

## Unit 6 - Week 3 :

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# Assignment 3

The due date for submitting this assignment has passed. **Due on 2019-08-21, 23:59 IST.**  
As per our records you have not submitted this assignment.

1) Which among the following statements regarding thermodynamic work is/are TRUE? 1 point

(a) Work is done by a system if the sole effect on the surroundings could be the raising of a weight.  
(b) Work is a form of energy stored or possessed by a system.  
(c) Work is a form of energy in transit.  
(d) Work is a boundary phenomenon.

a  
 b  
 c  
 d

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

2) Consider the following expressions to calculate the work done by a simple compressible substance:  
(I)  $\delta W = P dv$   
(II)  $\delta W = F_{res} dx$ , where  $F_{res}$  is the force resisting the movement of the system boundary and  $dx$  is a differential displacement of the system boundary in the direction of the force.  
Which among the following statements regarding the applicability of the above equations is/are TRUE?

(a) (I) is applicable ONLY for a system undergoing a quasiequilibrium process.  
(b) (I) is applicable for a system undergoing either a quasiequilibrium or a nonequilibrium process.  
(c) (II) is applicable ONLY for a system undergoing a quasiequilibrium process.  
(d) (II) is applicable for a system undergoing either a quasiequilibrium or a nonequilibrium process.

a  
 b  
 c  
 d

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

3) Which among the following statements is/are TRUE? 1 point

(a) The amount of work done during a quasi-equilibrium process between two given states does not depend on the path followed in going from the initial state to the final state.  
(b) The amount of work done during a quasi-equilibrium process between two given states also depends on the path followed in going from the initial state to the final state.  
(c) The change in volume during a quasi-equilibrium process between two given states does not depend on the path followed in going from the initial state to the final state.  
(d) The change in volume during a quasi-equilibrium process between two given states also depends on the path followed in going from the initial state to the final state.

a  
 b  
 c  
 d

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

4) Which among the following statements regarding heat is/are TRUE? 1 point

(a) Heat is a form of energy possessed or stored by a system by virtue of its temperature.  
(b) Heat is the form of energy that is transferred across the boundary of a system by virtue of the temperature difference between the system and its surroundings.  
(c) The amount of heat transferred when a system undergoes a change from state 1 to state 2 does not depend on the path that the system follows during the change of state.  
(d) The amount of heat transferred when a system undergoes a change from state 1 to state 2 depends on the path that the system follows during the change of state.

a  
 b  
 c  
 d

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

5) Which among the following statements regarding the differentials of point or path functions is/are TRUE? 1 point

(a) The differentials of path functions are exact differentials.  
(b) The differentials of point functions are inexact differentials.  
(c) The differentials of path functions are inexact differentials.  
(d) The differentials of point functions are exact differentials.

a  
 b  
 c  
 d

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

6) Which among the following statements is TRUE about work and heat? 1 point

(a) Work is a path function whereas heat is a point function  
(b) Work is a point function whereas heat is a path function.  
(c) Both work and heat are path functions.  
(d) None of the above

a  
 b  
 c  
 d

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

7) An ideal gas goes through an expansion process in which the volume doubles. Which process will lead to a larger work output: an isothermal process or a polytropic process with exponent  $n = 1.25$ ? 1 point

(a) Isothermal process  
(b) Polytropic process with  $n=1.25$   
(c) Both the processes deliver the same work output  
(d) Cannot say

a  
 b  
 c  
 d

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

8) The figure below shows a gas separated from the vacuum by a membrane. The membrane ruptures and the gas fills the entire volume. Considering gas as the system, which among the following statements regarding the work done by the gas during this process is/are TRUE? Neglect any work associated with the rupturing of the membrane. 1 point

(a) The system undergoes a change in volume and hence work is done during this process of filling the vacuum.  
(b) The work done during this process can be calculated from the expression  $\int_1^2 P dv$ .  
(c) The work done during this process cannot be calculated from the expression  $\int_1^2 P dv$ .  
(d) No work is done during this process of filling the vacuum.

a  
 b  
 c  
 d

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

9) Derive an expression for the polytropic exponent  $n$  if we know the end state properties  $(P_1, v_1)$  and  $(P_2, v_2)$ . 1 point

(a)  $\frac{\ln\left(\frac{P_2}{P_1}\right)}{\ln\left(\frac{v_2}{v_1}\right)}$   
(b)  $\frac{\ln\left(\frac{P_2}{P_1}\right)}{\ln\left(\frac{v_1}{v_2}\right)}$   
(c)  $\frac{\ln\left(\frac{v_2}{v_1}\right)}{\ln\left(\frac{P_2}{P_1}\right)}$   
(d)  $\frac{\ln\left(\frac{v_1}{v_2}\right)}{\ln\left(\frac{P_2}{P_1}\right)}$

a  
 b  
 c  
 d

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

10) A 400-L tank, A (see the figure below), contains argon gas at 250 kPa and 30°C. Cylinder B, having a frictionless piston of such mass that a pressure of 100 kPa will float it, is initially empty. The valve is opened, and argon flows into B and eventually reaches a uniform state of 100 kPa and 30°C throughout. What is the work done by the argon? Assume argon to be an ideal gas. 1 point

(a) 60 kJ  
(b) 100 kJ  
(c) 91.63 kJ  
(d) 0

a  
 b  
 c  
 d

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

11) A piston/cylinder assembly contains 1.5 kg of water at 200 kPa, 150°C. It is now heated by a process in which pressure is linearly related to volume to a state of 600 kPa, 350°C. Find the work done by the water during this process. 1 point

(a) 194.16 kJ  
(b) 291.24 kJ  
(c) -194.16 kJ  
(d) -291.24 kJ

a  
 b  
 c  
 d

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

12) **Common Data for Questions 12 and 13** 1 point

A balloon behaves such that the pressure inside is proportional to the diameter squared. It contains 2 kg of water at 150 kPa, with 85% quality. The balloon and water are now heated so that a final pressure of 600 kPa is reached. The process undergone by water is given by the equation:

(a)  $Pv^{\frac{2}{3}} = \text{constant}$   
(b)  $Pv^{-\frac{2}{3}} = \text{constant}$   
(c)  $Pv^2 = \text{constant}$   
(d)  $Pv^{-2} = \text{constant}$

a  
 b  
 c  
 d

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

13) Considering the water as a control mass, find the amount of work done in this process. 1 point

(a) 221.76 kJ  
(b) 443.52 kJ  
(c) 2750 kJ  
(d) 5500 kJ

a  
 b  
 c  
 d

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

14) A gas of mass 0.5 kg initially at 1 MPa and 500°C is contained in a piston/cylinder arrangement with an initial volume of 0.1 m³. The gas then slowly expands according to the relation  $PV = \text{constant}$  until a final pressure of 100 kPa is reached. Determine the work done by the gas during this process. 1 point

(a) 230.26 kJ  
(b) 115.13 kJ  
(c) -230.26 kJ  
(d) -115.13 kJ

a  
 b  
 c  
 d

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

15) A piston/cylinder shown in the figure contains 0.5 kg of saturated liquid and vapor water at 200 kPa with quality 25%. The mass of the piston is such that a pressure of 600 kPa will float it. The water is heated until it exists as saturated vapour. Find the work done by the water during this process. 1 point

(a) 9.35 kJ  
(b) 56.08 kJ  
(c) 28.04 kJ  
(d) 18.7 kJ

a  
 b  
 c  
 d

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