Gibbs free Energy Questions

① On heating, silver (I) oxide decomposes into silver and oxygen:

$$2 Ag_2O_{(s)} \longrightarrow 4 Ag_{(s)} + O_{2(g)}$$
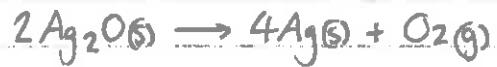
$\Delta H^{\ominus} = +62 \cdot 0 \text{ kjmol}^{-1}$

$\Delta S_{system} = +132 \cdot 8 \text{ Jk}^{-1}\text{mol}^{-1}$

a) Calculate the free energy change, ΔG for this reaction at i) 400K and ii) 600K then comment on the feasibility of the reaction at these temperatures.

b) what is the minimum temperature you would have to use to decompose silver (I) oxide?

② Magnesium carbonate and barium carbonate both decompose on heating according to the equation

$$XCO_{3(s)} \longrightarrow XO_{(s)} + CO_{2(g)}$$

$\Delta H^{\ominus}_{formation}$ $(kJmol^{-1})$	$S^{\ominus}$ $Jk^{-1}mol^{-1}$
$MgCO_{3(s)}$ -1096	$MgCO_{3(s)}$ 65.7
$MgO_{(s)}$ -602	$MgO_{(s)}$ 26.9
$CO_{2(g)}$ -394	$CO_{2(g)}$ 213.6
$BaCO_{3(s)}$ -1216	$BaCO_{3(s)}$ 112.1
$BaO_{(s)}$ -554	$BaO_{(s)}$ 70.4

a) Calculate ΔH and ΔS_{system} for both reactions, and use these values to calculate ΔG at 900K for both reactions. Comment on the feasibility of both.

b) Calculate the minimum temperature needed to decompose each carbonate.

③ When heated strongly, copper (II) sulfate decomposes according to the equation

$$CuSO_4(s) \longrightarrow CuO(s) + SO_3(g)$$

Plot the following values of ΔG against temperature, T, and use your graph to find a) the enthalpy change for the reaction, b) ΔS system and c) the minimum temperature needed for the decomposition to become feasible.

T (K)	400	800	1200	1600
ΔG (kJmol^{-1})	+145	+71	-4	-78