Unit 8 - Week 5 :

Assignment 5

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-09-04, 23:59 IST.

1) Consider a steady state steady flow device with one inlet and one exit. Which among the following statements about this device is/are TRUE? *1 point*

(a) The volume flow rates at the inlet and at the exit must be equal.
(b) The volume flow rates at the inlet and at the exit need not necessarily be equal.
(c) The mass flow rates at the inlet and at the exit must be equal.
(d) The mass flow rates at the inlet and at the exit need not necessarily be equal

- a
- b
- c
- d

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

2) *1 point*

Common Data for Questions 2 to 4:
Steam at 4 MPa and 400°C enters a nozzle steadily with a velocity of 60 m/s, and it leaves at 2 MPa and 300°C. The inlet area of the nozzle is 50 cm^2, and heat is being lost from the nozzle at a rate of 75 kJ/s.

Determine the mass flow rate of the steam.

(a) 2.04 kg/s
(b) 4.08 kg/s
(c) 8.16 kg/s
(d) 16.32 kg/s

- a
- b
- c
- d

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

3) Determine the exit velocity of the steam. *1 point*

(a) 645.54 m/s
(b) 616.46 m/s
(c) 588.99 m/s
(d) 18.53 m/s

- a
- b
- c
- d

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

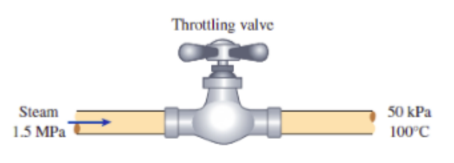
4) Determine the exit area of the nozzle. *1 point*

(a) 8.70×10^{-4} m^2
(b) 8.32×10^{-4} m^2
(c) 7.94×10^{-4} m^2
(d) 2.77×10^{-2} m^2

- a
- b
- c
- d

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

5) Saturated liquid-vapor mixture of water, called wet steam, in a steam line at 1500 kPa is throttled to 50 kPa and 100°C. What is the initial quality in the steam line? *1 point*

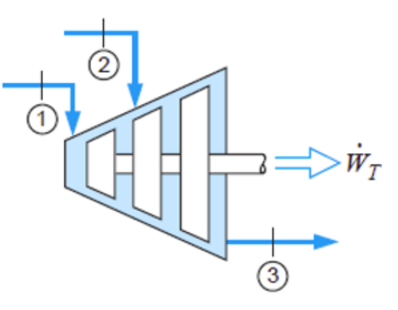


(a) 0.056
(b) 0.082
(c) 0.918
(d) 0.944

- a
- b
- c
- d

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

6) A steam turbine receives steam from two boilers. One flow is 15 kg/s at 3 MPa, 700°C and the other flow is 5 kg/s at 800 kPa, 500°C. The exit state is 10 kPa, with a quality of 96%. Neglecting the changes in kinetic and potential energies, find the total power output of the adiabatic turbine. *1 point*



(a) 16.38 MW
(b) 26.3 MW
(c) 28.74 MW
(d) 68.63 MW

- a
- b
- c
- d

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

7) Steam is compressed by an adiabatic compressor from 0.2 MPa and 150°C to 0.8 MPa and 350°C at a rate of 1.30 kg/s. Neglecting the changes in kinetic and potential energies, determine the power input to the compressor. *1 point*

(a) 511 kW
(b) 393 kW
(c) 302 kW
(d) 717 kW

- a
- b
- c
- d

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

8) Saturated water vapour at 40°C is to be condensed as it flows through a tube at a rate of 0.20 kg/s. The condensate leaves the tube as a saturated liquid at 40°C. The rate of heat transfer from the tube is *1 point*

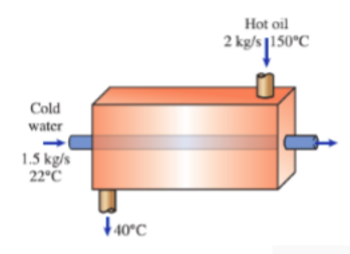
(a) 2406.7 kW
(b) 2262.6 kW
(c) 452.4 kW
(d) 481.3 kW

- a
- b
- c
- d

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

9) *1 point*

Common Data for Questions 9 and 10:
A thin-walled double-pipe counter-flow heat exchanger is used to cool oil ($c_p = 2.20$ kJ/kg.°C) from 150 to 40°C at a rate of 2 kg/s by water ($c_p = 4.18$ kJ/kg.°C) that enters at 22°C at a rate of 1.5 kg/s. There is no heat transfer to the surroundings from the heat exchanger.



