Unit 6 - Week 4

Assignment 4

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

Due on 2019-08-28, 23:59 IST.

1) Which of the following is the correct expression for Darcy's Law? *1 point*

a. $\left(\frac{-\Delta P}{H}\right) \propto U$
b. $\left(\frac{-\Delta P}{H}\right) \propto \frac{1}{U}$
c. $\left(\frac{-\Delta P}{H}\right) \propto U^{1/2}$
d. $\left(\frac{-\Delta P}{H}\right) \propto U^2$

a.
b.
c.
d.

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

2) The equivalent diameter for a packed bed can be calculated as: *1 point*

a. $D_e = \frac{4 \times \text{flow area}}{\text{wetted cross-section}}$
b. $D_e = \frac{4 \times \text{flow area}}{\text{wetted perimeter}}$
c. $D_e = \frac{4 \times \text{wetted perimeter}}{\text{flow area}}$
d. $D_e = \frac{\text{flow area}}{\text{wetted perimeter}}$

a.
b.
c.
d.

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

3) Which one of the following is the correct expression for Hagen–Poiseuille equation? *1 point*

a. $\left(\frac{-\Delta P}{H}\right) = \frac{64\mu U}{D^2}$
b. $\left(\frac{-\Delta P}{H}\right) = \frac{32\mu U}{D}$
c. $\left(\frac{-\Delta P}{H}\right) = \frac{32\mu U}{D^2}$
d. $\left(\frac{-\Delta P}{H}\right) = \frac{64\mu U}{D}$

a.
b.
c.
d.

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

4) For spherical particles, Carman-Kozeny equation can be expressed as: *1 point*

a. $\left(\frac{-\Delta P}{H}\right) = 180\frac{\mu U(1-\varepsilon)^2}{x^2\varepsilon^3}$
b. $\left(\frac{-\Delta P}{H}\right) = 180\frac{\mu U(1-\varepsilon)^2}{x^2\varepsilon}$
c. $\left(\frac{-\Delta P}{H}\right) = 180\frac{\mu U(1-\varepsilon)}{x\varepsilon^3}$
d. $\left(\frac{-\Delta P}{H}\right) = 180\frac{\mu U(1-\varepsilon)^2}{x\varepsilon^3}$

a.
b.
c.
d.

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

5) For randomly packed bed of monosized spheres, Burke-Plummer equation can be written as: *1 point*

a. $\left(\frac{-\Delta P}{H}\right) = 1.75\frac{\rho_f U^2(1-\varepsilon)}{x\varepsilon^3}$
b. $\left(\frac{-\Delta P}{H}\right) = 175\frac{\rho_f U^2(1-\varepsilon)}{x\varepsilon^3}$
c. $\left(\frac{-\Delta P}{H}\right) = 1.75\frac{\rho_f U^2(1-\varepsilon)}{x\varepsilon}$
d. $\left(\frac{-\Delta P}{H}\right) = 175\frac{\rho_f U(1-\varepsilon)}{x\varepsilon^3}$

a.
b.
c.
d.

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

6) The pressure gradient value in Ergun equation for laminar flow ____________ with superficial fluid velocity? *1 point*

a. increases linearly
b. decreases linearly
c. does not depend
d. none of the above

a.
b.
c.
d.

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

7) For flow through a randomly packed bed of spherical particles, the Ergun equation can be expressed as: *1 point*

a. $\left(\frac{-\Delta P}{H}\right) = 150\frac{\mu U(1-\varepsilon)^2}{x\varepsilon^3} + 175\frac{\rho_f U^2(1-\varepsilon)}{x\varepsilon^3}$
b. $\left(\frac{-\Delta P}{H}\right) = 150\frac{\mu U(1-\varepsilon)}{x\varepsilon^3} + 1.75\frac{\rho_f U^2(1-\varepsilon)^2}{x\varepsilon^3}$
c. $\left(\frac{-\Delta P}{H}\right) = 150\frac{\mu U(1-\varepsilon)^2}{x^2\varepsilon^3} + 1.75\frac{\rho_f U^2(1-\varepsilon)}{x\varepsilon^3}$
d. $\left(\frac{-\Delta P}{H}\right) = 150\frac{\mu U(1-\varepsilon)}{x^2\varepsilon} + 1.75\frac{\rho_f U^2(1-\varepsilon)^2}{x\varepsilon}$

a.
b.
c.
d.

