

# Nuclear Chemistry

There was a nuclear emergency in Japan on March 11, 2011. The emergency was brought on because the flow of cooling water in nuclear reactors was interrupted. Cooling water interruptions were the cause of the following incidents as well:

- (A) There have been no other situations similar to the Japan situation
- (B) Cooling water was the initial problem at Chernobyl
- (C) Cooling water was the initial problem at 3 Mile Island
- (D) Cooling water was the problem at both Chernobyl and 3 Mile Island

## Look at now: Earthquake and Tsunami:

- <http://video.nytimes.com/video/2011/03/11/world/asia/100000000718996/tc-031111.html>

This first video didn't play in class, you should have a look at it though. - dr mccord

## Look at later: Vlog Brother Explanation:

<http://www.youtube.com/watch?v=rBvUtY0PfB8>

Did a nuclear explosion occur at the Fukushima plant?

A) Yes, but only at 4 of the 6 reactors.

B) No, but experts expect a nuclear explosion to occur if the situation isn't brought under control soon

C) Yes, they all of the reactors have had nuclear explosions to varying degrees

D) No, there have been no nuclear explosions, nor do experts believe that a nuclear explosion will occur at the facility

- Status of the 6 reactors:
- <http://www.nytimes.com/interactive/2011/03/16/world/asia/reactors-status.html>

# Chernobyl-What Happened: April 26, 1986

Operator error – cooling  
water mistake

Explosion

9 tons of nuclear  
material blown into sky  
100 times normal  
background radiation

