Physics 12-Q2W4-H.W.-Thermodynamics

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. Which thermodynamic process takes place at constant volume so that no work is done on or by the system?
a. isothermal
b. isobaric
c. isovolumetric
d. adiabatic

____ 2. According to the first law of thermodynamics, the difference between energy transferred to or from a system as heat and energy transferred to or from a system by work is equivalent to which of the following?
a. volume change
b. internal energy change
c. entropy change
d. pressure change

____ 3. Which of the following is *not* a way in which a cyclic process resembles an isothermal process?
a. Energy can be transferred as heat.
b. Energy can be transferred as work.
c. The temperature of the system remains constant throughout the process.
d. There is no net change in the internal energy of the system.

____ 4. Which statement applies when all of the entropy changes in a process are taken into account?
a. The increases in entropy can be greater or less than the decreases.
b. The increases in entropy are always greater than the decreases.
c. The increases in entropy are always equal to the decreases.
d. The increases in entropy are always less than the decreases.

____ 5. The requirement that a heat engine must give up some energy at a lower temperature in order to do work corresponds to which law of thermodynamics?
a. first
b. second
c. third
d. No law of thermodynamics applies.

____ 6. Which thermodynamic process takes place when work is done on or by the system but no energy is transferred to or from the system as heat?
a. isothermal
b. isovolumetric
c. adiabatic
d. isobaric

____ 7. How is conservation of internal energy expressed for an isolated system?
a. $Q = 0$, so $\Delta U = -W$
b. $Q = W = 0$, so $\Delta U = 0$ and $U_i = U_f$
c. $\Delta V = 0$, so $P\Delta V = 0$ and $W = 0$; therefore, $\Delta U = Q$
d. $\Delta T = 0$, so $\Delta U = 0$; therefore, $\Delta U = Q - W = 0$, or $Q = W$

____ 8. How does a real heat engine differ from an ideal cyclic heat engine?
a. A real heat engine is not cyclic.
b. An ideal heat engine converts all energy from heat to work.
c. An ideal heat engine is not isolated, so matter enters and leaves the engine.
d. A real heat engine is not isolated, so matter enters and leaves the engine.

____ 9. An ideal gas system undergoes an adiabatic process in which it expands and does 20 J of work on its environment. How much energy is transferred to the system as heat?
a. 20 J
b. 0 J
c. 5 J
d. –20 J

____ 10. How is conservation of internal energy expressed for a system during an isothermal process?
a. $\Delta V = 0$, so $P\Delta V = 0$ and $W = 0$; therefore, $\Delta U = Q$
b. $Q = W = 0$, so $\Delta U = 0$ and $U_i = U_f$
c. $Q = 0$, so $\Delta U = -W$
d. $\Delta T = 0$, so $\Delta U = 0$; therefore, $\Delta U = Q - W = 0$, or $Q = W$

____ 11. An ideal heat engine has an efficiency of 50 percent. Which of the following statements is *not* true?
a. The amount of energy exhausted as heat is half the energy added to the engine as heat.
b. The amount of energy exhausted as heat equals the work done.
c. The amount of work done is half the energy added to the engine as heat.
d. The amount of energy exhausted as heat equals the energy added to the engine as heat.

____ 12. Which of the following is a set of particles or interacting components to which energy is added or from which energy is removed?
a. an ideal gas
b. an environment
c. an engine
d. a system

____ 13. An electrical power plant manages to transfer 88 percent of the heat produced in the burning of fossil fuel to convert water to steam. Of the heat carried by the steam, 40 percent is converted to the mechanical energy of the spinning turbine. Which best describes the overall efficiency of the heat-to-work conversion in the plant?
a. greater than 88 percent
b. less than 40 percent
c. 40 percent
d. 88 percent

____ 14. An ideal gas system undergoes an isovolumetric process in which 20 J of energy is added as heat to the gas. What is the change in the system's internal energy?
a. –20 J
b. 5 J
c. 0 J
d. 20 J

