CHAPTER 9

1. Which state of matter is associated with the very highest of temperatures?

    a. liquid
    b. plasma
    c. gas
    d. solid

2. A copper wire of length 2.0 m, cross sectional area 7.1×10^{-6} m^2 and Young's modulus 11×10^{10} N/m^2 has a 200-kg load hung on it. What is its increase in length? ($g = 9.8$ m/s^2)

    a. 0.50 mm
    b. 1.0 mm
    c. 2.5 mm
    d. 5.0 mm

3. What is the total force on the bottom of a 2.0-m-diameter by 1.0-m-deep round wading pool due to the weight of the air and the weight of the water? (Note the pressure contribution from the atmosphere is 1.0×10^5 N/m^2, the density of water is 1 000 kg/m^3, and $g = 9.8$ m/s^2.)

    a. 3.4×10^5 N
    b. 2.4×10^6 N
    c. 3.2×10^6 N
    d. 6.0×10^6 N

5. A piece of aluminum has density 2.70 g/cm^3 and mass 775 g. The aluminum is submerged in a container of oil (oil's density $= 0.650$ g/cm^3). How much oil does the metal displace?

    a. 287 cm^3
    b. 309 cm^3
    c. 232 cm^3
    d. 1 125 cm^3

6. A piece of aluminum has density 2.70 g/cm^3 and mass 775 g. The aluminum is submerged in a container of oil of density 0.650 g/cm^3. A spring balance is attached with string to the piece of aluminum. What reading will the balance register in grams (g) for the submerged metal?

    a. 960 g
    b. 775 g
    c. 588 g
    d. 190 g

7. A block of wood has density 0.50 g/cm^3 and mass 1 500 g. It floats in a container of oil (the oil's density is 0.75 g/cm^3). What volume of oil does the wood displace?

    a. 3 000 cm^3
    b. 2 000 cm^3
    c. 1 500 cm^3
    d. 1 000 cm^3

11. In a large tank of liquid, the hydrostatic pressure at a given depth is a function of:

    a. depth
    b. surface area
    c. liquid density
    d. choices a and c are both valid

14. A 15 000-N car on a hydraulic lift rests on a cylinder with a piston of radius 0.20 m. If a connecting cylinder with a piston of 0.040-m radius is driven by compressed air, what force must be applied to this smaller piston in order to lift the car?

    a. 600 N
    b. 1 500 N
    c. 3 000 N
    d. 15 000 N

15. By what factor is the total pressure greater at a depth of 850 m in water than at the surface where pressure is one atmosphere? (water density = 1.0×10^3 kg/m^3, 1 atmosphere pressure = 1.01×10^5 N/m^2 and $g = 9.8$ m/s^2)

    a. 100
    b. 83
    c. 74
    d. 19

16. What volume of water is displaced by a submerged 2.0-kg cylinder made of solid aluminum? (aluminum density = 2.7×10^3 kg/m^3 and water density = 1.0×10^3 kg/m^3)

    a. 7.4×10^{-4} m^3
    b. 1.4×10^3 m^3
    c. 9.9×10^3 m^3
    d. 6.0×10^2 m^3

17.   A ping-pong ball has an average density of 0.0840 g/cm^3 and a diameter of 3.80 cm. What force would be required to keep the ball completely submerged under water?

    a. 1.000 N
    b. 0.788 N
    c. 0.516 N
    d. 0.258 N

18. A cube of wood of density 0.78 g/cm^3 is 10 cm on a side. When placed in water, what height of the block will float above the surface? (water density = 1.00 g/cm^3)

    a. 7.8 cm
    b. 5.0 cm
    c. 2.2 cm
    d. 6.4 cm

19. The bottom of a flat-bottomed aluminum boat has an area of 4.0 m^2 and the boat's mass is 60 kg. When set afloat in water, how far below the water surface is the boat bottom? (water density = 1.0×10^3 kg/m^3)

    a. 0.060 m
    b. 0.015 m
    c. 0.030 m
    d. 0.075 m

20. The bottom of a flat-bottomed aluminum boat has area = 4.0 m^2 and mass = 60 kg. If two fishermen and their fishing gear with total mass of 300 kg are placed in the boat, how much lower will the boat ride in the water? (H$_2$O density = 1.0×10^3 kg/m^3)

    a. 0.15 m
    b. 0.12 m
    c. 0.075 m
    d. 0.060 m

21. A uniform pressure of 7.0×10^5 N/m^2 is applied to all six sides of a copper cube. What is the percentage change in volume of the cube? (for copper, $B = 14 \times 10^{10}$ N/m^2)

    a. 2.4×10^{-2} %
    b. 0.4×10^{-2} %
    c. 8.4×10^{-2} %
    d. 0.5×10^{-3} %

23. If the column of mercury in a barometer stands at 72.6 cm, what is the atmospheric pressure? (The density of mercury is 13.6×10^3 kg/m^3 and $g = 9.80$ m/s^2)

    a. 0.968×10^5 N/m^2
    b. 1.03×10^5 N/m^2
    c. 0.925×10^5 N/m^2
    d. 1.07×10^5 N/m^2

