**Homework #1: Chemistry 1013 Spring 2015**

**Due Wednesday 4 February in class 15 pts**

**Your name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 pt**

1. Order the masses of the particles below from lightest to heaviest (listed left to right):
2. **neutron b) helium atom c) water molecule d) electron**

**LIGHTEST \_\_\_d\_\_ < \_\_\_a\_\_\_ < \_\_b\_\_\_< \_\_\_c\_\_\_\_ HEAVIEST**

1. If an orange has a diameter of 3 inches and we assign it to be the nucleus of an atom

how many miles away do we expect the orbit of the electrons to begin ? (show work or no credit) 2 pts

100,000/1= x(in)/3(in)

X=300,000 inches = 300,000\*1 ft/12 in \* 1 mile/5280 ft = 4.7 miles

1. Fill in the missing information about the elements below: (2 pts/line)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Atomic # | Element symbol | Mass  Number | # protons | # neutrons | # electrons | Net  charge |
| 20 | Ca | 32 | 20 | 12 | 20 | 0 |
| 50 | Sn | 120 | 50 | 70 | 50 | 0 |
| 33 | As | 78 | 33 | 45 | 36 | -3 |

4a) The volume, V, of a sphere follows the recipe: V= 4πr3/3, where r is the radius of the sphere.

Given that the radius of a nucleus is about 10-15 m and radius of an electron orbit is about 10-10m

compute the ratio Ve/Vn of the electron orbit volume Ve to the nuclear volume Vn. (2 pts. show

work or no credit)

Ve/Vn = re3/rn3 =(10-10)3/(10-15)3 = 1015

Ve/Vn=\_\_\_1015\_\_\_\_\_\_\_\_

(or Vp/Ve =10-15)

4b) The mass mp of the proton in Hydrogen atoms is 1.66\*10-24  grams. What is the density dp of a

proton if it obeys the formula: dp = mp/Vn g/m3 (2 pts. show work or no credit)

V­p =4/3 πrp3 =4/3\*π\*(10-15)3 4.19\*10-45 m3

d=mp/Vp = 1.66\*10-24 g/4.19\*10-45 m3 =3.96\*1020 g/m3~ 4\*1020

(if used the incorrect formula: V= π/3 r3…would get 1.6\*1021)

dp = mp/Vn =\_\_4\*1020\_\_\_\_

4c) Which object below most closely matches the proton’s density? (circle answer) 1 pt

**neutron star Sun lead water**

**~1.5\*1021**  ~1.6\*108  1.2\*107 1\*106 g/m3