

Worksheet: Entropy and the Second and Third Laws of Thermodynamics



Q1: Which of the following statements correctly expresses the relationship between the work done by a heat engine, W , and the internal energy lost by the heat engine's high-temperature reservoir, ΔQ ?

A $\Delta Q > W$

B $\Delta Q < W$

C $\Delta Q = W$

Q2: At what temperature is a gas heated by 45 kJ if its entropy increases by 125 J/K?

A 360 K

B 80 K

C 170 K

D 0.36 K

E 17 K

Q3: Work done on an object can heat the object by dissipation. A heat engine can use heating of an object to do work.

► When work is done on an object, what is the lowest number of joules dissipated per joule of work done?

A 1

B $\frac{1}{3}$

C $\frac{1}{4}$

D 0

E $\frac{1}{2}$

► When work is done on an object, what is the greatest number of joules dissipated per joule of work done?

A 0

B $\frac{1}{3}$

C $\frac{1}{2}$

D 1

E $\frac{1}{4}$

► For a heat engine that has the highest possible efficiency for a heat engine, what is the lowest number of joules of work per joule of input heating that the heat engine cannot output?

A 0

B $\frac{1}{3}$

C $\frac{1}{2}$

D 1

E $\frac{1}{4}$

► When a heat engine operates, what is the greatest number of joules of work done that cannot be supplied per joule of heating?

A 0

B $\frac{1}{4}$

C $\frac{1}{2}$

D 1

E $\frac{1}{3}$

► Which of the following changes in the net entropy of the systems involved in energy transfers, including energy transfers from the systems to their surroundings, can occur?

- A Entropy remains constant.
- B Entropy increases, decreases, or remains constant.
- C Entropy increases.
- D Entropy increases or remains constant.

Q4: Water at a temperature of 100°C changes state, requiring 2,260 J per gram of water that changes to steam. If 175 g of water is converted to steam, how much more entropy does the steam have than the water? Answer in kilojoules per kelvin to three significant figures.

- A 3.96 kJ/K
- B 1.06 kJ/K
- C 6.06 kJ/K
- D 1.45 kJ/K
- E 4.82 kJ/K

Q5: Calculate the magnitude of the heating of a gas at a temperature of 550 K that increases the entropy of the gas by 230 J/K. Answer in kilojoules to three significant figures.

A 127 kJ

B 2.39 kJ

C 279 kJ

D 830 kJ

E 15.8 kJ