Questions

Chapter 20
Entropy and
the Second Law of Thermodynamics

20-1 What is Physics?
20-2 Irreversible Processes and Entropy
20-3 Change in Entropy
20-4 The Second Law of Thermodynamics
20-5 Entropy in the Real World: Engines
20-6 Entropy in the Real World: Refrigerators
20-7 The Efficiencies of Real Engines

20-3 Change in Entropy
M1-062

A system consists of an equilibrium mixture of ice and water at constant pressure. On heating the system, some of the ice melts, then:

A) the internal energy decreases
B) the entropy decreases
C) the temperature decreases
D) the entropy increases
E) the temperature increases

Answer D

20-3 Change in Entropy
M1-062

The change in entropy for melting 6.0 kg of a solid which melts at 27 ^{o}C is:
[The latent heat of fusion of the solid is 2.5×10^4 J/kg]

A) -5.0×10^2 J/K
B) $+5.0 \times 10^2$ J/K
C) $+5.6 \times 10^3$ J/K
D) -5.6×10^3 J/K
E) zero

Answer B

20-3 Change in Entropy
M1-061

Liquid water having a mass of 50 grams was initially at 0 ^oC. Heat was added to the water so that its entropy increases by 94.0 J/K, what is the final temperature of the water?

A) 428 K
B) 175 K
C) 273 K
D) 478 K
E) Zero

Answer A

20-3 Change in Entropy
M1-061

A 2.50-mole sample of an ideal monatomic gas was initially at a temperature of 300 K. The gas is compressed isobarically to half of its original volume, what is the change of entropy of the gas?

A) + 21.6 J/K
B) + 36.0 J/K
C) – 36.0 J/K
D) – 21.6 J/K
E) – 104 J/K

Answer C

20-3 Change in Entropy
M1-042

A 5.00-kg block of copper is at 296 K. If it is heated such that its entropy increases by 1.07 kJ/K, what is the final temperature? [The specific heat of copper is 386 J/(kg × K)]

A) 100 K.
B) 310 K.
C) 760 K.
D) 515 K.
E) 273 K.

Answer D

20-3 Change in Entropy
M1-041

In this question use: W = work, Q = heat, S = Entropy. Which of the following are state functions, i.e. path independent?

1. W
2. Q-W
3. S
4. Q
5. Q-2*W

A) 3 and 4.
B) Only 2.
C) 1, 2 and 4.
D) 2 and 5.
E) 2, 3.

Answer E

20-3 Change in Entropy
M1-041

Two moles of an ideal gas undergo an adiabatic free expansion from an initial volume of 0.6 L to 1.3 L. Calculate the change in entropy of gas.

A) 12.9 J/K.
B) zero.
C) 16.6 J/K.
D) -12.9 J/K.
E) -5.3 J/K.

Answer A

20-3 Change in Entropy
M1-041

System A (one kilogram of ice at zero degrees Celsius) is added to system B (one kilogram of water at 100 degrees Celsius) in an insulator container. Calculate the total change in entropy of system A.

A) -1.41 kJ/K.
B) 1.20 kJ/K.
C) 6.00 kJ/K.
D) 1.36 kJ/K.
E) Infinite.

Answer D

20-5 Entropy in the Real World: Engines
M1-062

A Carnot heat engine operates between two reservoirs at temperatures of 500 K and 375 K. If the engine extracts 6.0×10^7 J/cycle, find the heat rejected per cycle.

A) 1.0×10^7 J/cycle
B) 1.5×10^7 J/cycle
C) 2.5×10^7 J/cycle
D) 7.5×10^7 J/cycle
E) 4.5×10^7 J/cycle

Answer E

20-5 Entropy in the Real World: Engines
M1-061

A Carnot heat engine operates between two reservoirs at temperatures of 400 K and 500 K. What is the ratio of the work done by the engine to the heat expelled to the low-temperature reservoir?

A) 0.25
B) 0.35
C) 0.75
D) 2.25
E) 0.20

Answer A

20-5 Entropy in the Real World: Engines

M1-041

A heat engine has a thermal efficiency of 20%. It runs 2 revolutions per second and delivers 80 W. For each cycle find the heat discharged to the cold reservoir.

A) 160 W.
B) 200 W.
C) 40 W.
D) 61 W.
E) 121 W.

Answer A

20-6 Entropy in the Real World: Refrigerators
M1-071

A carnot refrigerator operating between -20 °C and +20 °C extracts heat from the cold reservoir at the rate 200 J/s. What is the rate at which work is done on the refrigerator?

A) 50 J/s
B) 6.3 J/s
C) 100 J/s
D) 32 J/s
E) 25 J/s

Answer D