47815462092 52770753930 29259208480 76495494229 49280243858 9178363.7575758 136041693674 1887685.5625 78301740330 24584605056

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If this system is used as a heat pump, how many MJ of heat would be available for heating for each MJ of heat input to the engine?

(**Ans.** 1.8 MJ)

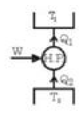
Solution: COP of the Ref. is 5

So for each MJ removed from the cold body we need work

$$= \frac{1\ MJ}{5} = 200\ kJ$$

For 200 kJ work output of heat engine hair $\eta = 30\%$

We have to supply heat $= \frac{200\ kJ}{0.3} = 666.67\ kJ$



Now

COP of H.P. = COP of Ref. + 1

$= 5 + 1 = 6$

Heat input to the H.E. = 1 MJ

$\therefore$ Work output (W) = 1×0.3 MJ = 300 kJ

That will be the input to H.P.

$\therefore (COP)_{H.P} = \frac{Q_1}{W}$

$\therefore Q_1 = (COP)_{H.P.} \times W = 6 \times 300\ kJ = 1.8\ MJ$

Q6.4 **An electric storage battery which can exchange heat only with a constant temperature atmosphere goes through a complete cycle of two processes. In process 1-2, 2.8 kWh of electrical work flow into the battery while 732 kJ of heat flow out to the atmosphere. During process 2-1, 2.4 kWh of work flow out of the battery.**

(a) Find the heat transfer in process 2-1.

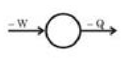
(b) If the process 1-2 has occurred as above, does the first law or the second law limit the maximum possible work of process 2-1? What is the maximum possible work?

(c) If the maximum possible work were obtained in process 2-1, what will be the heat transfer in the process?

(**Ans.** (a) – 708 kJ (b) Second law, $W_{2-1} = 9348$ kJ (c) $Q_{2-1} = 0$)

Solution: **From the first Law of thermodynamics**

(a) For process 1–2



$Q_{1-2} = E_2 - E_1 + W_{1-2}$

$-732 = (E_2 - E_1) - 10080$

$[2.8\ kWh = 2.8 \times 3600\ kJ]$

$\therefore E_2 - E_1 = 9348\ kJ$

For process 2–1

$Q_{21} = E_1 - E_2 + W_{21}$

$= -9348 + 8640$

$= -708$ kJ i.e. Heat flow out to the atmosphere.

(b) Yes Second Law limits the maximum possible work. As Electric energy stored in a battery is High grade energy so it can be completely converted to the work. Then,

$W = 9348$ kJ

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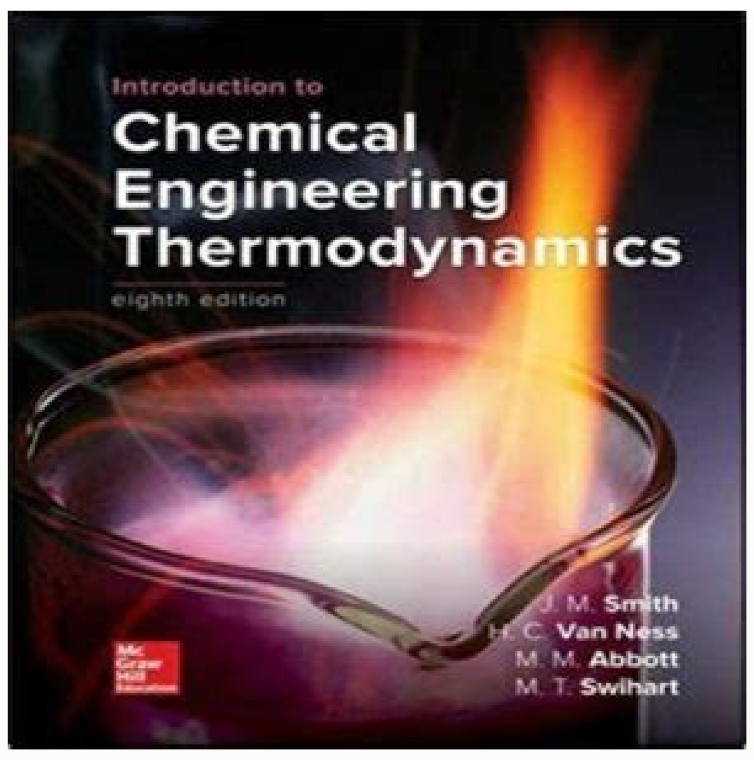

