Old-Exam-Questions-Ch.20

T081

Q17. The efficiency of a car engine is 20% when the engine does 1.2 kJ of work per cycle. What is the energy $|Q_L|$ the engine loses per cycle as heat? (Ans: 4.8 kJ)

Q18. The freezing compartment of a Carnot refrigerator is at 269 K while outside air in the room is at 298 K. If the power of refrigerator motor is 150 W, what is maximum amount of energy that can be extracted as heat from the freezing compartment in 10.0 min? (Ans: 8.35×10^5 J)

Q19. Calculate the change in entropy of 1.0 kg of ice at 0.0 °C when its temperature is increased to 20.0 °C [$L_{fusion\text{-}ice}$= 333 kJ/kg; c_{water}= 4190 J/kg.K. (Ans:1.5×10^3 J/K)

Q20. A 5.00 mol sample of an ideal gas expands reversibly and isothermally at 355 K until its volume doubled. What is the change in entropy of the gas? (Ans: 28.8 J/K)

T072:

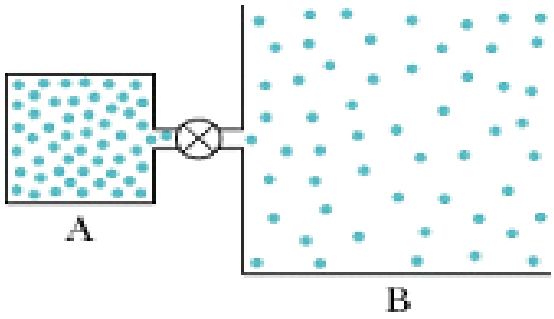
Q18: In an isolated container, a 0.10 kg block of aluminum initially at 600 K is brought into thermal contact with a very large block of iron at 200 K until thermal equilibrium is reached. The iron block is so large that we can assume that its temperature does not change. What is the change in entropy of the iron block? (specific heat of iron is 0.11 kcal/kg.K and specific heat of aluminum is 0.22 kcal/kg.K) (Ans: 44 cal/K)

Q19.A carnot engine completes 4 cycles per second. In every cycle, it delivers a power 120 W and discharges 40 J. what is the efficiency of the engine? (Ans: 43%)

Q20. A refrigerator converts 7.0 kg of water at 0 ^oC inti ice at 0 ^oC in one hour. What is the coefficient of performance of the refrigerator if its power input is 300 W? Heat of fusion for water is 333 kJ/kg. (Ans: 2.2)

T071:

Q15. As shown in Fig. 1 container A, of volume 1.0 L, holds 2.0 moles of oxygen. Container B, of volume 4.0 L, holds 2.0 moles of nitrogen. Both containers are isolated and are at the same temperature. The valve between the two containers is open and the molecules of each gas spread to fill the whole volume of the two containers. What is the total entropy change in the process? (Ans: 30 J/K)



Q16. An ice cube of mass 400 g at temperature of 0 ^{o}C melts to water at 0 ^{o}C. The process takes place very slowly, so it is reversible. What is the change in entropy of the ice when it has all melted. (Ans: 488 J/K)

Q17. A carnot heat engine operates between reservoirs at temperatures of 700 K and 300 K. In one cycle it absorbs 1500 J heat. How much work is done by the engine? (857 J)

Q18. A carnot refrigerator operating between –20 ^{o}C and +20 ^{o}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? (Ans: 32 J/s)

T062:

Q19. 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] (Ans: $+5.0\times10^{2}$ J/K)

Q20. 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. (Ans: 4.5×10^{7} J/cycle)

T061:

Q20. 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? (Ans: 0.25)

Q18. Liquid water having a mass of 50 grams was initially at 0 ^{o}C. Heat was added to the water so that its entropy increases by 94.0 J/K, what is the final temperature of the water?(Ans: 428 K)

Q19. 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? (Ans: – 36.0 J/K)

T052:

Q5. A 100 g of ice at -10 ^{o}C is placed in a lake whose temperature is 20 ^{o}C. Calculate the change in entropy of the lake. (Ans: –150 J/K.)

