Inquiry

Kinetics

&

Equilibrium

Click on:

http://www.harpercollege.edu/tm-ps/chm/100/dgodambe/thedisk/equil/8perform.htm

- Go to the URL link above.
- Scroll down to find "Equilibrium and LeChatelier's Principle."
- Click on the "Experiments" tab.

Click on the “Cobalt System”

Performing the Experiment and Results

I. Cobalt system

II. Ammonium system

III. Iron thiocyanate system

IV. Chromate system

V. Nitrogen dioxide system

VI. Copper sulfate system

Cobalt System

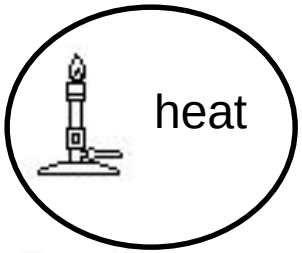
$$CoCl_4^{-2}\ \{blue\} + 6\ H_2O \rightleftharpoons Co(H_2O)_6^{+2}\ \{red\} + 4\ Cl^- + heat$$

heat

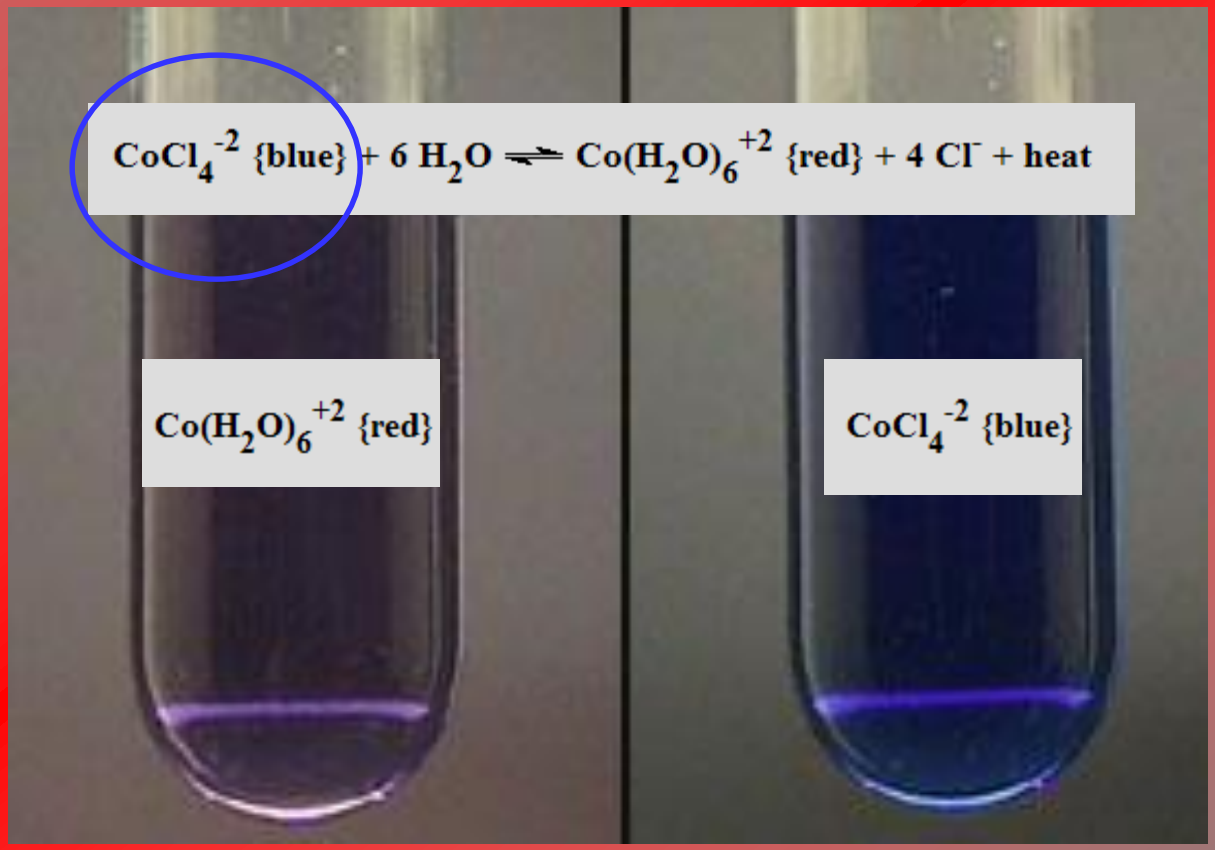
cold

Predict what will happen if you click on the heat.

