This print-out should have 16 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

001 (part 1 of 2) 10.0 points

A force $\vec{F} = F_x\,\hat{\imath} + F_y\,\hat{\jmath}$ acts on a particle that undergoes a displacement of $\vec{s} = s_x\,\hat{\imath} + s_y\,\hat{\jmath}$ where $F_x = 6$ N, $F_y = -3$ N, $s_x = 1$ m, and $s_y = 1$ m.

Find the work done by the force on the particle.

Answer in units of J

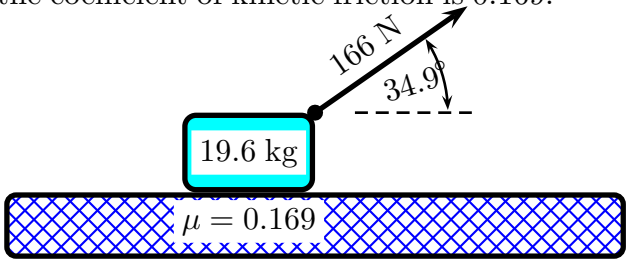
002 (part 2 of 2) 10.0 points

Find the angle between $\vec{F}$ and $\vec{s}$.

Answer in units of °

003 (part 1 of 5) 10.0 points

A 19.6 kg block is dragged over a rough, horizontal surface by a constant force of 166 N acting at an angle of angle 34.9° above the horizontal. The block is displaced 96.5 m and the coefficient of kinetic friction is 0.169.



Find the work done by the 166 N force. The acceleration of gravity is 9.8 m/s^2 .

Answer in units of J

004 (part 2 of 5) 10.0 points

Find the magnitude of the work done by the force of friction.

Answer in units of J

005 (part 3 of 5) 10.0 points

What is the sign of the work done by the frictional force?

1. positive

2. negative

3. zero

006 (part 4 of 5) 10.0 points

Find the work done by the normal force.

Answer in units of J

007 (part 5 of 5) 10.0 points

What is the net work done on the block?

Answer in units of J

008 10.0 points

A cart loaded with bricks has a total mass of 14.9 kg and is pulled at constant speed by a rope. The rope is inclined at 26.1 ° above the horizontal and the cart moves 22.3 m on a horizontal floor. The coefficient of kinetic friction between ground and cart is 0.3 .

The acceleration of gravity is 9.8 m/s^2 .

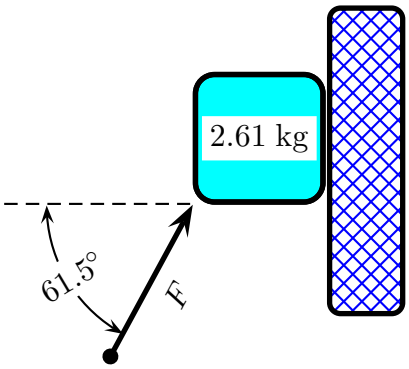
How much work is done on the cart by the rope?

Answer in units of kJ

009 10.0 points

A 2.61 kg block is pushed 1.57 m up a vertical wall with constant speed by a constant force of magnitude F applied at an angle of 61.5° with the horizontal.

The acceleration of gravity is 9.8 m/s^2 .



If the coefficient of kinetic friction between the block and wall is 0.563, find the work done by F.

Answer in units of J

010 10.0 points

A force

$$\vec{F} = a\,x\,\hat{\imath} + b\,y\,\hat{\jmath}\,,$$

where $a = 2.8$ N/m and $b = 4.3$ N/m, acts on an object as the object moves in the $\hat{\imath}$

direction along the x-axis from the origin to $c = 5.6$ m.

Find the work done on the object by the force.

Answer in units of J

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011 10.0 points

A 1580 kg pile driver is used to drive a steel I-beam into the ground. The pile driver falls 4.28 m before contacting the beam, and it drives the beam 9.98 cm into the ground before coming to rest.

Find the magnitude of the average force the beam exerts on the pile driver while the pile driver is brought to rest. The acceleration of gravity is 9.8 m/s^2 .

Answer in units of N

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012 10.0 points

A car that outputs a constant power $P = 70$ kW moves along a level highway with a constant speed $v = 74$ km/h.

The car encounters a hill inclined at an angle of $\theta = 9.8^\circ$ with respect to the horizontal. Assume that the dissipative forces on the car (e.g. air drag, friction in bearings, etc) are the same when the car moves up the incline.

What is the speed of the car on the hill?

Answer in units of km/h

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013 (part 1 of 2) 10.0 points

A 1630 kg car starts from rest and accelerates uniformly to 11.4 m/s in 18.5 s .

Find the average power developed by the engine. Assume that air resistance remains constant at 366 N during this time.

Answer in units of hp

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014 (part 2 of 2) 10.0 points

Find the instantaneous power output of the engine at $t = 18.5$ s just before the car stops accelerating.

Answer in units of hp

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015 10.0 points

At a certain point, when a spring is stretched near its elastic limit, the spring force satisfies the equation

$$F = -\alpha\, x + \beta\, x^3 ,$$

where $\alpha = 15$ N/m and $\beta = 1700$ N/m^3 .

Calculate the work done by the spring when it is stretched from its equilibrium position to 0.12 m past its equilibrium.

Answer in units of mJ

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016 10.0 points

Steam enters a 10 MW output turbine at a fluid speed of 814 m/s and emerges at a fluid speed of 144 m/s.

Assuming the turbine has a 88.2% mechanical efficiency, determine the mass of steam which passes through the turbine per second.

Answer in units of kg/s