*Complete the following worksheet using the Nuclear Energy Power Point.*

[Page #s in the PPT are indicated to the right of each question]

1) Distinguish between chemistry and physics in regard to which part of the atom is stressed. [pp 3-4]

2) The nucleus is made up of \_\_\_\_\_ and \_\_\_\_\_ (nuclear particles). [p 5]

3) Isotopes contain the same number of \_\_\_\_\_ but a different number of \_\_\_\_\_. [p 6]

4) Give two isotopes of the helium atom using symbols and numbers. Label the atomic number and mass for both isotopes in the appropriate places. [pp 6 - 7]

 5) Circle the properties that are **different** between two isotopes of the same element: [pp 6-8]

 a. mass b. chemical properties c. # of protons d. # of neutrons e. # of electrons

6) How many protons are in 6C14? \_\_\_\_\_ How many neutrons? \_\_\_\_\_ [pp 8]

7) How radioactive is a gram of carbon in a living plant? \_\_\_\_\_\_beta emissions/minute [p 9]

8) What is the half-life of Carbon 14 \_\_\_\_\_ years? How long would it take for a sample to drop to one half of its present amount? \_\_\_\_\_ years One quarter of its present amount? \_\_\_\_\_ years One eighth of its present amount? \_\_\_\_\_ years [pp 12 - 13]

9) If our body contains 400 grams of Carbon 14, how many years would it take to only have 25 grams (TIPS?) [p 14]

10) Complete the table below showing nuclear radiation particles. [p 16-18]

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Type of Radiation |  | Name of Particle |  | Travel Range |  | Outside Forces |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

11) What type of radiation is given off by radium and radon as it transmutates into lead? [p 19]

12) What famous scientist discovered radium and won the Noble Peace Prize in Physics? Where did she find the radium? [p 20]

13) What happens when alpha particles come near positively charged particles? When they come near negatively charged particles? [p 21]

14) What potentially harmful element accumulates in house basements as a result of radium decaying? [pp 22 - 24]

15) What is the term used for nuclear particles which possess only the nucleus of the atom without its electrons? [pp 26 - 28]

16) Compare the amount of energy released in a nuclear reaction to a chemical reaction. [p 31]

17) What does each symbol in the equation: E = mc2 represent (“m” is not simply "mass")? [pp 32-35]

 E 🡪

 m 🡪

 c 🡪

18) Write the symbols and names for the two isotopes that work well to produce energy by nuclear fission? [p 39]

 a. b.

19) In order to split the Uranium 235 nucleus (fission), a \_\_\_\_\_ bombards it and begins a \_\_\_\_\_ reaction. [pp 40 - 41]

20) To keep the neutrons from just bouncing off the Uranium 235 nucleus, a \_\_\_\_\_ is used to slow down the neutrons before they make impact. [p 42]

21) American nuclear power reactors use \_\_\_\_\_ as a moderator. The Chernobyl reactor in Russia used \_\_\_\_\_ as a moderator, which led to disaster. [p 43]

22) Name three important components of electricity production using nuclear fission. [pp 44 - 45]

 a. b. c.

23) \_\_\_\_\_ can be used as a moderator, coolant and storage material for nuclear fuel rods. [p 47]

24) Only \_\_\_\_% of Uranium on earth is U235. It takes \_\_\_\_\_% of U235 to make a nuclear reactor produce nuclear fission. It would take \_\_\_\_% to make a nuclear bomb. [p 50]

24) A "breeder" reactor can “enrich” abundant U238 into \_\_\_\_\_, a highly fissionable isotope often used to make nuclear weapons. [pp 52 - 55]

25) Presently nuclear \_\_\_\_\_\_\_\_\_\_ is stored temporarily on-site, but may eventually be permanently stored at a facility like \_\_\_\_\_\_\_\_\_\_\_ mountain in Nevada. [pp 56 – 58]

Answer Key for Nuclear Energy Worksheet

1) Distinguish between chemistry and physics in regard to which part of the atom is stressed. [pp 3-4]

 **Chemistry focuses on the electrons of the atoms to determine properties and reactivity while Physics focuses on the nuclear particles**