Determine the rate of heat transfer in the heat exchanger.

(a) 220 kW
(b) 242 kW
(c) 484 kW
(d) 968 kW

- a
- b
- c
- d

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

10) Determine the exit temperature of water. *1 point*

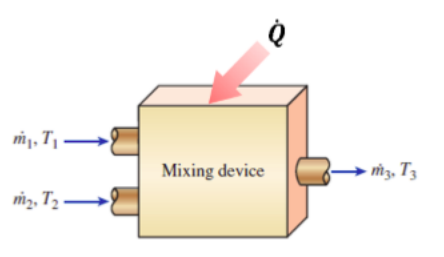
(a) 80°C
(b) 99.2°C
(c) 134°C
(d) 168.7°C

- a
- b
- c
- d

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

11) *1 point*

Common Data for Questions 11 to 13:
Two mass streams of the same ideal gas are mixed in a steady-flow chamber while receiving energy by heat transfer from the surroundings as shown in the figure below. The mixing process takes place at constant pressure with no work and negligible changes in kinetic and potential energies. Assume the gas has constant specific heats.



Determine the expression for the final temperature of the mixture in terms of the rate of heat transfer to the mixing chamber and the inlet and exit mass flow rates.

(a) $T_3 = \frac{\dot{m}_3}{\dot{m}_1}T_1 + \frac{\dot{m}_3}{\dot{m}_2}T_2 - \frac{\dot{Q}}{\dot{m}_3 c_p}$
(b) $T_3 = \frac{\dot{m}_3}{\dot{m}_1}T_1 + \frac{\dot{m}_3}{\dot{m}_2}T_2 + \frac{\dot{Q}}{\dot{m}_3 c_p}$
(c) $T_3 = \frac{\dot{m}_1}{\dot{m}_3}T_1 + \frac{\dot{m}_2}{\dot{m}_3}T_2 - \frac{\dot{Q}}{\dot{m}_3 c_p}$
(d) $T_3 = \frac{\dot{m}_1}{\dot{m}_3}T_1 + \frac{\dot{m}_2}{\dot{m}_3}T_2 + \frac{\dot{Q}}{\dot{m}_3 c_p}$

- a
- b
- c
- d

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

12) Obtain an expression for the volume flow rate at the exit of the mixing chamber in terms of the volume flow rates of the two inlet streams and the rate of heat transfer to the mixing chamber. *1 point*

(a) $\dot{V}_3 = \dot{V}_1 + \dot{V}_2 + \frac{R\dot{Q}}{p_3 c_p}$
(b) $\dot{V}_3 = \dot{V}_1 + \dot{V}_2 - \frac{R\dot{Q}}{p_3 c_p}$
(c) $\dot{V}_3 = \frac{\dot{m}_3}{\dot{m}_1}\dot{V}_1 + \frac{\dot{m}_3}{\dot{m}_2}\dot{V}_2 + \frac{R\dot{Q}}{p_3 c_p}$
(d) $\dot{V}_3 = \frac{\dot{m}_3}{\dot{m}_1}\dot{V}_1 + \frac{\dot{m}_3}{\dot{m}_2}\dot{V}_2 - \frac{R\dot{Q}}{p_3 c_p}$

- a
- b
- c
- d

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

13) For the special case of adiabatic mixing, the exit volume flow rate at the exit is given by *1 point*

(a) $\dot{V}_3 = \frac{\dot{m}_3}{\dot{m}_1}\dot{V}_1 + \frac{\dot{m}_3}{\dot{m}_2}\dot{V}_2$
(b) $\dot{V}_3 = \frac{\dot{m}_1}{\dot{m}_3}\dot{V}_1 + \frac{\dot{m}_2}{\dot{m}_3}\dot{V}_2$
(c) $\dot{V}_3 = \dot{V}_1 + \dot{V}_2$
(d) $\dot{V}_3 = |\dot{V}_1 - \dot{V}_2|$

- a
- b
- c
- d

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