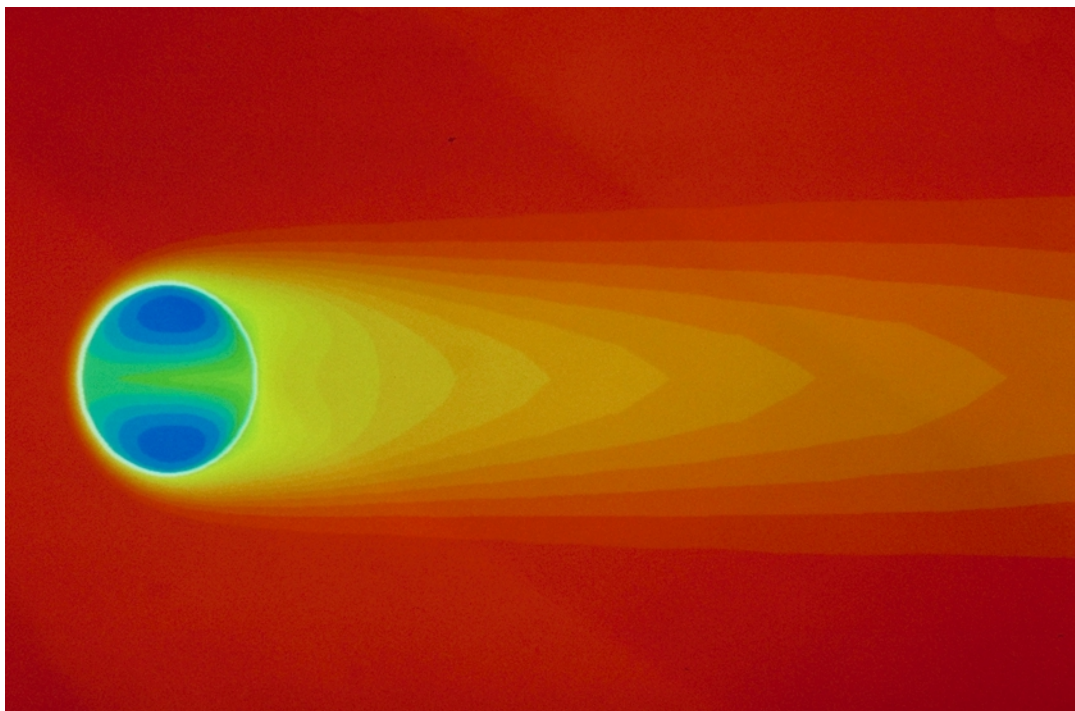


Laboratory Manual

FLUID MECHANICS

ME 211



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August 2003

ME211: EXPOSITORY DEMONSTRATIONS

The purpose of the following demonstrations is to display some of the fluid properties that are important in the study of fluid mechanics. You may have observed some of the phenomena that these demonstrations intend to bring to your attention. A more rigorous attempt will be made in the demonstrations to bring out the physical and engineering importance of such phenomena. Their relevance to fluid behavior will be investigated further in your course of study.

CONCEPTS RELEVANT TO FLUIDS AT REST (FLUID STATICS)

PRESSURE

DEMONSTRATION: A tall clear-plastic cylinder, almost full of water, has holes down its side, each plugged by a cork. The cork plugs are removed, and the fluid flow is examined.

OBSERVATION:

BRAINSTORM: Explain the differences in trajectories of the streams.

EXPLANATION:

APPLICATION:

DEMONSTRATION: A tall clear-plastic cylinder (with plugged holes down its side) is fitted with an air-tight lid. A straight tube is passed through the lid and is aligned with the cylinder axis. One of the side holes is unplugged and the open end of the tube is pushed down to the level of the side opening. What happens to the fluid level in the tube?

OBSERVATION:

BRAINSTORM: Under what conditions do bubbles move into the cylinder through the side opening?

EXPLANATION:

APPLICATION:

BOUYANCY

DEMONSTRATION: An aluminum cylinder is weighed in air first, and then is immersed in a liquid. Note the weight of the cylinder in the fluid.

OBSERVATION:

BRAINSTORM:

EXPLANATION:

APPLICATION:

CAPILLARITY

DEMONSTRATION: One end of a capillary tube is immersed in water. Note the water level in the tube.

OBSERVATION:

BRAINSTORM:

EXPLANATION:

APPLICATION:

FLUID PROPERTIES

DENSITY

DEMONSTRATION: A golf ball is released first in water, and then in glycerin.

OBSERVATION:

BRAINSTORM:

EXPLANATION:

APPLICATION:

DEMONSTRATION: Two test tubes contain glycerin. One of the test tubes is cooled by immersion in ice for about ten minutes. Observe the speed of the bubbles rising in the test tubes when the tubes are inverted.

OBSERVATION:

BRAINSTORM:

EXPLANATION:

APPLICATION:

DEMONSTRATION: A 'diver' toy floats in water contained in a capped clear-plastic soda bottle. Observe what happens to the toy when the bottle is compressed manually. Also, when the pressure on the bottle is released.

OBSERVATION:

BRAINSTORM:

EXPLANATION:

APPLICATION:

SPECIFIC GRAVITY

DEMONSTRATION: Two different liquids are sucked up two identical vertical tubes by the same pressure (which is lower than p_{atm}).

OBSERVATION:

BRAINSTORM:

EXPLANATION:

APPLICATION: If the specific gravity of one liquid is given, can you determine the specific gravity of the other liquid?

SURFACE TENSION

DEMONSTRATION: A needle is placed on a sheet of paper, which floats in water. Once soaked, the paper sinks. Follow what happens to the needle.

OBSERVATION:

BRAINSTORM: How can the needle stay afloat?

EXPLANATION:

APPLICATION:

DEMONSTRATION: Different wire frames are immersed in a bubble making solution. They are subsequently removed slowly, carrying liquid forming complex-shaped bubbles.

OBSERVATION:

BRAINSTORM:

EXPLANATION:

APPLICATION:

PROPERTIES OF FLUID IN MOTION (FLUID DYNAMICS)

VISCOSITY

DEMONSTRATION: A thin film of viscous fluid (similar to honey) is placed between two parallel plates. One of the plates is pulled slowly parallel to the fixed plate. The same plate is then pulled fast. Note the resistance in both cases.

OBSERVATION:

BRAINSTORM:

EXPLANATION:

APPLICATION:

LAMINAR AND TURBULENT FLOW

DEMONSTRATION: A candle is lit and the shape of the luminous flame is observed. The candle is then extinguished and the character of the rising smoke plume is examined.

OBSERVATION:

BRAINSTORM:

EXPLANATION:

APPLICATION:

PRESSURE/VELOCITY RELATION

DEMONSTRATION: A ping pong (or a styrofoam) ball is balanced along the axis of a vertical air stream generated by the nozzle of a blower. The ball motion is noted when it is pushed away from the axis.

OBSERVATION:

BRAIN STORM:

EXPLANATION:

APPLICATION: