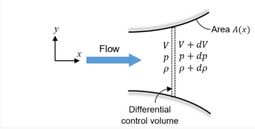
Unit 13 - Week 11

Assignment 11

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

Due on 2019-10-16, 23:59 IST.

Common Data for Questions 1 and 2:
Consider steady one-dimensional flow of an ideal gas with constant specific heats through a variable area duct as shown in the figure below. Assume the flow to be isentropic. Consider a differential control volume for your analysis as shown in the figure.



1) Which among the following relations is/are correct for this flow? 1 point

(A) $\frac{dV}{V} = \frac{dA}{A} + \frac{dp}{\rho}$
(B) $\frac{dV}{V} = -\frac{dA}{A} - \frac{d\rho}{\rho}$
(C) $\frac{dp}{\rho V^2} = \frac{dV}{V}$
(D) $\frac{dp}{\rho V^2} = \frac{dV}{V}$

a
b
c
d

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

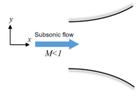
2) Which among the following relations is/are correct for this flow? 1 point

(A) $\frac{dV}{V} = \frac{1}{(M^2-1)}\frac{dA}{A}$
(B) $\frac{dV}{V} = \frac{1}{(1-M^2)}\frac{dA}{A}$
(C) $\frac{dp}{\rho V^2} = \frac{1}{(M^2-1)}\frac{dA}{A}$
(D) $\frac{dp}{\rho V^2} = \frac{1}{(1-M^2)}\frac{dA}{A}$

a
b
c
d

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

3) Consider a diverging channel as shown in the figure below. If the Mach number at the inlet is subsonic, which among the following statements regarding the changes in velocity V and pressure p is/are correct? 1 point

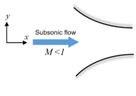


(A) In a subsonic flow, when area increases, velocity decreases i.e. $dV < 0$
(B) In a subsonic flow, when area increases, velocity increases i.e. $dV > 0$
(C) In a subsonic flow, when area decreases, pressure increases i.e. $dp > 0$
(D) In a subsonic flow, when area increases, pressure decreases i.e. $dp < 0$

a
b
c
d

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

4) Consider a converging channel as shown in the figure below. If the Mach number at the inlet is subsonic, which among the following statements regarding the changes in velocity V and pressure p is/are correct? 1 point

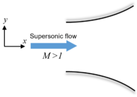


(A) In a subsonic flow, when area decreases, velocity decreases i.e. $dV < 0$
(B) In a subsonic flow, when area decreases, velocity increases i.e. $dV > 0$
(C) In a subsonic flow, when area decreases, pressure decreases i.e. $dp < 0$
(D) In a subsonic flow, when area decreases, pressure increases i.e. $dp > 0$

a
b
c
d

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

5) Consider a diverging channel as shown in the figure below. If the Mach number at the inlet is supersonic, which among the following statements regarding the changes in velocity V and pressure p is/are correct? 1 point

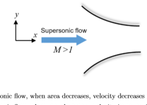


(A) In a supersonic flow, when area increases, velocity decreases i.e. $dV < 0$
(B) In a supersonic flow, when area increases, velocity increases i.e. $dV > 0$
(C) In a supersonic flow, when area increases, pressure decreases i.e. $dp < 0$
(D) In a supersonic flow, when area increases, pressure increases i.e. $dp > 0$

a
b
c
d

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

6) Consider a converging channel as shown in the figure below. If the Mach number at the inlet is supersonic, which among the following statements regarding the changes in velocity V and pressure p is/are correct? 1 point



(A) In a supersonic flow, when area decreases, velocity decreases i.e. $dV < 0$
(B) In a supersonic flow, when area decreases, velocity increases i.e. $dV > 0$
(C) In a supersonic flow, when area decreases, pressure decreases i.e. $dp < 0$
(D) In a supersonic flow, when area decreases, pressure increases i.e. $dp > 0$

a
b
c
d

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

7) Consider the following statements: 1 point

(I) For an isentropic flow, the sonic condition $M = 1$ can only be attained at a throat, or section of minimum area.
(II) For an isentropic flow, the throat or section of minimum area always corresponds to the sonic condition $M = 1$.

Choose the correct option:

(A) Statement (I) is FALSE, but statement (II) is TRUE.
(B) Statement (I) is TRUE, but statement (II) is FALSE.
(C) Both statements (I) and (II) are TRUE.
(D) Both statements (I) and (II) are FALSE.

a
b
c
d

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

Common Data for Questions 8 to 10:
Air flows isentropically through a channel. At section ①, the Mach number is 0.3, the area is 0.001 m^2, and the absolute pressure and the temperature are 650 kPa and 62°C, respectively. At section ②, the Mach number is 0.8.

8) What is the temperature at section ②? 1 point

(A) 302 K
(B) 335 K
(C) 376 K
(D) 423 K

a
b
c
d

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

9) What is the velocity at section ②? 1 point

(A) 158 m/s
(B) 196 m/s
(C) 279 m/s
(D) 330 m/s

a
b
c
d

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

10) The value of area A_2 is 1 point

(A) 5.10×10^{-3} m^2
(B) 8.50×10^{-3} m^2
(C) 8.50×10^{-4} m^2
(D) 5.10×10^{-4} m^2

a
b
c
d

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