Arrhenius Equation Problems

1. The rate constant, ***k***, was determined for the decomposition of hydrogen iodide at various temperatures. The results giving in ***k*** for a range of temperatures are given below.

Temperature T (K)	ln ***k***	T^{-1} (K^{-1})
550	- 15.6	$1.82 * 10^{-3}$
600	- 12.2	$1.67 * 10^{-3}$
650	- 9.4	$1.54 * 10^{-3}$
700	-7	$1.43 * 10^{-3}$
750	- 4.9	$1.33 * 10^{-3}$

a) Plot a graph of ln k against T^{-1}. (Take the ln k axis from - 20 tp 0 and the T^{-1} axis from 1.2×10^{-3} to 1.9×10^{-3} K^{-1}.
b) Calculate the gradient (slope) of your graph and use it to determine a value for the activation energy, E_a, stating its units.
c) Without obtaining the actual value, state two different ways in which the value of A in the Arrhenius equation could be determined.

2. The rate constants for the decomposition of ethanol:

$$CH_3\,CHO_{(g)} \longrightarrow CH_{4\,(g)} + CO_{(g)}$$

Were measured at five digits different temperature, the data are shown in the table below:

Rate Constant k ($M^{-1}s^{-1}$)	Temperature T(K)
0.011	700
0.035	730
0.105	760
0.343	790
0.789	810

Plot ln k versus 1/T and determine E_a (KJ mol^{-1}) for the above reaction.

3. $N_2O \longrightarrow N_2 + O$
The second order rate constant for the decomposition of nitrous oxide (N_2O) into $N_{2(g)}$ and O (atom) has been measured at different temperatures as shown below.
Determine E_a for the above reaction.

Rate Constant k (1/Ms)	Temperature T (^0C)
$1.87 * 10^{-3}$	600
0.0113	650
0.0569	700
0.244	750