Multiple Choice
Identify the letter of the choice that best completes the statement or answers the question.

____ 1. The design of a wing
   a. causes the air above the wing to travel faster than the air below the wing.
   b. helps create lift.
   c. creates a low-pressure zone above the wing.
   d. All of the above

____ 2. An object displaces a volume of fluid that
   a. is equal to its own volume.
   b. is less than its own volume.
   c. is greater than its own volume.
   d. is more dense than itself.

____ 3. Fluid pressure is always directed
   a. up.
   b. down.
   c. sideways.
   d. in all directions.

____ 4. If an object weighing 50 N displaces a volume of water with a weight of 10 N, what is the buoyant force on the object?
   a. 60 N
   b. 50 N
   c. 40 N
   d. 10 N

____ 5. A helium-filled balloon will float in air because
   a. there is more air than helium.
   b. helium is less dense than air.
   c. helium is as dense as air.
   d. helium is more dense than air.

____ 6. Materials that can flow to fit their containers include
   a. gases.
   b. liquids.
   c. both gases and liquids.
   d. neither gases nor liquids.

____ 7. Of the following, where would atmospheric pressure be greatest?
   a. at sea level
   b. on a mountaintop
   c. at the altitude at which planes fly
   d. at the outer edge of the atmosphere

____ 8. If a fluid flows from area A to area B, then area A must be an area of greater
   a. temperature.
   b. mass.
   c. volume.
   d. pressure.

____ 9. Which statement best explains why air bubbles in water rise to the surface?
   a. Liquids cannot be compressed very much.
   b. Water is about 1,000 times denser than air.
   c. Pressure is the amount of force exerted on a given area.
   d. The weight of the atmosphere pushes down on the water.

____ 10. Fluid pressure is exerted evenly in all directions, which explains why
    a. some objects float.
    b. birds and airplanes can fly.
    c. bubbles are round.
    d. objects seem to weigh less in water.

____ 11. Which of the following does NOT affect the amount of lift on an airplane’s wing?
   a. turbulence
   b. gravity
   c. wing surface area
   d. the airplane's speed

____ 12. Which of the following would NOT affect the level at which a cargo ship floats in a body of water?
   a. the depth of the water
   b. the shape of the ship
   c. the mass of the ship's cargo
   d. the density of the ship's material

____ 13. The SI unit for pressure is
   b. N.
14. Which of the following is NOT a fluid?
   a. water
   b. ice
   c. oil
   d. oxygen

15. What is the pressure exerted on the floor by a 3,000 N crate with an area of 2 m$^2$?
   a. 1,500 Pa
   b. 3,000 Pr
   c. 3,000 Pa
   d. 6,000 N

16. What is the weight of a rock with an area of 10 m$^2$ that exerts a pressure of 250 Pa in correct SI units?
   a. 25 m$^2$Pa
   b. 250 N
   c. 2,500 m$^2$Pa
   d. 2,500 N

17. Gases exert pressure
   a. randomly in varying directions.
   b. evenly in all directions.
   c. horizontally.
   d. vertically.

18. At sea level, the atmosphere exerts a pressure of approximately
   a. 101,000 Pa.
   b. 101,000 N on every square meter.
   c. 10 N on every square centimeter.
   d. All of the above

19. You heat an empty aluminum soda can for several minutes with a high-wattage hair dryer, causing the heated, "energized" particles of air inside the can to escape through the opening. Quickly, you seal the can's opening with strong tape. As the can cools, atmospheric pressure will
   a. cause the can to explode.
   b. do nothing to the can.
   c. crush the can.
   d. allow the can to float.

20. At the top of Mount Everest, atmospheric pressure is about
   a. a quarter of what it is at sea level.
   b. a third of what it is at sea level.
   c. half of what it is at sea level.
   d. two-thirds of what it is at sea level.

21. At _____ below the surface of water, pressure is about 5,000 kPa and divers below this level must wear special suits to survive the bone-crushing pressure.
   a. 10 m
   b. 100 m
   c. 500 m
   d. 5,000 m

22. Pressure exerted on a diver 10 m below the water's surface is twice the pressure at the surface. The pressure at this depth is
   a. 50 kPa.
   b. 101 kPa.
   c. 202 kPa.
   d. 400 kPa.

23. The Titanic rests 3,660 m below sea level. The water pressure exerted on the Titanic is
   a. 36 kPa.
   b. 360 kPa.
   c. 3,660 kPa.
   d. 36,600 kPa.

