

The initial height and concentration of a suspension in a graduated cylinder were 100 cm, 10 kg/m<sup>3</sup>, 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

$$\text{initial height} = 100 \text{ cm}, c_0 = 10 \text{ kg/m}^3$$

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

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

$$\text{at time } 50 \text{ sec } \frac{u_c}{\checkmark} ? \quad c ?$$

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 1 + plates see 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

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

note:

the solution is from chat gpt



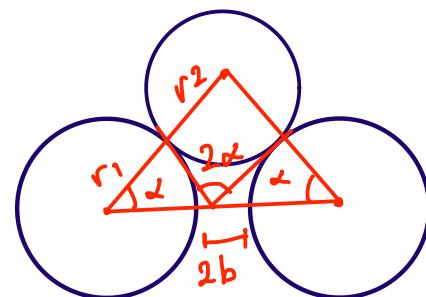
If crushing rolls, 1 m in diameter, are set so that the crushing surfaces are 8.462 mm apart and the angle of nip is 30-degree, what is the maximum size of particle which should be fed to the rolls?

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

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

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

Solution ::



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

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

$$\cos 15^\circ r_2 + \cos 15^\circ \times 0.5 = 0.504231$$

$$r_2 = 0.22 \text{ m}$$



m

$\rho_s$

h

3.6 kg of solid particles of density  $2590 \text{ kg/m}^3$  form a packed bed of height 47.5 cm in a circular vessel of diameter 7.57 cm. The voidage of the bed is

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

Solution :

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

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

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

$$\Sigma = \frac{7.5 \times 10^{-4}}{2.13 \times 10^{-3}} = .35$$

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 \_\_\_\_\_.

$$ds = \sqrt{\frac{SP}{\pi}}$$

$$SP = 6 \times 2 = 6 * (3 * 10^{-3})^2 = 5.4 * 10^{-5}$$

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



$\rho_f$   $3.5 \times 10^3$   
 A liquid, of density 850 kg/m<sup>3</sup> and viscosity 3.5E-03 Ns/m<sup>2</sup>, 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<sup>3</sup>. At what mass rate of flow per unit area of bed will transport of particles occur? assume stokes regime  $d$

$$\begin{aligned}
 u_t &= \frac{g d \rho^2 (\rho_s - \rho_f)}{18 \mu} \\
 &= \frac{9.81 \times (0.2 \times 10^{-3})^2 (2500 - 850)}{18 \times 3.5 \times 10^{-3}}
 \end{aligned}$$

$$u_t = 0.0103 \text{ m/s}$$

$$\begin{aligned}
 G &= \rho_f u_t \\
 &= 850 \times 0.0103
 \end{aligned}$$

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



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  
(نقطة 2)

up thrust, suspension concentration

a decrease, sedimentation flux

No effect, sedimentation rate

Little effect, sedimentation rate

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A liquid, of density  $850 \text{ kg/m}^3$  and  $0.11$  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  $0.2 \text{ mm}$  and density  $2500 \text{ kg/m}^3$ . At what mass rate of flow per unit area of bed will transport of particles occur? assume stokes regime

\*

(نقطة 3)

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

$\text{kg/m}^2 \text{ s } 0.9$

$\text{kg/m}^2 \text{ s } 16.4$

$\text{kg/m}^2 \text{ s } 8.7$

$\text{kg/m}^2 \text{ s } 4.8$

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)

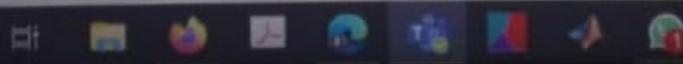
Little effect, sedimentation rate

No effect, sedimentation rate

a decrease, sedimentation flux



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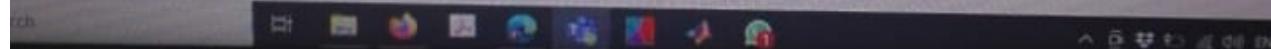
9. The separation of solid particles from a suspension consists of fine particles of different materials in water using a flotation technique depends upon the differences in the \_\_\_\_\_. \*  
(2 Points)

- 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.



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✓ ~~1. Theoretical cut particle size for a gas cyclone is \_\_\_\_\_.~~

- 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  $d_{50}$  particle of the cyclone.
- The exit core size of the cyclone.

