COURSE – THERMODYNAMICS AND STATISTICAL MECHANICS

PRACTICE SET – 3 (LAWS OF THERMODYNAMICS) **Date: 08-06-2017**

MCQ

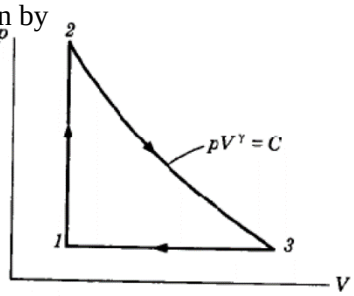
1 A gas contained in a cylinder is compressed, the work required for compression being 5000 kJ. During the process, heat interaction of 2000 kJ causes the surroundings to the heated. The change in internal energy of the gas during the process is:

(a) – 7000 kJ (b) – 3000 kJ (c) + 3000 kJ (d) + 7000 kJ

2 The contents of a well-insulated tank are heated by a resistor of 23Ω in which 10 A current is flowing. Consider the tank along with its contents as a thermodynamic system. The work done by the system and the heat transfer to the system are positive. The rates of heat (Q), work (W) and change in internal energy ΔU during the process in kW are

(a) $Q = 0, W = -2.3, \Delta U = +2.3$ (b) $Q = +2.3, W = 0, \Delta U = +2.3$
(c) $Q = -2.3, W = 0, \Delta U = -2.3$ (d) $Q = 0, W = +2.3, \Delta U = -2.3$

3 An ideal cycle is shown in the figure. Its thermal efficiency is given by



(a) $1 - \dfrac{\left(\frac{v_3}{v_1} - 1\right)}{\left(\frac{p_2}{p_1} - 1\right)}$ (b) $1 - \dfrac{1}{\gamma}\dfrac{\left(\frac{v_3}{v_1} - 1\right)}{\left(\frac{p_2}{p_1} - 1\right)}$

(c) $1 - \gamma \dfrac{(v_3 - v_1)}{(p_2 - p_1)}\dfrac{p_1}{v_1}$ (d) $1 - \dfrac{1}{\gamma}\dfrac{(v_3 - v_1)}{(p_2 - p_1)}\dfrac{p_1}{v_1}$

4 A closed system undergoes a process 1-2 for which the values of $Q_{1\text{-}2}$ and $W_{1\text{-}2}$ are +20 kJ and +50 kJ, respectively. If the system is returned to state, 1, and $Q_{2\text{-}1}$ is -10 kJ, what is the value of the work $W_{2\text{-}1}$?

(a) + 20 kJ (b) –40 kJ (c) –80 kJ (d) +40 kJ

5 A gas is compressed in a cylinder by a movable piston to a volume one-half of its original volume. During the process, 300 kJ heat left the gas and the internal energy remained same. What is the work done on the gas?

(a) 100kNm (b) 150 kNm (c) 200 kNm (d) 300 kNm

6 Gas contained in a closed system consisting of piston cylinder arrangement is expanded. Work done by the gas during expansion is 50 kJ. Decrease in internal energy of the gas during expansion is 30 kJ. Heat transfer during the process is equal to:

(a) –20 kJ (b) +20 kJ (c) –80 kJ (d) +80 kJ

7 170 kJ of heat is supplied to a system at constant volume. Then the system rejects 180 kJ of heat at constant pressure and 40 kJ of work is done on it. The system is finally brought to its original state by adiabatic process. If the initial value of internal energy is 100 kJ, then which one of the following statements is correct?

(a) The highest value of internal energy occurs at the end of the constant volume process

(b) The highest value of internal energy occurs at the end of constant pressure process.

(c) The highest value of internal energy occurs after adiabatic expansion

(d) Internal energy is equal at all points

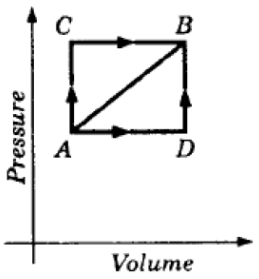
8 85 kJ of heat is supplied to a closed system at constant volume. During the next process, the system rejects 90 kJ of heat at constant pressure while 20 kJ of work is done on it. The system is brought to the original state by an adiabatic process. The initial internal energy is 100 kJ. Then what is the quantity of work transfer during the process?

(a) 30 kJ (b) 25 kJ (c) 20 kJ (d) 15 kJ

9 A system undergoes a process during which the heat transfer to the system per degree increase in temperature is given by the equation: $dQ/dT = 2\ kJ/°C$. The work done by the system per degree increase in temperature is given by the equation $dW/dT = 2 - 0.1\,T$, where T is in °C. If during the process, the temperature of water varies from 100°C to 150°C, what will be the change in internal energy?

(a) 125 kJ (b) –250 kJ (c) 625 kJ (d) –1250 kJ

10 When a system is taken from state A to state B along the path A-C-B, 180 kJ of heat flows into the system and it does 130 kJ of work (see figure given): How much heat will flow into the system along the path A-D-B if the work done by it along the path is 40 kJ?



(a) 40 kJ (b) 60 kJ
(c) 90 kJ (d) 135 kJ

Question	Answer	Question	answer
1	c	6	b
2	a	7	a
3	c	8	d
4	b	9	c
5	d	10	c