MECHANICAL OPERARATION ASSIGNMENT

1. Equivalent diameter of a particle is the diameter of the sphere having the same

   (a) Ratio of surface to volume as actual volume

   (b) Ratio of volume to surface as the particle

   (c) Volume as the particles

   (d) None of these

2. A certain crusher takes rock whose overage partial diameter is 0.025 m and crusher it to a product whose average particle diameter is 0.018 m, at the rate of 20, 000 kg/hour. At this rate mill takes 9 HP of power and 0.46 of power is required to run it empty.

   (a) What would be power consumption for same capacity if the average particle diameter in the product is 0.008 m. by rittingers law

   (b) How much power be required under condition by kick's law

3. A material is crushed in blake jaw crusher and avg, size of particles is reduced form 5 cm. to 1.3 cm. with consumption of energy at the rate of 37 watts hr / matric ton. what will be the consumption of energy necessary to crush the same material of avg. size 8 cm to an avg. size of 3 cm. mechanical efficiency remains unchanged.

   (i) Using rittinger's law

   (ii) Using kick's law

4. Calculate energy required to crush 100 tonnes per hour of limestone if 80% of feed passes through a screen 3.75 cm aperture and 80% of pdt passes through a screen with 0.03 cm aperture work index for limeston is 12.74 when capacity is expressed in tones per minute. How much of energy isrequired in HP .

5. A pair of rolls is to take a feed equivalent to sphere 4 cm in diameter and crush then to spheres having a dia. Of 2 cm .if coefficient of friction b/w roll surfaces and feed is 0.3 calculate diameter of rolls

6. 200 mesh screen means 200 openings per

(a) cm^2

(b) cm

(c) inch

(d) $inch^2$

7. Energy required per unit mass to find limestone particles of very large size to 100 μm is 12.7 kwh / ton . An estimate of energy to find particles from a very large size to 50 μm is

8. Filter aid is used to

(a) Increase rate of filtration

(b) Decrease pressure drop

(c) Increase porosity of cake

(d) Acts a support base for septuns

9. A pitot tube having a coefficient of 0.95 is inserted in central line of a long smooth pipe of 250 mm diameter in which crude oil density 900 kg $/m^3$ and viscosity 16.3 cp is flowing calculate maximum velocity of oil in pipe if differential pressure in the manometer is 5 cm of pipe

10. Water flows through an orifice 25 diameter in a 100 mm pipe at the rate of 630.9 cm^3/sec. what is difference in level on a manometer connected across the orifice. Discharge coefficients may be taken as 0.62 viscosity of water is 1 C.P.

11. Local velocity of a fluid along a streamline can be measured by

(a) Pitot tube

(b) Venture meter

(c) Roto meter

(d) Orifice meter

12. A pump draws oil ($\int$ = 800) form a storage tank and discharge it to an overhead tank mechanical energy delivered to pump is 50 J/kg velocities at suction and discharge pt are 1 m/s and 7m/s respectively. Neglecting friction losses and kinetic energy correction factor to be unity .pressure developed by the pump is

13. Two identical sized spherical particles A and B having densities ρ_A & ρ_B resp are setting in a fluid of density ρ . Assume free setting under turbulent flow conditions. Ratio of terminal setting velocity of. P. A to that of particle B is given by

(a) $\sqrt{\frac{(\rho_A - \rho)}{(\rho_B - \rho)}}$

(b) $\sqrt{\frac{(\rho_B - \rho)}{(\rho_A - \rho)}}$

(c) $\frac{\rho_A - \rho}{\rho_B - \int}$

(d) $\frac{\rho_B - \rho}{\rho_A - \rho}$

14. Consider scale up of a cyl. Ressel configured to have 5td geometry (h = d) in order to maintain an equal rate of mass transfer under turbulent cond. For a Newtonian fluid, ratio of the agitator speed should be

(a) $\frac{N_1}{N_2} = \frac{D_1}{D_2}$

(b) $\frac{N_1}{N_2} = \frac{D_2}{P_1}$

(c) $\frac{N_1}{N_2} = \left(\frac{D_1}{D_2}\right)^{2/3}$

(d) $\frac{N_1}{N_2} = \left(\frac{D_2}{P_1}\right)^{2/3}$

15. In the stok's regime, terminal velocity of particle for centrifugal sedimentation is given by

$$U_t = \frac{w^2 r\,(\rho_p - \rho)\,d_p^2}{18\mu}$$

w : angular velocity

r : Distance of particles form axis of rotation

ρ_p : Density of particle

ρ : Density of fluid

d_p Diameter of particle

μ : Viscosity of fluid

In a bowl. Centrifugal classifier operating at 60 rpm with water / μ = 0.001 kg/ms/ the time takes for a particle [d_p = 0.001mm, $\int$ = 2500) in seconds to traverse a distance of 0.05 from liquid surface is

(a) 4.8

(b) 5.8

(c) 6.8

(d) 7.8

16. two spherical particles have same outer diameter but are made of diff. materials. The first one (ρ_1) is solid where as the second (p_2) is a hollow sphere with inner shell diameter equal to half

of outer diameter if both spheres have same terminal velocity in any fluid, ratio of their mat. Density $\left(\rho_2 / \rho_1\right)$ is

Answers

1. C

2. 29.62

3. 13.54 , 26.94

4. 195.05 kW 261.56 HP

5. C 43.62 cm

6.

7. 18 kwh / ton

8 A

9. 0.99 m/s

10. 21 cm

11 A

12. 20.8

13.A

14. D

15. 7.8

16. 8/7