

Unit 6 - Week 4: Normal Shock Waves

Course outline
How does an NPTEL online course work?
Week 0: Prerequisite
Week 1: Review Concepts of Fluid Mechanics and Thermodynamics
Week 2: Wave Propagation in Compressible Medium
Week 3: Quasi-One Dimensional Isentropic Flow
Week 4: Normal Shock Waves
<input type="radio"/> Lec 10: Normal Shock Waves-I
<input checked="" type="radio"/> Lec 11: Normal Shock Waves-II
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<input type="radio"/> Quiz : Assignment 4
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Week 5: Expansion Waves and Oblique Shocks
Week 6: Interaction of Shocks and Expansion Waves
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Assignment 4

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

Due on 2020-10-14, 23:59 IST.

1) The Mach numbers behind a normal shock and ahead of the normal shock are M_1 and M_2 , respectively. Find out the incorrect statement? **2 points**

- (A) $M_1^* M_2^* = 1$
- (B) $M_1 > 1$
- (C) $M_1 M_2 = 1$
- (D) $M_2 < 1$

No, the answer is incorrect.
Score: 0

Accepted Answers:
(C) $M_1 M_2 = 1$

2) Which thermodynamic parameter is invariant across a stationary normal shock? **2 points**

- (A) Stagnation temperature
- (B) Static temperature
- (C) Stagnation pressure
- (D) Static pressure

No, the answer is incorrect.
Score: 0

Accepted Answers:
(A) Stagnation temperature

3) The specific volume of the gas _____ across a normal shock. **2 points**

- (A) Decreases
- (B) Increases

No, the answer is incorrect.
Score: 0

Accepted Answers:
(A) Decreases

4) On a pressure–volume curve, the slope of shock wave compression is _____ than the isentropic compression. **2 points**

- (A) Higher
- (B) Lower

No, the answer is incorrect.
Score: 0

Accepted Answers:
(A) Higher

5) A pitot tube placed in a supersonic flow of air ($R = 0.287 \text{ kJ/kg-K}$) encounters a shock wave at its nose for which the stagnation pressure ratio is 2.0 across the shock. The specific entropy change (in kJ/kg-K) across the normal shock is _____.

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 0.195,0.205

2 points

6) A gas (specific volume $1.12 \text{ m}^3/\text{kg}$) is moving with a velocity of 380 m/s encounters a normal shock. If the specific volume behind the shock is $0.33 \text{ m}^3/\text{kg}$, find out the pressure (kPa) increase caused by the shock.

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 90.55,92.55

2 points

Q07 to Q10. A re-entry vehicle encounters a bow shock wave while moving with a velocity of 1800 m/s at an altitude of 15000 m . The pressure and temperature conditions before the shock wave are, 12 kPa and 216 K , respectively. Determine the parameters on the re-entry vehicle center line (where the shock wave may be treated as normal shock). Neglect dissociation effect and the air may be assumed to behave as perfect gas, with $\gamma=1.4$ and $R=287 \text{ J/kg-K}$. Use these information to answer the following questions.

7) The stagnation pressure (MPa) just behind the shock wave _____.

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 0.53,0.63

2 points

8) The stagnation temperature (K) just behind the shock wave _____.

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 1813,1832

2 points

9) The static pressure (MPa) after the shock wave _____.

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 0.50,0.55

2 points

10) The static temperature (K) after the shock wave _____.

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 1760,1783

2 points