A far higher problem is to develop the capability to cause within the context of thermodynamics in order that one can apply thermodynamic rules within the answer of sensible issues. 3 Kinetic and potential energy changes are negligible. The second regulation is developed in Chap. 9)kJ/kg (1.669 kg/s) 2 (300 K)(7.101 7.117)kJ/kg.K 1 kJ/kg 1000 m 2 /s 2 12.4 kW (c) The second-law efficiency for this device may be defined as the exergy output divided by the exergy input: V2 X 1 m h1 h0 1 T0 (s1 s 0) 2 (205 m/s) 2 1 kJ/kg (1.669 kg/s)(88.39 1.93) kJ/kg 2 1000 m 2 /s 2 (300 K)(7.101 6.846)kJ/kg.K 51.96 kW II X X 2 12.4 kW 1 dest 1 0.761 76.1% 51.96 kW X 1 X 1 PROPRIETARY MATERIAL. 6-32C The coefficient of performance of a refrigerator represents the amount of heat removed from the refrigerated space for each unit of work supplied. The purpose of a refrigerator is to remove heat from a cold medium whereas the purpose of a heat pump is to supply heat to a warm medium. There is no creation of energy, and thus no violation of the conservation of energy principle. Analysis Using variable specific heats, the properties can be determined using the air table as follows u1 u2 214.07 kJ/kg 0 0 T1 T2 300 K s1 s2 1.70203 kJ/kg.K Pr1 Pr 2 1.3860 T = const. 6-30C No. Because the refrigerator consumes work to accomplish this task. 1-kg-force is the force required to accelerate a 1-kg mass by 9.807 m/s2. energies WATER 0 U or, Copper 50 kg UCu U water 0 [mc(T2 T1)]Cu [mc(T2 T1)]water 0 90 L where mwater V (997 kg/m3)(0.090 m 3) 89.73 kg Using specific heat values for copper and liquid water at room temperature and substituting, (50 kg)(0.386 kJ/kg C)(T2 140)C (89.73 kg)(4.18 kJ/kg C)(T2 10)C 0 T2 = 16.4C = 289.4 K The entropy generated during this process is determined from T 289.4 K 6.864 kJ/K S copper mc avg ln 2 50 kg 0.386 kJ/kg K ln 413 K T1 T 289.4 K 8.388 kJ/K S water mc avg ln 2 89.73 kg 4.18 kJ/kg K ln 283 K T1 Thus, S total S copper S water 6.864 8.388 1.52 kJ/K PROPRIETARY MATERIAL. © 2015 McGraw-Hill Education. 2 The system is stationary and thus the kinetic and potential energies are negligible. kJ / kg s1o 1.66802 kJ / kg K T2 440 K 600 kPa 167C h2 441.61 kJ / kg s2o 2.0887 kJ / kg K Analysis The increase in exergy is the difference between the exit and inlet flow exergies, AIR 8 kW Increase in exergy 2 1 0 0 [(h2 h1) ke pe T0 (s 2 s1)] (h2 h1) T0 (s 2 s1) 100 kPa 17C where P2 P1 600 kPa (2.0887 1.66802)kJ/kg K - (0.287 kJ/kg K) ln 100 kPa 0.09356 kJ/kg K s 2 s1 (s 2o s1o) R ln Substituting, Increase in exergy 2 1 (441.61 290.16)kJ/kg - (290 K)(0.09356 kJ/kg K) 178.6 kJ/kg Then the reversible power input is (2 1) (2.1 / 60 kg/s)(178.6 kJ/kg) 6.25 kW W rev,in m (b) The rate of exergy destruction (or irreversibility) is determined from its definition, X destroyed W in W rev,in 8 6.25 1.75 kW Discussion Note that 1.75 kW of power input is wasted during this compression process. Analysis Applying Newton's second law, the weight is determined to be W mg (200 kg)(9.6 m/s 2) 1920N 1-10 A plastic tank is filled with water. Certainly, there is no such thing as a approach to make it easy. The height at which the weight of a body will decrease by 0.3% is to be determined. The place solely a single-semester course in chemical engineering thermodynamics is offered, these chapters might symbolize adequate content material. Download full file from buklibry.com Full file at 7-33 Entropy Change of Incompressible Substances 7-59C No, because entropy is not a conserved property. (Similar problems and their solutions can be obtained easily by modifying numerical values). 