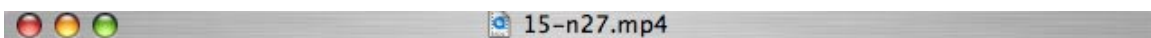


38) Water flows in a pipe as shown in **Figure 15-2**. The pipe is horizontal at points A and B, then rises in elevation while decreasing in diameter and is again horizontal at points C and D. Vertical tubes, open at the top, are connected to the pipe at A and C, flush with the edge of the pipe. Which of the following statements is correct?

- A)  $h_A > h_C$
- B)  $h_A < h_C$
- C)  $h_A = h_C$
- D) The answer depends on the direction of the flow.
- E) The answer depends on the speed of the flow.

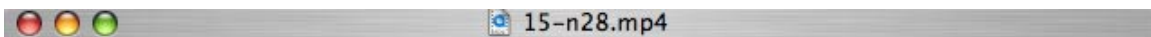
Answer: A



27) A barge is 10.0 m wide and 60.0 m long and has vertical sides. The bottom of the hull is 1.20 m below the water surface. What is the weight of the barge and its cargo, if it is floating in fresh water?

- A) 3.53 MN
- B) 6.39 MN
- C) 6.82 MN
- D) 7.06 MN
- E) 9.54 MN

Answer: D



29) A hot air balloon plus its cargo has a mass of 400 kg, and it holds  $700 \text{ m}^3$  of hot air. It is floating at a constant height in air with a density of  $1.29 \text{ kg/m}^3$ . What is the density of the hot air in the balloon?

- A)  $1.39 \text{ kg/m}^3$
- B)  $0.72 \text{ kg/m}^3$
- C)  $0.57 \text{ kg/m}^3$
- D)  $0.86 \text{ kg/m}^3$
- E)  $0.43 \text{ kg/m}^3$

Answer: B



15-n32.mp4

32) A cylinder, semicircular in cross-section, 10.0 m long and 5.00 m in radius, is completely submerged in water. What is the buoyant force on the cylinder?

- A)  $1.92 \times 10^6$  N
- B)  $3.85 \times 10^6$  N
- C)  $5.78 \times 10^6$  N
- D)  $6.28 \times 10^6$  N
- E)  $7.70 \times 10^6$  N

Answer: B



15-n34.mp4

34) In a certain one-lane road there are no entrances or exits. As the road passes through open country and populated areas, the speed limit changes. Assume that cars travel at the posted speed limit. In the open road, where the speed limit is 55 mph, the cars are spaced so there are 51 cars per mile. If the flow of cars is steady, how many cars per mile are there in a stretch of road where the speed limit is 40 mph?

- A) 56 cars/mile
- B) 60 cars/mile
- C) 66 cars/mile
- D) 70 cars/mile
- E) 76 cars/mile

Answer: D



15-n40.mp4

40) An airplane is flying in air with a density of  $1.29 \text{ kg/m}^3$ . A pressure gauge measures the difference in pressure between a point on the nose of the airplane and a point on the fuselage. The pressure on the nose is higher by 60.0 kPa. What is the speed of the plane relative to the air?

- A) 295 m/s
- B) 300 m/s
- C) 305 m/s
- D) 310 m/s
- E) 315 m/s

Answer: C

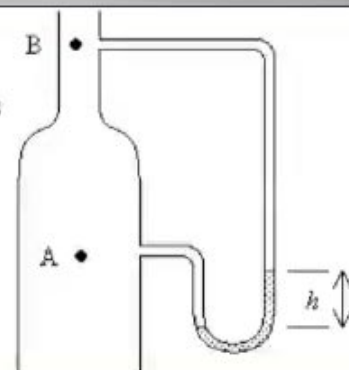


15-n47.mp4

47) Water flows in the vertical pipe shown in **Figure 15-12**. At A the area is  $25.0 \text{ cm}^2$  and the speed of the water is 3.30 m/s. At B the area is  $16.0 \text{ cm}^2$ . The fluid in the manometer is mercury, which has a density of  $13,600 \text{ kg/m}^3$ . What is the manometer reading  $h$ ?