11. A liquid, of density  $850 \text{ kg/m}^3$  and viscosity  $3.5 \times 10^{-3} \text{ Ns/m}^2$ , is passed vertically through a bed of solid material consisting of approximately spherical particles of  $0.5 \text{ mm}$  and density  $2500 \text{ kg/m}^3$ . At what mass rate of flow per unit area of bed will the particles occur? assume stokes regime. \*



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 نقطه)

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

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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

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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 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 material. \*

(2 Points)

False

True

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 time of sedimentation process?



DELL

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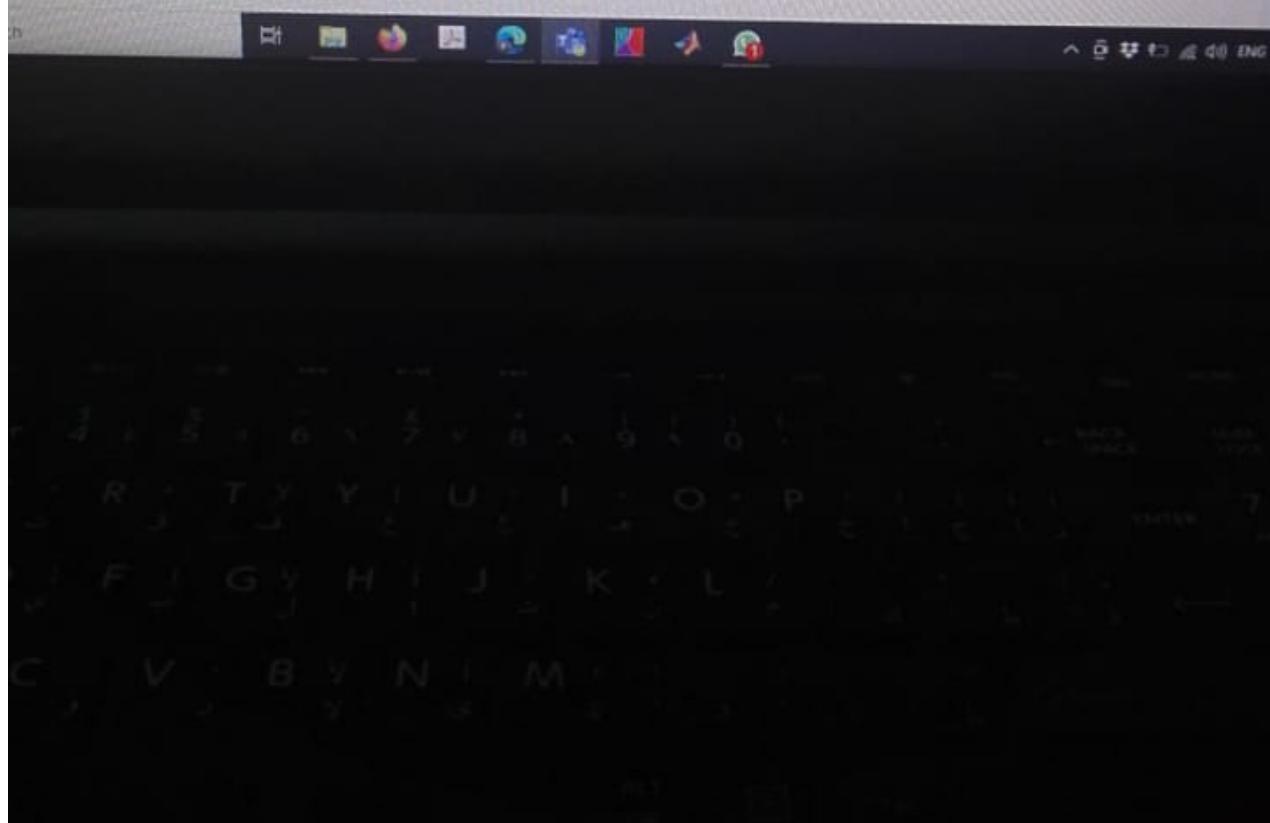
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5. The main principle of the cyclone equipment is to convert the \_\_\_\_\_ into \_\_\_\_\_. \*

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

6. Ball mill should operate \_\_\_\_\_ meanwhile absorption packed column must operate

(2 Points)



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Ball mill should operate .6  
\_\_\_\_\_ meanwhile absorption  
packed column must operate

\*

(نقطة 2)

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

A solid particle with a cuboid shape .7  
has a dimension of 3 mm a side. The  
\* surface diameter is