Chemical equilibria worksheet 9

An amount equal to 3.200 mol of Hydrogen and 2.200 mol of chlorine gases are mixed in a 2.00 Litre reaction vessel. Gaseous hydrochloric acid is formed. The mixture is allowed to reach equilibrium at a particular temperature and at which point it was found that 4.00 mol of HCl gas is present. During the reaction the contents of the reaction vessel increased in temperature.

(a) Write a balanced equation to the above information.

$Cl_2(g) + H_2(g) \rightleftharpoons 2HCl(g)$
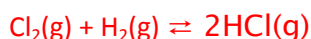
(b) Using the above equation, give an expression for the equilibrium constant for this reaction.
$K = [HCl]^2 / ([H_2][Cl_2])$

(c) Is the reaction endothermic or exothermic? Explain.
Exothermic because it heated up the contents

(d) Calculate the equilibrium constant at the particular temperature .
$K = [HCl]^2 / ([H_2][Cl_2]) = [2.00]^2 / ([0.600][0.100]) = 66.7$

(e) Show the effect on the percentage yield of hydrochloric acid vapour if the following stresses are placed on the equilibrium by completing the following table.

	Impact on the [HCl] once the mixture reaches equilibrium once again.	Response of the system. (right, left, no change)	Value of the equilibrium constant
At t1 more hydrogen gas is added at constant volume and constant temperature	Increased	Moves right	No change
At t2 helium gas is added at constant volume and constant temperature	No change	No change	No change
At t3 volume of the reaction vessel is doubled at constant temperature	Decreased	No change	No change
At t4 temperature is increased at constant volume	Decreased	Moves left	Decreases

(f) Given the changes to the system mentioned above, complete the graph below.