Unit 2 HW Packet - Atomic Structure

**HW#1**

1. State the subatomic particle that is described in each of the following statements.

\_\_PROTON\_\_+1 charge

\_\_NEUTRON\_ No Charge

\_\_ELECTRON\_-1 charge

\_ELECTRON\_\_found outside nucleus

PROTON & NEUTRON\_\_found inside nucleus

ELECTRON\_\_least massive

# What is an Atom?

1. How many protons are found in 12C? \_\_\_**6**\_\_\_\_\_\_\_ 13C? \_\_\_\_**6**\_\_\_\_\_\_ 13C- ? \_\_\_\_\_**6**\_\_\_\_\_
2. How many neutrons are founds in 12C? \_\_\_\_**6**\_\_\_\_\_\_ 13C? \_\_\_\_\_**7**\_\_\_\_\_ 13C- ? \_\_\_\_\_**7**\_\_\_\_\_
3. How many electrons are found in 12C? \_\_\_\_\_**6**\_\_\_\_\_ 13C? \_\_\_\_**6**\_\_\_\_\_\_ 13C- ? \_\_\_\_\_**7**\_\_\_\_\_
4. Based on the data presented above,
   1. What do all carbon atoms (and ions) have in common? **All have 6 protons**
   2. What do all hydrogen atoms (and ions) have in common? **All have 1 proton**
5. What is the significance of the atomic number? Where will you find it on the periodic table? **Atomic number signifies the number of protons. Top number in the symbol’s box.**
6. Look at a periodic table, what do all nickel (Ni) atoms have in common? **All Ni atoms have 28 protons**
7. How is the mass number determined? **Number of protons + neutrons**
8. What structural feature is different in isotopes of a particular element? **Different # of neutrons**
9. What feature distinguishes a neutral atom from an ion? **Ions have a charge. Neutral = no charge**
10. Where is most of the mass of an atom, within the nucleus or outside of the nucleus? Explain your reasoning**. INSIDE the nucleus. Protons and neutrons are heavier than electrons.**
11. Complete the chart below:

|  |  |  |  |
| --- | --- | --- | --- |
| **Isotope** | **Atomic Number (Z)** | **Mass Number (A)** | **Number of Electrons** |
| **31P** | **15** | **31** | **15** |
| **18O** | **8** | **18** | **8** |
| **39K** | **19** | **39** | **18** |
| **58Ni2+** | **28** | **58** | **26** |

13. How many electrons, protons, and neutrons are found in each of the following?

|  |  |  |  |
| --- | --- | --- | --- |
| Atom or ion | **Electrons** | **Protons** | **Neutrons** |
| 24Mg | **12** | **12** | **12** |
| 23Na+ | **10** | **11** | **12** |
| 35Cl | **17** | **17** | **17** |
| 35Cl- | **18** | **17** | **17** |
| 56Fe3+ | **23** | **26** | **30** |
| 15N | **7** | **7** | **8** |
| 16O2- | **10** | **8** | **8** |
| 27Al3+ | **10** | **13** | **14** |

14. Complete the chart below:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Isotope | Protons | Neutrons | Mass Number | Electrons | Nuclear Notation |
| K-40 | 19 | 21 | 40 | 19 |  |
| Li-6 | **3** | **3** | **6** | **3** |  |
| **He-3** | 2 | 1 | **3** | **2** | ***3***  ***2***  ***He*** |
| **I-131** | **53** | **78** | **131** | **53** |  |
| **Sr-90** | **38** | **52** | 90 | 38 | ***Sr***  ***90***  ***38*** |

**HW#2**

**Atomic Emission Spectrum of the Bohr Hydrogen Atom**

1. In which transition is the most energy released?
2. n = 3 to n = 2
3. n = 3 to n = 1
4. n = 5 to n = 2
5. n = 1 to n = 3
6. Which transition required the largest quanta of energy input?
7. n = 2 to n = 4
8. n = 1 to n = 2
9. n = 2 to n = 1
10. n = 4 to n = 1
11. a) What wavelength of light is produced during a transition from n = 5 to n = 2?

\_\_\_\_\_\_\_\_**434**\_\_\_\_\_\_\_\_\_\_\_\_\_\_ nm = \_\_\_\_\_\_\_\_**4.34 x 10-7**\_\_\_\_\_\_\_\_\_\_\_\_\_\_ m  
  
b) What color is the light that is released?  Color = \_\_\_\_\_\_\_**BLUE**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. a) What wavelength of light is produced during a transition   
    from n = 3 to n = 2?   \_\_\_\_**656**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ nm = \_\_\_\_\_\_**6.56 x 10-7**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ m  
     
   b) What color of light does this correspond to?   Color = \_\_\_\_\_**RED**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. If violet light of wavelength 4.1 x 10-7 m is released, what transition did the electron make?

n = \_\_\_\_\_**6**\_\_\_\_\_ to  n = \_\_\_\_**2**\_\_\_\_\_\_

1. Put in order from lowest to highest frequency:
   1. Radio waves, gamma rays, IR, X-rays, UV, Microwaves  
      **Radio, Microwaves, IR, UV, X-rays, Gamma**
   2. Blue, Red, Violet, Orange

