

The initial height and concentration of a suspension in a graduated cylinder were 100 cm, 10 kg/m³, respectively. At time 50 sec the height of interface between clear liquid and suspension was 60 cm. At this point (60 cm, 50 sec), a tangent was drawn on the height-time curve of the sedimentation of the suspension in which the intercept of this tangent at time zero was 80 cm. At time 50 sec, the sedimentation velocity is _____ and the concentration of suspension is

initial height = 100 cm, $C_0 = 10 \text{ kg/m}^3$

$t = 50 \text{ s}$, $h = 60 \text{ cm}$,

tangent $\rightarrow h = 80 \text{ cm}$, $t = 0$

at time 50 sec $\frac{u_c}{?}$ $\frac{C}{?}$

Solution:.

the sedimentation velocity = the slope of the tangent
we have two point
(0, 80), (50, 60)

$$1) \text{ the } u_c = \frac{80 - 60}{50} = 0.4 \text{ cm/s}$$

$$2) C = C_0 \left(\frac{\text{initial height}}{\text{the height we are at}} \right) \\ = 10 \left(\frac{100}{80} \right) = 12.5 \text{ kg/m}^3$$



1 + frames use / plates use sides

A frame-and-plate filter press consists of 3 frame and 4 plates. If the length of the growing cake during the filtration process is 2 cm, the total thickness of the cake in the filter press is _____.

* each frame forms cake on both sides

So Per frame ::

$$2 + 2 = 4 \text{ cm}$$

per 3 frame

$$3 \times 4 = 12 \text{ cm}$$

note:

the solution is from chat gpt



If crushing rolls, 1 m in diameter, are set so that the crushing surfaces are 8.462 mm apart and the angle of nip is 30-degree, what is the maximum size of particle which should be fed to the rolls?

$$2b = 8.462 \text{ mm}$$

$$2\alpha = 30^\circ$$

$$r_1 = 0.5 \text{ m}$$

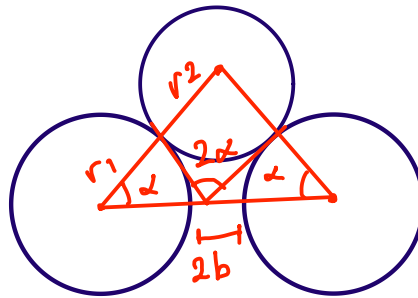
Solution ::

$$\cos \alpha = \frac{(r_1 + b)}{(r_2 + r_1)}$$

$$\cos 15^\circ = \frac{0.5 + 4.231 \times 10^{-3}}{r_2 + 0.5}$$

$$\cos 15^\circ r_2 + \cos 15^\circ \times 0.5 = .501231$$

$$r_2 = .021 \text{ m}$$



m ρ_s h
 3.6 kg of solid particles of density 2590 kg/m³ form a packed bed of height 47.5 cm in a circular vessel of diameter 7.57 cm. The voidage of the bed is

$$\Sigma = \frac{V_{\text{void}}}{V_{\text{bed}}}, \quad \begin{array}{l} d \\ V_s \rightarrow \text{volume of solid particles} \\ V_b \rightarrow \text{the bed} \end{array}$$

Solution:

$$V_s = \frac{3.6 \text{ kg}}{2590 \text{ kg/m}^3} = 1.38 \times 10^{-3} \text{ m}^3$$

$$V_b = AL = \frac{\pi d^2}{4} \cdot L = \frac{\pi}{4} \cdot (7.57 \times 10^{-2})^2 \cdot (47.5 \times 10^{-2}) = 2.13 \times 10^{-3}$$

$$V_{\text{voids}} = V_{\text{bed}} - V_{\text{solids}} = 7.5 \times 10^{-4}$$

$$\Sigma = \frac{7.5 \times 10^{-4}}{2.13 \times 10^{-3}} = 0.35$$

note..
 the solution is from chat gpt



.A solid particle with a cuboid shape has a dimension of 3 mm a side. The surface diameter is _____.

$$d_s = \sqrt{\frac{S_p}{\pi}}$$

$$S_p = 6x^2 = 6 * (3 * 10^{-3})^2 = 5.4 * 10^{-5}$$

$$d_s = 4.14 * 10^{-3}$$



$$3.5 \times 10^{-3}$$

A liquid, of density 850 kg/m^3 and viscosity $3.5 \times 10^{-3} \text{ Ns/m}^2$, is passed vertically upwards through a bed of solid material consisting of approximately spherical particles of diameter 0.2 mm and density 2500 kg/m^3 . At what mass rate of flow per unit area of bed will transport of particles occur? assume stokes regime

$$u_t = \frac{g d_p^2 (\rho_s - \rho_f)}{18 \mu}$$

$$= \frac{9.81 \times (.2 \times 10^{-3})^2 (2500 - 850)}{18 \times 3.5 \times 10^{-3}}$$

$$u_t = .0103 \text{ m/s}$$

$$G = \rho_f u_t$$

$$= 850 \times .0103$$

$$G = 8.76 \text{ kg/m}^2 \cdot \text{s}$$



Final Exam 2020/202...



Suppose we have a batch .15 sedimentation experiment and we only change the initial height of the suspension by increasing it to a higher value, what do you expect to happen to the trend of the sedimentation process?

*. _____ I expect _____ on
(2 نقطة)

up thrust, suspension
concentration ☐

a decrease, sedimentation flux ☐

No effect, sedimentation rate ☒

Little effect, sedimentation
rate ☐

Final Exam 2020/202...



