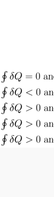
Unit 11 - Week 8 :

Assignment 8

The due date for submitting this assignment has passed. **Due on 2019-09-25, 23:59 IST.**
As per our records you have not submitted this assignment.

1) Which among the following equalities/inequalities is TRUE for all reversible heat engines operating between two constant temperature thermal reservoirs at temperatures T_H and T_L ($< T_H$) as shown in the figure below? *1 point*



(a) $\oint \delta Q = 0$ and $\oint \frac{\delta Q}{T} = 0$
(b) $\oint \delta Q < 0$ and $\oint \frac{\delta Q}{T} < 0$
(c) $\oint \delta Q > 0$ and $\oint \frac{\delta Q}{T} > 0$
(d) $\oint \delta Q > 0$ and $\oint \frac{\delta Q}{T} < 0$
(e) $\oint \delta Q > 0$ and $\oint \frac{\delta Q}{T} = 0$

a
b
c
d
e

No, the answer is incorrect.
Score: 0
Accepted Answers:
e

2) A closed system undergoes a process between two fixed states in a reversible manner in the first case and in an irreversible manner in the second case. How do the values of the change in entropy of the system (ΔS) compare for these processes? *1 point*

(a) $(\Delta S)_{rev} > (\Delta S)_{irrev}$
(b) $(\Delta S)_{rev} < (\Delta S)_{irrev}$
(c) $(\Delta S)_{rev} = (\Delta S)_{irrev}$
(d) Can't say

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
c

3) A closed system undergoes a process between two fixed states in a reversible manner in the first case and in an irreversible manner in the second case. How do the values of the integral $\int \frac{\delta Q}{T}$ compare for these processes? *1 point*

(a) $\int_1^2 \left(\frac{\delta Q}{T}\right)_{rev} > \int_1^2 \left(\frac{\delta Q}{T}\right)_{irrev}$
(b) $\int_1^2 \left(\frac{\delta Q}{T}\right)_{rev} < \int_1^2 \left(\frac{\delta Q}{T}\right)_{irrev}$
(c) $\int_1^2 \left(\frac{\delta Q}{T}\right)_{rev} = \int_1^2 \left(\frac{\delta Q}{T}\right)_{irrev}$
(d) Can't say

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
a

4) A closed system is taken from an initial equilibrium state i to a final equilibrium state f by an irreversible process. Which among the following relations for this process is/are TRUE? *1 point*

(a) $S_f - S_i = \int_i^f \left(\frac{\delta Q}{T}\right)_{actual}$
(b) $S_f - S_i > \int_i^f \left(\frac{\delta Q}{T}\right)_{actual}$
(c) $S_f - S_i < \int_i^f \left(\frac{\delta Q}{T}\right)_{actual}$
(d) $S_f - S_i = \int_i^f \left(\frac{\delta Q}{T}\right)_{rev}$, where the integral is evaluated along an imaginary reversible path connecting the initial and final states.

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
b
d

5) Which among the following statements is TRUE? *1 point*

(a) The entropy of a control mass during a process always decreases or in the limit of a reversible process, remains constant.
(b) The entropy of a control mass during a process always increases or in the limit of a reversible process, remains constant.
(c) The entropy of a control mass during a process always remains constant.
(d) The entropy of a control mass during a process may increase or decrease or remain constant depending its interactions with the surroundings.

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
d

6) Which among the following statements is TRUE? *1 point*

(a) The entropy of an isolated system always decreases or in the limit of a reversible process, remains constant.
(b) The entropy of an isolated system always increases or in the limit of a reversible process, remains constant.
(c) The entropy of an isolated system always remains constant.
(d) The entropy of an isolated system may increase or decrease or remain constant depending on the processes occurring within it.

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
a

7) Consider the following statements: *1 point*

(I) A reversible adiabatic process must incur no change in entropy of the system.
(II) A process with no change in entropy of the system must be reversible and adiabatic.

Choose the correct option.

(a) Statement (I) is true but statement (II) is false.
(b) Statement (II) is true but statement (I) is false.
(c) Both statements (I) and (II) are true.
(d) Both statements (I) and (II) are false.