$$CoCl_4^{-2}\ \{blue\} + 6\ H_2O \rightleftharpoons Co(H_2O)_6^{+2}\ \{red\} + 4\ Cl^- + heat$$



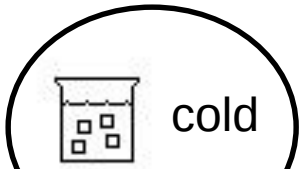
This reaction is EXOthermic (heat is a product). Therefore, heat will push the reaction toward the reactants



Predict what will happen if you click on the COLD.

$$CoCl_4^{-2}\ \{blue\} + 6\ H_2O \rightleftharpoons Co(H_2O)_6^{+2}\ \{red\} + 4\ Cl^- + heat$$

heat



cold

H_2O

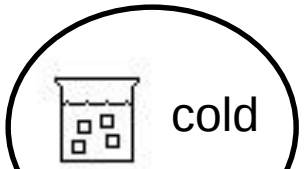
KCl

$AgNO_3$

This reaction is ENDOthermic (taking heat away from the product side).

$$CoCl_4^{-2}\ \{blue\} + 6\ H_2O \rightleftharpoons Co(H_2O)_6^{+2}\ \{red\} + 4\ Cl^-$$

heat



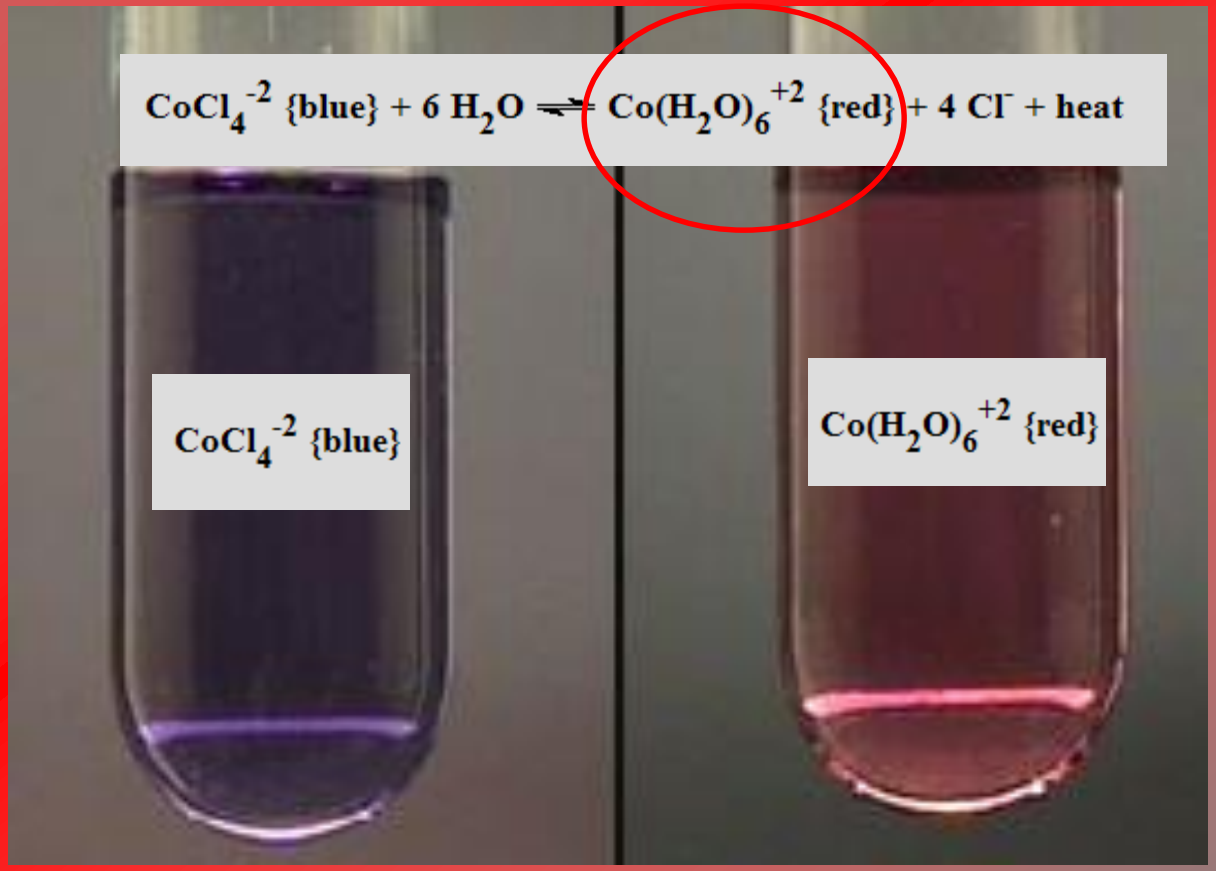
cold

H_2O

KCl

$AgNO_3$

This reaction is ENDOthermic (taking heat away from the product side). Therefore, pushing the reaction back toward the products



