Name _____

Phet Simulation
Nuclear Fission

Go to Phet Simulations. Find and open the sim called Nuclear Fission
http://phet.colorado.edu/simulations/sims.php?sim=Nuclear_Fission

Click on 'Run Now' and select the tab that says 'Fission: One Nucleus'

Fission: One Nucleus:

Experiment with shooting the neutron gun and watch what happens.

1) What happens when the U-235 nucleus is "hit" with a neutron? There are a number of things that happen here, describe all of them in as much detail as you can. Use the pause button when needed.

Chain Reaction:

Select the "Chain Reaction" tab at the top. Experiment with changing the settings and shooting the neutron gun and watch what happens. Then answer the questions below.

2) Click the 'Reset All' button and then set the initial number of U-235 nuclei to 100 and U-238 to 0. What happens when you fire the neutron gun?

3) Explain what makes this a "chain reaction".

4) Click 'Reset' and then set the initial number of U-238 nuclei to 100 and U-235 to 0. Explain what happens when you fire the gun. Does this cause a chain reaction? Try multiple times to start a chain reaction with the U-238. Explain why this happens.

What is U-239? In what ways is it different from U-238?

5) Set the initial numbers of U-235 nuclei and U-238 nuclei to the numbers in the table below. Record your results.

U-235	**100**	**70**	**50**	**30**	**0**
U-238	**0**	**30**	**50**	**70**	**100**
% of ^{235}U fissioned after 1 firing					
# firings required to fission all ^{235}U					N/A

What happens to the reaction as the proportion of U-238 nuclei increases? Explain why this happens.

6) If you were trying to design the most efficient nuclear fission reactor possible, what ratio of U-235 to U-238 would you want? Explain why.

Nuclear Reactor:

Select the "Nuclear Reactor" tab at the top. Experiment with changing the settings and firing the neutrons and watch what happens. Then answer the questions below.

7) Watch very closely to the fission reactions as they happen. Specifically watch what happens to the loose neutrons after the reaction.
   a) What happens if the neutrons hit another nucleus?

   b) What happens if the neutrons hit a control rod?

8) Compare the chain reaction that occurs when the control rods are inserted further into the reactor versus when they are pulled all/mostly out of the reactor.

9) If the purpose of a nuclear reactor in a power plant is to produce energy, why are there control rods?

10) The bar graphs on the right of the display show the "Power Output" and the "Energy Produced". What is the difference between these two quantities?