24. Water is about 1,000 times more ____ than air and, therefore, exerts greater pressure than air.
   a. dense
   b. fluid
   c. buoyant
   d. heavy

25. The deepest an undersea vessel (the Trieste) has traveled and withstood the pressure (110,000 kPa) was
   a. 10 m.
   b. 100 m.
   c. 1,100 m.
   d. 11,000 m.

26. Fluids flow
   a. from regions of high pressure to low pressure.
   b. only when pressures are even.
   c. from regions of low pressure to high pressure.
   d. only under extremely warm conditions.

27. An example of a fluid flowing during a change in pressure is
   a. sipping a drink through a straw.
   b. opening a carbonated beverage.
28. Sipping a drink through a straw that has been bent and cracked is difficult because air flowing through the crack
   a. keeps the pressure high in the straw so there's not enough change in air pressure to allow the liquid to flow.
   b. causes the pressure to drop dramatically, forcing the liquid to stay down.
   c. keeps the pressure low in the straw so there's not enough change in air pressure to allow the liquid to flow.
   d. None of the above

29. The water-pumping station in your town increases the water pressure by 20 Pa. At which of the following locations will the water pressure be increased the most?
   a. the kitchen at the pumping station
   b. a supermarket two blocks away
   c. a home 2 km away
   d. The water pressure will be the same at all of the stations.

30. Hydraulic devices use liquids instead of gases because
   a. liquids take on the shape of their containers and gases do not.
   b. liquids can be compressed and gases cannot.
   c. gases can be compressed and liquids cannot.
   d. gases cannot exert a force but liquids can.

31. Although the brake pads on each wheel of a car are much larger than the brake pedal the driver uses to stop a car, the pressure applied to the brake pedal is evenly exerted on all four brake pads because
   a. of hydraulics.
   b. of Pascal's principle.
   c. the brake fluid's change in pressure is equally transmitted to all four pads at the same time.
   d. All of the above

32. An object that weighs 2 N displaces 250 mL of water, which weighs 2.5 N. What is the buoyant force on the object? Will it sink or float?
   a. 2.5 N and it will float
   b. 2.5 N and it will sink
   c. 2 N and it will float
   d. 2 N and it will sink

33. An object sinks when it displaces a volume of liquid that has a weight
   a. less than the object's weight.
   b. equal to the object's weight.
   c. more than the object's weight.
   d. None of the above

34. What is the density of a 20 cm$^3$ sample of liquid with a mass of 25 g?
   a. 0.8 g/cm$^3$
   b. 1.25 g/cm$^3$
   c. 45 g/cm$^3$
   d. 500 g/cm$^3$

35. A 546 g fish displaces 420 cm$^3$ of water. What is the density of the fish?
   a. 0.77 g/cm$^3$
   b. 1.3 g/cm$^3$
   c. 126 g/cm$^3$
   d. 966 g/cm$^3$

36. If a rock displaces 5 L of water, it means the volume of the rock is
   a. 5 cm$^3$
   b. 5 g.
   c. 5,000 mL.
   d. 5,000 cm$^3$

37. Most substances
   a. are less dense than air.
   b. have the same density as air.
   c. are more dense than air.
   d. have less mass than an equal volume of air.

38. Helium floats in air because
   a. it is much less dense than air.
b. it is twice as dense as air.
c. it contains more mass than an equal volume of air.
d. the buoyant force is less than the weight of helium.

39. Steel is almost eight times more dense than water. A steel ship can float in water instead of sink because of its
   a. mass.
   b. weight.
   c. shape.
   d. density.

40. Because density is mass per unit volume, an increase in a steel ship's
   a. mass leads to a decrease in its density.
   b. volume leads to a decrease in its density.
   c. volume leads to an increase in its density.
   d. density is caused by an increase in its volume.

41. A submarine can travel both on the surface of the water and underwater because it can change its
   a. interior pressure.
   b. gravitational force.
   c. density.
   d. volume.

42. If you blow a steady stream of air between two sheets of paper, the papers will
   a. blow apart because the fast-moving air has a lower pressure than the air outside the pieces of paper.
   b. blow apart because the fast-moving air has a higher pressure than the air outside the pieces of paper.
   c. move toward each other because the fast-moving air has a lower pressure than the air outside the pieces of paper.
   d. move toward each other because the fast-moving air has a higher pressure than the air outside the pieces of paper.