____ 15. Which thermodynamic process takes place at a constant temperature so that the internal energy of a system remains unchanged?
a. isovolumetric
b. isobaric
c. isothermal
d. adiabatic

____ 16. An ideal gas system undergoes an adiabatic process in which it expands and does 20 J of work on its environment. What is the change in the system's internal energy?
a. –20 J
b. 0 J
c. –5 J
d. 20 J

____ 17. How is conservation of internal energy expressed for a system during an adiabatic process?
a. $\Delta T = 0$, so $\Delta U = 0$; therefore, $\Delta U = Q - W = 0$, or $Q = W$
b. $\Delta V = 0$, so $P\Delta V = 0$ and $W = 0$; therefore, $\Delta U = Q$
c. $Q = 0$, so $\Delta U = -W$
d. $Q = W = 0$, so $\Delta U = 0$ and $U_i = U_f$

____ 18. A heat engine has taken in energy as heat and used a portion of it to do work. What must happen next for the engine to complete the cycle and return to its initial conditions?
a. It must give up energy as heat to a higher temperature so work can be done on it.
b. It must do work to transfer the remaining energy as heat to a lower temperature.
c. It must do work to transfer the remaining energy as heat to a higher temperature.
d. It must give up energy as heat to a lower temperature so work can be done on it.

____ 19. When a drop of ink mixes with water, what happens to the entropy of the system?
a. The system's entropy increases, and the total entropy of the universe decreases.
b. The system's entropy increases, and the total entropy of the universe increases.
c. The system's entropy decreases, and the total entropy of the universe increases.
d. The system's entropy decreases, and the total entropy of the universe decreases.

____ 20. Imagine you could observe the individual atoms that make up a piece of matter and that you observe the motion of the atoms becoming more orderly. What can you assume about the system?
a. Its entropy is decreasing.
b. Its entropy is increasing.
c. Positive work is being done on the system.
d. It is gaining thermal energy.

____ 21. Which of the following is a thermodynamic process in which a system returns to the same conditions under which it started?
a. an isothermal process
b. an isovolumetric process
c. an adiabatic process
d. a cyclic process

____ 22. When an ideal gas does positive work on its surroundings, which of the gas's quantities increases?
a. pressure
b. internal energy
c. temperature
d. volume

____ 23. Air cools as it escapes from a diver's compressed air tank. What kind of process is this?
a. isobaric
b. adiabatic
c. isothermal
d. isovolumetric

____ 24. In an isovolumetric process for an ideal gas, the system's change in the energy as heat is equivalent to a change in which of the following?
a. volume
b. temperature
c. internal energy
d. pressure

____ 25. What accounts for an increase in the temperature of a gas that is kept at constant volume?
a. Energy has been removed as heat from the gas.
b. Energy has been added as heat to the gas.
c. Energy has been added as work done on the gas.
d. Energy has been removed as work done by the gas.

____ 26. A chunk of ice with a mass of 1 kg at 0°C melts and absorbs 3.33×10^5 J of heat in the process. Which best describes what happened to this system?
a. Work was converted to energy.
b. Its entropy remained constant.
c. Its entropy decreased.
d. Its entropy increased.

____ 27. Which of the following is a way to improve the efficiency of a heat engine?
a. increase Q_c
b. increase Q_h
c. reduce Q_h
d. reduce W_{net}

____ 28. How is conservation of internal energy expressed for a system during an isovolumetric process?
a. $Q = W = 0$, so $\Delta U = 0$ and $U_i = U_f$
b. $\Delta V = 0$, so $P\Delta V = 0$ and $W = 0$; therefore, $\Delta U = Q$
c. $\Delta T = 0$, so $\Delta U = 0$; therefore, $\Delta U = Q - W = 0$, or $Q = W$
d. $Q = 0$, so $\Delta U = -W$

____ 29. What occurs when a system's disorder is increased?
a. No energy is available to do work.
b. No work is done.
c. More energy is available to do work.
d. Less energy is available to do work.

