0. **(0 points)** /opt/webwork/webwork2/conf/snippets/ASimpleCombinedHeaderFile.pg

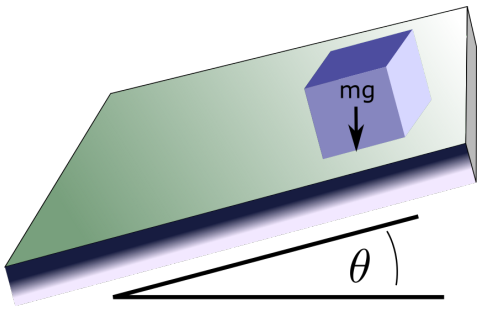
Alice Quillen **fall22phy141**

Assignment PHY141_WW4 due 09/30/2022 at 11:59pm EDT

---

1. **(2 points)** setPHY141_WW4/friction.pg

On the static friction coefficient



A block of mass m is on an inclined plane. There is friction between the block's base and the plane's surface. The angle between the inclined plane and horizontal is θ. This angle is slowly increased. The block starts to slide when $\theta = 22\ ^\circ$.

What is the coefficient of static friction μ?

Enter a value for $\mu =$ ___

Enter a number good to 2 decimal places.

---

2. **(2 points)** setPHY141_WW4/work_damp.pg

On work, energy and power

A particle with mass $m = 1$ kg moves along a line with coordinate x. A damping force is exerted on m in the form $F = -\alpha v$ where v is the particle's velocity $v = \frac{dx}{dt}$. The equation of motion $m\frac{dv}{dt} = -\alpha v$

The particle's initial velocity $v_0 = 3$ m/s and the damping coefficient $\alpha = 0.1$ kg/s. The damping force eventually brings the particle to rest.

What is the total work W done by the damping force?

Enter $W =$ ___ J.

Hint: What is the kinetic energy?

The power exerted by the damping force (the energy dissipation rate) is

$\frac{dW}{dt} = -\alpha v_0^2 \exp\left(-\ \_\_\_\ \frac{\alpha}{m}t\right)$

Fill in the blank with a number.

Hint: you need to find the solution $v(t)$.

---

3. **(1 point)** setPHY141_WW4/rel1.pg

On relativistic energy and momentum

A particle has relativistic energy $E = \gamma mc^2$ with Lorenz factor $\gamma = 7$.

What is its velocity v ?

Enter a value for $\frac{v}{c}$: ___

What is its momentum p ?

Enter a value for $\frac{p}{mc}$: ___

What is its kinetic energy $K = E - mc^2$?

Enter a value for $\frac{K}{mc^2}$: ___

(Enter numbers accurate to 2 decimal places).

---

4. **(1 point)** setPHY141_WW4/rel2.pg

On rest mass.

A particle has relativistic energy $E = 3.5000$ MeV and momentum $p = 3.4641$ MeV/c.

What is the particle's rest mass energy $E_0 = mc^2$?

Enter a value for E_0: ___ MeV

(Enter a number accurate to 2 decimal places).