1. Consider the following statements:

1) If an internally irreversible process is isentropic, it must be non adiabatic
2) Any process undergone by an isolated system is isentropic
3) The entropy of the universe can change only due to entropy generation
4) If unavailable energy of a system increases, the system must be internally irreversible
   Which of the above statement (s) is/are correct
   (a) 1 only   (b) 2 and 4
   (c) 1 and 3   (d) 1 and 4

2. Helium is to be compressed from 120 kPa and 310K to 700kPa and 430K. A heat loss of 20kJ/kg occurs during the compression process. Neglecting kinetic and potential energy changes. The power input required for a mass flow rate of 90kg/min is _____kW

   $$\left[R_{H_e} = 2.077 \left(kJ / kg\, k \right) \right]$$

   $$\left[\gamma_{H_e} = 1.67 \right]$$

   Common Data Questions 3 and 4
   A solar power heat pump receives heat from a solar collector at T_h, rejects heat to the atmosphere at T_a, and pumps heat from a cold space at T_c. Three heat transfer rates are Q_h, Q_a and Q_c respectively. Consider reversible processes

3. If $T_h = 400k$, $T_a = 300k$, $T_c = 200k$, $Q_c = 12kW$, values of Q_h is _____kW

4. If the collector caputres $0.2kW / m^2$, The minimum collector area required is _____ m^2

5. Values of heat transfer and work transfer for the processes of a thermodynamic cycle are given below

Process	Heat transfer (kJ)	Work transfer (kJ)
1	300	300
2	00	250
3	-100	-100
4	00	-250

The thermal efficiency of the cycle is
(a) 33%   (b) 66%
(c) 36%   (d) 63%

6. To start an automobile engine 5.2 MJ of energy is required. Let compressed air be considered for doing this amount of work in starting the engine. The compressed air is to be stored at 7MPa, 25⁰C. The volume of the tank that would be required to let the compressed air have an availability of 5.2 MJ is _____ m³
   [for air [$pv = 0.287\, T$] where T is in k, p is in kPa, and v in m^3 / kg]

7. A closed gaseous system undergoes a reversible constant pressure process at 2 bar in which 100 kJ of heat is rejected and the volume changes from 0.2m³ to 0.1m³. The change in internal energy of the system is
   (a) -100 kJ   (b) -80 kJ
   (c) -60 kJ   (d) - 40 kJ

8. An adiabatic vessel contains 2 kg of water at 25⁰C. By paddle wheel work tranfer, the temperature of water is increased to 30⁰C. If the specific heat of water is assumed constant at 4.187 kJ/kgk, the entropy change of universe is _____ kJ/k

9. At triple point of water the no. of independent properties required to fix the state of the system is/ are
   (a) 3   (b) 2
   (c) 1   (d) 0

10.
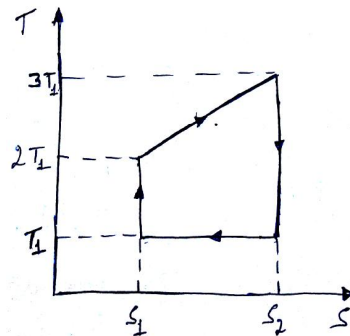
ENGINEERS CAREER POINT
PANCHKULA: SCO-211, TOP FLOOR, SECTOR 14, PKL 9815411737, 0172-4061483
PATIALA : SCB- 7 TOP FLOOR,CHOTTI BARADARI, 9855273076

1

The figure shown above corresponds to a reversible heat engine cycle on a T-S chart. The efficiency of the heat engine is

(a) $\dfrac{3}{5}$ (b) $\dfrac{2}{5}$

(c) $\dfrac{1}{2}$ (d) $\dfrac{3}{4}$

ENGINEERS CAREER POINT
PANCHKULA: SCO-211, TOP FLOOR, SECTOR 14, PKL 9815411737, 0172-4061483
PATIALA : SCB- 7 TOP FLOOR,CHOTTI BARADARI, 9855273076

2