

Chapter 9: The Behavior of Fluids

1. Archimedes Principle states that

- A. the pressure in a fluid is directly related to the depth below the surface of the fluid.
- B. an object immersed in a fluid is buoyed up by a force equal to the weight of the displaced fluid.
- C. the pressure of a fluid is inversely proportional to the temperature of the fluid.
- D. the velocity of a fluid is directly proportional to the pressure exerted on the fluid.

Answer: B

2. One morning you discover that a tire on your auto is in need of air. As you add air to the tire, which of the following statements is true?

- A. The pressure of the air in the tire increases.
- B. The number of moles of air in the tire increases.
- C. The density of the air in the tire is increased
- D. All of the above

Answer: D

3. A child blows up a balloon with air. This balloon will not float to the ceiling because

- A. the balloon and the air it contains weigh more than the air displaced by the balloon.
- B. the weight of the balloon is less than the weight of the air displaced by the balloon.
- C. the pressure of the air inside the balloon is greater than the atmospheric pressure.
- D. the pressure of the air inside the balloon is less than the atmospheric pressure.
- E. the temperature of the air inside the balloon is less than the atmospheric temperature.

Answer: A

4. A balloon inflated with helium is able to float toward the ceiling because

- A. the weight of the balloon is greater than the weight of the air displaced by the balloon.
- B. the balloon and the gas it contains weigh less than the air displaced by the balloon.
- C. the density of the gas inside the balloon is greater than the density of the atmosphere.
- D. the pressure of the gas inside the balloon is greater than the atmospheric pressure.
- E. the pressure of the gas inside the balloon is less than the atmospheric pressure.

Answer: B

5. A child is drinking a liquid with a straw. Which of the following statements is true?

- A. The fluid is being pulled up into the straw.
- B. It is easier to use a longer straw than a shorter straw, because liquid weight increases the pressure at the bottom.
- C. When the pressure in the straw is reduced, atmospheric pressure on the surface of the liquid pushes the liquid up the straw.
- D. Thick, viscous fluids are easier to drink with a straw than thin, nonviscous liquids.

Answer: C

6. A sharp knife can more easily cut objects than can a dull knife because
- A. a greater force can be applied with a sharp knife.
 - B. a greater pressure can be applied with a sharp knife.
 - C. dull knives cannot apply large forces.
 - D. sharp knives have edges that can fit between the molecules of the object.

Answer: B

7. The skinny tires of a 10-speed racing bicycle require more air pressure than the fat tires on an equally massive mountain bike because
- A. the racing bike moves faster.
 - B. the area of contact of the racing bike's tires is greater than that of the bike with fat tires.
 - C. the racing bike touches the ground over a smaller area than the bike with fat tires.
 - D. the racing bike exerts more force on the ground.

Answer: C

8. An ant and an elephant are walking through the jungle. On which does the greater buoyant force act?
- A. The ant.
 - B. The elephant.
 - C. The same buoyant force acts on both.
 - D. Neither is floating, so no buoyant force is acting at all.

Answer: B

9. If you hold a light tissue in your hands and gently blow across its top, the tissue will rise slightly because
- A. the pressure of moving air is less than that of static air.
 - B. collisions of the moving air with the tissue cause it to rise.
 - C. blowing across the tissue removes all of the air, and then the air below the tissue pushes the tissue up.
 - D. according to Archimedes' principle, moving air exerts more buoyant force.

Answer: A

10. A hot air balloon derives its lift from the property of fluids as stated by
- A. Bernoulli's Principle.
 - B. Archimedes' Principle.
 - C. Boyle's Law.
 - D. Pascal's Principle.

Answer: B

11. A helium inflated balloon and an air inflated balloon are placed inside a van. The van doors and windows are closed. While the helium balloon is at rest near the ceiling and the air balloon is at rest on the floor, the van driver suddenly accelerates forward. What happens?
- A. Both balloons move toward the rear of the van.
 - B. Both balloons move toward the front of the van.
 - C. The helium balloon moves to the front while the air balloon moves to the rear.

D. The helium balloon moves to the rear while the air balloon moves to the front.

Answer: C

12. An ice cube in a glass of water is pushed to the bottom of the glass and held there with a straw. Consequently, the buoyant force on the ice cube is now

- A. exactly balanced by the force exerted by the straw.
- B. exactly balanced by the weight of the ice cube
- C. the same as when the cube was floating at the top.
- D. greater than when the cube was floating at the top.

