

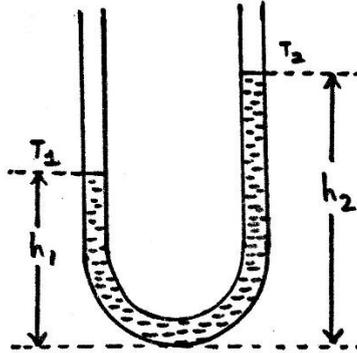
# HEAT AND THERMODYNAMICS

1. A 250 ml beaker is completely filled with mercury. The mercury and the beaker are in thermalequilibrium with a temperature of 25°C. The volume of the mercury overflows when their temperatures are raised to 65°C is: (The linear expansion coefficient for mercury and glass are  $6 \times 10^{-5}/K$  and  $4 \times 10^{-6}/K$  resp.)

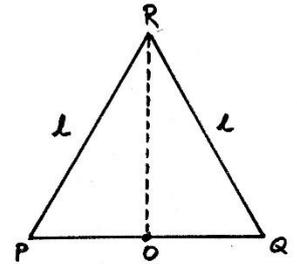
- a. 3.36 ml                                      b. 0.56 ml                                      c. 1.68 ml                                      d. 1.12 ml

2. In a vertical U - tube containing a liquid, the two arms are maintained at temperatures  $T_1$  and  $T_2$ . The liquid levels in the arms have heights  $h_1$  and  $h_2$ . The coefficient of volume expansion of the liquid is:

- a.  $\frac{h_1-h_2}{h_2t_1-h_1t_2}$   
 b.  $\frac{h_1-h_2}{h_1t_1-h_2t_2}$   
 c.  $\frac{h_1+h_2}{h_2t_1+h_1t_2}$   
 d.  $\frac{h_1+h_2}{h_1t_1+h_2t_2}$



3. Three rods each of length  $l$  form an equilateral triangle  $PQR$  with  $O$  as the midpoint of  $PQ$ . The distance  $OR$  remains constant for small changes in temperature. If the coefficient of linear expansion for  $PR$  and  $RQ$  are  $\alpha_2$  and that for  $PQ$  is  $\alpha_1$ , then:



- a.  $\alpha_2 = 3\alpha_1$                                       b.  $\alpha_2 = 4\alpha_1$                                       c.  $\alpha_1 = 3\alpha_2$                                       d.  $\alpha_1 = 4\alpha_2$

4. The temperatures of equal masses of three different liquids  $A$ ,  $B$  and  $C$  are 12 °C, 19 °C and 27 °C respectively. When  $A$  and  $B$  are mixed, the temperature of the mixture is 16 °C and the temperature of the mixture of  $B$  and  $C$  is 23 °C. The temperature of the mixture of  $A$  and  $C$  is:

- a. 18.2 °C                                      b. 22 °C                                      c. 20.5 °C                                      d. 16.75 °C

5. The pressure of  $CO_2$  in a container is given by:  $P = \frac{RT}{2V-b} - \frac{a}{4V^2}$  then the mass of the gas in the container is:

- a. 11 g                                      b. 22 g                                      c. 33 g                                      d. 44 g

6. A solid cylinder of radius  $r$  and thermal conductivity  $K_1$  is surrounded by a cylindrical shell of inner radius  $r$  and outer radius  $2r$ , same length and conductivity  $K_2$ . The equivalent thermal conductivity is:

- a.  $\frac{K_1+3K_2}{4}$                                       b.  $\frac{3K_1+K_2}{4}$                                       c.  $\frac{4K_1+k_2}{3}$                                       d.  $\frac{K_1+4K_2}{3}$

7. A gas mixture has 16 g of helium and 14 g of nitrogen. The ratio between  $C_p$  to  $C_v$  is:

- a. 1.4                                      b. 1.54                                      c. 1.59                                      d. 1.61





**Keys**

1	C	6	A	11	A	16	C	21	B
2	B	7	D	12	C	17	D		
3	D	8	C	13	C	18	D		
4	C	9	A	14	B	19	B		
5	B	10	C	15	B	20	A		