說明：1. 請依序作答並標明題號
　　　2. 計算題必須寫出計算過程，只寫答案不給分
　　　3. $R = 8.314 \, J \, mol^{-1} \, k^{-1} = 1.987 \, cal \, mol^{-1} \, k^{-1}$

1. Since $C_v = ( \partial E/\partial T)_v$ by definition, one often writes, without any restrictions understood，"$dE = C_v \, dT$". It is not generally true, however, that $dE = C_v \, dT$; $dE = C_v \, dT$ only under special circumstances. What are the circumstances？ (15%)

2. A student made the following erroneous statement in a laboratory report on bomb calorimetry: "$\Delta H = \Delta E + P\Delta V$. Since the bomb calorimetry process is a constant volume one, $\Delta V = 0$, and $\Delta E = \Delta H$" Explain why this argument is incorrect. (15%)

3. Calculate $\Delta S$ for the isobaric heating of 1 mole of $N_2$ from 300 °K to 1000 °K
$C_p = 6.4492 + 1.4125 \times 10^{-3}T - 0.807 \times 10^{-7}T^2$ (14%)

4. Write a mathematical expression for the entropy change taking place in the working substance ： (28%)
   (a) Free expansion of 1 mole of an ideal gas from $V_1$ to $V_2$
   (b) Reversible, isothermal phase transition
   (c) Reversible, adiabatic expansion of 1 mole of an ideal gas from $V_1$ to $V_2$
   (d) Reversible, isothermal expansion of 1 mole of an ideal gas from $V_1$ to $V_2$

5. The hypothetical reaction $A \rightarrow B$ is of the $-1$ order; that is, $-dc/dt = kc^{-1}$,
   where $c = [A]$　　(28%)
   (a) Obtain an equation for c as a function of t, k, and the initial concentration $c_0$
   (b) Find the time required for the concentration to fall to 10 percent of its initial value, in terms of k and $c_0$.
   (c) Does this reaction ever reach completion？ Explain that process.