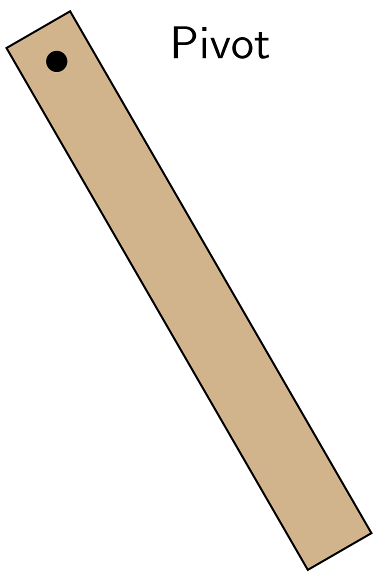
Question 1

Consider a rigid rod which pivots about a point near one of its ends.



Consider the forces acting on the rod and ignore air resistance and friction. We will determine the torques about the pivot point.

Which of the following is true?

1. There is one force and it produces zero torque.
2. There is one force and it produces a non-zero torque.
3. There are two forces and both produce non-zero torques.
4. There are two forces and only one produces a non-zero torque.
5. There are two forces and none produce a non-zero torque.

Question 2

The exact equation of motion for a physical pendulum is

$$\frac{d^2\theta}{dt^2} = -\frac{Lmg}{I}\ \sin\theta$$

where L is the distance from the pivot point to the center of mass, I is the moment of inertia about the pivot and m is the total mass of the pendulum.

Which of the following is true?

1. This is exactly the equation of motion for a simple harmonic oscillator.
2. This would be the equation of motion for a simple harmonic oscillator if $\sin\theta$ were replaced by $\cos\theta$.
3. This might yield the equation of motion for a simple harmonic oscillator with a suitable approximation involving just m, L, I.
4. This might yield the equation of motion for a simple harmonic oscillator with a suitable approximation for $\sin\theta$.

Question 3

The equation of motion for a physical pendulum, with a small angle approximation, is:

$$\frac{d^2\theta}{dt^2} = -\frac{mgL}{I}\,\theta$$

where I is the moment of inertia, L the distance from the pivot point to the center of mass and m the total mass.

Which of the following represents the angular frequency?

1. $\omega = \sqrt{\frac{mgL}{I}}$
2. $\omega = \frac{mgL}{I}$
3. $\omega = \left(\frac{mgL}{I}\right)^2$
4. $\omega = \sqrt{\frac{gL}{I}}$

Question 4

An inductor of inductance L and a capacitor of capacitance C are connected in series.

The angular frequency of oscillation is:

1. $\omega = \dfrac{L}{C}$
2. $\omega = \sqrt{\dfrac{L}{C}}$
3. $\omega = \dfrac{1}{\sqrt{LC}}$
4. $\omega = \dfrac{1}{LC}$
5. $\omega = \sqrt{LC}$