EQUILIBRIA (A)

Ethanol can be made by hydration of ethene at 300°C, 6 MPa pressure and with concentrated phosphoric acid catalyst. The reaction mixture reaches a state of dynamic equilibrium in a closed system.

$$C_2H_4(g) + H_2O(g) \rightleftharpoons C_2H_5OH(g) \qquad \Delta H = -45 \text{ kJ mol}^{-1}$$

a What is happening when the system is in dynamic equilibrium?

both forward and reverse reactions take place simultaneously

and at the same rate

b What happens to the yield of ethanol if the temperature is increased? Explain your answer.

equilibrium position moves left in endothermic direction to oppose increase in temperature

and so decreases yield of hydrogen

c What happens to the yield of ethanol if the pressure is increased? Explain your answer.

equilibrium position moves right to side with fewer gas molecules to oppose increase in pressure

and so increases yield of hydrogen

d What effect does using have a catalyst have on the yield of ethanol? Explain your answer.

no effect on yield

catalyst increases rate of forwards and reverse reactions by the same amount