Assignment: Module 5

The due date for submitting this assignment has passed. Due on 2018-02-28, 23:59 IST.

Submitted assignment

Fluidization Engineering

Module 5: Gas Distribution

Each question has only one correct answer and carries one mark. (1x25)

1) The shortcoming of laboratory scale distributors for small scale fluidization

- Increased pumping power
- Clogging by fine particles
- Low resistivity against thermal stresses
- All of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

All of the above

2) Perforated or multiporous plate distributors are used as

- Industrial scale distributors
- Laboratory scale distributors
- Both (a) and (b)
- None of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

Industrial scale distributors
Perforated plate without screen

No, the answer is incorrect.
Score: 0
Accepted Answers: Perforated plate without screen

4) The type of perforated plate distributor which can withstand heavy loads and thermal stresses

- Curved plate type
- Grate bars type
- Straight plate type
- Both (a) and (b)

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

5) What type of distributors is used for high-temperature operations and in highly reactive environment?

- Tuyers type distributor
- Pipe grides and sparger
- None of the above
- Perforated plate distributor

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

6) The main disadvantages of bubble cap distributor are

- Difficult to avoid stagnant regions
- Not suitable for sticky solids
- Lower pressure drop
- Both (a) and (b)

No, the answer is incorrect.
Score: 0
Accepted Answers: Difficult to avoid stagnant regions

7) For the same bed height and same ‘U’

- \( \Delta P_d/\Delta P_b \) – porous plate > \( \Delta P_d/\Delta P_b \) – orifice plate
- \( \Delta P_d/\Delta P_b \) – porous plate < \( \Delta P_d/\Delta P_b \) – orifice plate
- \( \Delta P_d/\Delta P_b \) – porous plate = \( \Delta P_d/\Delta P_b \) – orifice plate
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers: \( \Delta P_d/\Delta P_b \) – porous plate > \( \Delta P_d/\Delta P_b \) – orifice plate
8) The main advantages of bubble cap distributor are

- Minimizes weeping
- Good turndown ratio
- Lower pressure drop
- All of the above

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

9) The change of \( \Delta P_d/\Delta P_b \) with the increase of \( U/U_{mf} \)

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

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

10) For even distribution of fluidizing gas to a bed where ‘\( U \)’ is close to ‘\( U_{mf} \)’

- \( \Delta P_d/\Delta P_b \geq 0.05 \)
- \( \Delta P_d/\Delta P_b \leq 0.05 \)
- \( \Delta P_d/\Delta P_b \geq 0.15 \)
- \( \Delta P_d/\Delta P_b \leq 0.15 \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
\( \Delta P_d/\Delta P_b \geq 0.15 \)

11) The stirring effect measuring factor is defined as

\[
\alpha = \frac{\rho g U_{mf}^3}{2} \frac{1}{\Delta P_b}
\]

\[
\alpha = \frac{\rho g U_{mf}^2}{4} \frac{1}{\Delta P_b}
\]

\[
\alpha = \frac{\rho g U_{mf}^2}{4} \frac{1}{\Delta P_b}
\]

\[
\alpha = \frac{\rho g U_{mf}^2}{2} \frac{1}{\Delta P_b}
\]

No, the answer is incorrect.
Score: 0
Accepted Answers:
\[ \alpha = \frac{\rho_2 u_m^2}{2 \Delta P_d} \]

12) The jets will not contribute much to bed stirring and bubble rising when

- \( \alpha = 1 \)
- None of the above
- \( \alpha << 1 \)
- \( \alpha << 1 \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
\( \alpha << 1 \)

13) The effect of excessive distributor pressure drop is

- Power consumption at the blower or compressor increases
- Design cost of blower or compressor increases
- Total pressure drop increases
- All the above

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

14) For porous plate distributor the pressure is related to fluid velocity as

- \( \Delta P_d \propto u^{0.5} \)
- \( \Delta P_d \propto u^3 \)
- \( \Delta P_d \propto u \)
- \( \Delta P_d \propto u^2 \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
\( \Delta P_d \propto u \)

15) The thumb rule for the pressure drop across distributors is

- \( \Delta P_d = (1.2 - 0.4) \Delta P_b \)
- \( \Delta P_d = (0.2 - 0.4) \Delta P_b \)
- \( \Delta P_d = (1.2 + 0.4) \Delta P_b \)
\[ \Delta P_d = (0.2 + 0.4) \Delta P_b \]