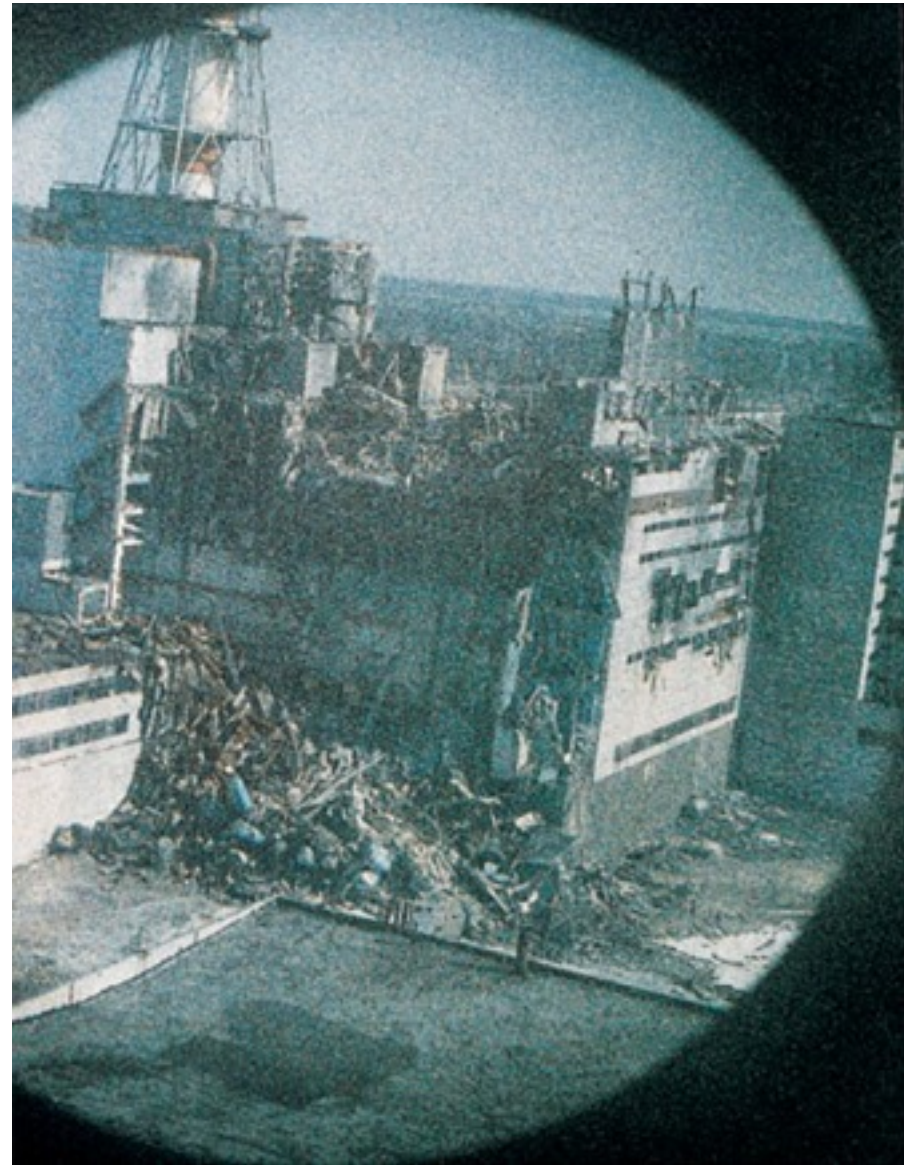


Figure 31. Radiation Hotspots Resulting From the Chernobyl Nuclear Power Plant Accident



If a nuclear explosion would have happened at the power  
plant  
this is what it would have looked like:

[http://www.globalsecurity.org/wmd/ops/  
hiroshima01.htm](http://www.globalsecurity.org/wmd/ops/hiroshima01.htm)





