41. If you dribble a basketball with a frequency of 1.77 Hz, how long does it take for you to complete 12 dribbles?

A. 6.78 s  B. 21.2 s  C. 0.32 s  D. 42.5 s  E. 1.07 s

42. A 0.46-kg mass attached to a spring undergoes a simple harmonic motion with a period of 0.77 s. What is the force constant of the spring?

A. 8.2 N/m  B. 3.6 N/m  C. 31 N/m  D. 62 N/m  E. 0.78 N/m

43. A guitar player produces the standing wave pattern on a guitar string shown on the right. The mass of string is \( m = 0.02 \) kg, the length of the string is \( L = 60 \) cm and its tension \( F = 650 \) N. What is the fundamental frequency of the sound?

A. 94 Hz  B. 116 Hz  C. 136 Hz  D. 194 Hz  E. 226 Hz

44. When a 0.213-kg mass is attached to a vertical spring, it causes the spring to stretch a distance \( d \). If the mass is now displaced slightly from equilibrium, it is found to make 102 oscillations in 56.7 s. Find the stretched distance \( d \). (use \( g = 9.81 \text{ m/s}^2 \))

A. 15.3 cm  B. 2.09 cm  C. 40.3 cm  D. 0 cm  E. 7.68 cm

45. A pendulum of length \( L \) has a period \( T \). How long must the pendulum be if its period is to be \( 2T \).

A. \( L/4 \)  B. \( L/2 \)  C. \( L \)  D. \( 2L \)  E. \( 4L \)

46. A quiet radio has an intensity level of about 30 dB. Busy street traffic has a level of about 60 dB. How much greater is the intensity of the street traffic compared to the radio?

A) about 10,000 times  B) about 1000 times  C) about 100 times  D) about 10 times  E) about the same
47. A wave traveling along a stretched horizontal rope. The vertical distance from crest to trough for this wave is 26 cm and the horizontal distance from crest to trough is 28 cm. What are the wavelength and amplitude of the wave. Choose a correct set of (wavelength, amplitude).

A. (28 cm, 13 cm)  
B. (56 cm, 26 cm)  
C. (56 cm, 13 cm)  
D. (14 cm, 13 cm)  
E. (14 cm, 26 cm)

48. A brother and sister try to communicate with a string tied between two tin cans as shown above. If the string is 9.5 m long, has a mass of 0.032 kg, and pulled taut with a tension of 8.6 N, how much time does it take for a travel from one end of the string to the other?

A. 0.19 s  
B. 0.58 s  
C. 12 s  
D. 3.6 s  
E. 0.01 s

49. A motorcycle and a police car are moving toward one another. The police car emits sound with a frequency of 502 Hz and has a speed of 27.0 m/s. The motorcycle has a speed of 13.0 m/s. What frequency does the motorcyclist hear? The speed of sound in air is 343 m/s.

A) 521 Hz  
B) 544 Hz  
C) 566 Hz  
D) 588 Hz  
E) 599 Hz

50. The frequency of the standing wave in a pipe (both ends open) shown in the right figure is 202 Hz. What is the fundamental frequency of the pipe?

A) 50.5 Hz  
B) 101 Hz
51. Two timpani (tunable drums) are played at the same time. One is correctly tuned so that when it is struck, sound is produced that has a wavelength of 2.24 m. The second produces sound with a wavelength of 2.08 m. If the speed of sound is 343 m/s, what beat frequency is heard?

A) 8.05 Hz  B) 10.2 Hz  C) 11.8 Hz  D) 14.5 Hz  E) 16.8 Hz

52. A 65-kg person sits on a four-leg chair whose mass is 5.0 kg. Each leg of the chair makes contact with the floor in a circle that is 0.020 m in diameter. Find pressure exerted on the floor by each leg of the chair, assuming the weight is evenly distributed. (use \( g = 9.81 \text{ m/s}^2 \))

A) \( 1.4 \times 10^5 \text{ Pa} \)  B) \( 5.5 \times 10^5 \text{ Pa} \)  C) \( 21 \times 10^5 \text{ Pa} \)  D) \( 42 \times 10^5 \text{ Pa} \)  E) \( 10 \times 10^5 \text{ Pa} \)

53. The right figure shows four containers, each filled with water to the same level. Which one of the followings is correct for pressure of the containers at the depth \( h \).

A) \( A > C > D > B \)  B) \( A > C > B = D \)  C) \( A > C = B = D \)  D) \( A = C = B = D \)  E) \( A < C < B < D \)

54. A column of water of height 70.0 cm supports a column of an unknown liquid as suggested in the right figure (not drawn to scale). Assume that both liquids are at rest and that the density of water is \( 1.0 \times 10^3 \text{ kg/m}^3 \). Determine the density of the unknown liquid.

A) \( 1.0 \times 10^3 \text{ kg/m}^3 \)  B) \( 1.3 \times 10^3 \text{ kg/m}^3 \)
55. A piece of wood with density of 706 kg/m$^3$ is tied with a string to the bottom of a water-filled flask (see the right figure). The wood is completely immersed, and has a volume of 8.00×10$^{-6}$ m$^3$. What is the tension in the string? The density of water is 1000 kg/m$^3$. (Use $g = 9.81$ m/s$^2$)

A) 0.0554 N  
B) 0.0785 N  
C) 0.133 N  
D) 0.0231 N  
E) 0.101 N

56. A runner generates power 1250 W (=J/s) of thermal energy. If this heat has to be removed by evaporation, how much water does this runner lose in 25 minutes of running? The latent heat of vaporization of water is 22.6 × 10$^5$ J/kg.

A) 125 g  
B) 500 g  
C) 830 g  
D) 380 g  
E) 980 g

57. In a section of horizontal pipe with a diameter of 4.00 cm the pressure is 95 kPa and water is flowing with a speed of 1.25 m/s. The pipe narrows to 2.00 cm and speeds up to 4.25 m/s. What is the pressure in the narrower region? (Density of water is 1000 kg/m$^3$)

A) 95.0 kPa  
B) 43.7 kPa  
C) 116.7 kPa  
D) 86.7 kPa  
E) 77.7 kPa

58. Object 1 has three times the specific heat capacity and four times the mass of Object 2. The two objects are heated from the same initial temperature, $T_0$, to the same final temperature $T_f$. You determine that the amount of heat gained by Object 1 is $Q$. The amount of heat absorbed by Object 2 will be

A) $12Q$  
B) $6Q$  
C) $\frac{3}{4}Q$  
D) $\frac{4}{3}Q$  
E) $\frac{1}{12}Q$

59. The world’s longest suspension bridge is the Akashikaikyo Bridge in Japan. The bridge is
3910 m long and is constructed of steel. How much longer is the bridge on a warm summer day (30.0 °C) than on a cold winter day (0.00 °C)? The coefficient of thermal expansion for steel is \( \alpha = 12 \times 10^{-6} \, (\text{°C})^{-1} \).

A) 0.6 m  B) 0.8 m  C) 1.0 m  D) 1.2 m  E) 1.4 m

60. A heat transfer of \( 9.5 \times 10^5 \, \text{J} \) is required to convert a block of ice at \(-15.0 \, \text{°C}\) to water at 15 °C. What was the mass of the block of ice? The specific heat of ice is 2090 J/(kg K), the specific heat of water is 4186 J/(kg K), and the latent heat of fusion of water is \( 33.5 \times 10^4 \, \text{J/kg} \).

A) 1.1 kg  B) 2.2 kg  C) 3.3 kg  D) 4.4 kg  E) 5.5 kg