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
d

8) The thermodynamic property relation, $TdS = dU + pdV$ is derived from the first law of thermodynamics applied for a control mass system (in the absence of motion or gravitational effects), $\delta Q = dU + \delta W$ by making the substitutions $\delta Q = TdS$ and $\delta W = pdV$. Which among the following statements is/are TRUE? *1 point*

(a) Since $\delta Q = TdS$ and $\delta W = pdV$ are applicable only for internally reversible processes, the property relation $TdS = dU + pdV$ is valid only for internally reversible processes.
(b) Since $\delta Q \neq TdS$ and $\delta W \neq pdV$ for processes with internal irreversibilities, $TdS \neq dU + pdV$ for processes with internal irreversibilities.
(c) $\delta Q \neq TdS$ and $\delta W \neq pdV$ for processes with internal irreversibilities, but still the property relation $TdS = dU + pdV$ is applicable for processes with internal irreversibilities.
(d) $\delta Q = TdS$ and $\delta W = pdV$ are also applicable for processes with internal irreversibilities and therefore the property relation $TdS = dU + pdV$ is valid for processes with internal irreversibilities.

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
c

9) Suppose that 1 kg of saturated water vapor at 100°C is condensed to saturated liquid at 100°C in a constant-pressure process by heat transfer to the surrounding air, which is at 25°C. What is the net increase in entropy of the water plus surroundings during this process? *1 point*

(a) 0.954 kJ/K
(b) 1.522 kJ/K
(c) -0.635 kJ/K
(d) 0

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
b

10) *1 point*

Common Data for Questions 10 and 11:
A rigid insulated tank contains 2 kg of air at 200 kPa and an ambient temperature of 300 K. An electric current now passes through a resistor inside the tank. Consider (tank+air+resistor) as the system. A total of 100 kJ of electrical work has crossed the system boundary. Assume air to be an ideal gas with constant specific heats, $c_{p0} = 1.004$ kJ/kg.K and $c_{v0} = 0.717$ kJ/kg.K.

Determine the temperature of air inside the tank after the electric resistance heating. Neglect the changes in internal energy of the resistor and the tank.

(a) 439.5 K
(b) 399.6 K
(c) 349.8 K
(d) 369.7 K

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
d

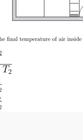
11) Find the entropy generated during this process. *1 point*

(a) 0.333 kJ/K
(b) 0.299 kJ/K
(c) 0.220 kJ/K
(d) 0

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
b

12) **Common Data for Questions 12 and 13:**
A piston/cylinder device is divided into two equal volumes by a membrane as shown in the figure below. It contains air of mass m_1 at an absolute temperature T_1 on one side of the membrane and an unknown mass of air at an absolute temperature T_2 on the other side of the membrane. Initially the pressure is P_1 on both sides of the membrane. The membrane is broken and air inside the cylinder comes to a uniform state with no external heat transfer. The loading on the piston maintains a constant pressure P_1 inside the cylinder throughout this process. *1 point*



Determine the final temperature of air inside the cylinder.

(a) $\frac{T_1+T_2}{2}$
(b) $\sqrt{T_1 \cdot T_2}$
(c) $\frac{T_1 T_2}{T_1+T_2}$
(d) $\frac{2T_1T_2}{T_1+T_2}$

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
d

13) Find the entropy generated during this process. *1 point*

(a) $2m_1c_p \ln \frac{(T_1+T_2)/2}{\sqrt{T_1T_2}}$
(b) $m_1c_p\left(\ln\frac{T_2}{T_1+T_2} + \frac{T_1}{T_2}\ln\frac{T_1}{T_1+T_2}\right)$
(c) $m_1c_p\left(\ln\frac{2T_2}{T_1+T_2} + \frac{T_1}{T_2}\ln\frac{2T_1}{T_1+T_2}\right)$
(d) $m_1c_p\left(\ln\frac{T_2}{T_1+T_2} + \ln\frac{T_1}{T_1+T_2}\right)$

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
c