43. A spray gun, used to apply paint, contains two tubes inside of it: one tube comes up from the supply of paint and one supplies a flow of compressed air that blows across the top of the paint tube. This rush of air creates _____, which sucks the paint up the tube and into the stream of air.
   a. thrust
   b. drag
   c. low pressure
   d. high pressure

44. The shape of a bird's wings can create
   a. lift.
   b. thrust.
   c. gravity.
   d. weight.

45. Larger wings on a plane allow it to achieve greater
   a. lift.
   b. thrust.
   c. drag.
   d. speed.

46. Jet engines can create a great deal of _____, so the wings do not have to be very big.
   a. weight
   b. thrust
   c. lift
   d. drag

47. Flaps on airplane wings help reduce turbulence, which causes drag and can reduce
   a. weight.
   b. altitude.
   c. air resistance.
   d. lift.

48. Bernoulli's principle can be demonstrated by using
   a. hydraulics.
   b. a Frisbee®.
   c. helium balloons.
   d. a rubber duck.

49. In baseball, a good curveball can be explained by
   a. Pascal's principle.
   b. Archimedes' principle.
   c. Bernoulli's principle.
   d. Boyle's principle.

50. The reason you blow round bubbles and not square ones is explained by
   a. Pascal's principle.
   b. Archimedes' principle.
   c. Bernoulli's principle.
   d. Boyle's principle.
51. The atmosphere stretches approximately _____ above us.
   a. 10 km  
   b. 15 km  
   c. 50 km  
   d. 150 km

52. Eighty percent of the gases in the atmosphere are found within _____ of the Earth's surface.
   a. 1 km  
   b. 5 km  
   c. 10 km  
   d. 50 km

53. Pressure depends on
   a. the total amount of fluid present.  
   b. the depth of the fluid.  
   c. the temperature of the fluid.  
   d. the compressibility of the fluid.

54. A volume of water exerts greater pressure than the same volume of air because the water
   a. has more mass.  
   b. has more weight.  
   c. is more dense.  
   d. All of the above

55. Where would you notice the most pressure?
   a. 100 m above the surface of the Earth  
   b. 10 m above the surface of the Earth  
   c. 10 m below the surface of water  
   d. 100 m below the surface of water

56. When nurses use needles to draw a sample of blood from your arm, they begin with a needle that has the
   plunger pushed all the way in and then slowly pull the plunger out. This causes
   a. a decrease in pressure inside the needle and since fluids flow from high pressure to low
      pressure, blood flows into the needle.  
   b. an increase in pressure inside the needle and since fluids flow from high pressure to low
      pressure, blood flows into the needle.  
   c. an increase in pressure inside the needle and since fluids flow from low pressure to high
      pressure, blood flows into the needle.  
   d. a decrease in pressure inside the needle and since fluids flow from low pressure to high
      pressure, blood flows into the needle.

57. A force of 15 N is required to lift an object that is underwater. The object displaces 2 L of water. If 1 L of
   water weighs 10 N, what is the weight of the object out of water?
   a. 10 N  
   b. 15 N  
   c. 20 N  
   d. 35 N

58. A pitcher throwing a curve ball knows how to take advantage of
   a. Pascal's principle.  
   b. Archimedes' principle.  
   c. Bernoulli's principle.  
   d. Boyle's principle.

59. Earth's continental crust floats on the asthenosphere below it because the rock that makes up the Earth's
   continental crust is _____ the molten mantle rock.
   a. more dense than  
   b. less dense than  
   c. the same density as  
   d. in a bowl-like shape, unlike

60. Air travels _____ over the top of a wing.
   a. faster  
   b. slower  
   c. the same speed as  
   d. turbulently

61. Birds with _____ must generate more thrust in order to achieve lift.
   a. large wings  
   b. small wings  
   c. two wings  
   d. triangular wings

62. Some people who keep parakeets as pets trim the flight feathers. This makes it more difficult to fly because
   the size of the wing has changed, which
   a. prevents the bird from flapping its wings.  
   b. creates more drag.  
   c. decreases the amount of lift the bird can achieve.  
   d. increases the amount of weight the bird must carry.
63. Upside-down wings, or spoilers, mounted on the rear end of race cars help to reduce the danger of accidents because they
   a. decrease the air pressure above the car, decreasing lift.
   b. increase the air pressure above the car, decreasing lift.
   c. increase the air pressure below the car, decreasing lift.
   d. prevent the car from rolling.

64. Meteorologists can predict the direction of a warm front by knowing the pressure of the front and the pressure around the front because
   a. a low-pressure front will move to an area with higher pressure.
   b. a low-pressure front will move to an area with the same pressure.
   c. a high-pressure front will move to an area with higher pressure.
   d. a high-pressure front will move to an area with lower pressure.

65. You may feel discomfort in your ears when you take off in an airplane because the pressure in your inner ear
   a. is less than the atmospheric pressure at a high altitude.
   b. is greater than the atmospheric pressure at a high altitude.
   c. is equal to the atmospheric pressure at a high altitude.
   d. is not affected and cannot be related to the atmospheric pressure at a high altitude.