2) The nucleus is made up of **protons** and **neutrons** (nuclear particles). [p 5]

3) Isotopes contain the same number of **protons** but a different number of **neutrons** [p 6]

4) Give two isotopes of the helium atom using symbols and numbers. Label the atomic number and mass for both isotopes in the appropriate places. [pp 6 - 7]

Atomic mass

 2He4 2He5

Atomic number

 5) Circle the properties that are **different** between two isotopes of the same element: [pp 6-8]

 **a. mass d. # of neutrons**

6) How many protons are in 6C14? **6** How many neutrons? **8** [pp 8]

7) How radioactive is a gram of carbon in a living plant? **15.3** beta emissions/minute [p 9]

8) What is the half-life of Carbon 14 **5730** years? How long would it take for a sample to drop to one half of its present amount? **5730** years One quarter of its present amount? **11,460** years One eighth of its present amount? **17,190** years [pp 12 - 13]

9) If our body contains 400 grams of Carbon 14, how many years would it take to only have 25 grams? [p 14]

**400 grams 🡪 200 grams 🡪 100 grams 🡪 50 grams 🡪 25 grams = 4 half-lives**

10) Complete the table below showing nuclear radiation particles. [p 16-18]

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Type of Radiation |  | Name of Particle |  | Travel Range |  | Outside Forces |
|  |  |  |  |  |  |  |
| **Alpha** |  | **Helium** |  | **short** |  | **High ioniz** |
| **Beta** |  | **Electron** |  | **longer** |  | **Lower ioniz** |
| **Gamma** |  | **Photon** |  | **long** |  | **No ionization** |
| **Neutron**  |  | **Neutron** |  | **longest** |  | **Lower ioniz** |

11) What type of radiation is given off by radium and radon as it transmutates into lead? [p 19]

**alpha**

12) What famous scientist discovered radium and won the Noble Peace Prize in Physics? Where did she find the radium? [p 20]

**Madame Marie Curie**

13) What happens when alpha particles come near positively charged particles? When they come near negatively charged particles? [p 21]

 **Alpha particles will repel positive charges while attracting negative charges**

14) What potentially harmful element accumulates in house basements as a result of radium decaying? [pp 22 - 24]

**radon**

15) What is the term used for nuclear particles which possess only the nucleus of the atom without its electrons? [pp 26 - 28]

**nuclides**

16) Compare the amount of energy released in a nuclear reaction to a chemical reaction. [p 31]

 **Nuclear reactions possess millions of times more energy than chemical reactions**

17) What does each symbol in the equation: E = mc2 represent (“m” is not simply "mass")? [pp 32-35]

 E 🡪 **energy**

 m 🡪 **the mass of the nucleus after the nuclear reaction has taken away smaller masses**

 c 🡪 **speed of a photon or light**

18) Write the symbols and names for the two isotopes that work well to produce energy by nuclear fission? [p 39]

 a. **92U235** b. **94Pu239**

19) In order to split the Uranium 235 nucleus (fission), a **neutron** bombards it and begins a **chain** reaction. [pp 40 - 41]

20) To keep the neutrons from just bouncing off the Uranium 235 nucleus, a **moderator** is used to slow down the neutrons before they make impact. [p 42]

21) American nuclear power reactors use **water** as a moderator. The Chernobyl reactor in Russia used **graphite** as a moderator, which led to disaster. [p 43]

22) Name three important components of electricity production using nuclear fission. [pp 44 - 45]

 a. **boiling water** b. **steam turns turbine generator** c. **generator produces electricity**

23) **Water** can be used as a moderator, coolant and storage material for nuclear fuel rods. [p 47]

24) Only **0.7** % of Uranium on earth is U235. It takes **3** % of U235 to make a nuclear reactor produce nuclear fission. It would take **90** % to make a nuclear bomb. [p 50]

24) A "breeder" reactor can “enrich” abundant U238 into **plutonium**, a highly fissionable isotope often used to make nuclear weapons. [pp 52 - 55]

25) Presently nuclear **waste** is stored temporarily on-site, but may eventually be permanently stored at a facility like **Yucca** mountain in Nevada. [pp 56 – 58]