Predict what will happen if you click on the water.

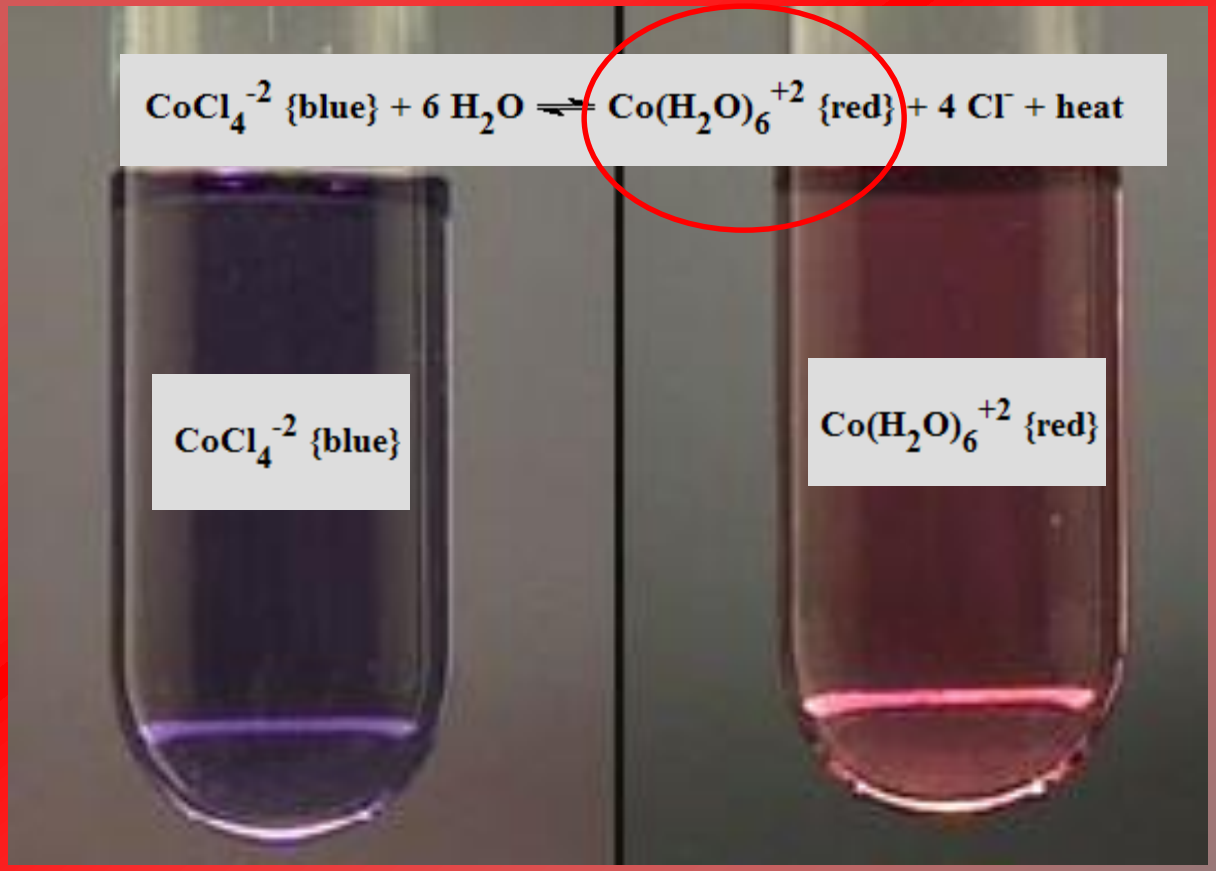
$$CoCl_4^{-2}\ \{blue\} + 6\ H_2O \rightleftharpoons Co(H_2O)_6^{+2}\ \{red\} + 4\ Cl^- + heat$$

heat

cold

Adding water (REACTANT)

will push the reaction to make more product.