____ 30. According to the second law of thermodynamics, which of the following statements about a heat engine operating in a complete cycle must be true?
a. Heat from a high-temperature reservoir equals the entropy increase.
b. Heat from a high-temperature reservoir cannot be completely converted to work.
c. Heat from a high-temperature reservoir must be completely converted to work.
d. Heat from a high-temperature reservoir must be completely converted to internal energy.

____ 31. Which equation describes the net work done for a complete cycle of a heat engine?
a. $W_{net} = Q_c - Q_h$
b. $W_{net} = Q_h - Q_c$
c. $W_{net} = Q - \Delta U$
d. $W_{net} = P\Delta V$

____ 32. An ideal gas system is maintained at a constant volume of 4 L. If the pressure is constant, how much work is done by the system?
a. 8 J
b. 0 J
c. 30 J
d. 5 J

____ 33. A thermodynamic process occurs, and the entropy of a system decreases. What can be concluded about the entropy change of the environment?
a. It decreases.
b. It increases.
c. It could increase or decrease, depending on the process.
d. It stays the same.

____ 34. During an isovolumetric process, which of the following does not change?
a. internal energy
b. volume
c. pressure
d. temperature

____ 35. What thermodynamic process for an ideal gas system has an unchanging internal energy and a heat intake that corresponds to the value of the work done by the system?
a. adiabatic
b. isobaric
c. isovolumetric
d. isothermal

Problems

36. A container of gas is at a pressure of 3.8×10^5 Pa. How much work is done by the gas if its volume expands by 1.8 m^3?

A. 4.8×10^5 J B. 5.8×10^5 J C. 6.8×10^5 J D. 7.8×10^5 J

37. An engine adds 62 000 J of energy as heat and removes 17 000 J of energy as heat. What is the engine's efficiency?

A. 0.63 B. 0.73 C. 0.83 D. 0.93

38. The gas within a cylinder of an engine undergoes a net change in volume of 1.40×10^{-3} m10^3 when it does work at a constant pressure of 3.56×1010^5 Pa. If the efficiency of the engine is 0.278, how much work must the engine give up as heat to the low-temperature reservoir?

A. 1.10×10^3 J B. 1.15×10^3 J C. 1.20×10^3 J D. 1.29×10^3 J

39. A turbine exhausts 62 500 J of energy as heat when it puts out 22 100 J of network. What is the efficiency of the turbine?

A. 0.261 B. 0.300 C. 0.320 D. 0.350

40. A total of 198 J of work is done on a gaseous refrigerant as it undergoes compression. If the internal energy of the gas increases by 121 J during the process, what is the total amount of energy transferred as heat?

A. –77 J, or 77 J transferred from the system as heat
B. –79 J, or 79 J transferred from the system as heat
C. –82 J, or 82 J transferred from the system as heat
D. –90 J, or 90 J transferred from the system as heat

41. An engine absorbs 2310 J as heat from a hot reservoir and gives off 830 J as heat to a cold reservoir during each cycle. What is the efficiency of the engine?

A. 0.60 B. 00.62 C. 0.64 D. 0.66

42. A steam engine takes in 2.54×1010^5 J of energy added as heat and exhausts 1.75×1010^5 J of energy removed as heat per cycle. What is its efficiency?

A. 0.311 B. 0.322 C. 0.333 D. 0.344

43. A gas compressed within a cylinder with a piston with a radius of 5.5 cm is displaced 8.6 cm. What is the net pressure on the gas if the work done on the gas equals –380 J?

A. 4.0×10^5 Pa B. 4.2×10^5 Pa
C. 4.4×10^5 Pa D. 4.6×10^5

44. An ideal gas is maintained at a constant pressure of 9.8×10^4 N/m^2 while its volume decreases by 0.38 m^3. What work is done by the system on its environment?

A. -3.7×10^4 J B. -3.4×10^4 J C. -3.2×10^4 J D. -3.0×10^4 J

45. A heat engine performs 2300.0 J of network while adding 7100.0 J of heat to the low-temperature reservoir. What is the efficiency of the engine?

A. 0.22468 B. 0.23468 C. 0.24468 D. 0.25468

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