24. A solid rock, suspended in air by a spring scale, has a measured mass of 9.00 kg. When the rock is submerged in water, the scale reads 3.30 kg. What is the density of the rock? (water density = 1 000 kg/m^3)

    a. 4.55×10^3 kg/m^3
    b. 3.50×10^3 kg/m^3
    c. 1.20×10^3 kg/m^3
    d. 1.58×10^3 kg/m^3

25. Bar One has a Young's modulus that is bigger than that of Bar Two. This indicates Bar One:

    a. is longer than Bar Two.
    b. has a greater cross-sectional area than Bar Two.
    c. has a greater elastic limit than Bar Two.
    d. is made of material that is different from Bar Two.

26. Consider two steel rods, A and B. B has three times the area and twice the length of A, so Young's modulus for B will be what factor times Young's modulus for A?

    a. 3.0
    b. 0.5
    c. 1.5
    d. 1.0

28. As ice floats in water, about 10% of the ice floats above the surface of the water. If we float some ice in a glass of water, what will happen to the water level as the ice melts?

    a. The water level will rise 10% of the volume of the ice that melts.
    b. The water level will rise, but not as much as the 10% indicated in answer A.
    c. The water level will remain unchanged.
    d. The water level will become lower.

31. A large stone is resting on the bottom of the swimming pool. The normal force of the bottom of the pool on the stone is equal to the:

    a. weight of the stone.
    b. weight of the water displaced.
    c. sum of the weight of the stone and the weight of the displaced water.
    d. difference between the weight of the stone and the weight of the displaced water.

32. The pressure inside a commercial airliner is maintained at 1.00 atm (10^5 Pa). What is the net outward force exerted on a 1.0 m × 2.0 m cabin door if the outside pressure is 0.30 atm?

    a. 140 N
    b. 1 400 N
    c. 14 000 N
    d. 140 000 N

33. A stonecutter's chisel has an edge area of 0.50 cm^2. If the chisel is struck with a force of 45 N, what is the pressure exerted on the stone?

    a. 9 000 Pa
    b. 90 000 Pa
    c. 450 000 Pa
    d. 900 000 Pa

36. The Greenland ice sheet can be one km thick. Estimate the pressure underneath the ice. (The density of ice is 918 kg/m^3.)

    a. 9.0 × 10^5 Pa (9 atm)
    b. 2.5 × 10^6 Pa (25 atm)
    c. 4.5 × 10^6 Pa (45 atm)
    d. 9.0 × 10^6 Pa (90 atm)

37. The water behind Grand Coulee Dam is 1 200 m wide and 150 m deep. Find the hydrostatic force on the back of the dam. (Hint: the total force = average pressure × area)

    a. 5.2 × 10^9 N
    b. 8.8 × 10^{10} N
    c. 13.2 × 10^{10} N
    d. 18.0 × 10^{10} N

38. A blimp is filled with 400 m³ of helium. How big a payload can the balloon lift? (The density of air is 1.29 kg/m³; the density of helium is 0.18 kg/m³.)

    a. 111 kg
    b. 129 kg
    c. 215 kg
    d. 444 kg

40. An ideal fluid flows through a pipe made of two sections with diameters of 1.0 and 3.0 inches, respectively. The speed of the fluid flow through the 3.0-inch section will be what factor times that through the 1.0-inch section?

    a. 6.0
    b. 9.0
    c. 1/3
    d. 1/9

41. The flow rate of a liquid through a 2.0-cm-radius pipe is 0.008 0 m³/s. The average fluid speed in the pipe is:

    a. 0.64 m/s
    b. 2.0 m/s
    c. 0.040 m/s
    d. 6.4 m/s

42. Think of Bernoulli's equation as it pertains to an ideal fluid flowing through a horizontal pipe. Imagine that you take measurements along the pipe in the direction of fluid flow. What happens to the sum of the pressure and energy per unit volume?

    a. it increases as the pipe diameter increases
    b. it decreases as the pipe diameter increases
    c. it remains constant as the pipe diameter increases
   d. no choices above are valid

43. An ideal fluid, of density 0.85×10^3 kg/m^3, flows at 0.25 kg/s through a pipe of radius 0.010 m. What is the fluid speed?