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

8) The pressure gradient value in Ergun equation for fully turbulent flow ____________. *1 point*

a. decreases with square of the superficial velocity
b. increases with square of the superficial velocity
c. increases linearly with superficial velocity
d. remains constant with superficial velocity

a.
b.
c.
d.

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

9) For fully turbulent flow through packed bed, the friction factor is: *1 point*

a. $\frac{150}{Re^*}$
b. $150\,Re^*$
c. 1.75
d. $\frac{1.75}{Re^*}$

a.
b.
c.
d.

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

10) Which of the following is correct for the pressure gradient value for laminar flow in Ergun equation? *1 point*

a. independent of fluid specific gravity
b. independent of fluid viscosity
c. independent of both fluid density and viscosity
d. independent of bed voidage

a.
b.
c.
d.

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

11) According to Darcy's law, for rate of flow of water through beds of sand of various thickness, the average velocity is ____________ the thickness of bed. *1 point*

a. directly proportional to
b. inversely proportional to
c. independent of
d. none of these

a.
b.
c.
d.

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

12) In the regeneration of an ion exchange resin, hydrochloric acid of density $1200\ kg/m^3$ and viscosity of $2 \times 10^{-3}\ Pa.s$ flows upward through a bed of resin particle of density $2400\ kg/m^3$ resting on a porous support in a tube of $6\ cm$ in diameter. The particles are spherical of diameter $0.4\ mm$ and the void fraction of the packed is 0.4. The height of the packed bed is $50\ cm$. Calculate the pressure drop across the bed and the velocity at which the acid is flowing through the bed. *3 points*

a. 4531.6 Pa, 8.70×10^{-4} m/s
b. 3531.6 Pa, 6.70×10^{-4} m/s
c. 2531.6 Pa, 6.07×10^{-4} m/s
d. 3013.8 Pa, 6.70×10^{-6} m/s

a.
b.
c.
d.

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

13) The reactor of a catalytic reformer contains spherical catalyst particles of diameter $2\ mm$. The packed volume of the reactor is $4.8\ m^3$ and the void fraction is 0.3. The reactor feed is a gas of density $30\ kg/m^3$ and viscosity of $2 \times 10^{-5}\ Pa.s$ flowing at a rate of $12000\ m^3/h$. The gas properties may be assumed constant. Pressure drop through the reactor is restricted to $70\ kPa$. Calculate the cross-sectional area for flow and the depth/height of the bed required. *3 points*

a. $12.76\ m^2, 0.72\ m$
b. $4.76\ m^2, 0.29\ m$
c. $8.14\ m^2, 0.59\ m$
d. $6.16\ m^2, 0.95\ m$

a.
b.
c.
d.

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

14) A gas absorption tower of diameter $3\ m$ contains ceramic Raschig rings randomly packed to a height of $4\ m$. Air containing a small proportion of SO_2 passes upwards through the absorption tower at a flow rate of $8\ m^3/s$. The viscosity and density of gas are $1.80 \times 10^{-5} Pa.s$ and $1.2\ kg/m^3$ respectively. (Details of the packing are $S_B = 180\ m^2/m^3$ and voidage = 0.6. Calculate the diameter of a sphere with the same surface-volume ratio as the Raschig rings and the frictional pressure drop across the packing in the tower. *3 points*

a. 0.0133 m, 1550 Pa
b. 0.133 m, 1750 Pa
c. 0.0198 m, 1800 Pa
d. 0.0103 m, 1050 Pa

a.
b.
c.
d.

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