

Physics 221

Quiz 8, Form: A

Name: _____

Date: _____

1. State the energy principle for a macroscopic system where energy can be transferred via thermal energy transfer or mechanical energy transfer.

2. This question is based on your reading of chapter 5. Potential energy, such as spring potential energy or gravitational potential energy or electrical potential energy for example,
 - (a) depends on the path taken.
 - (b) does not depend on the path taken.

3. What kind of energy is transferred between a system and its surroundings as a result of a temperature difference between the system and its surroundings?
 - (a) mechanical energy
 - (b) chemical energy
 - (c) kinetic energy
 - (d) thermal energy
 - (e) potential energy

4. A free neutron is highly unstable, meaning that it won't exist for very long before it decays. When it decays, it decays into a proton, an electron, and an antineutrino. If a neutron at rest decays, what will be the total kinetic energy of the proton, electron, and antineutrino when they are very far apart? (Note do not find the kinetic energy of each one, find the total kinetic energy; it's impossible using just the energy principle to find the kinetic energy of each one) The rest energy of the neutron is 1.503×10^{-10} J, and proton is 1.501×10^{-10} J, and the electron is 8.17×10^{-14} J. An antineutrino has no rest energy. Treat the system as a closed system.

5. You use a sling-shot to shoot a 0.010-kg marble vertically into the air. The sling shot acts like a single spring with a stiffness of 50 N/m. If you stretch the slingshot 0.25 m and release it from rest, how high above where it's released will the marble reach? Neglect the work done by air and any forces on the slingshot. Model the slingshot as an ideal spring.

Answer Key for Exam A

1. The change in the energy of a system is equal to the total work done by external forces plus the thermal energy transferred to the system ($\Delta E = Q + W$).

2. (b)

3. (d)

4. $\Delta E = 0$

$$K_{proton,electron,antineutrino} + (mc^2)_{proton} + (mc^2)_{electron} - (mc^2)_{neutron} = 0$$

$$K = 1 \times 10^{-13} \text{ J}$$

5. The system is the spring (sling-shot), marble, and earth.

$$\Delta E = 0$$

$$\Delta K + \Delta U_g + \Delta U_s = 0$$

$$mgh - 1/2ks^2 = 0$$

$$h = 16 \text{ m}$$