3 Nitrogen is an ideal gas with variable specific heats. Download full file from buklibry.com Full file at 1-2 Thermodynamics 1-1C Classical thermodynamics is based on experimental observations whereas statistical thermodynamics is based on the average behavior of large groups of particles. Though introductory in nature, the fabric of this textual content shouldn't be thought of easy. 6-33C The coefficient of performance of a heat pump represents the amount of heat supplied to the heated space for each unit of work supplied. Furthermore, we goal to encourage understanding by writing in easy active-voice, present-tense prose. Assumptions 1 Air is an ideal gas with variable specific heats. Properties The gas constant of air is R = 0.287 kPa.m3/kg.K (Table A-1). "Given" T1=298 [K] T2=3000 [K] "P=1 [atm]" m_dot=0.2 [kg/min] T0=298 [K] "The equilibrium constant for these two reactions at 3000 K are determined from Table A-28" K_p1=exp(-3.086) K_p2=exp(-2.937) "Properties" MM_H2O=molarmass(H2O) "Analysis" "(a)" "Actual reaction: H2O = N_H2O H2O + N_H2 H2 + N_O2 O2 + N_OH OH" 2=2*N_H2O+2*N_H2+N_OH "H balance" 1=N_H2O+2*N_O2+N_OH "O balance" N_total=N_H2O+N_H2+N_O2+N_OH "Stoichiometric reaction 1: H2O = H2 + 1/2 O2" "Stoichiometric coefficients for reaction 1" nu_H2O_1=1 nu_H2_1=1 nu_O2_1=1/2 "Stoichiometric reaction 2: H2O = 1/2 H2 + OH" "Stoichiometric coefficients for reaction 2" nu_H2O_2=1 nu_H2_2=1/2 nu_OH_2=1 "K_p relations are" K_p1=(N_H2^nu_H2_1*N_O2^nu_O2_1)/N_H2O^nu_H2O_1*(P/N_total)^(nu_H2_1+nu_O2_1-nu_H2O_1) K_p2=(N_H2^nu_H2_2*N_OH^nu_OH_2)/N_H2O^nu_H2O_2*(P/N_total)^(nu_H2_2+nu_OH_2-nu_H2O_2) "Enthalpy of formation data from Table A-26" h_f_OH=39460 "Enthalpies of products" h_H2O_R=enthalpy(H2O, T=T1) h_H2O_P=enthalpy(H2O, T=T2) h_H2=enthalpy(H2, T=T2) h_O2=enthalpy(O2, T=T2) h_OH=98763 "at T2 from the ideal gas tables in the text" "Standard state enthalpies" h_o_OH=9188 "at T0 from the ideal gas tables in the text" "Heat transfer" H_P=N_H2O*h_H2O_P+N_H2*h_H2+N_O2*h_O2+N_OH*(h_f_OH+h_OH-h_o_OH) H_R=N_H2O_R*h_H2O_R N_H2O_R=1 Q_in_a=H_P-H_R Q_dot_in_a=(m_dot/MM_H2O)*Q_in_a "(b)" Q_in_b=N_H2O_R*(h_H2O_P-h_H2O_R) Q_dot_in_b=(m_dot/MM_H2O)*Q_in_b PROPRIETARY MATERIAL. The energy balance for this system can be expressed as E Eout in Net energy transfer by heat, work, and mass Esystem Changein internal, kinetic, potential,etc. The fabric of those 16 chapters is greater than sufficient for an academic-year undergraduate course, and discretion, conditioned by the content material of different programs, is required within the selection of what's lined. 1-2C On a downhill road the potential energy of the bicyclist is being converted to kinetic energy, and thus the bicyclist picks up speed. 14. 1-7C There is no acceleration, thus the net force is zero in both cases. Analysis We take the entire contents of the tank, water + copper block, as the system. Properties The gas constant of nitrogen is R = 0.2968 kJ/kg.K. Analysis (a) For this problem, we use the properties from EES software. Nevertheless, a very powerful purposes of these legal guidelines, and the supplies and processes of biggest concern, differ from one department of science or engineering to one other. Limited distribution permitted only to teachers and educators for course preparation. The final results are to be plotted against the environment temperature. Therefore, this cannot happen. We'd additionally like to thank Professor Bharat Bhatt for his much-appreciated feedback and recommendation in the course of the accuracy verify. A scholar new to the topic will discover {that a} demanding job of discovery lies forward. Chemical-reaction equilibrium is roofed at size in Chap. From the air table (Table A-17) T1 290 K h1 29016 . The purpose of a refrigerator is to remove heat from a refrigerated space whereas the purpose of an air-conditioner is remove heat from a living space. Analysis The expressions for the isentropic compression and expansion processes are T2 T1 r p(k 1) / k 1 T4 T3 rp (k 1) / k For an ideal regenerator, T5 T4 T qin 5 4 2 1 T6 T 2 3 6 qout s The thermal efficiency of the cycle is th 1 q out T T T (T / T) 1 1 6 1 1 1 6 1 q in T3 T5 T3 1 (T5 / T3) 1 T1 (T2 / T1) 1 T3 1 (T4 / T3) 1 (k 1) / k 1 T1 r p (k 1) /k T3 1 r p 1 T1 (k 1) / k rp T3 PROPRIETARY MATERIAL. The effect of the environment temperature on the