

# Nuclear Chemistry Topics

## **Directions:**

Choose a topic related to Nuclear Chemistry that interests you. I have provided a list of topics below to help you identify areas that you find compelling. Many of these categories are very broad, while some are very specific. Feel free to take your study in any direction that you would like. You may also refer to the "Nuclear Power: The Issues" DVD that we watched in class.

## The Manhattan Project

- What was the Manhattan Project? When was it?
- Who was involved? Where was it? What was the purpose of it?
- What was the end result of the Manhattan Project?
- Write the nuclear reaction for the bomb that was developed during the Manhattan Project.
- Opinion – If we could do it all over again, should we have organized the Manhattan Project? Was it a good thing for society? Justify your answer.

## Nuclear Weapons (WWII)

- How many weapons were tested?
- How many weapons were dropped on cities? What cities?
- How many people were killed?
- What was the radioactive material that each bomb used?
- What were the long-term effects in the areas where the bombs were dropped?
- Opinion – Should we have dropped the bombs on Japan in WWII? Why or why not?

## Nuclear Weapons (Now)

- How many countries have nuclear weapons today? Which countries?
- What efforts have been made to make nuclear weapons illegal?
- What is disarmament? Who has been in favor of it? Who has been against it?
- How do nuclear weapons work?
- Write out the nuclear reaction for one type of nuclear weapon that exists today.
- Opinion – Should there be an international ban on nuclear weapons? Why or why not?

## How are nuclear weapons and nuclear energy related?

- Which came first? Nuclear weapons or nuclear energy? Provide a historical timeline comparing dates.
- How does the technology used in nuclear weapons relate to the technology used in nuclear energy? (fusion, fission, what elements and isotopes are needed for nuclear weapons and nuclear power)
- Are nuclear power plants and nuclear waste targets for terrorist activity? Why or why not?
- Why do countries, such as the United States, not want other countries, such as Iran, to have the technology necessary for nuclear power? Discuss uranium enrichment in your answer.
- Opinion – Should all countries be allowed to use nuclear energy, even if that means that they could potentially develop nuclear weapons?

## Nuclear Power Plants

- How many nuclear power plants are there in America?
- What is the closest nuclear power plant to Salem?
- What percentage of America's electricity comes from nuclear power?
- List some reasons why nuclear power is a better energy source than coal.
- List some reasons why nuclear power can be dangerous.
- What is the "fuel" that is used in nuclear plants today?
- Write out the nuclear reaction that is used in nuclear power plants.
- Opinion – When we build a new power plant in the United States, should it be nuclear or coal? Justify your answer.

## **Fusion Power**

- What is fusion power?
- Why do people think it is a better long-term energy source than current nuclear power plants?
- What is one difficulty in creating a fusion reactor?
- By what year do we expect to have operation fusion power plants?
- Write out the nuclear reaction for this type of fusion.
- Opinion – Is fusion the energy source of the future? Why or why not?

## **4<sup>th</sup> Generation Nuclear Reactor**

- What is a 4<sup>th</sup> Generation nuclear reactor?
- Why do people think it is a better long-term energy source than current nuclear power plants?
- What are some difficulties or cons to using a 4<sup>th</sup> Generation nuclear reactor?
- How many 4<sup>th</sup> Generation nuclear reactors are in operation now?
- Opinion – Is the 4<sup>th</sup> Generation nuclear reactors the energy source of the future? Why or why not?

## **Compare nuclear energy to fossil fuels and alternative energy sources.**

- How much energy is generated from a nuclear power plant compared to fossil fuels and alternative energy sources?
- What benefit(s) does nuclear power offer over fossil fuels? What benefit(s) do fossil fuels offer over nuclear power?
- Which sources of energy are most cost effective?
- Why do we not use more alternative sources of energy, such as solar, wind, and hydroelectric?
- Opinion – Should we devote more research dollars to developing more efficient nuclear reactors or to developing solar, wind, and hydroelectric power?

## **Uranium Mining**

- Where do we get uranium to be used in nuclear power plants?
- What isotope of uranium is normally obtained from mining? Can this directly be used in nuclear fuel rods? If not, what must be done to make the uranium usable for nuclear power?
- How much uranium ore is available in the earth's crust? How long will it last in our current consumption levels of nuclear power?
- Political debate has surrounded uranium mining in Danville, VA (approximately 75 mi south of Roanoke, VA). Has uranium mining been approved in Danville? What would be the advantages? What would be the disadvantages?
- Uranium was mined in the Grand Canyon long ago. Were there any environmental impacts there?
- Opinion – Uranium provides high energy output for a very small sample size. Is mining uranium for its concentrated energy potential worth it, even if the environment is impacted?

## **Nuclear Safety**

- In what areas are nuclear power plants allowed to be built? by oceans? by major cities?
- How long does it typically take for a nuclear power plant to be approved and built?
- Since nuclear disasters that occurred in the past, what new precautions been developed to improve nuclear safety?
- What does "meltdown" mean?
- What is "radiation poisoning?"
- Opinion – Should we be building new nuclear power plants? Why or why not?

## **Nuclear Disasters**

Choose a specific disaster, then:

- When did this happen?
- How many people were affected?
- What were/are the long-term effects? Where was it?
- What was the cause of the accident?
- What could have prevented the accident?
- Write the nuclear reaction for the radiation leak.
- Opinion – Should we be building new nuclear power plants? Why or why not?

OR each person in the group could select a different nuclear disaster to research. Instead of going in depth with one particular disaster, you would be giving a broad overview of several different disasters.

## **Nuclear Waste**

- What types of waste occur from nuclear power?
- Where are we currently putting the waste? Where have we put the waste in past? What are some proposals of where we can put the waste in the future?
- How long does nuclear waste "last?" How long does nuclear waste have to be monitored?
- How is nuclear waste transported?
- What affects could nuclear waste have on humans? on the environment?
- What does France do with its nuclear waste?
- Opinion – How should the United States store or use its current nuclear waste? Store it in Yucca Mountain? Use enrichment like France?

## **Nuclear Medicine**

- Choose one specific medical procedure, then:
- Describe the basics of your procedure.
- When was it invented? What is it supposed to do?
- Describe how your procedure works.
- Write the nuclear reaction that is used in your procedure.
- Opinion – Should we be using radiation to treat and diagnose patients? Why or why not?

## **Nuclear Chemistry**

- What exactly happens to a radioactive nucleus in beta decay?
- What are other particles that can be involved in nuclear decay? specifically positrons, cosmic rays, neutrinos
- Is the Law of Conservation of Mass always followed in nuclear reactions? Specifically, what is the relationship between mass and energy?
- Opinion – If you could rewrite the “Law of Conservation of Mass,” what would you write it to state?