- A) 0.546 cm
- B) 8.27 cm
- C) 1.11 cm
- D) 3.11 cm
- E) 6.35 cm

Answer: E





15-n61.mp4

61) A fluid is flowing with an average speed of 1.50 m/s through a tube that has a radius of 2.00 mm and is 18 cm long. The drop in pressure is 967 Pa. What is the viscosity of the fluid?

- A) 0.00179 Ns/m<sup>2</sup>
- B) 0.00562 Ns/m<sup>2</sup>
- C) 0.0278 Ns/m<sup>2</sup>
- D) 0.0134 Ns/m<sup>2</sup>
- E) 0.00335 Ns/m<sup>2</sup>

Answer: A



16-n17.mp4

17) Gas in a constant-volume gas thermometer registers a pressure of 95.0 kPa at 100°C. Assuming ideal behavior, what is the temperature of this gas when the pressure is 190 kPa?

- A) 546°C
- B) 527°C
- C) 491°C
- D) 473°C
- E) 200°C

Answer: D



16-n19.mp4

19) The coefficient of linear expansion of steel is  $12 \times 10^{-6} \text{ K}^{-1}$ . What is the change in length of a 25-m steel bridge span when it undergoes a temperature change of 40 K?

- A) 1.2 cm
- B) 1.4 cm
- C) 1.6 cm
- D) 1.8 cm
- E) 2.0 cm

Answer: A



16-n33.mp4

33) 330 g of water at 45°C are poured into an 855 g aluminum container with an initial temperature of 10°C. The specific heat of aluminum is 900 J/(kg·K). What is the final temperature of the system, assuming no heat is exchanged with the surroundings?

- A) 28°C
- B) 32°C
- C) 31°C
- D) 33°C
- E) 35°C

Answer: B



16-n36.mp4

36) An aluminum electric tea kettle has a mass of 500 g. It has a 500-W heating coil. How long will it take to heat up 1.0 kg of water from 18°C to 98°C in the tea kettle? The specific heat of aluminum is 900 J/(kg·K).

- A) 5 minutes
- B) 7 minutes
- C) 12 minutes
- D) 15 minutes
- E) 18 minutes

Answer: C



16-n48.mp4

48) How much power does a sphere with a radius of 10 cm radiate if it has an emissivity  $e = 1.0$  and is kept at a temperature of 400 K? The Stefan-Boltzmann constant is  $5.67 \times 10^{-8}$  W/(m<sup>2</sup>·K<sup>4</sup>).

- A) 60 W
- B) 70 W
- C) 180 W
- D) 210 W
- E) 360 W

Answer: C



17-c27.mp4

27) A liquid boils when its vapor pressure

- A) equals the equilibrium vapor pressure.
- B) equals the external pressure.
- C) exceeds the external pressure.
- D) is between the equilibrium vapor pressure and the external pressure.
- E) None of the other choices is correct.

Answer: B



17-c28.mp4

28) La Paz, Bolivia, is at an altitude of 3,650 meters above sea level. In La Paz, water will boil

- A) at 100°C.
- B) below 100°C.
- C) above 100°C.
- D) There is not enough information to answer this question.

Answer: B



17-c29.mp4

29) The point in the phase diagram where the fusion curve, the vapor pressure curve, and the sublimation curve join is called the

- A) critical point.
- B) triple point.
- C) melting point.
- D) boiling point.
- E) double point.

Answer: B



17-n28.mp4

28) At what temperature is the rms speed of hydrogen molecules, which have a molecular weight of 2.02 g/mole, equal to 2000 m/s?

- A) 17.0°C
- B) 34.0°C
- C) 51.0°C
- D) 68.0°C
- E) 72.0°C

Answer: C



17-n31.mp4

31) A 30-cm steel rod, 1.0 cm in diameter, supports a 300-kg mass. What is the change in length of the rod? Young's modulus for steel is  $20 \times 10^{10}$  N/m<sup>2</sup>.

- A)  $5.6 \times 10^{-5}$  m
- B)  $6.5 \times 10^{-5}$  m
- C)  $5.6 \times 10^{-6}$  m
- D)  $6.5 \times 10^{-6}$  m
- E)  $6.5 \times 10^{-4}$  m

Answer: A



17-n48.mp4

48) A runner generates 1260 W of thermal energy. If this heat has to be removed by evaporation, how much water does this runner lose in 15 minutes of running? The latent heat of vaporization of water is  $22.6 \times 10^5$  J/kg.

