Unit 7 - Week 6: Droplet and Spray Combustion

Week 6: Assignment
The due date for submitting this assignment has passed. As per our records you have not submitted this assignment.

Due on 2018-09-19, 11:59 IST.

1) Droplet burning rate
- increases with reduction in droplet size.
- decreases with reduction in droplet size.
- remains same.

No, the answer is incorrect.
Score: 0
Accepted Answers: increases with reduction in droplet size.

2) Droplet burning rate
- increases with increase in ambient pressure.
- decreases with decrease in ambient pressure.
- remains same.

No, the answer is incorrect.
Score: 0
Accepted Answers: increases with increase in ambient pressure.

3) The lifetime of a droplet if initial diameter is 200 micro meter and burning constant is $2.32 \times 10^{-6} \text{ m}^2/\text{s}$
- 0.01 sec
- 0.03 sec
- 0.017 sec
- 0.025 sec

No, the answer is incorrect.
Score: 0
Accepted Answers: 0.017 sec

In spray combustion, the number of droplets per unit volume
- increases
- decreases
- remains same

No, the answer is incorrect.
Score: 0
Accepted Answers: increases with increase in ambient pressure.
5) Choose the correct statement regarding droplet combustion

- Fuel and oxidizer mass fractions are zero at the interface of flame.
- Fuel mass fraction is 0 and oxidizer mass fraction is 1 at the interface of flame.
- Fuel mass fraction is 1 and oxidizer mass fraction is 0 at the interface of flame.
- Fuel and oxidizer mass fractions are 1 at the interface of flame.

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

5.1 Fuel and oxidizer mass fractions are zero at the interface of flame.
5.2 Fuel mass fraction is 0 and oxidizer mass fraction is 1 at the interface of flame.
5.3 Fuel mass fraction is 1 and oxidizer mass fraction is 0 at the interface of flame.
5.4 Fuel and oxidizer mass fractions are 1 at the interface of flame.

6) An methanol fuel droplet diameter of 200 micrometer gets evaporated in a quiescent air at temperature of 700 K and pressure of 0.5 MPa. The lifetime of this droplet is:

(Briling point of methanol=337 K, density of methanol=790 kg/m³, thermal conductivity of methanol=0.202 W/mK, thermal conductivity of air=.0404 W/mK, Heat capacity of gaseous mixture=1.1 kJ/kg.K, Heat of combustion=715 kJ/kg.K, Heat of vaporization=38.278 kJ/kg.K)

- 0.016 s
- 0.028 s
- 0.036 s
- 0.040 s

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

6.1 0.016 s
6.2 0.028 s
6.3 0.036 s
6.4 0.040 s

7) A liquid fuel combustor is to be designed, considering the flow to be 1-D with mono dispersed spray of initial diameter of 250 micro m. The initial velocity of air is 2 m/s at 600 K and 0.1 MPa. The fuel/air ratio by mass is estimated to be 0.05 with adiabatic flame temperature of 2300 K. Assume burning constant to be 0.9 mm²/s. The density of liquid fuel is 800 kg/m³.

The initial droplet number density, the length of reaction zone and the combustion intensity are: (Cp=1.2 kJ/kg K)

- 9.8 ×10⁶ m⁻³, 0.22 m and 9.5 MW/m³
- 4.2 ×10⁶ m⁻³, 0.37 m and 6.3 MW/m³
- 9.8 ×10⁶ m⁻³, 0.37 m and 6.3 MW/m³
- 4.2 ×10⁶ m⁻³, 0.22 m and 9.5 MW/m³

No, the answer is incorrect.
Score: 0
Accepted Answers:
8) An n-hexane fuel with droplet diameter of 1 mm is burning in air at ambient condition. The ratio of the flame radius to droplet radius is calculated to be:
(Boiling Temperature of hexane=342 K, $T_{\text{inf}}=1300$ K and $P=1$ atm, $C_{p_{\text{mix}}}=1.19$ kJ/kg.K, Heat of combustion=45000 kJ/kg.K, Heat of vaporization=316 kJ/kg.K)

No, the answer is incorrect.
Score: 0
Accepted Answers:
126

9) Droplets of n-hexane are burnt at two different temperatures 1000 K and 500 K. The ratio of the transfer number $B$ at these two temperatures:
(Boiling Temperature of hexane=342 K; At both temperatures, consider $C_{p_{\text{mix}}}=1.19$ kJ/kg.K, Heat of combustion=45000 kJ/kg.K, Heat of vaporization=316 kJ/kg.K)

No, the answer is incorrect.
Score: 0
Accepted Answers:
1.7

10) Two different fuels with same densities are injected into hot air at 1000 K using same atomizer. The atomizer produces two different size droplets of 100 micro m and 200 micro m. If the transfer numbers of two different fuels are 2 and 4 respectively then the ratio of droplet evaporation lifetime (Assume same heat capacity and thermal conductivity for both the fuel mixtures)

No, the answer is incorrect.
Score: 0
Accepted Answers:
0.37