

Rates of reaction and equilibrium

Calculating the rate of reaction

- ① Use the words in the box below to fill the gaps and complete the sentence. (4 marks, ★)

frequently

activation energy

kinetic energy

quickly

Increasing temperature increases the rate of reaction in two ways. When the temperature is raised particles have more so they move more This means that the particles collide more These collisions are more likely to be effective because they are more likely to collide with enough energy to overcome the

- ② Tick **two** statements about catalysts that are correct. (2 marks, ★)

Catalysts increase the rate of reaction by providing an alternative reaction route

Catalysts increase the rate of reaction by increasing the kinetic energy of reactants

Catalysts are chemically changed during the reaction

Catalysts are chemically changed during the reaction

NAILIT!



For the variables concentration and surface area, doubling either of them will possibly double the rate. This does not work with temperature. An approximate effect is that the rate for some reactions doubles if the temperature goes up by 10°C.

The effect of changing conditions on equilibrium

- H ① Methanol, an industrial solvent, can be produced from carbon monoxide gas, CO, and hydrogen gas, H₂, in the presence of a copper catalyst, as shown below:



The forward reaction is exothermic and the backward reaction is endothermic.

- a Balance the equation. (1 mark, ★)

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- b Complete the table below to explain what would happen following a change to the conditions. (3 marks, ★★★)

Change	What happens	Explanation
Increase the concentration of CO gas	Equilibrium shifts to Right —————→	The equilibrium moves to lower the concentration of CO gas by reacting it with hydrogen to make more methanol
Increase the pressure	Equilibrium Shifts to the	
..... the temperature	Equilibrium shifts to Right —————→	