Assignment: Module 4

The due date for submitting this assignment has passed. Due on 2018-02-21, 23:59 IST.

Submitted assignment

Fluidization Engineering

Module 4: Frictional Pressure Drop Characteristics

Each question has only one correct answers and carries one mark. (1x30)

1) Lockhart and Martinelli correlations can be used to estimate the frictional pressure drop in

- Two-phase flow
- Three-phase flow
- Both (a) and (b)
- Single-phase flow

No, the answer is incorrect.

Score: 0

Accepted Answers:
Both (a) and (b)

2) Slurry of a system can be defined as

- Liquid + Solid
- Gas + Solid
- Liquid + Gas
- Liquid + Liquid

No, the answer is incorrect.

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

Viscosity and density of the phases

4) Which model is suitable for estimation of frictional pressure gradient in annular flow map

- Friedel (1980) model
- Wallis (1969) model
- Baroczy (1966) model
- None of these

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

Wallis (1969) model

5) Friedel (1980) can be applied to estimate the frictional pressure drop in multiphase flow system, this model can be applied when the ratio of density of liquid to gas is

\[(\rho_l/\rho_g) < 1000\]
\[(\rho_l/\rho_g) > 1000\]
\[(\rho_l/\rho_g) < 0.1\]
\[(\rho_l/\rho_g) = 1000\]

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

\[(\rho_l/\rho_g) < 1000\]

6) The role of pressure drop in fluidization

- Governs the patterns of energy dissipation
- Change the fractional holdup of the phase
- Helps in modeling the system and forms the basis of assessment of performance of the fluidized bed
- All the above

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

All the above

7) The overall volumetric mass transfer coefficient with pressure at constant mass flow rate

- Decreases
- Increases
- Remains constant
- None of the above

No, the answer is incorrect.
8) The liquid axial dispersion coefficient with an increase of pressure in a wide range of superficial gas and liquid velocity

- Increases
- Decreases
- Remains constant
- None of the above

No, the answer is incorrect.

9) The bubble size in bubbling fluidized bed with the increase in pressure

- Increases
- Decreases
- Remains constant
- None of the above

No, the answer is incorrect.

10) The minimum fluidization velocity with the increase of particle diameter

- Increases
- Decreases
- Remains constant
- None of the above

No, the answer is incorrect.

11) The voidage at minimum bubbling with the increase in particle diameter

- Increases
- Decreases
- Remains constant
- None of the above

No, the answer is incorrect.

12) The pressure drop inside the bed may be due to

- Friction
- Head
13. Mixture density of a fluid-solid suspension can be expressed as
   - \( \rho_m = \rho_f \varepsilon + \rho_p (1 - \varepsilon) \)
   - \( \rho_m = \rho_f \varepsilon - \rho_p (1 + \varepsilon) \)
   - \( \rho_m = \rho_f \varepsilon - \rho_p (1 - \varepsilon) \)
   - \( \rho_m = \rho_f \varepsilon + \rho_p (1 + \varepsilon) \)

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

14. Maximum pressure contribution to the total pressure is
   - Hydrostatic
   - Accelerative
   - Frictional
   - Both (a) and (b)

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

15. Pressure drop between the particle and wall can be expressed as

   \[ \left( \frac{dp}{dz} \right)_{\text{particle-wall}} = 4f_p \frac{(1 - \varepsilon) \rho_p u_p^2}{d_{\text{bed}}} \]

   No, the answer is incorrect.
   Score: 0
   Accepted Answers: 
   \[ \left( \frac{dp}{dz} \right)_{\text{particle-wall}} = 2f_p \frac{(1 - \varepsilon) \rho_p u_p^2}{d_{\text{bed}}} \]

16. The terminal velocity \( (u_t) \) of a particle inside a fluidized bed can be expressed as
No, the answer is incorrect.
Score: 0

Accepted Answers:

\[ f_m = \frac{0.079}{Re_m^{0.25}} \]

17) The friction factor of a mixture \((f_m)\) at turbulent flow condition \((Re_m > 2300)\) can be calculated by

No, the answer is incorrect.
Score: 0

Accepted Answers:

\[ f_m = \frac{0.079}{Re_m^{0.25}} \]

18) The particle diameters almost have no influence on the frictional-pressure losses for the gas superficial velocities

No, the answer is incorrect.
Score: 0

Accepted Answers:

< 7 m/s

19) The changes in frictional-pressure differences with the increase of gas

No, the answer is incorrect.
Score: 0

Accepted Answers:

< 7 m/s
superficial velocities

- Increases
- Decreases
- Remains constant
- None of the above

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

The frictional-pressure losses with the increase of solid concentration if the other operating conditions remain same

