Fluid Mechanics

Unit 05: Dimensional Analysis

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Table of Contents

4. Chapter: Unit 05: Dimensional Analysis

4.1.1. Recall that the tank filling problem in Subunit 3.4 resulted in an ...

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Recall that the tank filling problem in Subunit 3.4 resulted in an ordinary differential equation dh/dt A = Q - fh, where h is the height of fluid in the tank, Q is the volumetric flow rate in, H is the height of the tank, A is the cross sectional area of the tank, and f is a parameter with units of length[sup]2[/sup]/time. We may write this equation in a dimensionless form d d = 1 - (fH/Q) , where = h/H. Which of the following definitions of is consistent with the dimensionless equation?

Please choose only one answer:

- tQ/AH
- fH/Q
- tf/AQ
- fAQ/t

Author: Stephanie Redfern

Which of the following combinations of physical quantities is dimensionless (= mass density, D is a length scale, v is a velocity, is kinematic viscosity, = dynamic viscosity, m = mass flow rate, Q = volumetric flow rate)?

Please choose only one answer:

- v/
- D/(v)
- m/ (D)
- v / (m)

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Which of the following best describes the physical meaning of the Froude number?

Please choose only one answer:

- Ratio of boundary layer thickness to solid object length scale
- Ratio of a characteristic velocity to a gravitationally induced velocity
- Ratio of lowest and highest mass densities in the flow field
- Ratio of a characteristic length times a characteristic velocity to the acceleration of gravity

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Author: Stephanie Redfern

Which of the following best describes the physical meaning of the Reynolds number?

Please choose only one answer:

- Ratio of viscous drag to inertia
- Ratio of inertia to viscous drag
- Ratio of viscous drag to form drag
- Ratio of form drag to viscous drag

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Author: Stephanie Redfern

We wish to perform wind tunnel tests on a 1/10 size model of an automobile. The model is geometrically similar to the full size automobile. If we wish our experiments to be dynamically similar to the full scale performance of the automobile we must have equivalent Re in addition to several other factors. If we wish to use air, then what should be the wind speed in the tunnel to mimic a full-scale automobile at 60 mph?

Please choose only one answer:

- 6 mph
- 36 mph
- 60 mph
- 600 mph