This is a take-home quiz. You may work with others and consult the book. You may ask me *indirect* questions, but I will not help you answer the questions on the quiz.

**Problem 7.11** (pg. 275): Two identical 0.1 kg blocks (labeled 1 and 2) were at rest on a nearly frictionless surface (i.e. neglect friction), connected by an unstretched spring whose stiffness is 100 N/m. Then a constant force of 5 N to the right was applied to block 2, and at a later time the blocks are in the new positions shown in the lower diagram. (see the figure in the book).

1. At this later time, what is $K + U$ of the two-block system? (i.e. find $\Delta E$)

2. What is the translational kinetic energy of the two-block system? (at the later time)
3. What is the speed of the center of mass of the two-block system? (at the later time)

4. What is the vibrational kinetic energy of the two-block system? Note that the spring is now stretched. (at the later time)

5. **Extra Credit**: Write a VPython program that simulates this situation. Email it to Dr. Titus (titus@mailaps.org). Verify that it gives you the same results as you calculated for questions 1–4.
Using a string, you pull a 2.0-kg box along a nearly frictionless table with a constant force of 100 N, starting from rest. The box is full of liquid and is a cube of dimensions 1m x 1m x 1m. The center of mass of the system is initially located at $\vec{r} = < 0.5, 0.5, 0 >$ relative to the left, lower corner of the box. At some time later, your hand has pulled through a distance of 0.5 m, and the center of mass has shifted to $\vec{r} = < 0.25, 0.5, 0 >$ relative to the left, lower corner of the box. The fluid and box is defined as “the system.” There is no energy transferred thermally between the system and its surroundings.

Figure 1:

6. What is $\Delta E$ of the system?

7. What is $\Delta K_{\text{trans}}$ of the system?
8. What is the speed of the system? (at the later time)

9. What is the change in the thermal energy of the system?
Answer Key for Exam A

1. see key.
2. see key.
3. see key.
4. see key.
5. see key.
6. $\Delta E = W + Q = (100 \text{ N})(0.5 \text{ m}) = 50 \text{ J}$
7. $\Delta K_{\text{trans}} = W \ (\text{by net force}) = (100 \text{ N})(0.75 \text{ m}) = 75 \text{ N}$
8. $K_2 = \frac{1}{2}m * v_2^2$
   $v_2 =$
9. see key.