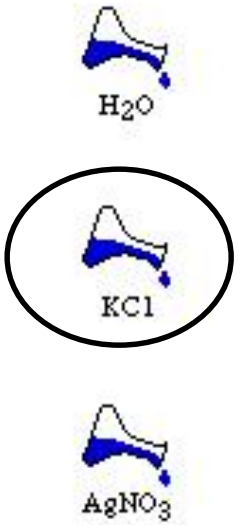


Predict what will happen if you click on the KCl.

$$CoCl_4^{-2}\ \{blue\} + 6\ H_2O \rightleftharpoons Co(H_2O)_6^{+2}\ \{red\} + 4\ Cl^- + heat$$

heat

cold



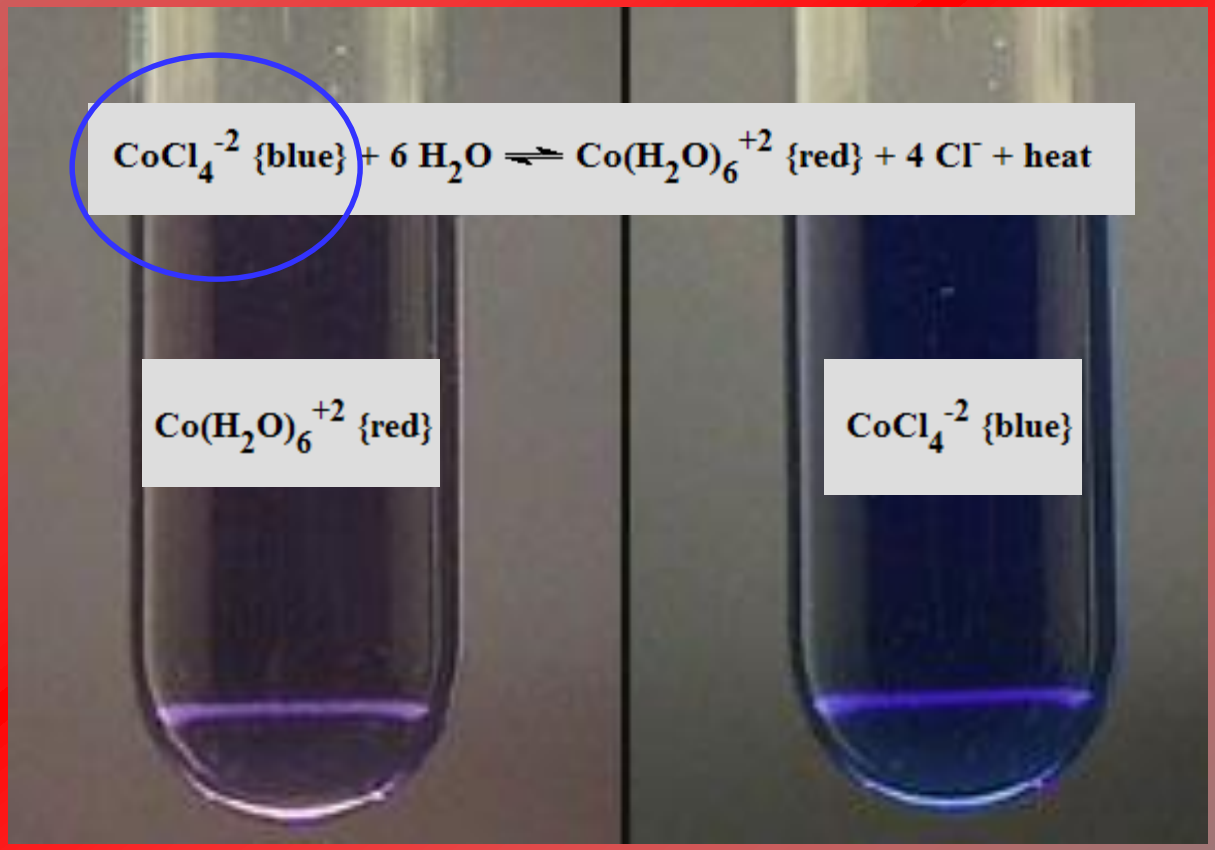
KCl dissociates into K+ and Cl- ions, making more Cl- ions available on the product side

$$CoCl_4^{-2}\ \{blue\} + 6\ H_2O \rightleftharpoons Co(H_2O)_6^{+2}\ \{red\} + 4\ Cl^- + heat$$

heat

cold

Adding KCl will, therefore, push the reaction towards the reactants



Predict what will happen if you click on the Silver Nitrate.

$$CoCl_4^{-2}\ \{blue\} + 6\ H_2O \rightleftharpoons Co(H_2O)_6^{+2}\ \{red\} + 4\ Cl^- + heat$$

heat

cold

NOTES:

- Silver ions react with chloride ions to form the insoluble compound silver chloride.