66. A bicycle tire remains inflated because air particles
   a. form a crystal matrix inside the tire.
   b. are constantly moving and pushing against the inside of the tire.
   c. are less dense than the tire.
   d. displace the tire's density.

67. A bicycle tire feels harder as you pump more air into it because as you pump more air into the tire,
   a. fewer air particles push against the walls of the tire, decreasing the tire pressure.
   b. fewer air particles push against the walls of the tire, increasing the tire pressure.
   c. more air particles push against the walls of the tire, decreasing the tire pressure.
   d. more air particles push against the walls of the tire, increasing the tire pressure.

68. You do not notice atmospheric pressure on your body because
   a. it is air.
   b. atmospheric pressure acts evenly on your body.
   c. of gravity.
   d. the fluids inside your body also exert pressure.

69. Astronauts wear pressurized suits in space because if they took their suits off,
   a. they would be unable to move.
   b. the fluids in their bodies would exert the same pressure as the pressure outside their bodies.
   c. the fluids in their bodies would overcome the pressure outside of their bodies, and they would explode.
   d. the fluids in their bodies would be overcome by the pressure outside of their bodies, and they would implode.

70. The atmospheric pressure at an altitude of 12,000 m is about one-fifth that at sea level. Airplanes that fly at this altitude pressurize the cabins for passenger safety. If these cabins were not pressurized, passengers would feel uncomfortable because the fluids inside their bodies would exert a pressure
   a. one-fifth the pressure exerted on the outside of their bodies by the atmosphere.
   b. approximately five times the pressure exerted on the outside of their bodies by the atmosphere.
   c. would be the same as atmospheric pressure.
   d. would stop exerting pressure because of the high altitude.

71. Air flows into your lungs as you inhale because the pressure inside your lungs
a. is greater than that of the surrounding air, and air flows from lower to higher pressure.
b. is less than that of the surrounding air, and air flows from higher to lower pressure.
c. is the same as that of the surrounding air.
d. does not change.

72. Mountain climbers who trek to the summit of Mount Everest (8,847 m above sea level) have difficulty breathing because
a. air stops flowing from high to low pressure.
b. air stops flowing from low to high pressure.
c. there is not that much difference in pressure between the inside of their lungs and the air.
d. the difference between the pressure inside their lungs and the surrounding air is too great.

73. When an athlete exhales during strenuous exercise, the lungs push out more air than if she were resting. When she inhales, the pressure inside her lungs _____ when she rests, resulting in deeper breaths.
a. is greater than
b. is less than
c. is the same as
d. is zero, unlike

Short Answer

Examine the illustration of an iceberg below and answer the questions that follow.

74. At what point (a, b, or c) is the water pressure greatest on the iceberg?
75. How much of the iceberg has a weight equal to the buoyant force?
   a. all of it
   b. the section from a to b
   c. the section from b to c
76. How does the density of ice compare with the density of water?
77. Why do you think icebergs are so dangerous to passing ships?
78. The following graph shows the relationship between atmospheric pressure and altitude above sea level. Examine the graph and answer the following question.
a. In which 10 km interval does air pressure change the most?
b. What conclusions can you draw from this graph?
MULTIPLE CHOICE

1. D
2. A
3. D
4. D
5. B
6. C
7. A
8. D
9. B
10. C
11. B
12. A
13. A
14. B
15. A
16. D
17. B
18. D
19. C
20. B
21. C
22. C
23. D
24. A
25. D
26. A
27. D
28. A
29. D
30. C
31. D
32. A
33. A
34. B
35. B
36. D
37. C
38. A
39. C
40. B
41. C
42. C
43. C
44. A
45. A
46. B
47. D
48. B
49. C
50. A
51. D
52. C
53. B
54. D
55. D
56. A
57. D
58. C
59. B
60. A
61. B
62. C
63. B
64. D
65. B
66. B
67. D
68. D
69. C
70. B
71. B
72. C
73. B

SHORT ANSWER

74. c
75. a
76. Ice is less dense than water.
77. Only a small portion of an iceberg floats above water, as shown in the image. A ship may actually be closer to running into a massive block of ice underwater than it would appear on the surface. If the ship is not turned or stopped in time, it could collide with or scrape the iceberg.
78. a. Air pressure changes the most in the first 10 km interval.
   b. Sample answer: As you move higher into the atmosphere, the atmospheric pressure decreases. Above 30 km, atmospheric pressure does not change as much.