STUDENT CHECK FOR UNDERSTANDING

DIRECTIONS:
Consider the following first-order, reversible reaction at equilibrium in a reaction vessel:

$$N_2O_4(g) \rightleftharpoons 2NO_2(g) \qquad \Delta H = +58 \text{ kJ mol}^{-1}$$

For each change to the system, determine what happens to the **number of molecules of the reactant, number of molecules of the product, and reaction rates (both directions)** at equilibrium compared to initial conditions. Use the terms "increase", "decrease", and "no change" for each scenario. For the "Shift Towards" column use the terms "reactant", "product", or "no shift". Explain your reasoning in the "Justification" column.

Scenario	Number of N_2O_4 molecules at equilibrium	Number of NO_2 molecules at equilibrium	Equilibrium Reaction Rates	Shift Towards...	Justification
The volume of the reaction vessel is reduced.					
The temperature of the reaction is increased by submerging the vessel in warm water.					

The number of moles of N_2O_4 in the reaction vessel is doubled.					
A catalyst is added to the reaction vessel that speeds up both the forward and reverse reactions to the same extent.					
The volume of the reaction vessel is increased.					
The temperature of the reaction is decreased by submerging the vessel in cold water.					
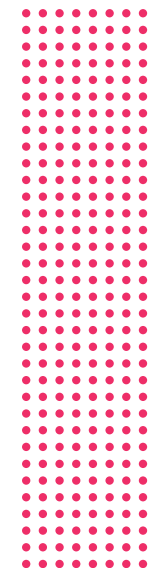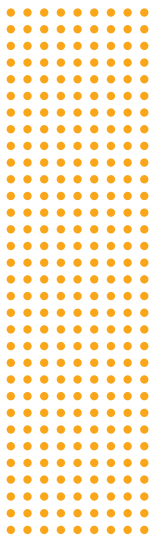
The number of moles of NO_2 in the reaction vessel is doubled.					
NO_2 is selectively removed from the reaction chamber as it is generated.					