Name ____________________________ Date _________
APES Topic 11 – Energy Resources Mr. Romano

AIM: ____

Uranium Ore Extraction : ____

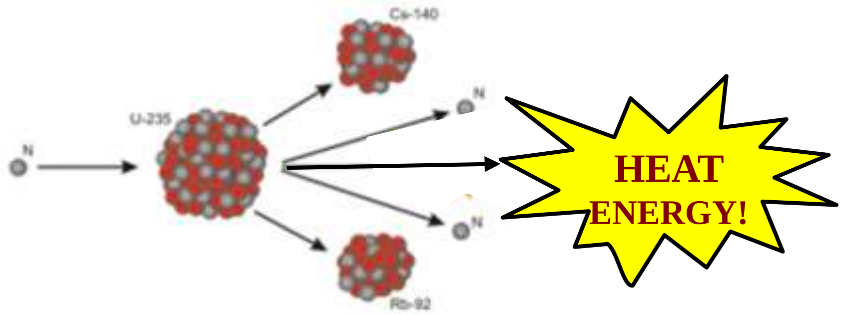
____

Half-Life – the amount of time it takes for half of the atoms in a radioactive material to naturally decay into a more stable decay product (half-life is basically the rate of decay)

The chart below is an oversimplification of the process, but is appropriate for what we need to understand…

Number of Half-Lives	% Radioactive Material Remaining	Radioactive Material / Radioactivity Remaining (grams/curies)	Years using U-235 as an example (half-life = 710 million years)
0	100	512	0
1			
2			
3			
4			
5			

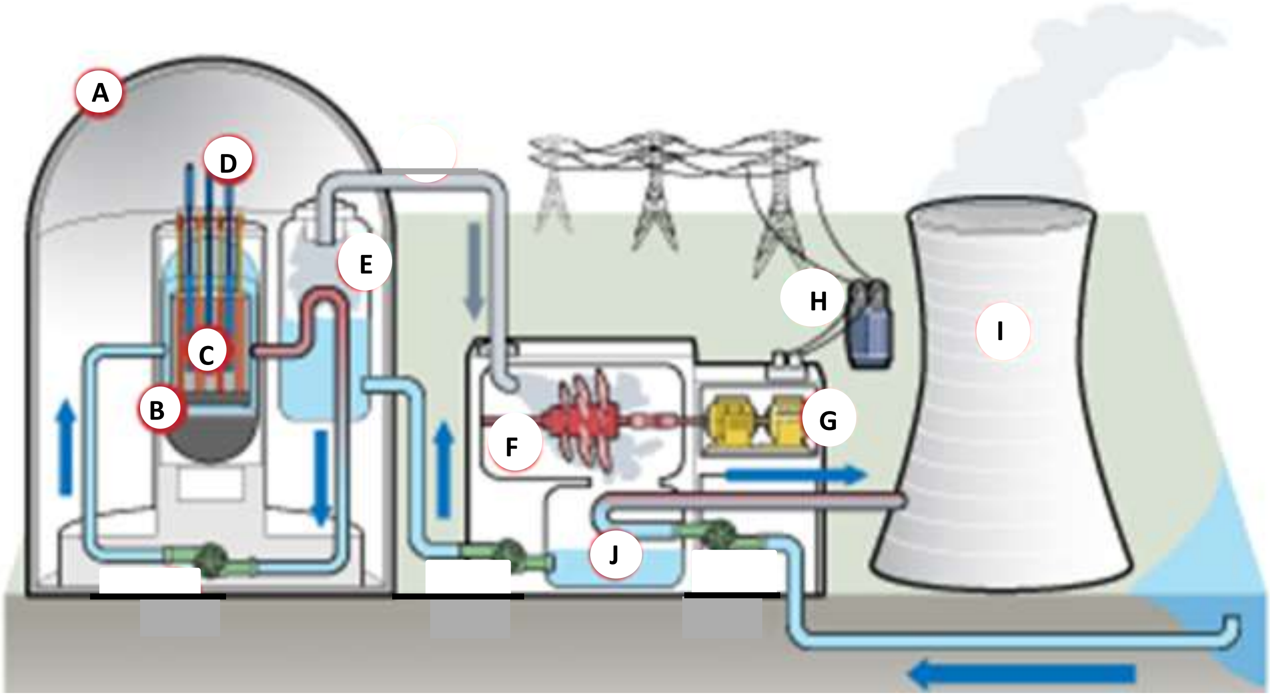
Nuclear Fission –



Uranium Reserves:

