First Law of Thermodynamics Quiz Questions and Answers PDF

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What type of system allows energy exchange but not matter exchange?

- ◯ Open system
- ◯ **Closed system ✓**
- ◯ Isolated system
- ◯ None of the above

> A closed system allows for the exchange of energy, such as heat or work, while preventing the exchange of matter with its surroundings. This concept is important in thermodynamics and various scientific applications.

Provide an example of an adiabatic process and explain its characteristics.

> **An example of an adiabatic process is the expansion of air in a piston where the gas expands without heat exchange with the environment, leading to a decrease in temperature.**

What is the significance of the First Law of Thermodynamics in understanding energy conservation?

The First Law of Thermodynamics is significant because it establishes that the total energy in a closed system is conserved, meaning energy can only change forms but cannot be created or destroyed.

Which processes are characterized by no heat exchange? (Select all that apply)

- [ ] Isothermal
- [ ] **Adiabatic ✓**
- [ ] Isochoric
- [ ] Isobaric

Processes characterized by no heat exchange are known as adiabatic processes. In these processes, the system does not exchange heat with its surroundings, leading to changes in temperature and pressure solely due to work done on or by the system.

Which of the following are state functions? (Select all that apply)

- [ ] **Internal energy ✓**
- [ ] Work
- [ ] Heat
- [ ] **Temperature ✓**

State functions are properties that depend only on the current state of a system, not on the path taken to reach that state. Common examples include temperature, pressure, volume, and internal energy.

Which of the following statements about energy conservation are true? (Select all that apply)

- [ ] **Energy can be transformed from one form to another. ✓**
- [ ] **Total energy in an isolated system remains constant. ✓**
- [ ] Energy can be created in a closed system.
- [ ] Energy can be destroyed in an open system.

Energy conservation refers to the principle that energy cannot be created or destroyed, only transformed from one form to another. This principle is fundamental in understanding how energy systems operate and the importance of efficiency in energy use.

In which type of system is neither energy nor matter exchanged with the surroundings?

- ◯ Open system
- ◯ Closed system
- ◯ **Isolated system ✓**

◯ None of the above

> An isolated system is defined as one that does not exchange energy or matter with its surroundings, making it completely self-contained. This concept is important in thermodynamics and helps in understanding various physical processes.

Which unit is used to measure energy in the International System of Units (SI)?

◯ Calorie
◯ Watt
◯ **Joule ✓**
◯ Newton

> In the International System of Units (SI), energy is measured in joules. This unit quantifies the amount of work done or heat transferred in a system.

What is the main principle of the First Law of Thermodynamics?

◯ Energy can be created and destroyed.
◯ **Energy cannot be created or destroyed, only transformed. ✓**
◯ Energy is always conserved in open systems.
◯ Energy is independent of mass.

> The First Law of Thermodynamics states that energy cannot be created or destroyed, only transformed from one form to another. This principle emphasizes the conservation of energy in any physical process.

Describe the difference between an open system and a closed system in thermodynamics.

> **In thermodynamics, an open system is one that can exchange both energy and matter with its environment, whereas a closed system can exchange energy but not matter.**

Which systems allow for the exchange of both energy and matter? (Select all that apply)

- [x] **Open system ✓**
- [ ] Closed system
- [ ] Isolated system
- [ ] None of the above

> Systems that allow for the exchange of both energy and matter include open systems, where both energy and matter can flow in and out. Examples of such systems are ecosystems and the human body, which interact with their surroundings.

Explain how the First Law of Thermodynamics applies to a refrigerator.

> **A refrigerator operates by removing heat from its interior and expelling it to the environment, thereby maintaining a lower temperature inside. This process adheres to the First Law of Thermodynamics, as the energy used to remove heat is derived from electrical energy, demonstrating that energy is conserved and transformed rather than created or destroyed.**

In an adiabatic process, what is the value of heat transfer (Q)?

- ○ Positive
- ○ Negative
- ○ **Zero ✓**
- ○ Equal to work done

> In an adiabatic process, there is no heat transfer between the system and its surroundings, which means that the heat transfer (Q) is equal to zero.

Which process occurs at constant volume?

- ○ Isothermal
- ○ Adiabatic
- ○ **Isochoric ✓**
- ○ Isobaric

> The process that occurs at constant volume is known as isochoric process. In this process, the volume of the system remains unchanged while other properties such as pressure and temperature may change.

What happens to the internal energy of a system if the work done by the system is greater than the heat added?

- ◯ Increases
- ◯ **Decreases ✓**
- ◯ Remains constant
- ◯ Beecomes zero

> If the work done by the system exceeds the heat added, the internal energy of the system decreases. This is because the system is using more energy to do work than it is receiving as heat.

What factors can change the internal energy of a system? (Select all that apply)

- ☐ **Heat added to the system ✓**
- ☐ **Work done by the system ✓**
- ☐ Change in system volume
- ☐ **Change in system temperature ✓**

> The internal energy of a system can change due to heat transfer, work done on or by the system, and changes in the number of particles or their state. These factors directly influence the energy content and state of the system.

In an isothermal process, what remains constant?

- ◯ Pressure
- ◯ Volume
- ◯ **Temperature ✓**
- ◯ Internal energy

> In an isothermal process, the temperature of the system remains constant throughout the process. This means that any heat added to the system is used to do work, rather than changing the temperature.

In an isobaric process, which of the following is true? (Select all that apply)

- ☐ **Pressure remains constant ✓**
- ☐ Volume remains constant
- ☐ **Work done is PΔV ✓**

- [ ] Temperature remains constant

> In an isobaric process, the pressure remains constant while the volume and temperature can change. This means that the work done by or on the system is equal to the pressure multiplied by the change in volume.

How does the First Law of Thermodynamics relate to energy efficiency in engines?

> **The First Law of Thermodynamics relates to energy efficiency in engines by indicating that the total energy input must equal the sum of useful work output and energy losses, thus limiting the maximum efficiency achievable.**

Discuss the implications of the First Law of Thermodynamics for renewable energy sources.

> **The implications of the First Law of Thermodynamics for renewable energy sources include the necessity to harness and convert natural energy flows (like solar, wind, and hydro) into usable energy, while ensuring that energy losses are minimized to maintain sustainability.**