



OLUSEGUN AGAGU UNIVERSITY OF SCIENCE AND TECHNOLOGY, OKITIPUPA  
SCHOOL OF SCIENCE

DEPARTMENT OF CHEMICAL SCIENCES  
FIRST SEMESTER EXAMINATIONS 2019/2020 SESSION  
CHM 305: Unit Operations Unit: 2

Time allowed: 2 Hrs

INSTRUCTION: Answer Question #1 and Any other Four (4) Questions.

1.  $2.32 \text{ m}^3/\text{h}$  of water is pumped in a  $35\text{mm}$  internal diameter pipe through a distance of  $125 \text{ m}$  in a horizontal direction and then up through a vertical height of  $12\text{m}$ . The frictional loss in the  $90^\circ$  square elbow may be taken as equivalent to  $60$  pipe diameters. Also in the line there is a control valve fully open and frictional losses may be taken equivalent to  $200$  pipe diameters. Calculate the total head  $\Delta h_m$  to be developed to overcome the total frictional losses in the pipeline. You may assume that for this pipe  $f = 0.079 \text{ Re}^{-0.25}$ . Assume the water to flow in the turbulent regime through the pipe. Density and viscosity of water in the pipe are  $1000 \text{ kg/m}^3$  and  $0.65 \text{ mN/m}^2\text{s}$  respectively. 20 mks

Download more on [stechitegist.com](http://stechitegist.com)

2. What do the term 'Velocity profile' connote for different flow regimes? Use graphical illustrations where necessary. 10 mks

3. It is necessary to make an energy balance between the two points in the system between which pressure loss has to be determined. How is this possible? State all necessary assumptions. 10 mks

4. Mention four purposes for agitating fluids. Describe two types of agitators used in the chemical industry (Use simple sketch where suitable) 10 mks

5a. In simple chart/diagram, classify pumps. Mention the limitations of Piston pumps. 7 mks  
b. What is cavitation? How can it be prevented? 3 mks

6. Write short notes on the flow pattern in vertical two-phase flow 10 mks

7. Comment on the types of mixer suitable for the mixing of powders, dough and paste 10 mks



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INSTRUCTION: Answer Question #1 and Any other Four (4) Questions.

1.  $2.37 \text{ m}^3/\text{h}$  of water is pumped in a 35mm internal diameter pipe through a distance of 125 m in a horizontal direction and then up through a vertical height of 12m. The frictional loss in the  $90^\circ$  square elbow may be taken as equivalent to 60 pipe diameters. Also in the line there is a control valve fully open and frictional losses may be taken equivalent to 200 pipe diameters. Calculate the total head  $\Delta h_T$  to be developed to overcome the total frictional losses in the pipeline. You may assume that for this pipe  $f = 0.079 \text{ Re}^{-0.25}$ . Assume the water to flow in the turbulent regime through the pipe. Density and viscosity of water in the pipe are  $1000 \text{ kg/m}^3$  and  $0.65 \text{ mN/m}^2\text{s}$  respectively. 20 mks

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