HIROSHIMA PEACE MEMORIAL MUSEUM

Friday, March 8, 13



HIROSHIMA PEACE MEMORIAL MUSEUM

Friday, March 8, 13



Friday, March 8, 13





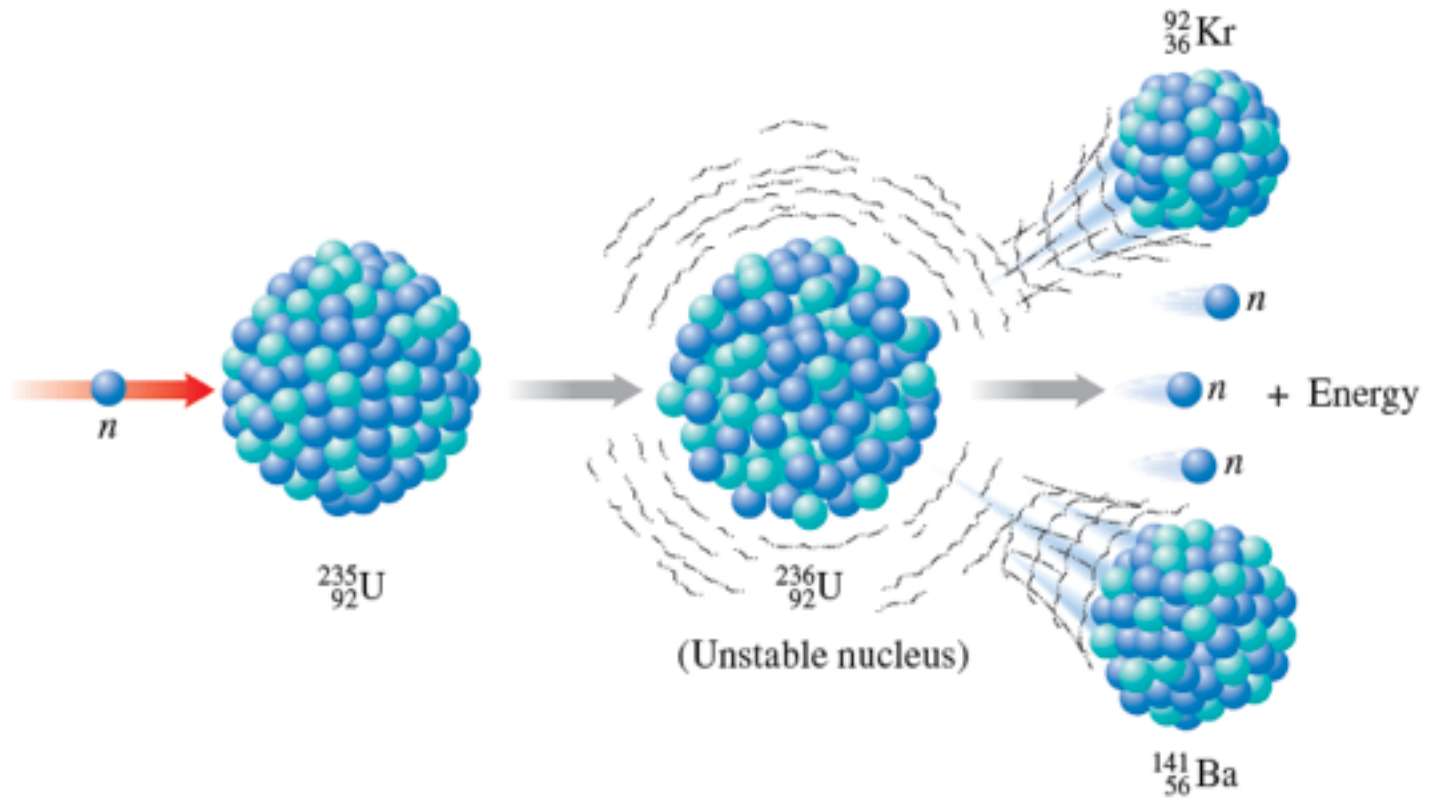
Friday, March 8, 13

Clearly a chemical explosion occurred.

But, we know that nuclear change occurs and that is what produces the heat energy for the nuclear power plant.

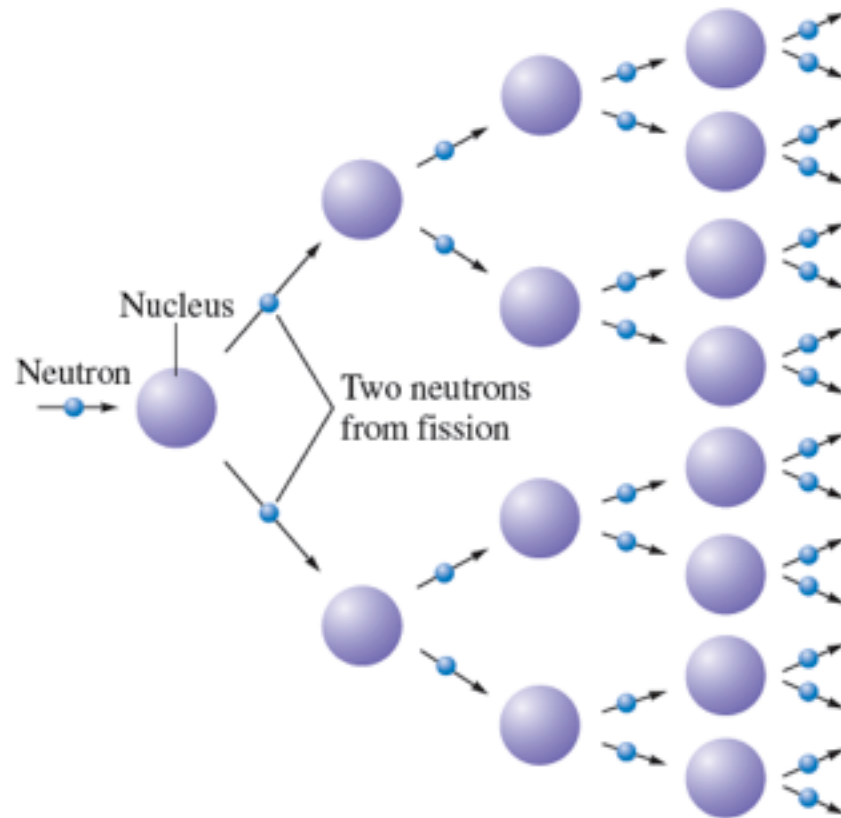
Sort out nuclear change vs nuclear explosion vs chemical changes

- During Fission reactions the number and type of atoms on the left hand side of the equation is
  - A) The **same** as the number and type of atoms on the **right** hand side of the equation, it's just that the atoms have rearranged (Law of Conservation of Mass).
  - B) The type of **atom** on the **right** hand side is the **same**, it is just the **number of atoms** that **changes**