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________

Parts of a Nuclear Power Plant



Parts of a Nuclear Power Plant

A ____________________ E ____________________ H ____________________

B ____________________ F ____________________ I ____________________

C ____________________ G ____________________ J ____________________

D ____________________

How it works:

The uranium provides the fuel source for the power plant and the controlled nuclear fission chain-reactions in the reactor core produces heat. Once heat is generated, the rest of the electricity generation process is the same as a convention power plant

Pros of Using Nuclear Power:

1. very high energy yield

2. lowest air pollution
   (no carbon dioxide emissions from nuclear power plant itself)

3. little land disruption

Fuel Type	Energy Density (kWh/kg)
Nuclear Fission (100% U-235)	24,513,889
Natural Uranium (99.3% U-238, 0.7% U-235) in a fast breeder reactor	6,666,667
Enriched Uranium (3.5% U-235) in a light water reactor	960,000
Natural Uranium (99.3% U-238, 0.7% U-235) in a light water reactor	123,056
LPG propane	13.8
LPG butane	13.6
Gasoline	13.0
Diesel fuel/Residential heating oil	12.7
Biodiesel oil	11.7
Anthracite Coal	9.0

Cons of Using Nuclear Power:

1. negative effects associated with the mining industry to acquire the uranium

2. thermal pollution - heat dispersed to surrounding water sources leads to massive fish kills

3. high cost of construction of nuclear power plants

4 nuclear waste storage / disposal (low and high level)
- low-level (contaminated gloves) – designated landfills
- high-level (right now) on site pools with concrete shielding

Nuclear Waste Policy Act of 1982 - the government must develop a high level nuclear waste site (still not done) Yucca Mountain, Nevada?

5. NIMBY (Not In My Backyard) and NIMTOO (Not In My Term Of Office) – cultural fear of nuclear power

6. safety / accidents:
- radiation exposure
- tumors and cancers (thyroid)
- decrease in biodiversity

Three Mile Island, Pennsylvania, March 28, 1978

The partial meltdown at Three Mile Island Unit 2 is considered the most serious nuclear accident in U.S. history, although it resulted in only small radioactive releases.

The accident began with failures in the non-nuclear secondary system, followed by a human-operated relief valve in the primary system that stuck open, which allowed large amounts of nuclear reactor coolant to escape. Plant operators' initial failure to correctly identify the problem compounded it. In particular, a hidden indicator light led to an operator manually overriding the automatic emergency cooling system because he mistakenly believed that too much coolant water in the reactor had caused the steam pressure release. Eventually the reactor was brought under control.

Chernobyl, Ukraine (former Soviet Union), April 26, 1986

Chernobyl is considered the world's worst nuclear disaster to date. It occurred when a sudden surge in power during a reactor systems test resulted in an explosion and fire that destroyed Unit 4. Massive amounts of radiation escaped and spread across the western Soviet Union and Europe. As a result of the disaster, approximately 220,000 people had to be relocated from their homes.

Unit 4 was to be shut down for routine maintenance. A test was conducted to determine the plant equipment's ability to provide sufficient electrical power to operate the reactor core cooling system and emergency equipment during the transition period between a loss of main station electrical power supply and the start-up of the emergency power supply. Workers did not implement adequate safety precautions or alert operators to the electrical test's risks. This lack of awareness led the operators to engage in actions that diverged from safety procedures. Consequently, a sudden power surge resulted in explosions and nearly completes destruction of the reactor. The fires that broke out in the building contributed to the extensive radioactive releases.

Fukushima, Japan, March 2011

An earthquake and tsunami that struck eastern Japan caused a serious accident at the Fukushima nuclear power plant on the northeastern coast of Japan. The earthquake cut off external power to the reactors. The tsunami, which reached levels more than twice as high as the plant was designed to withstand, disabled backup diesel generators, crippling the reactor cooling systems. Battery power was quickly exhausted and overheating fuel in the plant's operating reactor cores led to hydrogen explosions that severely damaged three of the reactor buildings. Fuel in three of the reactor cores melted, and radiation releases from the damaged reactors contaminated a wide area surrounding the plant and forced the evacuation of nearly half a million residents.