a mass of 72 kilograms who climbs a ladder a vertical distance of 4.0 meters?

Nov 28 - 9:12 AM

The third floor of a house is 8 m above street level. How much work is needed to move a 150 kg refrigerator to the third floor?

Oct 29 - 7:45 PM

After scoring a touchdown, a 84 kg wide receiver celebrates by leaping 1.2 m off the ground. How much work was done by the wide receiver in the celebration?

Oct 29 - 7:50 PM

A cyclist exerts a force of 15 N as he rides a bike 215 m in 30 seconds. How much work did he do?

Oct 29 - 7:51 PM

Igor is pushing a lawn mower with a force of 88 N along a handle that makes an angle of 41 degrees with the horizontal. How much work does he do moving the lawn mower 1.2 km to mow the yard?

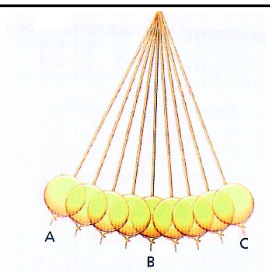
Oct 29 - 7:52 PM

Conservation of energy:
In a closed, isolated system energy is conserved. That is to say it can neither be created nor destroyed; but it can be changed from one form to another.

Nov 28 - 9:14 AM

Suppose a 72 kilogram boy is at rest at the top of a ski slope which is 20 meters high at a physics resort. He begins to slide (naturally there is no friction). How fast will he be going after he has lost 15 meters of altitude?

Nov 28 - 9:22 AM



A bowling-ball is set up as a simple pendulum. When it is at the extreme end of its swing it is .25 m above the lowest point of its swing. How fast will it be moving when it passes its lowest point?

Nov 28 - 9:26 AM

Two boys one of mass 70 kilograms and the other of mass 80 kilograms swing from a rope across a canyon. Assuming they start at the same height, what can you say about their relative velocities as they pass through the bottom of the arc?

Nov 28 - 9:24 AM

Quick Review

1. Energy is measured in (what unit) _____
2. Power is measured in (what unit) _____
3. Work = _____ times _____
4. Power = _____ / _____
5. A rock high on a hill has _____ energy
6. A bullet shot from a gun has _____ energy
7. As a pendulum moves from the end of its swing to the bottom the potential energy (increases, decreases, remains constant)
8. Holding a 3 kg box 2 m above the ground motionless for 30 seconds involves doing how much work?
9. I fire a gun vertically upward. As the bullet rises, its kinetic energy (increases, decreases, remains constant).
10. A book falls from a shelf which is 2.5 meters above the floor. Calculate its speed just before it strikes the floor.
11. Suppose someone fired a bullet straight up. The bullet left the gun at a speed of 120 meters/second. How far will it rise (assuming no friction)?
12. A car rolls down hill (without friction, and without hitting anyone or anything) until it is 30 meters vertically below the point where it started. How fast will it be moving at that point?

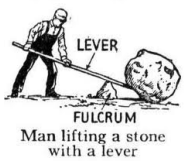
Nov 29-7:36 PM

Simple Machine

- Multiplies force (while dividing distance)
- Multiplies distance (while dividing force)
- Change the direction of the force

Nov 17-1:47 PM

Example: Lever



Man lifting a stone with a lever

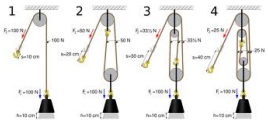
Effort * Effort Distance = Resistance*Resistance Distance

Nov 17-1:50 PM

A lever is used to lift a heavy load. When a 50N force pushes one end of the lever down 1.2 m, the load rises 0.2 m. Calculate the weight of the load.

Nov 17-2:16 PM

Pullies



Effort * Effort Distance = Resistance*Resistance Distance

Mechanical Advantage = # times force is multiplied

Nov 17-1:53 PM

A. In raising a 5000 N piano with a pulley system, the workers see that for every 2 m of rope pulled down, the piano rises 0.4 m. Ideally, how much force is required to lift the piano?

B. If the workers actually pull with 2500 N of force to lift the piano, what is the efficiency of the pulley system?

Nov 17-2:18 PM

Inclined Plane

Nov 17-2:05 PM

A mouse and an elephant both havbe the same kinetic energy. Can you tell which is moving faster?

Most earth satellites follow an oval shaped path, not a circular one. The Potential energy increases as the satellite moves away from the earth. Since energy is conserved, what must happen to the speed of the satellite as it moves away from the earth?

Nov 17-2:21 PM

Efficiency

$$\frac{\text{Useful Work Output}}{\text{Work input}}$$

Nov 17-2:10 PM