final pressure and the heat transfer as the environment temperature varies from 0°C to 50°C is to be investigated. The amount of electricity that can be produced by the turbine and the blade tip speed are to be determined. Chapters 3 and 4 then deal with the stress/quantity/temperature conduct of fluids and warmth results related to temperature change, section change, and chemical response, permitting the early software of the primary regulation to reasonable issues. Assumptions 1 Both the water and the copper block are incompressible substances with constant specific heats at room temperature. We are able to hardly provide the required motivation, however our goal, because it has been for all earlier editions, is a therapy which may be understood by any scholar keen to put forth the required effort. It violates the second law of thermodynamics. Assumptions Wind flows steadily at the specified speeds. Download full file from buklibry.com Full file at 8-38 8-51 Air is compressed steadily by an 8-kW compressor from a specified state to another specified state. Download full file from buklibry.com Full file at 4-99 4-132 Problem 4-131 is reconsidered. This Manual may not be sold and may not be distributed to or used by any student or other third party. To do the parametric study or to solve the problem when Q_out = 0, place this statement in {}." {Q_out=0 [kJ]} "To determine the surroundings temperature that makes Q_out = 0, remove the {} and resolve the problem." "Solution" "Conservation of Energy for the combined tanks:" E_in-E_out=DELTAE E_in=0 E_out=Q_out DELTAE=m_A*(u_A[2]-u_A[1])+m_B*(u_B[2]-u_B[1]) m_A=Vol_A/v_A[1] m_B=Vol_B/v_B[1] Fluid$='Steam_IAPWS' u_A[1]=INTENERGY(Fluid$,P=P_A[1], x=x_A[1]) v_A[1]=volume(Fluid$,P=P_A[1], x=x_A[1]) T_A[1]=temperature(Fluid$,P=P_A[1], x=x_A[1]) u_B[1]=INTENERGY(Fluid$,P=P_B[1],T=T_B[1]) v_B[1]=volume(Fluid$,P=P_B[1],T=T_B[1]) "At the final state the steam has uniform properties through out the entire system." u_B[2]=u_final u_A[2]=u_final m_final=m_A+m_B Vol_final=Vol_A+Vol_B v_final=Vol_final/m_final u_final=INTENERGY(Fluid$,T=T_final, v=v_final) P_final=pressure(Fluid$,T=T_final, v=v_final) Pfinal [kPa] 0.6112 0.9069 1.323 1.898 2.681 3.734 5.13 6.959 9.325 12.35 Qout [kJ] 2300 2274 2247 2218 2187 2153 2116 2075 2030 1978 Tfinal [C] 0 5.556 11.11 16.67 22.22 27.78 33.33 38.89 44.44 50 PROPRIETARY MATERIAL. Analysis The blade span area is A D 2 / 4 (185 ft) 2 / 4 26,880 ft 2 The wind power potential at the wind speed of 16 ft/s is 1 1 1 kW 174.0 kW W available,1 AV13 (0.075 lbm/ft 3)(26,880 ft 2)(16 ft/s) 3 2 3 2 2 23,730 lbm ft /s The wind power potential at the wind speed of 24 ft/s is 1 1 1 kW 587.2 kW W available,2 AV23 (0.075 lbm/ft 3)(26,880 ft 2)(24 ft/s) 3 2 3 2 2 23,730 lbm ft /s The overall wind turbine efficiency at a wind speed of 16 ft/s is wt,overall,1 wt,1 gen (0.30)(0.93) 0.2790 The overall wind turbine efficiency at a wind speed of 24 ft/s is wt,overall,2 wt,2 gen (0.35)(0.93) 0.3255 The electric power generated at a wind speed of 16 ft/s is W electric,1 wt,overall,1W available,1 (0.2790)(174.0 kW) 48.54 kW The electric power generated at a wind speed of 24 ft/s is W electric,2 wt,overall,2W available,2 (0.3255)(587.2 kW) 191.1 kW The amount of electricity produced at a wind speed of 16 ft/s is Welectric,1 W electric,1 Operating hours1 (48.54 kW)(3000 h) 145,630 kWh The amount of electricity produced at a wind speed of 24 ft/s is Welectric,2 W electric,2 Operating hours 2 (191.1 kW)(4000 h) 764,560 kWh The total amount of electricity produced is Welectric, total Welectric,1 Welectric,2 145,560 764,560 910,000kWh Noting that the tip of blade travels a distance of D per revolution, the tip velocity of the turbine blade for a rotational speed of n becomes 1 min 1 mi/h Vtip Dn (185 ft) (15 / min) 99.1mph 60 s 1.46667 ft/s PROPRIETARY MATERIAL. Introduction to Chemical Engineering Thermodynamics PDF Author(s): J.M. Smith, Hendrick Van Ness, Michael Abbott, Mark