- A) 50 g
- B) 500 g
- C) 35 g
- D) 350 g
- E) 40 g

Answer: B



17-n51.mp4

51) The melting point of aluminum is 660°C, the latent heat of fusion is  $4.00 \times 10^5$  J/kg, and its specific heat is 900 J/(kg K). How much heat must be added to 500 g of aluminum at 27°C to completely melt it?

- A) 485 kJ
- B) 395 kJ
- C) 273 kJ
- D) 147 kJ
- E) 14 kJ

Answer: A



18-c23.mp4

23) A certain gas is compressed adiabatically. The amount of work done on the gas is 800 J. What is the change in the internal energy of the gas?

- A) 800 J
- B) -800 J
- C) 400 J
- D) 0 J
- E) More information is needed to answer this question.

Answer: A



18-c26.mp4

26) In a given reversible process, the temperature of an ideal gas is kept constant as the gas is compressed to a smaller volume. Select the true statement from among the following:

- A) The gas must absorb heat from its surroundings.
- B) The gas must release heat to its surroundings.
- C) The pressure of the gas also stays constant.
- D) The process is adiabatic.
- E) It is impossible to predict on the basis of this data.

Answer: B



18-c35.mp4

35) From the following statements regarding the ratio of the molar specific heat at constant pressure to the molar specific heat at constant volume,  $C_p/C_v$ , the only correct one for an ideal monatomic gas is

- A)  $\frac{C_p}{C_v} = 1$ .
- B)  $\frac{C_p}{C_v} > 1$ .
- C)  $\frac{C_p}{C_v} < 1$ .
- D)  $C_p/C_v$  is sometimes more than 1, sometimes less than 1, but never equal to 1.
- E)  $C_p/C_v$  is sometimes more than 1, sometimes equal to 1, but never less than 1.

Answer: B



18-c38.mp4

38) When objects at different temperatures are brought into thermal contact with one another, the resulting spontaneous flow of heat proceeds from the object with the higher

- A) thermal conductivity to the one with the lower thermal conductivity.
- B) specific heat to the one with the lower specific heat.
- C) heat capacity to the one with the lower capacity.
- D) temperature to the one with the lower temperature.
- E) impossible to predict on the basis of this data.

Answer: D



18-c41.mp4

41) Which of the following is a statement of the third law of thermodynamics?

- A) If two objects are in equilibrium with a third, then they are in thermal equilibrium with one another.
- B) The entropy of the universe cannot decrease.
- C) The entropy of the universe cannot increase.
- D) All reversible engines operating between the same two temperatures have the same efficiency.
- E) It is impossible to lower the temperature of an object to absolute zero in a finite number of steps.

Answer: E



18-n39.mp4

39) A reversible engine operating between 500 K and 300 K has the same efficiency as a reversible engine operating between 400 K and what lower temperature?

- A) 200 K
- B) 220 K
- C) 240 K
- D) 260 K
- E) 280 K

Answer: C



P101Z S08 TF Q20.mp4

20. A spar buoy consists of a circular cylinder, which floats with its axis oriented vertically. One such buoy has a radius of 1.00 m, a height of 2.00 m and weighs 40.0 kN. What portion of it is submerged when it is floating in fresh water?

- [A] 1.35 m    [B] 1.30 m    [C] 1.25 m    [D] 1.20 m    [E] 1.50 m



P101Z S08 TF Q21.mp4

21. When a bimetallic strip is heated, the strip will bend toward the side

- [A] with the larger coefficient of linear expansion.
- [B] with the smaller coefficient of linear expansion.
- [C] with the higher temperature.
- [D] with the lower temperature.



P101Z S08 TF Q22.mp4

22. The process whereby heat flows by means of molecular collisions is referred to as

- [A] conduction.
- [B] convection.
- [C] radiation.
- [D] inversion.
- [E] evaporation.



**23. What is meant by "the heat death of the universe"?**

- [A] The universe will end in a giant inferno.
- [B] The universe will reach thermal equilibrium.
- [C] Some day the sun will explode and we will all burn.
- [D] Some day the sun will cease to provide electromagnetic radiation.
- [E] The radiation from the stars will continuously heat up the universe.