Answer: D

13. A boat floating in a large pool is loaded with wood blocks. The water level at the pool's edge is marked with a red line. The blocks are now thrown overboard and float outside the boat.

When the water becomes calm again,

- A. the red line is slightly higher than the water level.
- B. the red line is slightly lower than the water level.
- C. the red line is still at the water level.

Answer: C

14. A boat floating in a large pool is loaded with solid iron bars. The water level at the pool's edge is marked with a red line. The iron is now thrown overboard. When the water becomes calm again,

- A. the red line is slightly higher than the water level.
- B. the red line is slightly lower than the water level.
- C. the red line is still at the water level.

Answer: A

15. An iceberg is floating in the ocean with 10% of its volume extending above the ocean's surface. What can you say about the iceberg?

- A. Its weight is greater than the water it displaces.
- B. Its density is 90% that of the ocean water.
- C. It displaces only 90% of its weight in water.
- D. It must be resting on the bottom, since ice can't float in salt water.

Answer: B

16. If the atmospheric pressure is 15 lb/in^2 , what is the corresponding downward force on the top of a horizontal square area 6 inches on each side?

- A. 540 lbs.
- B. 90 lbs.
- C. 15 lbs.
- D. zero.

Answer: A

17. It is observed that as bubbles rise in a deep column of water, the diameter of the bubbles increases. This is best explained by

- A. Bernoulli's Principle.

- B. Archimedes Principle.
- C. Boyle's Law.
- D. Pascal's Principle.

Answer: C

18. Hot coffee is poured into a cylindrical container until it is nearly full. The container is immediately sealed by stretching a rubber balloon across the container mouth and tightly sealing the edges. Twenty minutes later, you observe that the still intact rubber seal

- A. has bulged outward in the center of the mouth of the container.
- B. is still flat across the entire mouth of the container.
- C. has bulged outward only at the edges of the container mouth.
- D. has sagged inward toward the coffee.

Answer: D

19. Three individuals stand with all of their weight on the heel of one foot: a man of weight 600 N and a heel area of 100 cm^2 , a child of weight 200 N and a heel area of 25 cm^2 and woman of weight 450 N and a heel area of 2 cm^2 . The one exerting the **least** pressure on the ground is:

- A. the man.
- B. the child.
- C. the woman.
- D. all exert the same.

Answer: A

20. A penny, a quarter and a silver dollar lie at the bottom of a wishing well filled with water. The coin experiencing the largest downward force on its top surface due to the water pressure is the:

- A. penny.
- B. quarter.
- C. silver dollar.
- D. all the same.

Answer: C

21. A hydraulic jack is used to lift a load of weight 1000 N. The load-bearing cylinder has a radius of 4 cm, and the other piston has a radius of 1 cm. What force must be exerted on the smaller piston to support the load?

- A. 62.5 N
- B. 125 N
- C. 250 N
- D. 1000 N
- E. 4000 N

Answer: A

22. A gas originally occupies a volume of 0.5 m^3 at a pressure of 100 kPa. It is slowly allowed to expand until the volume is 2.5 m^3 . Assuming the temperature is kept constant, the final pressure will be:

- A. 10 kPa.

- B. 20 kPa.
- C. 50 kPa.
- D. 100 kPa.
- E. 500 kPa.

Answer: B

23. In U.S. customary units, air pressure is measured in pounds per square inch. In the metric system, it is measured in Pascals, and one Pascal is equal to

- A. one pound per square foot.
- B. one metric ton per hectare.
- C. one newton per square centimeter.
- D. one newton per square meter.
- E. None of these.

Answer: D

24. Suppose a little bubble of air has gotten into the top of mercury barometer. If a person uses a barometer in the usual way, the reading of atmospheric pressure will be:

- A. correct.
- B. lower than the actual value.
- C. higher than the actual value.

Answer: B

25. The density of ice is about 900 kg/m^3 , and the density of water is about 1000 kg/m^3 . A cubic block of ice one meter on a side floats in water. Assuming that the lowest square face of the cube is horizontal, the height of the block above the water line is:

- A. 0.1 m.
- B. 0.2 m.
- C. 0.5 m.
- D. 0.8 m.
- E. 0.9 m.

