1. The maximum speed and maximum acceleration of a particle executing one-dimension simple harmonic motion are 15 cm/sec and 150 cm/sec^2, respectively. Find the period and the amplitude of the displacement. [10%]

2. A 100-g block is attached to a vertical spring whose stiffness constant is 10 N/m. The block is released at the position where the spring is unextended. (a) What is the maximum extension of the spring? (b) How long does it take the block to reach the lowest point? Neglect the mass of the spring and take the gravitational acceleration g as 9.8 cm/sec^2. [10%]

3. The amplitude of a standing wave on a string is 2.0 mm and the distance between adjacent nodes is 4π cm. Given that the mass linear density is 6.0 g/m and the tension is 15 N, write down the wave function, $y(x,t)$, of this standing wave. [10%]

4. Two submarines A and B move in the same direction in motionless water with A behind B. Sub A moves at 50.0 km/hour and sub B at 100.0 km/hour. Sub A sends out a sonar signal (sound wave in water) at 1000 Hz. Sonar waves travel at 5470 km/hour. (a) What is the signal's frequency as detected by sub B? (b) What frequency is detected by sub A in the signal reflected back to it by sub B? [10%]

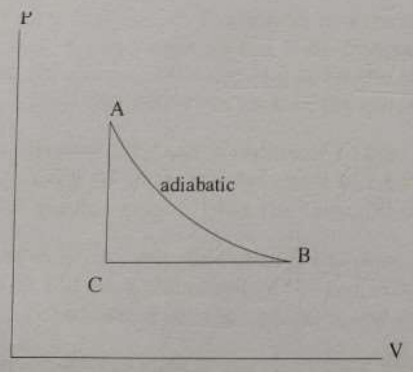
5. A speaker is supplied with 60 W of electric power. Its efficiency in converting electric power into acoustic power is 1%. Find the distance at which the sound is (a) painful (120dB), (b) at the level of conversation (60dB). Assume the speaker is an isotropic point acoustic source. [10%]

6. Two moles of oxygen (O_2), assumed to be ideal, are in a 5-liter container at a pressure of 500 kPa. Find the average kinetic energy of one molecule. [10%]

7. Heat is supplied to 0.5 kg of ice initially at -10°C and slowly changing it to $+10$°C. What is the change in entropy of the sample? [10%]

8. An ideal diatomic gas initially at a temperature of 0 °C and a pressure of 100 kPa is compressed quasi-statically from 30 liters to 20 liters. What is the work required to compress the gas if the process is (a) isothermal; (b) adiabatic? [10%]

9. Describe whether the quantities Q, W, and ΔU for an ideal gas are positive, negative or zero for processes $A \to B$, $B \to C$, and $C \to A$ respectively, where Q is the heat received by the gas, W the work done by the gas, and ΔU the change of the gas internal energy. [10%]



10. Find the change in entropy for 2 moles of an ideal diatomic gas with temperatures changing from 0 °C to 100 °C and volume doubled. [10%]

1. The maximum speed and maximum acceleration of a particle executing one-dimension simple

harmonic motion are 15 cm/sec and 150 cm/sec, respectively. Find the period and the amplitude of the displacement. (10%)

2. A 100-g block is attached to a vertical spring whose stiffness constant is 10 N/m. The block is released at the position where the spring is unextended. (a) What is the maximum extension of the spring? (b) How long does it take the block to reach the lowest point? Neglect the

mass of the spring and take the gravitational acceleration g as 9.8 cm/sec, 10%

3. The amplitude of a standing wave on a string is 2.0 mm and the distance between adjacent nodes is 4 cm. Given that the mass linear density is 6.0 g/m and the tension is 15 N, write down the wave function, y(x, t), of this standing wave. (10%)

4. Two submarines A and B move in the same direction in motionless water with A behind B.. Sub A moves at 50.0 km/hour and sub B at 100.0 km/hour. Sub A sends out a sonar signal (sound wave in water) at 1000 Hz. Sonar waves travel at 5470 km/hour. (a) What is the signal's frequency as detected by sub B? (b) What frequency is detected by sub A in the signal reflected back to it by sub B? (10%)

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7. Heat is supplied to 0.5 kg of ice initially at -10°C and slowly changing it to +10°C. What is the change in entropy of the sample? (10%)

8. An ideal diatomic gas initially at a temperature of 0 °C and a pressure of 100 kPa is compressed quasi-statically from 30 liters to 20 liters. What is the work required to compress the gas if the process is (a) isothermal; (b) adiabatic? (10%)

9. Describe whether the quantities Q, W, and AU for an ideal gas are positive, negative or zero for processes A + B, B+ C, and C + A respectively, where Q is the heat received by the gas, W the work done by the gas, and AU the change of the gas internal energy. (10%

adiabatic

10. Find the change in entropy for 2 moles of an ideal diatomic gas with temperatures changing

from 0 °C to 100 °C and volume doubled. (10%)