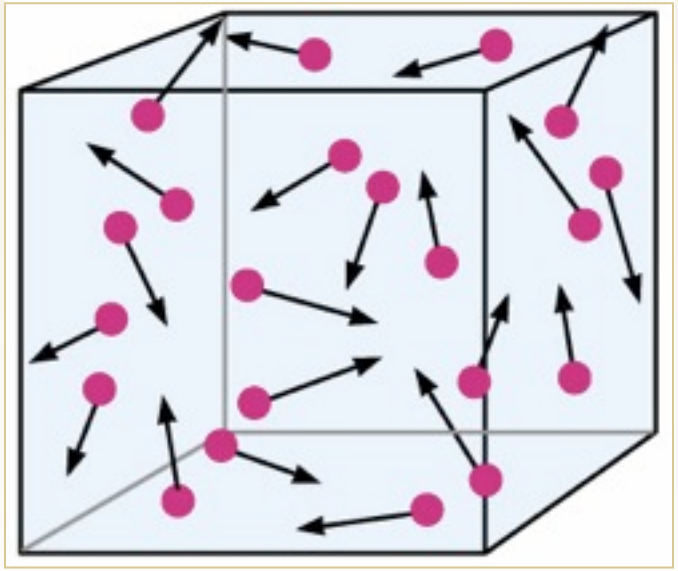
REVERSIBLE REACTIONS

What happens to gas when temperature changes?



REVERSIBLE REACTIONS

1) When the system is heated:

2) When the system is cooled:

- brown gas = NO_2
- colourless gas = N_2O_4

REVERSIBLE REACTIONS

Both reactions are occurring simultaneously in a closed system at all times.

The reaction:

$N_2O_{4(g)}$ + energy <==> 2 $NO_{2(g)}$ is described as reversible.

Only when both reactions are occurring at the same rate and no changes can be observed, a chemical equilibrium has been reached.

REVERSIBLE REACTIONS

Factors to Reach Equilibrium

1.

2.

3.

4.

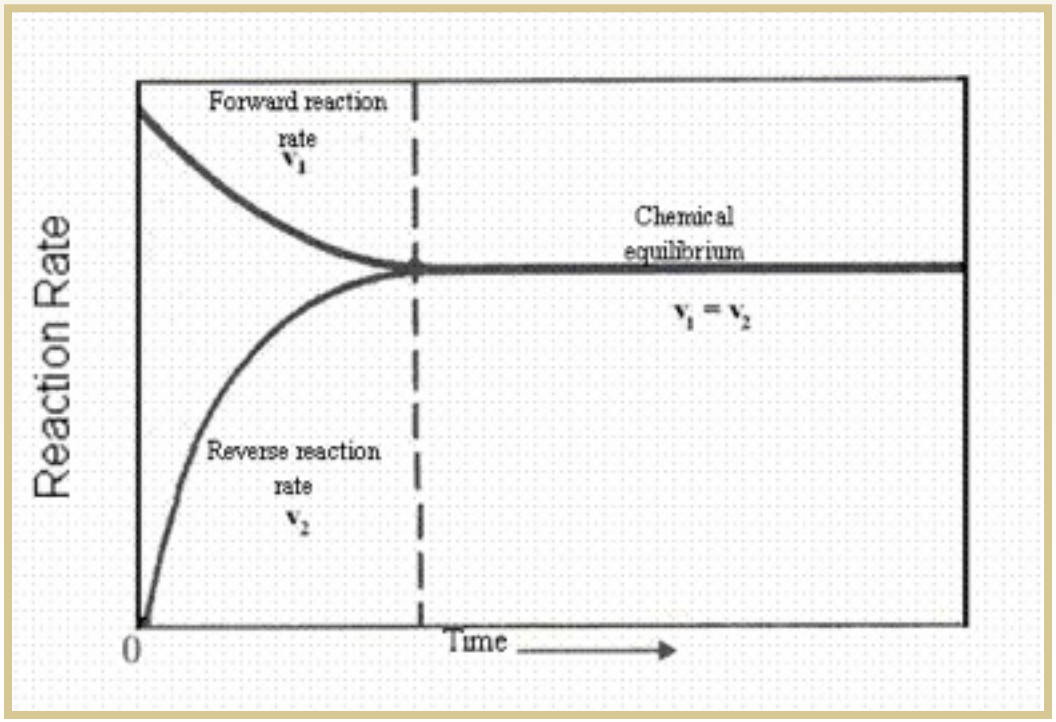
REVERSIBLE REACTIONS

Equilibrium **DOES NOT** mean the same concentrations of products and reactants.

- only that the rxn rates are equal

Reaction rates change because of temperature change.

- equilibrium rxn rates are different at different temperatures



REVERSIBLE REACTIONS

When chemicals are reacted, there are 3 possible outcomes:

1.

2.

3.

REVERSIBLE REACTIONS

Factors Determining Rxn Occurrence

1.

2.

When both of these statements are true, the reaction tends to completion.

REVERSIBLE REACTIONS

Predicting Reaction Occurrence

Example #1

$$Zn_{(s)} + 2\ HCl_{(aq)} \rightarrow ZnCl_{2(aq)} + H_{2(g)} \qquad \Delta H = -152\ kJ$$

Enthalpy?

Entropy?

Prediction?

REVERSIBLE REACTIONS

Predicting Reaction Occurrence

Example #2

$$3\ C_{(s)} + 3\ H_{2(g)} \rightarrow C_3H_{6(g)} \qquad \Delta H = +20.4\ kJ$$

Enthalpy?

Entropy?

Prediction?

reaction v

REVERSIBLE REACTIONS

Predicting Reaction Occurrence

Example #3

$$2Pb(NO_3)_{2(s)} \rightarrow 2PbO_{(s)} + 4NO_{2(g)} + O_{2(g)} \quad \Delta H = +597\ kJ$$

Enthalpy?

Entropy?

Prediction?

REVERSIBLE REACTIONS

Predicting Reaction Occurrence

Recall, some reactions require very large E_A values.

Therefore another factor in determining reaction occurrence.

If no information on E_A is given, assume sufficient energy is available.