PHYS1110D – Engineering Physics: Mechanics and Thermodynamics

Tutorial Problems for Week 6: Kinetic and Potential Energy

![A picture containing object, clock, table, mirror

Description automatically generated]()**Problem 1 – Conservation of Energy Applied to Old Problems**

Block A (mass ) and B (mass ) are tied to a rope hanging over through two pulleys. Neglecting all frictions and the mass of the pulleys, try using conservation of energy to find the acceleration of block A (specify both its magnitude and direction, ).

**Solution:**

Now that you are a grown-up adult in the University, we advise you to use energy arguments instead of the old free-body diagram to solve such “ideal” problems with no disgusting frictions.

Suppose that A drops a distance starting from time . Obviously

are the speed and (magnitude of) the acceleration of the two blocks.

The system has constant total mechanical energy. Its value is

Here we choose the initial configuration to have zero potential energy. Take the time derivative of the energy, we get

Or

Crossing out the common factor , the magnitude of the acceleration is

**Problem 2 – From Potential Energy to Force**

A particle moving on the -axis has potential energy (unit: Joule; unit of : meter)

1. What is the force on this particle at position ? Please specify the direction of the force.
2. Suppose the particle is initially at position with zero velocity. What is the minimum kinetic energy required for the particle to be able to reach ?

**Solution:**

**Problem 3 – Conservative or Not?**

A force given by   acts on an object moving on the *x-y* plane. Find the work done on the object by the fore if

1. it moves from (0,0) to (1,0) on a straight line. And then to (1,1), on a straight line.
2. it moves from (0,0) to (0,1), on a straight line. And then to (1,1), on a straight line.

Then conclude whether is a conservative force or not.

A picture containing object, clock

Description automatically generated**Solution:**

1. When it moves along a straight line from (0,0) to (1,0),

When it moves along a straight line from (1,0) to (1,1),

So, the total work done is 1 J.

1. When it moves along a straight line from (0,0) to (0,1),

When it moves along a straight line from (0,1) to (1,1),

So, the total work done is 0, which is different from the answer in (1).

As the integral is path-dependent, the force is non-conservative.