- Increases
- Decreases
- Remains constant
- None of the above

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

Static pressure drop due to change in potential energy of the gas and solids can be expressed as

\[
\left( \frac{dp}{dz} \right) = \left[ \rho_p (1 - \varepsilon) \frac{du_p}{dz} \right]
\]

\[
\left( \frac{dp}{dz} \right) = [\rho_p (1 - \varepsilon) + \rho_f \varepsilon]g
\]

\[
\left( \frac{dp}{dz} \right) = \left[ 2f_f \frac{(1 - \varepsilon)^2 \rho_p u_p^2}{d_{bed}} \right]
\]

None of the above

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

According to Blasius empirical formula, the fluids friction factor \( f_f \) for \( Re_f < 2300 \) is calculated by

\[
f_f = \frac{16}{Re_f}
\]

\[
f_f = \frac{32}{Re_f}
\]
23. Hydrostatic pressure drop is defined as

\[ f_f = \frac{64}{Re_f} \]

\[ f_f = \frac{24}{Re_f} \]

No, the answer is incorrect.
Score: 0
Accepted Answers:
\[ f_f = \frac{24}{Re_f} \]

24. A gas liquid fluidized bed of cross-sectional area of 50.26 cm² is operating with air flow rate of 5 lph and water flow rate of 500 lph with catalyst particle size of 100 µm and of sphericity of 0.97. Mass of the solid intake in the bed is 2.855 Kg. Density of the particle is 3950 Kg/m³. Calculate volume fraction of gas

\[ \varepsilon_g = \frac{3.464 \times 10^{-2} \ u_{sl}^{-0.66} \ (\phi_s \ d_p)^{0.50}}{1 + 1.74 \ \left( \frac{u_{sl}}{u_{sl} + u_{sg}} \right)^{3.74}} \]

\[ L^{0.43} \ \left( \frac{\rho_l - \rho_g}{\rho_g} \right)^{0.06} \ \mu_i^{0.08} \ \bar{d}_{bed}^{0.23} \]

0.667
0.081
0.056
0.077

No, the answer is incorrect.
Score: 0
Accepted Answers:
0.056

25. The property index \( I_p \) in terms of viscosity and density of the phases is expressed as

\[ I_p = \left( \frac{\mu_s}{\mu_g} \right)^{\phi_s} \left( \frac{\rho_s}{\rho_g} \right) \]

None of these

1 point
\[ I_p = \left( \frac{\rho_i}{\rho_g} \right) \left( \frac{\mu_i}{\mu_g} \right)^{0.2} \]

\[ I_p = \left( \frac{\rho_i}{\rho_g} \right) \left( \frac{\mu_i}{\mu_g} \right)^{0.5} \]

No, the answer is incorrect.
Score: 0
Accepted Answers:
\[ I_p = \left( \frac{\mu_i}{\mu_g} \right)^{0.2} \left( \frac{\rho_i}{\rho_g} \right) \]

26) The parameter \( (X) \) is called Lockhart-Martinelli’s parameter which is defined as 1 point

\[ X = \left( \frac{\Delta P_{\text{tot}}}{\Delta P_{\text{f}} \mu} \right)^{0.75} \]

\[ X = \left( \frac{\Delta P_{\text{tot}}}{\Delta P_{\text{f}} \mu} \right)^{2.0} \]

\[ X = \left( \frac{\Delta P_{\text{tot}}}{\Delta P_{\text{f}} \mu} \right)^{1.3} \]

\[ X = \left( \frac{\Delta P_{\text{tot}}}{\Delta P_{\text{f}} \mu} \right)^{0.5} \]

No, the answer is incorrect.
Score: 0
Accepted Answers:
\[ X = \left( \frac{\Delta P_{\text{tot}}}{\Delta P_{\text{f}} \mu} \right)^{0.5} \]

27) The pressure drop multiplier for the liquid is related to the Lockhart-Martinelli’s 1 point parameter \( (X) \) as

\[ \phi^2 = 1 + \frac{C}{X} + \frac{1}{X^2} \]

\[ \phi^2 = 1 + CX + X^2 \]

None of the above
Both (a) and (b)

No, the answer is incorrect.
Score: 0
Accepted Answers:
Fluidization Engineering - Unit 5 - Frictional Pressure Drop

28) The frictional pressure drop is due to the types of frictional forces:
   - Frictional force between gas and solid
   - Frictional force between the solid and the walls of the bed
   - Frictional force between the gas and the wall of the bed
   - All the above

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

29) If G-L-S mixing height is 20 cm and clean liquid height is 12 cm, then calculate gas hold up:
   - 1
   - 0.73
   - 0.667
   - 1.4

   No, the answer is incorrect.
   Score: 0
   Accepted Answers:
   0.667

30) If Reynolds number is greater than 2300 then:

   \[ f_m = \frac{0.079}{Re_m^{0.25}} \]

   - 1
   - None of these

   No, the answer is incorrect.
   Score: 0
   Accepted Answers:
   \[ f_m = \frac{0.079}{Re_m^{0.25}} \]
You were allowed to submit this assignment only once.