Swihart Publisher: McGraw-Hill Education, Year: 2018 ISBN: 9781259696527 Solution Manual Introduction to Chemical Engineering Thermodynamics 7th Edition Download Introduction to Chemical Engineering Thermodynamics eighth Version PDF Free. At the inlet of the diffuser and at the dead state, we have T1 110C 383 K h1 88.39 kJ/kg P1 100 kPa s1 7.101 kJ/kg K T1 300 K h0 1.93 kJ/kg P1 100 kPa s 0 6.846 kJ/kg K q Nitrogen 100 kPa 110C 205 m/s 110 kPa 45 m/s An energy balance on the diffuser gives V12 V2 h2 2 q out 2 2 2 (205 m/s) 1 kJ/kg (45 m/s)2 1 kJ/kg 88.39 kJ/kg h 2 2 2 1000 m 2 /s 2 1000 m 2 /s 2 h1 2.5 kJ/kg h2 105.9 kJ/kg The corresponding properties at the exit of the diffuser are h2 105.9 kJ/kg T2 127C 400 K P1 110 kPa s 2 7.117 kJ/kg K (b) The mass flow rate of the nitrogen is determined to be 2 A2V2 m P2 110 kPa A2V2 (0.04 m 2)(45 m/s) 1.669 kg/s RT2 (0.2968 kJ/kg.K)(400 K) The exergy destruction in the nozzle is the exergy difference between the inlet and exit of the diffuser: V 2 V22 X dest m h1 h2 1 T0 (s1 s 2) 2 (205 m/s)2 (45 m/s)2 (88.39 105 . Properties The density and specific heat of water at 25C are = 997 kg/m3 and cp = 4.18 kJ/kg.C. It can be greater than unity. The guide is complete sufficient to make it a helpful reference each in graduate programs and for skilled apply. 5, the place its most simple purposes are additionally launched. P = const. 1-8 The variation of gravitational acceleration above the sea level is given as a function of altitude. 106 z) In our case, W (1 0.3 / 100)Ws 0.997Ws 0.997mg s 0.997(m)(9.807) Substituting, 0 6 0.997(9.807) (9.807 3.32 10 z) z 8862 m Sea level PROPRIETARY MATERIAL. 1-4C There is no truth to his claim. 7-60 A hot copper block is dropped into water in an insulated tank. The increase in the exergy of air and the rate of exergy destruction are to be determined. Chemical Engineering Thermodynamics Contents INTRODUCTION THE FIRST LAW AND OTHER BASIC CONCEPTS VOLUMETRIC PROPERTIES OF PURE FLUIDS HEAT EFFECTS THE SECOND LAW OF THERMODYNAMICS THERMODYNAMIC PROPERTIES OF FLUIDS APPLICATIONS OF THERMODYNAMICS TO FLOW PROCESSES PRODUCTION OF POWER FROM HEAT REFRIGERATION AND LIQUEFACTION THE FRAMEWORK OF SOLUTION THERMODYNAMICS MIXING PROCESSES PHASE EQUILIBRIUM: INTRODUCTION THERMODYNAMIC FORMULATIONS FOR VAPOR/LIQUID EQUILIBRIUM CHEMICAL-REACTION EQUILIBRIA TOPICS IN PHASE EQUILIBRIA THERMODYNAMIC ANALYSIS OF PROCESSES Preface to Chemical Engineering Thermodynamics eBook Thermodynamics, a key part of many fields of science and engineering, relies on legal guidelines of common applicability. Download full file from buklibry.com Full file at 16-45 16-49 Problem 16-48 is reconsidered. It does not create it. "Knowns" Vol_A=0.2 [m^3] P_A[1]=400 [kPa] x_A[1]=0.8 T_B[1]=250 [C] P_B[1]=200 [kPa] Vol_B=0.5 [m^3] T_final=25 [C] "T_final = T_surroundings. Download full file from buklibry.com Full file at 1-4 1-12 A rock is thrown upward with a specified force. 6-31C No. Because the heat pump consumes work to accomplish this task. Properties The gas constant of air is R = 0.287 kJ/kg.K (Table A-1). 3 P 1 s = const. Cengel, Michael A. Chapter 15 offers with subjects in section equilibria, together with liquid/liquid, stable/ liquid, stable/vapor, gasoline adsorption, and osmotic equilibria. "When R=constant and V= constant, P1/P2=m1*T1/m2*T2" m1=2 "kg" P1=4 "atm" P2=2.2 "atm" T1=40+273 "K" m2=0.5*m1 "kg" P1/P2=m1*T1/(m2*T2) T2_C=T2-273 "C" "Some Wrong Solutions with Common Mistakes:" P1/P2=m1*(T1-273)/(m2*W1_T2) "Using C instead of K" P1/P2=m1*T1/(m1*(W2_T2+273)) "Disregarding the decrease in mass" P1/P2=m1*T1/(m1*W3_T2) "Disregarding the decrease in mass, and not converting to deg. If you are a student using this Manual, you are using it without permission. Then the energy balance for this closed system reduces to Ein Eout Esystem Qin U U He U O2 He: U He mcv Tm T1 4 kg3.1156 kJ/kg K220 170K 623.1 kJ O2: T R1 1.10 Z 2.2 PR1 1.38 h1 T R2 1.42 9.97 Z h 1.2 PR2 1.963 2 5.08 (Fig. Download full file from buklibry.com Full file at 3-78 3-140 Consider a sealed can that is filled with refrigerant-134a. 2 Air is an ideal gas with constant specific heats at room temperature. The specific heat of copper at 27C is cp = 0.386 kJ/kg.C (Table A-3). Nevertheless, size concerns have required prudent selectivity. PROPRIETARY MATERIAL. Download full file from buklibry.com Full file at 11-60 30 27 Win,net [kW] 24 21 turb=0.70 18 15 turb=0.85 12 turb=1.0 9 0.7 0.75 0.8 0.85 0.9 0.95 1 comp 20 turb=1.0 QRefrig [kW] 16 turb=0.85 12 turb=0.70 8 0.7 0.75 0.8 0.85 comp 0.9 0.95 1 PROPRIETARY MATERIAL. A-29) h2 h1 Ru Tcr (Z h1 Z h2) (h2 h1) ideal (8.314 kJ/kmol K)(154.8 K)(2.2 1.2) (6404 4949)kJ/kmol 2742 kJ/kmol Also, PHe,1 N He Ru T1 V tank PO 2 ,1 Pm,1 PHe,1 (1 kmol)(8.314 kPa m 3 /kg K)(170 K) 0.229 m 3 7000 kPa 6172 kPa 828 kPa 6,172 kPa Thus, U O 2 N O 2 (h2 h1) (P2V 2 P1V1) N O 2 (h2 h1) (PO 2 ,2 PO 2 ,1)V tank (0.25 kmol)(2742 kJ/kmol) (1981 828)(0.229)kPa m 3 421.5 kJ Substituting, Qin 623.1 kJ 421.5 kJ 1045 kJ PROPRIETARY MATERIAL. Hence, this product forms a distance dimension and unit. The primary two chapters of the guide current primary definitions and improvement of the primary regulation of thermodynamics. Chapter 13 gives a full therapy of vapor/liquid equilibrium. 6 permits the overall software of the primary and second legal guidelines and gives for expanded therapy of circulate processes in Chap. 2 Potential energy change is negligible. Chapter 10 introduces the framework of answer thermodynamics, which underlies the purposes within the following chapters. Assumptions 1 Steady operating conditions exist. Properties The density of air is given to be = 0.075 lbm/ft3. Now a valve is opened, and half of mass of the gas is allowed to escape. In other words, the weight of 1-kg mass at sea level is 1 kg-force. No other use or distribution of this Manual is permitted. We're indebted to many individuals—college students, professors, reviewers—who've contributed in numerous methods to the standard of this eighth version, straight and not directly, by means of query and remark, reward and criticism, by means of seven earlier editions spanning greater than 65 years. A full therapy of the thermodynamic properties of pure fluids in Chap. Solutions can be verified by copying-and-pasting the following lines on a blank EES screen. The contents of the can are at the room temperature of 25C. The weight of the combined system is to be determined. 2 Kinetic and potential energy changes are negligible. Properties The density and specific heat of water are taken = 64.0 lbm/ft3 and c = 1.0 Btu/lbm.F, respectively. No work or mass crosses the system boundary, therefore this is a closed system with no work interactions. Download full file from buklibry.com Full file at 1-3 1-9 The mass of an object is given. Download full file from buklibry.com Full file at 7-133 7-176 A piston-cylinder device contains air that undergoes a reversible thermodynamic cycle composed of three processes. Full file at INSTRUCTOR SOLUTIONS MANUAL Download full file from buklibry.com Full file at 1-1 Solutions Manual for Thermodynamics: An Engineering Approach 8th Edition Yunus A. Download full file from buklibry.com Full file at 9-91 9-112 An expression for the thermal efficiency of an ideal Brayton cycle with an ideal regenerator is to be developed. 2 V u 283.71 kJ/kg P 400 kPa 1.3860 3.696 3 Pr 3 3 Pr 2 T3 396.6 K P2 150 kPa The mass of the air and the volumes at the various states are m P1V1 (400 kPa)(0.3 m 3) 1.394 kg RT1 (0.287 kPa m 3 /kg K)(300 K) V2 mRT 2 (1.394 kg)(0.287 kPa m 3 /kg K)(300 K) 0.8 m 3 P2 150 kPa V3 mRT3 (1.394 kg)(0.287 kPa m 3 /kg K)(396.6 K) 0.3967 m 3 P3 400 kPa Process 1-2: Isothermal expansion (T2 = T1) S12 mR ln P2 150 kPa (1.394 kg)(0.287 kJ/kg.K)ln 0.3924 kJ/kg.K P1 400 kPa Qin,12 T1S12 (300 K)(0.3924 kJ/K) 117.7kJ Wout,12 Qin,12 117.7kJ Process 2-3: Isentropic (reversible-adiabatic) compression (s2 = s1) Win,23 m(u3 u2) (1.394 kg)(283.71 - 214.07) kJ/kg 97.1kJ Q2-3 = 0 kJ Process 3-1: Constant pressure compression process (P1 = P3) Win,31 P3 (V3 V1) (400 kg)(0.3924 - 0.3) kJ/kg 37.0 kJ Qout,31 Win,31 m(u1 u3) 37.0 kJ - (1.394 kg)(214.07 - 283.71) kJ/kg 135.8kJ PROPRIETARY MATERIAL. Using a level meter (a device with an air bubble between two marks of a horizontal water tube) it can shown that the road that looks uphill to the eye is actually downhill. This is a closed system since no mass crosses the system boundary during the process. Download full file from buklibry.com Full file at 6-7 6-27E An OTEC power plant operates between the temperature limits of 86F and 41F. Its weight is to be determined. Assumptions 1 All processes are reversible. The textual content is structured to alternate between the event of thermodynamic rules and the correlation and use of thermodynamic properties in addition to between concept and purposes. z Analysis The weight of a body at the elevation z can be expressed as W mg m(9.807 332 . Boles McGraw-Hill, 2015 Chapter 1 INTRODUCTION AND BASIC CONCEPTS PROPRIETARY AND CONFIDENTIAL This Manual is the proprietary property of McGraw-Hill Education and protected by copyright and other state and federal laws. 2 Water is an incompressible substance with constant properties. Download full file from buklibry.com Full file at 18-29 18-64E A wind turbine is to generate power with two specified wind speeds. Analysis Using proper unit conversions, the constant-pressure specific heat is determined in various units to be 1 kJ/kg K 1.005 kJ/kg K c p (1.005 kJ/kg C) 1 kJ/kg C 1000 J 1 kg 1.005 J/g C c p (1.005 kJ/kg C) 1 kJ 1000 g 1 kcal c p (1.005 kJ/kg C) 0.240 kcal/kg C 4.1868 kJ 1 Btu/lbm F 0.240 Btu/lbm F c p (1.005 kJ/kg C) 4.1868 kJ/kg C PROPRIETARY MATERIAL. Chapter 12 then describes the evaluation of section equilibria, in a principally qualitative method. Assumptions 1 The air standard assumptions are applicable. The cooling water experiences a temperature rise of 6F in the condenser. 7. New ideas, phrases, and symbols seem at a bewildering charge, and a level of memorization and psychological group is required. T1=25 "C" P2=90 "kPa" T2=TEMPERATURE(R134a,x=0,P=P2) "Some Wrong Solutions with Common Mistakes:" W1_T2=T1 "Assuming temperature remains constant" 3-141 A rigid tank contains 2 kg of an ideal gas at 4 atm and 40C. Download full file from buklibry.com Full file at 13-75 (b) We take both gases as the system. Analysis The mass flow rate of the cooling water is 1 ft 3 = 113,790 lbm/min = 1897 lbm/s m water Vwater (64.0 lbm/ft 3)(13,300 gal/min) 7.4804 gal The rate of heat rejection to the cooling water is Q m C(T T) (1897 lbm/s)(1.0 Btu/lbm.F)(6F) = 11,380 Btu/s out water out in Noting that the thermal efficiency of this plant is 2.5%, the power generation is determined to be W W W 0.025 W 292 Btu/s = 308 kW W (11,380 Btu/s) Q W Q in out since 1 kW = 0.9478 Btu/s. The effect of the final temperature on the rate of heat supplied for the two cases is to be studied. We wish to thank McGraw-Hill Training and all the groups that contributed to the event and assist of this venture. C" W4_T2=(T1-273)/2 "Taking T2 to be half of T1 since half of the mass is discharged" PROPRIETARY MATERIAL. The exit temperature, the rate of exergy destruction, and the second law efficiency are to be determined. Assumptions The density of water is constant throughout. Properties The density of water is given to be = 1000 kg/m3. Thus, we consider there may be worth in presenting this materials from a chemical-engineering perspective, specializing in the applying of thermodynamic rules to supplies and processes probably to be encountered by chemical engineers. The final equilibrium temperature of the tank and the total entropy change are to be determined. By opening and using this Manual the user agrees to the following restrictions, and if the recipient does not agree to these restrictions, the Manual should be