

Name: \_\_\_\_\_

Date: \_\_\_\_\_



**Cornell University**  
Prison Education Program

## Conceptual Physics Homework Packet 4

**Due: April 20, 2018**

The content in this homework relates to material covered in class 9 (atomic/particle theory and light) and 10 (fields of force).

1. *Light and Matter*, Chapter 17 (Sections 1)
2. *Light and Matter*, Chapter 19 (Sections 3 and 4)
3. *Light and Matter*, chapter 26 (Sections 1 and 4)
4. *Light and Matter*, Chapter 22 (Sections 1 to 3):

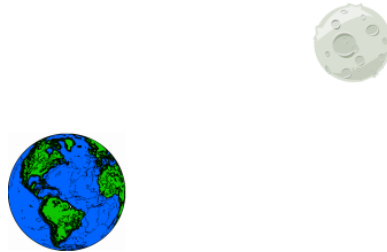
Periodic Table of the Elements																		18 VIIIA 8A			
<div>Atomic Number</div> <div>Symbol</div> <div>Name</div> <div>Atomic Mass</div>																		2			
1 1A 1A H Hydrogen 1.008																	He Helium 4.003				
3 Li Lithium 6.941	4 Be Beryllium 9.012															5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180
11 Na Sodium 22.990	12 Mg Magnesium 24.305															13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.066	17 Cl Chlorine 35.453	18 Ar Argon 39.948
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.88	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.933	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.723	32 Ge Germanium 72.61	33 As Arsenic 74.922	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 84.80				
37 Rb Rubidium 84.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.94	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.906	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.71	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.904	54 Xe Xenon 131.29				
55 Cs Cesium 132.905	56 Ba Barium 137.327	57-71		72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.967	80 Hg Mercury 200.59	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium [209]	85 At Astatine [210]	86 Rn Radon 222.018			
87 Fr Francium 223.020	88 Ra Radium 226.025	89-103		104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [268]	110 Ds Darmstadtium [289]	111 Rg Roentgenium [272]	112 Cn Copernicium [277]	113 Nh Nihonium [284]	114 Fl Flerovium [289]	115 Uup Ununpentium [288]	116 Lv Livermorium [293]	117 Uus Ununseptium [294]	118 Uuo Ununoctium [294]			
<div>Lanthanide Series</div> <div>Actinide Series</div>																					
<div>Alkali Metal</div> <div>Alkaline Earth</div> <div>Transition Metal</div> <div>Basic Metal</div> <div>Semimetal</div> <div>Nonmetal</div> <div>Halogen</div> <div>Noble Gas</div> <div>Lanthanide</div> <div>Actinide</div>																					

© 2014 Todd Helmenstine  
sciencememes.org

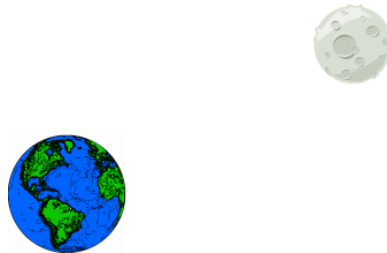
1. (6 points) (a) What is the difference between an *elementary* and a *composite* particle?  
  
(b) List 2 *elementary particles*:  
  
(c) List 2 *composite particles*:
2. (6 points) Plutonium-240 ( $Pu^{240}$ ) decays by emitting a helium-4 nucleus.  
(a) How many protons are in plutonium-240?  
  
(b) How many neutrons are in plutonium-240?  
  
(c) When a plutonium-240 nucleus decays and emits a helium-4 nucleus, what element does it turn into? How many protons and neutrons are in this nucleus?
3. (4 points) Primordial light from the big bang continues to exist in our universe, but it has been highly *red-shifted* due to the universe's expansion, to the point that it is in the microwave region. This is known as the *cosmic microwave background* (CMB) and physicists are highly interested in measuring it because we can use it as a probe of the early universe.  
(a) In the past, was the *frequency* of the CMB greater, smaller or the same as it is now?  
  
(b) In the past, was the *wavelength* of the CMB greater, smaller or the same as it is now?

4. (10 points) There is a gravitational field surrounding the Earth and Moon.

(a) Using field lines, draw the gravitational field around the Earth and Moon.



(b) Using a “field of arrows”, draw the gravitational field around the Earth and Moon.



(c) There is a point at which the gravitational field is zero. Indicate this point on each of the above diagrams for part (a) and (b).

(d) What force would a test mass experience at the location where the gravitational field is zero?

5. (6 points) When you stand on the surface of the Earth, you experience the full strength of its gravitational field.

(a) What happens to the strength of this gravitational field, if you were to dig deep into the Earth? (Does it increase, decrease, or stay the same?) Please explain your reasoning. Hint: Think about what is generating the gravitational field, and think about the pull of the earth beneath and *above* you as you did deeper.

(b) What is the strength of the Earth's gravitational field, at the center of the Earth?

(c) From this reasoning, draw the gravitational field (as arrows or lines, whichever you prefer) for a hollow sphere using the cross-section provided bellow.