A liquid, of density 850 kg/m^3 and viscosity $3.5\text{E-}03 \text{ Ns/m}^2$, is passed vertically upwards through a bed of solid material consisting of approximately spherical particles of diameter 0.2 mm and density 2500 kg/m^3 . At what mass rate of flow per unit area of bed will transport of particles occur? assume stokes regime

*

(3 نقطة)

note: if you want, you can only open slides or text to check formula

$\text{kg/m}^2 \text{ s } 0.9$ ☐

$\text{kg/m}^2 \text{ s } 16.4$ ☐

$\text{kg/m}^2 \text{ s } 8.7$ ☒

$\text{kg/m}^2 \text{ s } 4.8$ ☐

Final Exam 2020/2021 Solid Particulates Chemical Eng. Dept. (Solid Particulates)

14. The sedimentation experiment can be used to obtain the particle size distribution of a powder material. *

(2 Points)

☐ True

☐ False

15. Suppose we have a batch sedimentation experiment and we only change the initial height of the suspension by increasing it to a higher value, what do you expect to happen to the trend of the sedimentation process?

I expect _____ on _____.*

(2 Points)

☐ Little effect, sedimentation rate

☐ No effect, sedimentation rate

☐ a decrease, sedimentation flux

Search

10/2021 Solid Particulates Chemical Eng. Dept. (Solid Particulates)

9. The separation of solid particles from a suspension consists of fine particles of different materials in water using a flotation technique depends upon the differences in the _____.*
(2 Points)

- ☒ magnetic fields of the solid particles
- ☐ electrical charges of solid particles
- ☐ surface properties of the solid particles being used
- ☐ sizes of the solid particles being separated

10. Theoretical cut particle size for a gas cyclone is _____.*
(2 Points)

- ☐ the smallest particle size retained by the cyclone.
- ☐ The theoretical size of the standard cyclone.

Search

Exam 2020/2021 Solid Particulates Chemical Eng. Dept. (Solid Particulates)

...imate properties of the solid particles being used

- ☐ sizes of the solid particles being separated

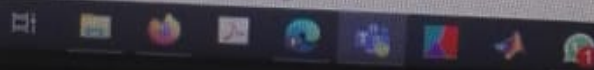
10. Theoretical cut particle size for a gas cyclone is _____. *

(2 Points)

- ☐ the smallest particle size retained by the cyclone.
- ☐ The theoretical size of the standard cyclone.
- ☒ The d50 particle of the cyclone.
- ☐ The exit core size of the cyclone.

11. A liquid, of density 850 kg/m^3 and viscosity $3.5\text{E-}03 \text{ Ns/m}^2$, is passed vertically through a bed of solid material consisting of approximately spherical particles of d_p mm and density 2500 kg/m^3 . At what mass rate of flow per unit area of bed will particles occur? assume stokes regime. *

o search



Final Exam 2020/202...



The dominant mechanism of mixing .19
process in case using a fluidized bed
mixer to mix two different materials
such as salt and sand grains
* ._____ is
(2 نقطة)

Conduction ☐

Shear ☐

Convective ☒

Laminar ☐

Diffusion ☐

The specific surface area of a solid .20

Gravity separators or settling chambers are commonly used to separate solid particles from a gas stream that contains a certain quantity of dust material. The system is characterized by _____ and a * _____ number of _____ in order to (2 نقطة)

A very large volume, plates, decrease the velocity of the gas stream ☐

A small volume, nozzles, spray liquid to dissolve dust particles ☐

A conical shape, trays, create centrifugal force or vortex ☒

A large volume, plates, increase the gas stream velocity ☐

Final Exam 2020/202...



Structural Packing is widely used in .3 chemical engineering applications such as cooling towers, distillations and absorption columns in order to
 * _____ between
 (2 نقطة)

increase the contact area, gas
and liquid fluids



decrease the mixing, both gas
and liquid streams



decrease the heat transfer,
packing and fluids



reduce the turbulent
movement, vapor and liquid
phases



kg of solid particles of density 4.3.6

Search

Chemical Eng. Dept. (Solid Particulates)

13. A manager asked a chemical engineer in his company to propose (يقترح) suitable designing a fluidized bed system. After the collection of data, the engineer has found min fluidization velocity = 3.5 m/s and the terminal particle velocity = 12.5 m/s. The engineer proposed to use _____. *

(2 Points)

- ☐ 3.5 m/s to obtain a max pressure drop through the bed
- ☐ Double of the terminal velocity (25 m/s) to provide strong turbulence in the bed
- ☐ Less than 3.5 m/s, say 3.0 m/s to keep the system in a good behavior
- ☐ 12.5 m/s to obtain a good bed expansion
- ☒ 8 m/s to insure appropriate design for the fluidized bed system

14. The sedimentation experiment can be used to obtain the particle size distribution of a material. *

(2 Points)

- ☐ False
- ☒ True

15. Suppose we have a batch sedimentation experiment and we only change the initial concentration of the suspension by increasing it to a higher value. What do you expect to happen to the sedimentation process?

DELL

5. The main principle of the cyclone equipment is to convert the _____ into _____.
(2 Points)

- tangential velocity, linear velocity
- linear lateral velocity, kinetic energy
- intrinsic energy, vortex energy
- linear velocity, tangential velocity
- kinetic energy, potential energy

Final Exam 2020/202...



6. Ball mill should operate _____ meanwhile absorption packed column must operate

*

(2 نقطة)

at the critical speed, below loading point ☐

below the critical speed, at 50% of the flooding velocity ☒

above the critical speed, above the loading time ☐

below the critical speed, at flooding point ☐

7. A solid particle with a cuboid shape has a dimension of 3 mm a side. The

*

surface diameter is