Assignment 07

The due date for submitting this assignment has passed. Due on 2018-09-19, 23:59 IST. As per our records you have not submitted this assignment.

1) Tick the correct statement about First Law and Second Law of Thermodynamics from the options given below.

- First Law of Thermodynamics: Conservation of energy in a process
- Second Law of Thermodynamics: Total energy in a process in constant
- First Law of Thermodynamics: Feasibility of a process
- Second Law of Thermodynamics: Conservation of energy in a process
- First Law of Thermodynamics: Total energy in a process in constant
- Second Law of Thermodynamics: Feasibility of a process

No, the answer is incorrect.
Score: 0
Accepted Answers:
- First Law of Thermodynamics: Conservation of energy in a process
- Second Law of Thermodynamics: Feasibility of a process

2) Hess's law states that the change of internal energy in a chemical reaction is independent of the pathway between the initial and final states.

State whether the above statement is True or False.

- True
- False

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

3) In a refrigerator, heat is transferred from a lower temperature medium (the refrigerated space) to a higher temperature one (the kitchen air). Which of the following option is correct?

No, the answer is incorrect.
Score: 0
Accepted Answers:
- True
This violates Kelvin-Planck statement of the Second Law of Thermodynamics

This violates Clausius Statement of the Second Law of Thermodynamics

This is a PMM2 device

None of these

No, the answer is incorrect.
Score: 0

Accepted Answers:
None of these

4) Tick the correct option.

All reversible processes are quasi-equilibrium processes

All quasi-equilibrium processes are reversible processes

both the above options are correct

both the above options are wrong

No, the answer is incorrect.
Score: 0

Accepted Answers:
All reversible processes are quasi-equilibrium processes

5) Somebody claims to have developed a new reversible heat-engine cycle (Device 1) that operates between the temperature limits same as that of Carnot cycle (Device 2). Which one of the following is correct?

Thermal efficiency of Device 1 > Thermal efficiency of Device 2

Thermal efficiency of Device 2 > Thermal efficiency of Device 1

Thermal efficiency of Device 1 = Thermal efficiency of Device 2

None of these

No, the answer is incorrect.
Score: 0

Accepted Answers:
Thermal efficiency of Device 1 = Thermal efficiency of Device 2

6) A fuel is completely burned first with the (1) stoichiometric amount of air and then with the (2) stoichiometric amount of pure oxygen. For which case will the adiabatic flame temperature be higher?

2 only

1 only

both 1 and 2, same temperature

None of these

No, the answer is incorrect.
Score: 0

Accepted Answers:
2 only

7) A food department is kept at -12 °C by a refrigerator in an environment at 30 °C. The total heat gain to the food department is estimated to be 3300 kJ/h and the heat rejection in the condenser is 4800 kJ/h. Determine the power input to the compressor and the COP of the refrigerator.

417 kW and 2.5

0.417 kW and 2.2

4.17 kW and 4.4

41.7 kW and 5

No, the answer is incorrect.
Score: 0

Accepted Answers:
0.417 kW and 2.2
8) An automobile engine consumes fuel at a rate of 25 L/h and delivers 60 kW of power to the wheels. If the fuel has a heating value of 50,000 kJ/kg and a density of 0.8 g/cm³, determine the efficiency of this engine.

- 30%
- 26%
- 22%
- 18%

No, the answer is incorrect.
Score: 0
Accepted Answers: 22%

9) A household refrigerator that has a power input of 500 W and a COP of 2.5 is to cool 5 large watermelons, 10 kg each, to 10 °C. If the watermelons are initially at 25 °C, determine how long will it take for the refrigerator to cool those watermelons. The watermelons can be treated as water whose specific heat is 4.2 kJ/kg °C.

- 42 min
- 35 min
- 49 min
- 25 min

No, the answer is incorrect.
Score: 0
Accepted Answers: 42 min

10) Determine the Standard heat of reaction for the famous water gas shift reaction. Following information are given for analysis.

\[
\text{CO}_2(g) + \text{H}_2(g) \rightarrow \text{CO}(g) + \text{H}_2\text{O}(g)
\]

The enthalpy of formation at 25 °C and 1 atm is: -393.51 kJ/mol for \(\text{CO}_2\), -241.82 kJ/mol for \(\text{H}_2\text{O}\), and -110.59 kJ/mol for CO

- -41.1 kJ/mol
- -262.28 kJ/mol
- 262.28 kJ/mol
- 41.1 kJ/mol

No, the answer is incorrect.
Score: 0
Accepted Answers: 41.1 kJ/mol

11) Determine the adiabatic flame temperature of the stoichiometric butane-air mixture at 298 K, 0.1 MPa, assuming no dissociation of the products. The \(C_p\) and standard heat of formation at 298 K are given below.

\[
\Delta H_{R,298}^0 \text{C}_4\text{H}_{10} = -131.8 \text{ kJ/mol}
\]
\[
\Delta H_{R,298}^0 \text{CO}_2 = -393.51 \text{ kJ/mol}
\]
\[
\Delta H_{R,298}^0 \text{H}_2\text{O} = -241.82 \text{ kJ/mol}
\]
\[
C_p, \text{CO}_2 = 37.129 \text{ J/mol.K}
\]
\[
C_p, \text{H}_2\text{O} = 35.59 \text{ J/mol.K}
\]
\[
C_p, \text{N}_2 = 29.124 \text{ J/mol.K}
\]

- 2428 K
- 2852 K
No, the answer is incorrect.
Score: 0
Accepted Answers: 2852 K