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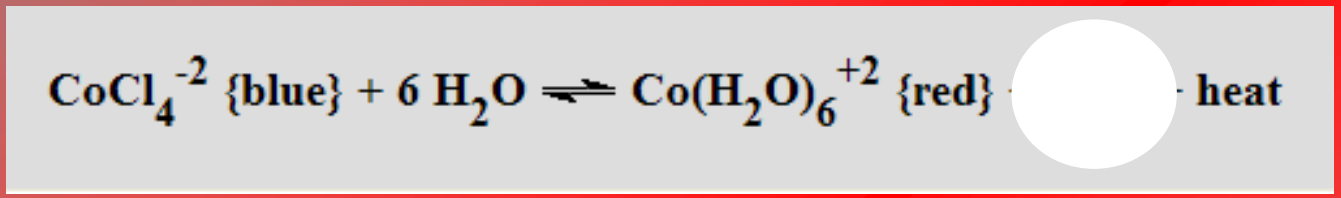

Adding silver nitrate removes the Cl- ions from the product side and will push the reaction to make more product.

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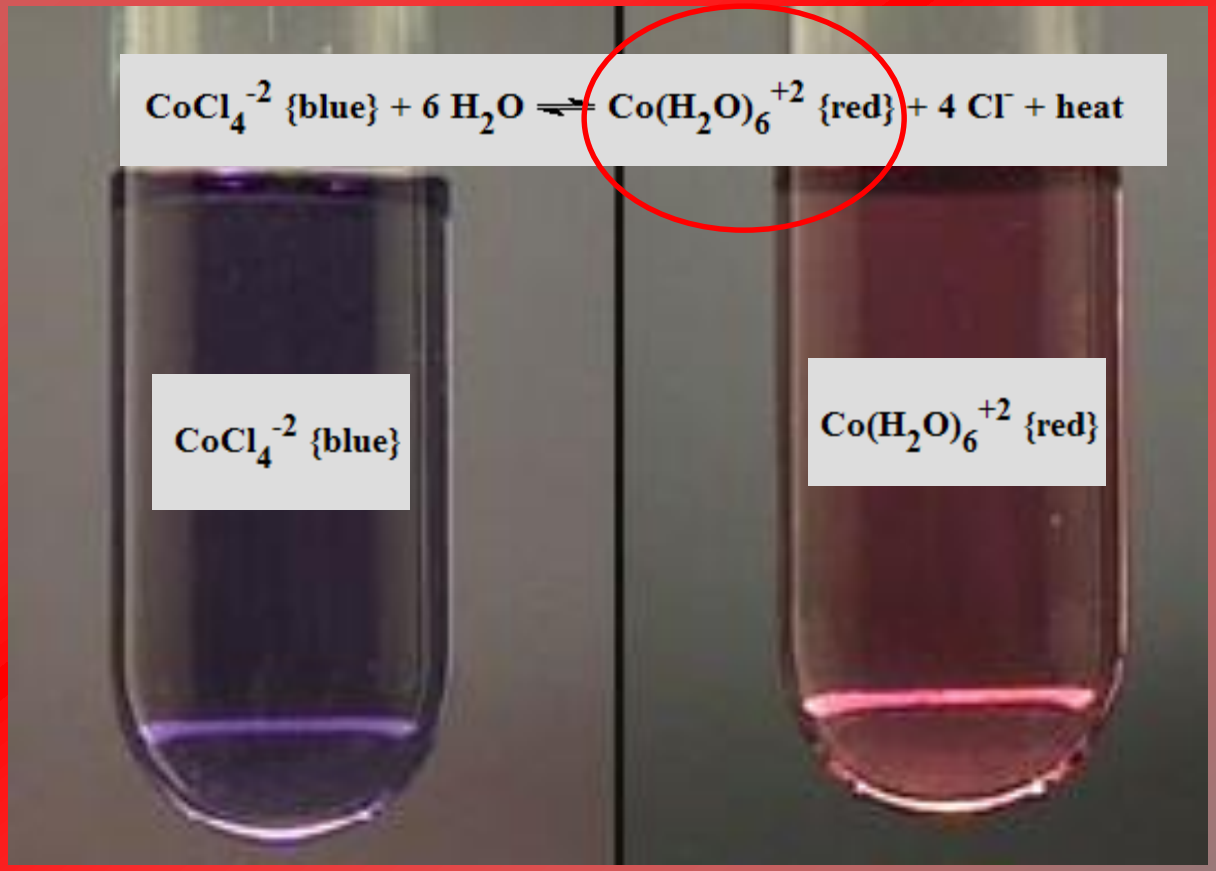