**Red, Orange, Blue, Violet**

1. Put in order from lowest energy to highest energy:

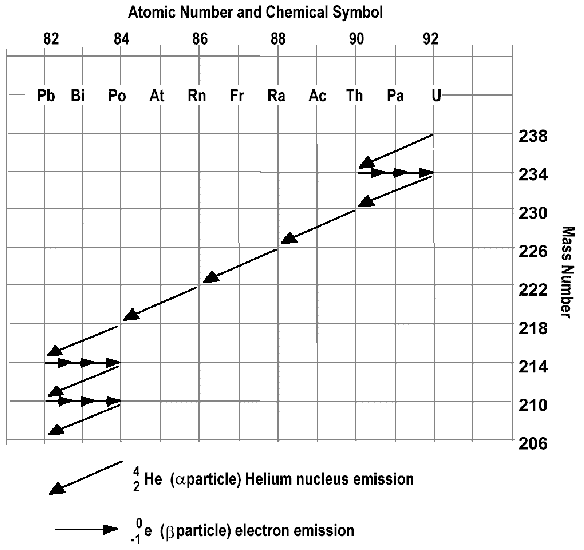
- Gamma Rays, IR, Radio Waves, UV, Red light, Violet Light **Radio, IR, Red light, Violet Light, UV, Gamma**

**HW#3**

**Nuclear Chemistry Homework**

*Using your knowledge of nuclear chemistry, write the equations for the following processes:*

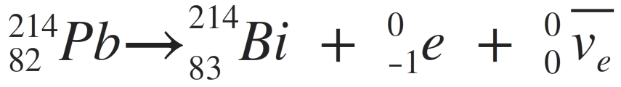
1) The alpha decay of radon-219

 http://www.bbc.co.uk/staticarchive/8ee333f1783d861b6561384678cda56b9b24bc2d.gif

http://img.sparknotes.com/content/testprep/bookimgs/sat2/chemistry/0002/chemistry11.gif2) The beta decay of uranium-233

http://4.bp.blogspot.com/-yt1OWXvxEYI/VU5YdszlA9I/AAAAAAAAyfk/8LiEEcA9tQg/s1600/equation4.gif3) Use the disintegration series to write a decay equation for:

a) Ra-226

 b) Pb-214

4) What is the difference between nuclear fusion and nuclear fission? Fission is the SPLITTING of atoms. Fusion is the COMBINING of atoms.

5) Name three uses for nuclear reactions. **Atomic Bombs, medical treatments (i.e. radiation), smoke detectors, dating fossils**

**Radioactivity and half-life questions**

1. What is *a radioactive isotope\_*\_**An isotope of an atom that is unstable and will emit energy in the form of alpha, beta, and/or gammy rays.**

2. What is radioactive decay? \_**The process an atom undergoes as it loses energy. As it is undergoing decay, the atom is considered radioactive.**

3. What is *half-life*? **The amount of time it takes for half of the atoms in a given sample to undergo decay**.

4. If we start with 400 atoms of a radioactive substance, how many would remain after one half life?\_\_\_**200**\_\_\_\_\_\_

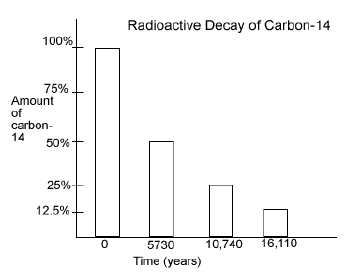
after two half-lives? \_\_**100**\_\_\_\_\_\_\_ after three half-lives? \_\_**50**\_\_\_\_\_\_\_ after four half lives? \_\_\_\_**25**\_\_\_\_

5. If we start with 48 atoms of a radioactive substance, how many would remain after one half life?\_\_\_**24**\_\_\_\_\_\_

after two half-lives? \_\_**12**\_\_\_\_\_\_\_ after three half-lives? \_\_\_\_**6**\_\_\_\_\_\_\_ after four half lives?\_\_\_**3\_**\_\_\_

6. If we start with 16 grams of a radioactive substance, how much will remain after three half-lives?\_\_\_**2 g**\_\_\_\_\_

7. If we start with 120 atoms of a radioactive substance, how many will remain after three half-lives?\_\_**15 g**\_\_\_\_\_\_



*Use the following graph to answer questions 8-11…*

8. How long is a half-life for C-14?\_\_\_**5730 yrs**\_\_\_\_\_\_\_\_\_

9. If only 25% of the carbon-14 remains, how old is the material containing the carbon-14? \_\_**10,740 yrs**\_\_\_\_\_\_

10. If a sample originally had 120 atoms of C-14, how many atoms will remain after 16,110 years? \_\_**15 atoms**\_\_\_\_\_

11. If a sample known to be about 10,740 years old has 400 carbon-14 atoms, how many atoms were in the sample when the organism died? \_\_**1600 atoms**\_\_\_\_\_\_\_

12. Which type of nuclear radiation (beta particles, gamma rays, or alpha particles) can be blocked by…

a) a piece of paper \_\_**alpha**\_\_\_\_\_\_\_\_\_\_ b) a sheet of aluminum \_\_\_\_**beta**\_\_\_\_\_ c) a piece of lead \_\_**gamma**\_\_\_\_\_\_\_\_\_\_

*Use the following chart to answer questions 13-16…*

|  |  |
| --- | --- |
| **Radioactive Substance** | **Approximate half-life** |
| Radon-222 | 4 days |
| Iodine-131 | 8 days |
| Radium-226 | 1600 years |
| Carbon-14 | 5730 years |
| Plutonium-239 | 24,120 years |
| Uranium-238 | 4,470,000,000 |

13. If we start with 8000 atoms of radium-226, how much would remain after 3,200 years? \_\_\_**2000 atoms**\_\_\_\_\_\_\_

14. If we start with 20 atoms of plutonium-239, how many would remain after 48,240 years? \_\_**5 atoms**\_\_\_\_\_\_\_\_

15. If we start with 60 atoms of uranium-238, how many remain after 4,470,000,000 years? \_\_**30 atoms\_\_\_\_\_\_\_**

# 16. If we start with 24 atoms of iodine-131, how many remain after 32 days? \_1.5 atoms\_\_\_\_\_\_\_\_\_\_