No, the answer is incorrect.
Score: 0
Accepted Answers:
\[ \Delta P_d = (0.2 - 0.4) \Delta P_b \]

16) The jet penetration length \( L_j \) for the horizontal jet \( (d_{or} = 2.1 \text{ mm}) \) is

- \( L_j = 10-15 \text{ cm} \) for many small holes
- \( L_j = 15-20 \text{ cm} \) for many small holes
- None of the above
- \( L_j = 5-10 \text{ cm} \) for many small holes

No, the answer is incorrect.
Score: 0
Accepted Answers:
\[ L_j = 5-10 \text{ cm for many small holes} \]

17) At higher flow rate, the jet penetration length \( L_j \)

- Decreases
- None of these
- Remains constant
- Increases

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

18) Above a perforated plate, the dead zone shrinks when

- The gas velocity increases
- The particle size increases
- The spacing of orifices decreased
- All the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
The gas velocity increases

19) The change in bubble size with the increase of orifice flow

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

No, the answer is incorrect.
Score: 0
Accepted Answers:
Increases
20) At a bubble cap tuyer
- At higher flow rate jet forms
- At low gas flow rate bubbles form and detach in orderly procession
- Prevents solids from falling through the distributor
- All the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
Prevents solids from falling through the distributor

21) The ideal shaft work \(-w_{s,\text{ideal}}\) for an axial blower which is being used to supply the hot air in a fluidized bed reactor is 100 kJ. The efficiency of the blower is 0.85. The actual shaft work is as

- \(-w_{s,\text{actual}} = 300.98 \text{ KJ}\)
- \(-w_{s,\text{actual}} = 130.64 \text{ KJ}\)
- \(-w_{s,\text{actual}} = 150.23 \text{ KJ}\)
- \(-w_{s,\text{actual}} = 117.64 \text{ KJ}\)

No, the answer is incorrect.
Score: 0
Accepted Answers:
\(-w_{s,\text{actual}} = 117.64 \text{ KJ}\)

22) The outlet temperature of the air when it is compressed in a compressor in reversible adiabatic compression? Data: Inlet pressure of air \(P_1 = 1 \text{ atm}\), Outlet pressure of air \(P_2 = 10 \text{ atm}\), Inlet temp of air \(T_1 = 298 \text{ k}\), \(g = 1.33\)

- 900.59 K
- 827.52 K
- 300.56 K
- 527.64 K

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

23) A real operation conditions two-stage compressor with frictional losses

- None of these
- \(-w_{s,\text{actual}} < -w_{s,\text{ideal}}\)
- \(-w_{s,\text{actual}} = -w_{s,\text{ideal}}\)
- \(-w_{s,\text{actual}} > -w_{s,\text{ideal}}\)

No, the answer is incorrect.
Score: 0
Accepted Answers:
\(-w_{s,\text{actual}} > -w_{s,\text{ideal}}\)

24) What is the ideal power consumption of the compressor to deliver the hot reacting gas to the fluidized bed reactor in the petrochemical plant. The volumetric flow rate of the reacting gas is 25 m\(^3\)/s. The Inlet pressure at the compressor is 101 kPa while the outlet pressure is 500 kPa. Specific heat capacity ratio is 2.4
A fluidized bed reactor in a polymer processing plant is attached with a compressor to transport the reacting fluid to the catalyst bed. What is the outlet pressure?

The inlet pressure and temperature at the compressor is $101 \times 10^3$ Pa and $27^\circ C$. System parameter are as follows: $\Delta p_{\text{bed}} = 18 \times 10^3$ Pa, $\Delta p_{\text{grid distributor}} = 10 \times 10^3$ Pa, $\Delta p_{\text{cyclone+filters}} = 20 \times 10^3$ Pa, $\Delta p_{\text{filter exit}} = 399 \times 10^3$ Pa

1 point

$P_2 = 458 \times 10^2$ kPa
$P_2 = 447 \times 10^3$ kPa
$P_2 = 358 \times 10^2$ kPa
$P_2 = 799 \times 10^4$ kPa

No, the answer is incorrect.
Score: 0
Accepted Answers:
$P_2 = 447 \times 10^3$ kPa