Click on each system one at a time. PREDICT the results and then perform the experiment

Performing the Experiment and Results

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II. Ammonium system

III. Iron thiocyanate system

IV. Chromate system

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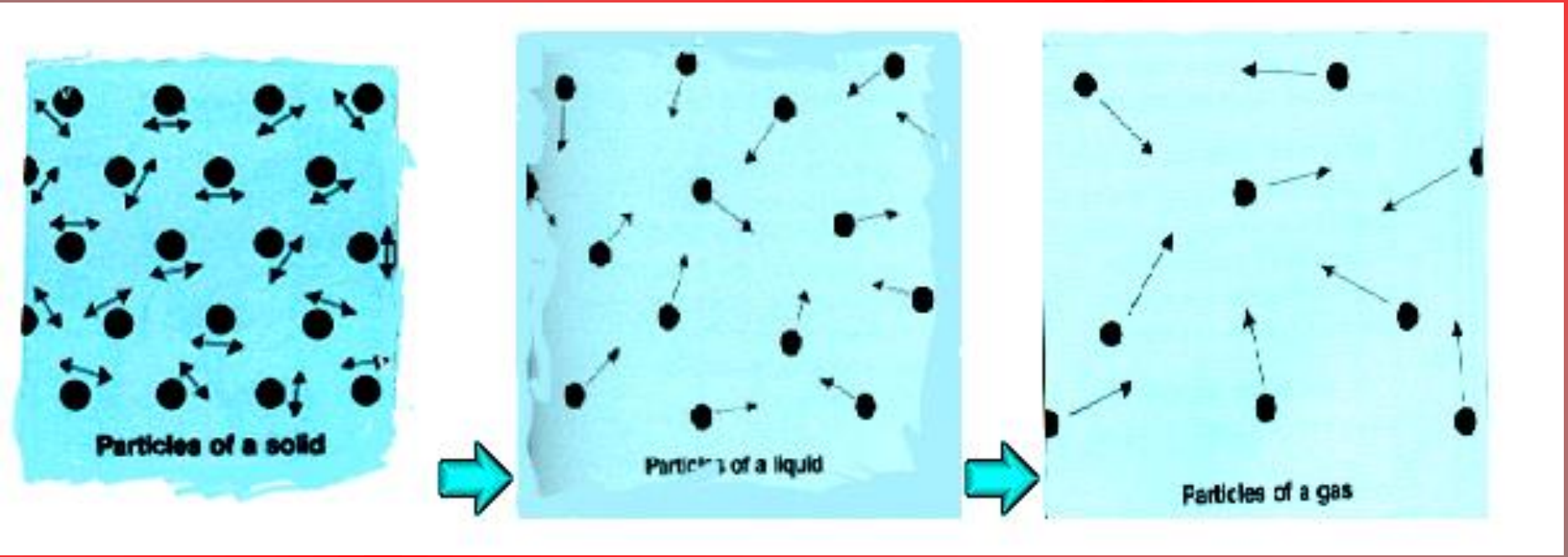
Consider Gases



Assume a reaction is taking place in the gas phase

- What would be the effect on equilibrium position of increasing the pressure inside the container?

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- What would be the effect on equilibrium position of increasing the pressure inside the container?

Pressure would affect the gases IF there is an unequal number of moles of reactants than products.

e.g. squeeze a balloon on the left side and it pushes to the right … and vice versa

Define “Pressure” in terms of molecules in a container

- How does pressure affect a solid?
- How does pressure affect a liquid?
- How does pressure affect a gas?

Define “Pressure” in terms of molecules in a container

- How does pressure affect a solid?

  Very little

- How does pressure affect a liquid?

  Very little

- How does pressure affect a gas?

  Gases are extremely compressive and expansive