1. An oil is flowing down a vertical wall as a film 1.7 mm thick. The oil density is 820 kg/m$^3$ and the viscosity is 0.2 Pa.s. calculate the mass flow rate per unit width of wall.

   a) 0.54 Kg m$^{-1}$. s$^{-1}$
   b) 0.054 Kg m$^{-1}$. s$^{-1}$
   c) 0.27 Kg m$^{-1}$. s$^{-1}$
   d) 0.014 Kg m$^{-1}$. s$^{-1}$

   Ans. B

2. In question 1 calculate Reynolds number?

   a) 1.08
   b) 10.80
   c) 5.4
   d) 1.28

   Ans. A

3. In question 1 calculate average velocity of flow in m/s?

   a) 0.0037
   b) 0.037
   c) 0.028
   d) 0.0028

   Ans. b

4. The sphericity of cylinder with diameter 1 cm and height 1 cm is

   a) 0.834
   b) 0.874
   c) 0.912
   d) 0.956

   Ans. b
5. If an object has the volume $V_p$, Diameter $D_p$ and surface area $S_p$, then the sphericity of that object can be given as

a) \[ \frac{6 \cdot V_p}{D_p \cdot S_p} \]

b) \[ \frac{6 \cdot D_p}{V_p \cdot S_p} \]

c) \[ \frac{6 \cdot S_p}{V_p \cdot D_p} \]

d) None of the above

Ans. a

6. If $\varepsilon_{mf}$ is the porosity of the bed at minimum fluidization then the height of the bed at minimum fluidization when there is no porosity can be found out as

a) $L^* (1 - \varepsilon_{mf})$

b) $L/(1 - \varepsilon_{mf})$

c) $L^* \varepsilon_{mf}$

d) $L/ \varepsilon_{mf}$

Ans. B

7. A plate heat exchanger is used to sterilize apple juice. The gap between the plates is 10 mm and of 3 m long. Assume density and viscosity of apple juice to be 1060 kg m$^{-3}$ and $1 \times 10^{-3}$ respectively. What is the average velocity in cm/s if the Reynolds Number is 1200?

a) 5.6

b) 11.2

c) 0.056

d) 0.112

Ans. a

8. Calculate the pressure drop in question 7.

a) 0.20 Pa
b) 20.16 Pa

c) 3.7 Pa

d) 0.37 Pa

Ans. B