Multiple Choice

12.1 Zeroth Law of Thermodynamics: Thermal Equilibrium 30.

What thermodynamic principle forms the basis for our ability to measure temperature?

a. the zeroth law
b. the first law
c. the second law
d. the third law

31.

Name any two industries in which the principles of thermodynamics are used.

a. aerospace and information technology (IT) industries
b. industrial manufacturing and aerospace
c. mining and textile industries
d. mining and agriculture industries

12.2 First law of Thermodynamics: Thermal Energy and Work 32.

What is the value of the Boltzmann constant?

a. k = 1.23 \times 10^{-38}\,\text{J/K}
b. k = 1.38 \times 10^{-23}\,\text{J/K}
c. k = 1.38 \times 10^{23}\,\text{J/K}
d. k = 1.23 \times 10^{38}\,\text{J/K}

33.

Which of the following involves work done BY a system?

a. increasing internal energy
b. compression
c. expansion
d. cooling

34.

What is conserved in the first law of thermodynamics?

a. mass
b. work
c. energy
d. heat

35.

What is the change in internal energy of a system that does 20 J of work when Q = 50\,\text{J} and Q = 20\,\text{J}?

a. 20\,\text{J}

b. 30\,\text{J}
c. 50\,\text{J}
d. 100\,\text{J}

36.

When does a real gas behave like an ideal gas?

a. A real gas behaves like an ideal gas at high temperature and low pressure.
b. A real gas behaves like an ideal gas at high temperature and high pressure.
c. A real gas behaves like an ideal gas at low temperature and low pressure.
d. A real gas behaves like an ideal gas at low temperature and high pressure.

12.3 Second Law of Thermodynamics: Entropy 37.

In an engine, what is the unused energy converted into?

a. internal energy
b. pressure
c. work
d. heat

38.

It is natural for systems in the universe to _____ spontaneously.

a. become disordered
b. become ordered
c. produce heat
d. do work

39.

If Q is 120\,\text{J} and T is 350\,\text{K}, what is the change in entropy?

a. 0.343\,\text{J/K}
b. 1.51\,\text{J/K}
c. 2.92\,\text{J/K}
d. 34.3\,\text{J/K}

40.

Why does entropy increase during a spontaneous process?

a. Entropy increases because energy always transfers spontaneously from a dispersed state to a concentrated state.
b. Entropy increases because energy always transfers spontaneously from a concentrated state to a dispersed state.
c. Entropy increases because pressure always increases spontaneously.
d. Entropy increases because temperature of any system always increases spontaneously.

41.

A system consists of ice melting in a glass of water. What happens to the entropy of this system?

a. The entropy of the ice decreases, while the entropy of the water cannot be predicted without more specific information.
b. The entropy of the system remains constant.
c. The entropy of the system decreases.
d. The entropy of the system increases.

12.4 Applications of Thermodynamics: Heat Engines, Heat Pumps, and Refrigerators 42.

Which equation represents the net work done by a system in a cyclic process?

a. W = \frac{Q_{\text{c}}}{Q_{\text{h}}}
b. W = Q_{\text{h}} + Q_{\text{c}}
c. W = Eff\left(Q_{\text{c}} - Q_{\text{h}} \right)
d. W = Q_{\text{h}} - Q_{\text{c}}

43.

Which of these quantities needs to be zero for efficiency to be 100 percent?

a. ΔU
b. W
c. Q_{h}
d. Q_{c}

44.

Which of the following always has the greatest value in a system having 80 percent thermal efficiency?

a. ΔU
b. W
c. Q_{h}
d. Q_{c}

45.

In the equation $Q = Q_{\text{h}} - Q_{\text{c}}$, what does the negative sign indicate?

a. Heat transfer of energy is always negative.
b. Heat transfer can only occur in one direction.
c. Heat is directed into the system from the surroundings outside the system.
d. Heat is directed out of the system.

46.

What is the purpose of a heat pump?

a. A heat pump uses work to transfer energy by heat from a colder environment to a warmer environment.
b. A heat pump uses work to transfer energy by heat from a warmer environment to a colder environment.
c. A heat pump does work by using heat to convey energy from a colder environment to a warmer environment.
d. A heat pump does work by using heat to convey energy from a warmer environment to a colder environment.