Answer: A

26. The density of aluminum is 2700 kg/m^3 . An aluminum block has a mass of 0.25 kg. The buoyant force exerted on this block when it is completely submerged in water of density 1000 kg/m^3 is approximately:

- A. 2.4 N.
- B. 1.2 N.
- C. 0.91 N.
- D. 0.093 N.
- E. $2.45 \times 10^{-3} \text{ N}$.

Answer: C

27. One section of a pipe carrying water has a cross-sectional area of 20 cm^2 ; in this section the water has flow velocity of 1.0 m/s. Another section of this pipe has a constricted cross-sectional area of 5 cm^2 . If the flow is steady, what is the water velocity in the constricted section?

- A. 0.25 m/s

- B. 0.50 m/s
- C. 1.0 m/s
- D. 2.0 m/s
- E. 4.0 m/s

Answer: E

28. How does the velocity of air moving over the top of the wing of an airplane in flight compare to the velocity of air moving under the wing?

- A. The velocities are the same.
- B. The velocity over the wing is greater.
- C. The velocity under the wing is greater.

Answer: B

29. The glass in a window is 30 inches wide and 20 inches tall, and standard atmospheric pressure is 14.7 pounds per square inch. What net force would result on the glass if the air pressure outside the house were 1% lower than the air pressure inside?

- A. 88 pounds outward.
- B. 88 pounds inward.
- C. 8800 pounds outward.
- D. 8800 pounds inward.
- E. There would be no net force.

Answer: A

30. According to Bernoulli's equation, the pressure in a fluid will tend to decrease if its velocity increases. Assuming that a wind speed of 1 m/s causes a pressure drop of 0.645 Pa, what pressure drop is predicted by Bernoulli's equation for a wind speed of 4 m/s?

- A. 10.32 Pa.
- B. 2.58 Pa.
- C. 1.94 Pa.
- D. 1.29 Pa.

Answer: A

31. Two cylindrical pipes both carry an ideal fluid (zero viscosity) in laminar flow. Pipe A has radius $R_A = 2$ cm and flow velocity $v_A = 8$ cm/s. Pipe B has radius $R_B = 4$ cm and flow velocity $v_B = 4$ cm/s. Compared to the rate of flow in pipe A, that in pipe B is

- A. the same.
- B. twice as large.
- C. half as large.
- D. depends on the length of the pipe.

Answer: B

32. Some people say that based on the arrangement of its molecules, glass should be considered a liquid. If we think of glass as a liquid, in which of these properties is it most unlike other common liquids?

- A. Weight
- B. Density
- C. Transparency
- D. Viscosity

Answer: D

33. A uniform wooden plank floats in a swimming pool. The plank weighs 100 pounds, and exactly 10% of its volume is above the waterline. The maximum weight of iron which could be suspended from underneath the plank without causing the whole combination to sink to the bottom of the pool is

- A. somewhat more than 10 pounds.
- B. somewhat less than 10 pounds.
- C. exactly 10 pounds.
- D. more information needed.

Answer: A

34. Suppose you have a helium-filled weather balloon above the house. As a storm approaches the atmospheric pressure drops. Assuming the air temperature is the same, the volume of the balloon will _____.

Answer: increase

35. The fact that an increase of pressure on an enclosed fluid is transmitted uniformly throughout the fluid is _____ Law.

Answer: Pascal's

36. The carburetor of a car is a pipe with a constriction. Compared to the velocity of flow of a mixture of air and gasoline in the main pipe, the velocity in the constriction will be _____. The pressure in the constriction will be _____ than the pressure in the main pipe.

Answer: greater / less

37. If a barometer were to be made using water as the liquid instead of mercury, the length of the barometer tube for water would be _____ than the tube for a standard mercury barometer.

Answer: longer

38. A piece of soft wood floats in water with half of its volume submerged. If it is placed in alcohol which has a density 70% of that of water, it will float _____ (higher, lower, same) compared with floating in water.

Answer: lower

39. The operation of a hydraulic jack is based upon _____ Law.

Answer: Pascal's

40. Other things (density, altitude, temperature) being equal, a moving gas exerts less pressure than a stationary gas. This is predicted by _____ (2 words).

Answer: Bernoulli's equation

41. A gas initially is at a pressure of 100 kPa. If its volume is halved while the absolute temperature is kept constant the new pressure will be _____ kPa.

Answer: 200