ESS 312 Lab 3 - Making diamonds - answer sheet

Q1 (a) graphite + $O_2 \leftrightarrow CO_2$

ΔH = ΔS =

diamond + $O_2 \leftrightarrow CO_2$

ΔH = ΔS = at 298 K / 1 bar (incl units).

(b) graphite $\leftrightarrow$ diamond

ΔH =

ΔS = at 298 K / 1 bar (include units).

(c) $\Delta G_{\text{graphite} \leftrightarrow \text{diamond}}$ = at 298 K / 1 bar (include units).

The stable polymorph at 298 K / 1 bar is:

Q2 (a) $\Delta G_{\text{graphite} \leftrightarrow \text{diamond}}(T, P_r)$ =

(b) Enter values for each piece of the formula (write out expressions for each of the definite integrals before substituting values into them):

$\Delta G_{\text{graphite} \leftrightarrow \text{diamond}}(T_r, P_r)$

$+ T_r \Delta S_{graphite \leftrightarrow diamond} (T_r, P_r)$

$$+ \int_{T_r}^{T} \Delta C_{P,graphite \leftrightarrow diamond} dT$$

$- T \Delta S_{graphite \leftrightarrow diamond} (T_r, P_r)$

$$- \int_{T_r}^{T} \frac{\Delta C_{P,graphite \leftrightarrow diamond}}{T} dT$$

Add these up to get $\Delta G_{graphite \leftrightarrow diamond} (1300, 1 \text{ bar}) =$

(c) $\Delta G_{graphite \leftrightarrow diamond} (T, P) = \Delta G_{graphite \leftrightarrow diamond} (T, P_r) +$

(d) Co-existence pressure ($\Delta G_{graphite \leftrightarrow diamond} (1300, P) = 0$) :

Q3 Clapeyron slope:

$\Delta S_{graphite \leftrightarrow diamond} =$ (use 298 K / 1 bar values; include units).

$\Delta V_{graphite \leftrightarrow diamond} =$ (use 298 K / 1 bar values; include units).

$dP/dT = \Delta S / \Delta V =$

Q4 What do your results imply about the origin of these diamonds, and the structure and development of the oldest (Archean) continents preserved on Earth?