promptly returned unopened to McGraw-Hill Education: This Manual is being provided only to authorized professors and instructors for use in preparing for the classes using the affiliated textbook. Refrigerators and Heat Pumps 6-28C The difference between the two devices is one of purpose. The work and heat transfer for each process are to be determined. Analysis The mass of the water in the tank and the total mass are mtank = 3 kg V =0.2 m mw =V =(1000 kg/m)(0.2 m) = 200 kg 3 3 3 H2O mtotal = mw + mtank = 200 + 3 = 203 kg Thus, 1N 1991 N W mg (203 kg)(9.81 m/s2) 2 1 kg m/s 1-11E The constant-pressure specific heat of air given in a specified unit is to be expressed in various units. These embody purposes to polymers, electrolytes, and biomaterials. 6-29C The difference between the two devices is one of purpose. The acceleration of the rock is to be determined. 6-34C No. The heat pump captures energy from a cold medium and carries it to a warm medium. 1-3C A car going uphill without the engine running would increase the energy of the car, and thus it would be a violation of the first law of thermodynamics. Introduction to Chemical Engineering Thermodynamics eighth Version by J.M. Smith, Hendrick Van Ness, Michael Abbott, and Mark Swihart | PDF Free Download. 3 The tank is wellinsulated and thus there is no heat transfer. The rest of the guide, involved with fluid mixtures, treats subjects within the distinctive area of chemical-engineering thermodynamics. Now a leak developes, and the pressure in the can drops to the local atmospheric pressure of 90 kPa. The temperature of the refrigerant in the can is expected to drop to (rounded to the nearest integer) (a) 0C (b) -29C (c) -16C (d) 5C (e) 25C Answer (b) -29C Solution Solved by EES Software. Download full file from buklibry.com Chapters 8 and 9 cope with energy manufacturing and refrigeration processes. The amount of power that can be generated by this OTEC plans is to be determined. Download full file from buklibry.com Full file at 8-138 8-131 Heat is lost from the air flowing in a diffuser. Chapter 16 treats the thermodynamic evaluation of actual processes, affording a evaluation of a lot of the sensible material of thermodynamics. The light-year unit is then the product of a velocity and time. The primary 14 chapters embody materials thought of obligatory for any chemical engineer's schooling. Analysis The problem is solved using EES, and the solution is given below. Whereas sustaining the rigor attribute of sound thermodynamic evaluation, we've made each effort to keep away from pointless mathematical complexity. Mass, Force, and Units 1-5C Kg-mass is the mass unit in the SI system whereas kg-force is a force unit. Remember that for an ideal gas, enthalpy is a function of temperature only whereas entropy is functions of both temperature and pressure. 3 Air is an ideal gas with variable specific heats. Thus, we don't embody sure subjects which are worthy of consideration however are of a specialised nature. If the final pressure in the tank is 2.2 atm, the final temperature in the tank is (a) 71C (b) 44C (c) -100C (d) 20C (e) 172C Answer (a) 71C Solution Solved by EES Software. Particularly, we want to thank the next editorial and manufacturing workers for his or her important contributions to this eighth version: Thomas Scaife, Chelsea Haupt, Nick McFadden, and Laura Bies. No part of this Manual may be reproduced, displayed or distributed in any form or by any means, electronic or otherwise, without the prior written permission of McGraw-Hill Education. Analysis The weight of the rock is 1N W mg (3 kg)(9.79 m/s 2) 1 kg m/s 2 29.37 N Then the net force that acts on the rock is Fnet Fup Fdown 200 29.37 170.6 N Stone From the Newton's second law, the acceleration of the rock becomes a F 170.6 N 1 kg m/s 2 m 3 kg 1 N 56.9 m/s 2 PROPRIETARY MATERIAL. 1-6C In this unit, the word light refers to the speed of light.

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