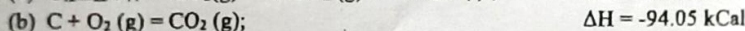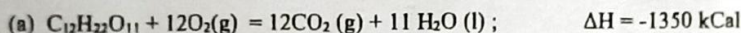1. The heat of formation of ammonia from its elements is -11030 cal/mole at 300 K. Calculate the heat of formation at 1273 K.   **5**
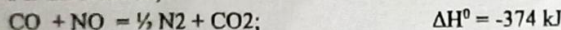
   Given:

   $C_p(N_2) = 6.5 + 1.4.\,10^{-3} \times T; C_p(NH_3) = 6.2 + 0.00078 \times T - 7.2.\,10^{-6} \times T^2; C_p(H_2) = 6.94 - 0.2.\,10^{-2} \times T$

2. One mole of an ideal gas is allowed to expand isothermally from a volume of 1 litre to 20 litres at 27°C. Calculate q, w, ΔU, and ΔH.   **3**

3. A diatomic gas expands adiabatically to a volume 1.35 times larger than the initial volume. The initial temperature is 18°C. Find the final temperature.   **2**

4. What is the maximum efficiency of a thermal engine working between an upper temperature of 400°C and a lower temperature of 18°C?   **2**

5. The heats produced in the oxidation of cane sugar, carbon and hydrogen are given as: **5**

   (a) $C_{12}H_{22}O_{11} + 12O_2(g) = 12CO_2(g) + 11\,H_2O\,(l)$; $\Delta H = -1350$ kCal
   (b) $C + O_2(g) = CO_2(g)$; $\Delta H = -94.05$ kCal
   (c) $H_2 + \frac{1}{2}O_2 = H_2O\,(l)$; $\Delta H = -68.3$ kCal

   Calculate the heat produced if the cane sugar were produced directly from the elements.

6. For the reaction,   **3**
   $CO + NO = \frac{1}{2}N_2 + CO_2$; $\Delta H^0 = -374$ kJ
   Find out the heat of formation of CO, if $\Delta H^0_{f(NO)} = +90.2$ kJ and $\Delta H^0_{f(CO2)} = -394$ kJ.