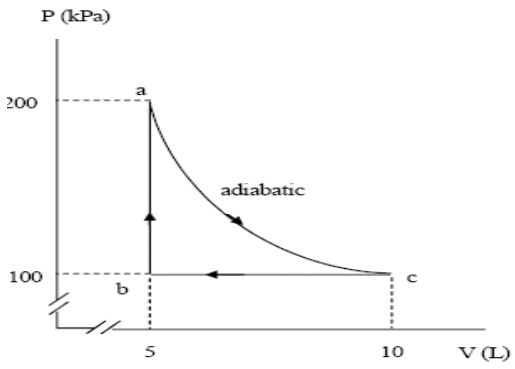
Q17. The temperature of 2.0 mole of a monatomic ideal gas is raised reversibly from 100 K to 300 K, with its volume kept constant. The entropy change for the gas is: (Ans: 27 J/K)

T051:

Q17. One mole of an ideal gas expands reversibly and isothermally at temperature T =27 ^{o}C until its volume is doubled. The change of entropy of this gas for this process is: (Ans: 5.8 J/K)

Q18. A 300 g of lead melts at 327 C. The latent heat of fusion of lead is 24.5 kJ/kg. The change in entropy is (Ans: 12.3 J/K)

Q19. Two moles of an ideal monatomic gas are taken around the cycle shown in the figure 1. If T_a = 60K, T_b=30K and T_c=38K, find the efficiency? (C_v=12.5 and C_p=20.75J/mol.K). (Ans: 56%)



T042:Q#19 A car engine delivers 8.6 kJ of work per cycle. If its efficiency is 30%, find the energy lost by the engine per cycle. (Ans: 20 kJ)

Q20. A 5.00-kg block of copper is at 296 K. If it is heated that its entropy increases by 1.07 kJ/K, what is the final temperature? [The specific heat of copper is 386 J/(kg.K)] (Ans: 515 K)

T041:

Q1. 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.(Ans: 160 W.)

Q2. 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.(Ans: 12.9 J/K)

Q3. 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. (Ans: 1.37 kJ/K)

T032:

Q1. One mole of a monatomic ideal gas is taken from an initial state to a final state (f) as shown in figure 1. The curved line is an isotherm. Calculate the increase in entropy of the gas for this process. (Ans: 36.5 J/K.)

Q2. One mole of a diatomic ideal gas is taken through the cycle shown in Figure 2. Process bc is adiabatic, Pa = 0.3 atm, Pb = 3.0 atm, Vb = 1.0×10^{-3} m^3, and Vc = $4.0V_b$. What is the efficiency of the cycle? (Ans: 53%)

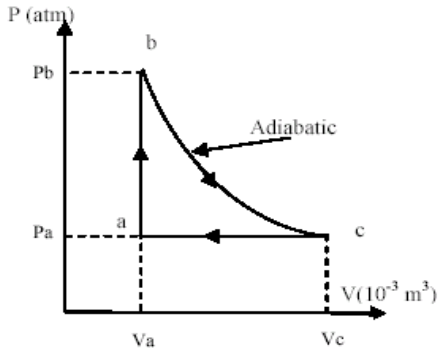


Figure 2

Q3. You mix two samples of water, A and B. Sample A is 100 g at 20 ^{0}C and sample B is also 100 g but at 80 ^{0}C. Calculate the change in the entropy of sample B. (Ans: – 8.9 cal/K.)

Q4. What mass of water at 0 degrees-C can a freezer make into ice cubes in one hour, if the coefficient of performance of the refrigerator is 3.0 and the power input is 0.2 Kilowatt? (Ans: 6.5 kg.)

T031:

Q1. Five moles of an ideal gas undergo a reversible isothermal compression from volume V to volume V/2 at temperature 30 ^{0}C. What is the change in the entropy of the gas? (Ans: –29 J/K.)

Q2. An automobile engine operates with an overall efficiency of 20%. How many gallons of gasoline is wasted for each 10 gallons burned? (Ans: 8)

Q3. A heat engine operates between 600 K and 300 K. In each cycle it takes 100 J from the hot reservoir, loses 25 J to the cold reservoir, and does 75 J of work. This heat engine violates:

A1 The second law but not the first law of thermodynamics.
A2 Both, the first law and the second law of thermodynamics.
A3 The first law but not the second law of the thermodynamics.
A4 Neither the first law nor the second law.
A5 Conservation of energy.