Chemistry Activation Energy

- Maxwell Boltzmann Distribution Graph
  - Be able to...
    - Draw
    - Label
      - Axes
      - Activation energy
      - Kinetic energy
      - Temperature
    - Explain all
  - Graph A

- Graph B

The white area shows the proportion of particles in the sample that do not have enough energy to react.

The blue area shows the proportion of particles in the sample that have enough energy to react.

lower temperature T1

higher temperature T2

average KE at T1

average KE at T2

activation energy $E_a$
Graph C

 Airport

Graphs

- **Graph A**
  - This has a good explanation, but will not be what you are expected to draw, it's a bit simpler

- **Graph B**
  - This looks a little more like what you would be expected to draw, you need the two curves, but all you need to label is
    - # of particles on the y-axis
    - Kinetic energy on the x-axis
    - Activation energy
    - $T_1$ and $T_2$ on the curves
  - This graph has a bit extra, don't pay attention to the average kinetic energy at $T_1$ and $T_2$ it is unneeded

- **Graph C**
  - This is really helpful with the explanation you will be expected to provide and the drawing is also pretty much exactly what you will be expected to draw, except the specific temperatures unless it is asked for in the question

Explanation of the graph

- **Axes**
  - The axes should be self explanatory, it is the number of particles at a certain kinetic energy

- **Temperatures**
  - According to graph B $T_1$ has the lower temperature and $T_2$ has the higher. This confuses many people because the curve of $T_1$ is higher than that of $T_2$ but it's the opposite because the second curve has more kinetic energy, which is related to having a higher temperature.
  - According to graph C you can see which has the greater number of particles that have enough activation energy to react, this is because with more
temperature there are more particles that are able to react so the second curve has more particles with the ability to react because it has higher temperature and therefore more kinetic energy relating to the first part of the explanation

- Or if you want to think about it this way, the one that has the greater area under the curve (calculus) has more particles that are able to react

- Reaction Mechanism Diagram
  - Be able to
    - Label
      - Reactants
      - Products
      - Activation energy
      - Activation energy complex

- Graph D
- Graph E
  - Ignore the chemical reactants and products; you will not need to produce this. Good graph with great labels, but missing activated complex

- Graph F
  - Graph D

- Graphs
The transition state is shown, will be explained later, is however missing a few things

- Graph F
  - W – reactants
  - Z - Products
  - A – activation energy
  - Y – activation energy complex
  - C – energy lost in reaction

Explanation

- With the catalyst you lower the activation energy making it easier to react, you add energy to the reaction so that it can react
- The reactants start out higher on the graph because they will have less potential energy than they had after the reaction
- The activation energy with the enzyme (catalyst) will be lower because it takes less to react and more without it
- The main thing is the transition on graph E or what we will be calling the activation energy complex. This is the area where new bonds are made and new bonds are broken, it has the highest energy and is therefore extremely unstable, it’s the transition state if anything changes in form (solid liquid gas)