**Reaction Rate Simulations**

**Surface Area - http://tinyurl.com/ph77dyc, Online Stopwatch - http://www.online-stopwatch.com/**

There are three different dishes with solutes of different surface areas. Circle the correct characteristic for each sample.

|  |  |  |
| --- | --- | --- |
| **Sample** | **Particle Size** | **Surface Area** |
|  | Small / Medium / Large  (circle one) | Small / Medium / Large  (circle one) |
|  | Small / Medium / Large  (circle one) | Small / Medium / Large  (circle one) |
|  | Small / Medium / Large  (circle one) | Small / Medium / Large  (circle one) |

Develop a hypothesis about surface area and reaction rates: When surface area increases, the reaction rate will ( increase / decrease / stay the same ).

Try three different trials for each of the different surface areas. Time each reaction until completion (completion occurs when all of the white reactant has become a gas or been removed).

|  |  |
| --- | --- |
| **Sample of Small Surface Area** | **Time (sec)** |
| Trial 1 |  |
| Trial 2 |  |
| Trial 3 |  |
| **Average:** |  |

|  |  |
| --- | --- |
| **Sample of Medium Surface Area** | **Time (sec)** |
| Trial 1 |  |
| Trial 2 |  |
| Trial 3 |  |
| **Average:** |  |

|  |  |
| --- | --- |
| **Sample of Large Surface Area** | **Time (sec)** |
| Trial 1 |  |
| Trial 2 |  |
| Trial 3 |  |
| **Average:** |  |

Based on your findings above, write a brief conclusion about how surface area affects reaction rates Be sure to include evidence from your data above::

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**Concentration - http://tinyurl.com/mnjc55s**

Develop a hypothesis about concentration and reaction rates: When concentration increases, the reaction rate will ( increase / decrease / stay the same ).

Try three different trials for each of the different concentrations. Time each reaction until completion (completion occurs when all the blue reactants have reacted or are gone):

|  |  |
| --- | --- |
| **Sample of 0.5 Concentration** | **Time (sec)** |
| Trial 1 |  |
| Trial 2 |  |
| Trial 3 |  |
| **Average:** |  |

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| --- | --- |
| **Sample of 1.0 Concentration** | **Time (sec)** |
| Trial 1 |  |
| Trial 2 |  |
| Trial 3 |  |
| **Average:** |  |

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| --- | --- |
| **Sample of 2.0 Concentration** | **Time (sec)** |
| Trial 1 |  |
| Trial 2 |  |
| Trial 3 |  |
| **Average:** |  |

Based on your findings above, write a brief conclusion about how concentration affects reaction rates Be sure to include evidence from your data above::

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**Temperature - http://tinyurl.com/lq6n3jg**

Develop a hypothesis about temperature and reaction rates: When temperature increases, the reaction rate will ( increase / decrease / stay the same ).

Try three different trials for each of the different concentrations. Time each reaction until completion (completion occurs when all of the blue reactants have reacted or are gone):

|  |  |
| --- | --- |
| **Sample at Low Temperature** | **Time (sec)** |
| Trial 1 |  |
| Trial 2 |  |
| Trial 3 |  |
| **Average:** |  |

|  |  |
| --- | --- |
| **Sample at Medium Temperature** | **Time (sec)** |
| Trial 1 |  |
| Trial 2 |  |
| Trial 3 |  |
| **Average:** |  |

|  |  |
| --- | --- |
| **Sample at High Temperature** | **Time (sec)** |
| Trial 1 |  |
| Trial 2 |  |
| Trial 3 |  |
| **Average:** |  |

Based on your findings above, write a brief conclusion about how temperature affects reaction rates Be sure to include evidence from your data above::

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**Pressure/Volume - http://tinyurl.com/lvc248k**

Develop a hypothesis about pressure, volume, and reaction rates: When pressure decreases and volume increases, the reaction rate will ( increase / decrease / stay the same ).

Click “Setup” to prepare the simulation. Click “Start” to begin the simulation. You will be changing the volume parameter to 100, 200, and 400 which you can type in on the right side of the simulation. Feel free to play around with other parameters, but make sure you complete the current assignment first.

Do not go beyond 100 particles for A or B as the computer will not be able to handle that many particles at once.

Try three different trials for each of the increasing volumes (or decreasing pressures). Time each reaction until completion (completion occurs when all A, green, and B, blue, particles turn to P, red, particles ):

|  |  |
| --- | --- |
| **Sample with Volume of 100** | **Time (sec)** |
| Trial 1 |  |
| Trial 2 |  |
| Trial 3 |  |
| **Average:** |  |

|  |  |
| --- | --- |
| **Sample with Volume of 200** | **Time (sec)** |
| Trial 1 |  |
| Trial 2 |  |
| Trial 3 |  |
| **Average:** |  |

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| --- | --- |
| **Sample with Volume of 400** | **Time (sec)** |
| Trial 1 |  |
| Trial 2 |  |
| Trial 3 |  |
| **Average:** |  |

Based on your findings above, write a brief conclusion about how volume and pressure affects reaction rates. Be sure to include evidence from your data above:

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**Analysis**

Based on the simulations that you’ve seen, if you wanted to perform the reaction below, describe what you would do to make it proceed as quickly as possible. (Hint: consider things like temperature, pressure, and concentration; does surface area affect this reaction?)

4NH3(g)+7O2(g)→4NO2(g)+6H2O(l)

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