Heat and Thermodynamics

Assignment 1

**Question 1** The coefficient of linear expansion of an inhomogeneous rod changes linearly from \( \alpha_1 \) to \( \alpha_2 \) from one end to the other end of the rod. The effective coefficient of linear expansion of the rod is

a. \( \alpha_1 + \alpha_2 \)
b. \( \frac{1}{2}(\alpha_1 + \alpha_2) \)
c. \( \sqrt{\alpha_1 \alpha_2} \)
d. \( (\alpha_1 - \alpha_2) \)

**Question 2** An Aluminum Rod of length \( L_0 \) rest on a smooth horizontal base if the temperature is increased by \( \Delta T \) °C. What will be the longitudinal strain developed

a. \( \alpha \Delta T \)
b. Zero

c. \( -\alpha \Delta T \)
d. None of the above

**Question 3** The ratio of adiabatic bulk modulus and isothermal bulk modulus of a gas \( (\gamma = \frac{C_P}{C_V}) \)

a) \( \gamma - 1 \)
b) \( \frac{\gamma}{\gamma + 1} \)
c) \( \frac{1}{\gamma} \)
d) \( \frac{\gamma}{\gamma - 1} \)

**Question 4** An animal of 70 kg is running with a speed of 6 m/s. If all the KE of animal can be used in increasing water from 18 °C to 32 °C, how much water can be heated with this energy

**Question 5** A copper cube of mass 300g slides down on a rough inclined plane of inclination 40 ° at a constant speed. Assume that any loss in mechanical energy goes into copper block as thermal energy find the increase in thermal energy of the block as it slides down through 50 cm. specific heat capacity of copper = 420J/kg-k.

**Question 6** It is known that curves A, B, C are Isobaric, Isothermal, Adiabatic process then when one is correct
Question 7 A container has a mixture of 1 mole of oxygen and 2 moles of nitrogen at 330K. The ratio of average rotational kinetic energy per O₂ molecule to that per H₂ molecule is
a) 2:1
b) 1:2
c) 1:1
d) None of these

Question 8 The sprinkling of water reduces the temperature of the closed room
a) The water has large latent heat of vaporization
b) Water is bad conductor of heat
c) Specific heat of water is high
d) the temperature of water is less than that of room

Question 9 Two boxes A and B containing different ideal gases are placed on table
Box A contain one mole of gas m where \(C_v = 5R/2\) at Temperature \(T_0\)
Box B contains one mole of gas n where \(C_v = 3R/2\) at temperature \((7/3) T_0\)
The boxes are then put into thermal contact with each other and heat flows between until
the gases reach a common final temperature \(T_f\)
Which of the following relation is correct?
a) \(2T_f - 3T_0 = 0\)
b) \(2T_f - 7T_0 = 0\)
c) \(2T_f - 5T_0 = 0\)
d) \(T_f - 3T_0 = 0\)

Question 10 During an adiabatic process the square of the pressure of a gas is
proportional to the fifth power of its absolute temperature. The ratio of specific heat \(C_p / C_v\) for that gas is
a. \(3/5\)
b. 4/3  
c. 5/3  
d. 3/2