1. Sonic velocity of sound in air can be described as

a) $\sqrt{\frac{K}{\rho}}$ b) $\sqrt{dp/d\rho}$

c) $\sqrt{\gamma p/\rho}$ d) all of the above

Ans. (d)

2. Mach number is ratio of

a) v to v_{max} b) v_{max} to v

c) both d) None

where, v, the speed of fluid in conduit, to v_{max}, the speed of sound in fluid at actual flow condition.

Ans. (a)

3. The flow is sonic at Mach number,

a)<1 b) >1

c) = 1 d) 0

Ans. (c)

4. Which of the following statement is true:

a) gas (diatomic) flowing through a nozzle, the maximum velocity is always less than sonic velocity.

b) gas (diatomic) flowing through a nozzle, the maximum velocity is always sonic velocity.

c) gas (diatomic) flowing through a nozzle, the minimum velocity is always sonic velocity.

d) gas (diatomic) flowing through a nozzle, the maximum velocity is always more than sonic velocity.

Ans. (b)

5. p_0/p will always be at critical level until
   a) p_a/p increases
   b) p_a/p remains constant
   c) p_a/p decreases
   d) None

Ans. (a)

6. In variable flow, p_0/p will be maintained at critical value, only if p_0/p is,

a) < 1.894 atm
b) = 1.894 atm
c) > 1.894 atm
d) All of the above

Ans. (c)

7. Air flows through a nozzle of diameter .93 mm having a discharge coefficient of 0.95, from a pressure of 1.01×10^6 Pa to a pressure of 1 atm at 28 ^oC. Find the desity of air in kg/m^3

   a) 1.174
   b) 1.16
   c) 0.116
   d) 11.74

Ans. (d)

$$\rho = \frac{pM}{RT}$$

$= (1.01 \times 10^6 * 29)/ (8314*(28+273) = 11.74 \ kg/m^3$

8. Variable flow is a flow which occurs

a) when downstream pressure varies
b) when upstream pressure varies
c) when both upstream and downstream pressures vary
d) when upstream pressure remains constant

Ans. (b)

9. A reservoir of oxygen is maintained at 1.184 atm pressure and 25 ^oC temperature. A 10 mm nozzle, fitted to this reservoir releases oxygen to a pressure of 650 mm of Hg. If molecular weight of oxygen is 32, what is the rate of release of oxygen?

a) 67.17 kg/h
b) 67.17 kg/s
c) 1.11 kg/h
d) 11.17 kg/s

Ans. (a)

$$W_{650} = C_D A_0 \sqrt{\frac{2\gamma p \rho}{(\gamma - 1)} \left[\left(\frac{p_0}{P} \right)^{\frac{2}{\gamma}} - \left(\frac{p_0}{p} \right)^{\frac{\gamma+1}{\gamma}} \right]}$$

Assume $C_D = 0.98$

P_0 = 650 mm Hg = 86,659.539 Pa and P = 1.18 atm = 19, 563.9 Pa, γ=1.4

So W_{650} = 0.0186594 kg/s = 67.17 kg/h (a)

10. Pressure ratio in air flow through nozzle is at critical condition if

a) upstream pressure is equal to downstream pressure
b) upstream pressure is 5 times greater than downstream pressure
c) downstream pressure is 5 times greater than upstream pressure
d) None of the above

Ans. (b)