Exam 3 Homework – Due March 29th
Chapters 7-10, **8 points total**. (Questions / Problems – Show your work where necessary!)

1. What does a negative force mean when calculating the electric force between two charges?
2. Two objects are separated by 1 meter and each has a positive charge. Describe what happens to the electric force when a) the total charge of one object is doubled; b) the distance between the objects is doubled; c) the distance between the objects is halved; d) one of the objects acquires a negative charge instead.
3. A droplet of ink in an ink-jet printer has a charge of 1.6 x 10^{-10} C. How many electrons does this charge represent? If the electric field between the paper and the ink droplet is 4 x 10^6 N/C, what force is applied to the droplet?
4. Find the voltage change when an electric field does 12 J of work on a charge of 0.0001 C.
5. Find the current drawn by a 1200W hair drier connected to a 120V outlet.
6. What two advantages do parallel circuits have over series circuits?
7. As more and more bulbs are connected in series to a flashlight battery, what happens to the brightness of each bulb? Assuming that heating inside the bulb is negligible, what happens to the brightness of each bulb when more and more bulbs are added to a parallel circuit?
8. Why do electrical circuits in homes require circuit breakers or fuses?
9. Distinguish between these different parts of a wave: amplitude, wavelength, frequency and period. What is the relationship between frequency, wavelength and speed?
10. Does the medium in which a wave travels move with the wave? Explain your answer.
11. What is the principle difference between a radio wave, light and x-rays?
12. Describe the relationship between wavelength and frequency for electromagnetic radiation.
13. A radar installation uses waves with a 3 cm wavelength. a) What is the frequency of the radar pulse? b) How long would it take for the installation to receive a return pulse from an object 100 km away?
14. Explain the Doppler Effect for sound.
15. If the Andromeda Galaxy is 2,000,000 light years away from us, how far is that in meters?
16. The wavelength of light changes as light goes from one medium to another but its frequency remains the same. Is the wavelength of light greater or less in water than in air? In air than in a vacuum? Explain your answers in terms of the equation v = λf.
17. How do interference experiments show that light is a wave? How does the photoelectric effect show that light is a particle? Which is correct?
18. Why is it impossible to see an atom with visible light?
19. What is the definition of atomic number? Atomic mass? Mass number?
20. What was Planck's quantum hypothesis?
21. Why do we say that atomic spectra are like fingerprints?
22. Explain how the atomic spectrum for a Hydrogen atom is formed.
23. If two protons and two neutrons are removed from the nucleus of an oxygen atom, a nucleus of which element remains?
24. Describe alpha, beta and gamma radiation. Where does radiation come from?
25. What is meant by radioactive half-life? What is the half-life of U-238? C-14?
26. An atom of uranium (m = 232.03174 amu) decays into an atom of thorium (m = 228.02873 amu) plus an atom of helium (m = 4.00260 amu). What is the total energy released in joules?
27. What is the half-life of a material if the amount of the substance is reduced from 160 g to 10 g in 8 hours?
28. If a sample of a radioactive isotope has a half-life of 10 years, how much of the original sample remains after 20 years? After 50 years? After 100 years?
29. How old would a wooden artifact be if the radioactive intensity of the Carbon-14 in the sample is only 12.5% of that measured in a fresh sample of wood?
30. Describe the processes of nuclear fusion and nuclear fission.