**FIGURE 20.11**

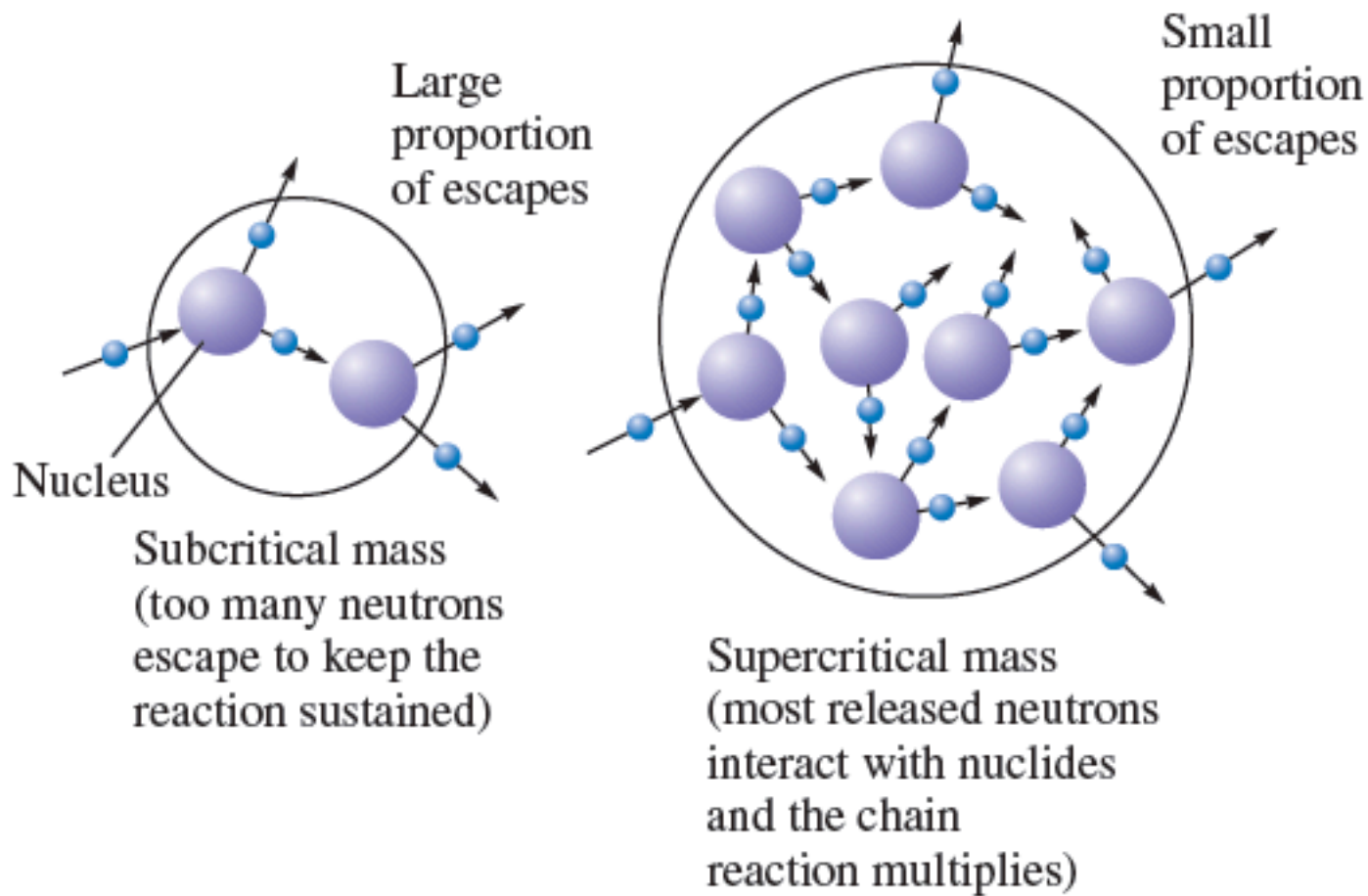
Upon capturing a neutron, the  $^{235}_{92}\text{U}$  nucleus undergoes fission to produce two lighter nuclides, free neutrons (typically three), and a large amount of energy.



**FIGURE 20.12**

Representation of a fission process in which each event produces two neutrons, which can go on to split other nuclei, leading to a self-sustaining chain reaction.





### FIGURE 20.13

If the mass of fissionable material is too small, most of the neutrons escape before causing another fission event; thus the process dies out.