    a. 0.85 m/s
    b. 1.3 m/s
    c. 3.0 m/s
    d. 0.94 m/s

44. An ideal fluid, of density 0.90×10^3 kg/m^3, flows at 6.0 m/s through a level pipe with radius of 0.50 cm. The pressure in the fluid is 1.3×10^5 N/m^2. This pipe connects to a second level pipe, with radius of 1.5 cm. Find the speed of flow in the second pipe.

    a. 54 m/s
    b. 18 m/s
    c. 0.67 m/s
    d. 0.33 m/s

45. The flow rate of blood through the average human aorta, of radius 1.0 cm, is about 90 cm^3/s. What is the speed of the blood flow through the aorta?

    a. 14 cm/s
    b. 32 cm/s
    c. 37 cm/s
    d. 29 cm/s

48. Air pressure is 1.0×10^5 N/m^2, air density is 1.3 kg/m^3, and the density of soft drinks is 1.0×10^3 kg/m^3. If one blows carefully across the top of a straw sticking up 0.100 m from the liquid in a soft drink can, it is possible to make the soft drink rise half way up the straw and stay there. How fast must the air be blown across the top of the straw?

    a. 76 m/s
    b. 27 m/s
    c. 19 m/s
    d. 0.99 m/s

49. A hole is poked through the metal side of a drum holding water. The hole is 18 cm below the water surface. What is the initial speed of outflow?

    a. 1.9 m/s
    b. 2.96 m/s
    c. 3.2 m/s
    d. 3.5 m/s

52. A fountain sends water to a height of 100 m. What must be the pressurization (above atmospheric) of the underground water system? (1 atm = 10^5 N/m^2)

    a. 1 atm
    b. 4.2 atm
    c. 7.2 atm
    d. 9.8 atm

58. Water is sent from a fire hose at 30 m/s at an angle of 30° above the horizontal. What is the maximum height reached by the water?

    a. 7.5 m
    b. 11 m
    c. 15 m
    d. 19 m

60. A fluid is drawn up through a tube as shown below. The atmospheric pressure is the same at both ends. Use Bernoulli's equation to determine the speed of fluid flow out of the tank. If the height difference from the top of the tank to the bottom of the siphon is 1.0 m, then the speed of outflow is

    a. 1.1 m/s
    b. 2.2 m/s
    c. 4.4 m/s
    d. 8.8 m/s
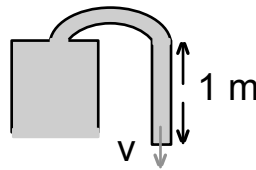
61. How deep under the surface of a lake would the pressure be double that at the surface? (1 atm = 1.01×10^5 Pa)

    a. 1.00 m
    b. 9.80 m
    c. 10.3 m
    d. 32.2 m

62. It takes 2.0 minutes to fill a gas tank with 40 liters of gasoline. If the pump nozzle is 1.0 cm in radius, what is the average speed of the gasoline as it leaves the nozzle? (1 000 liters = one cubic meter)

    a. 0.27 m/s
    b. 1.1 m/s
    c. 11 m/s
    d. 64 m/s

63. A heavily loaded boat is floating in a pond. The boat sinks because of a leak. What happens to the surface level of the pond?

    a. It stays the same.
    b. It goes up.
    c. It goes down.
    d. More information is needed to reach a conclusion.

64. A heavily loaded boat is floating in a pond. The boat starts to sink because of a leak but quick action plugging the leak stops the boat from going under although it is now deeper in the water. What happens to the surface level of the pond?

    a. It stays the same.
    b. It goes up.
    c. It goes down.
    d. More information is needed to reach a conclusion.

65. A block of wood has specific gravity 0.80. When placed in water, what percent of the volume of the wood is above the surface?

    a. 0, the block sinks.
    b. 20%
    c. 25%
    d. 80%

66. Water is being sprayed from a nozzle at the end of a garden hose of diameter 2.0 cm. If the nozzle has an opening of diameter 0.50 cm, and if the water leaves the nozzle at a speed of 10 m/s, what is the speed of the water inside the hose?

    a. 0.63 m/s
    b. 0.80 m/s
    c. 2.5 m/s
    d. also 10 m/s

67. A solid object is made of two materials, one material having density of 2 000 kg/m^3 and the other having density of 6 000 kg/m^3. If the object contains equal volumes of the materials, what is its average density?

    a. 3 000 kg/m^3
    b. 4 000 kg/m^3
    c. 5 300 kg/m^3
    d. more information is needed

68. A solid object is made of two materials, one material having density of 2 000 kg/m^3 and the other having density of 6 000 kg/m^3. If the object contains equal masses of the materials, what is its average density?

    a. 3 000 kg/m^3
    b. 4 000 kg/m^3
    c. 5 300 kg/m^3
    d. more information is needed