

Physics 100 HW 14: This assignment will not be collected. Some questions similar to those on this assignment will be on the final exam (on 5/11/2007 @ 2:15PM).

1. How can you tell if there is hydrogen near the surface of a star?
2. How could you use the fact that there is hydrogen near the surface of a star to determine whether the star is moving towards us or away from us?
3. What does Pauli's Exclusion Principle exclude?
4. There are three long-lived isotopes of carbon: ^{12}C and ^{13}C , which are stable, and ^{14}C , which has a half-life of 5,730 years. Sketch them, showing the number of neutrons and protons.
5. The ^{14}C isotope of carbon transmutes into the ^{14}N isotope of nitrogen via radioactive beta-decay with a half life of 5,700 years.
 - i Write down the reaction equation, indicating all particles that are produced in the decay.
 - ii Suppose you start out with 1×10^{12} ^{14}C nuclei. How many are remaining after 17,100 years?
6. What nuclear reaction is the source of energy in the Sun?
7. What particle was hypothesized by Pauli to be produced in β -decay and responsible for the apparent non-conservation of energy that was seen in these processes?
8. Some scientists have proposed the nuclear reaction as a new source of nuclear energy:
 $X + {}^3_2\text{He} \rightarrow {}^4_2\text{He} + {}^1_1\text{H} + {}^1_1\text{H}$. What is X ?
9. How many neutrons are in ${}^{235}_{92}\text{U}$? ${}^{238}_{92}\text{U}$?

10. What are some differences between leptons and hadrons? Name two hadrons. Name two leptons.
11. How many different types of quarks are there? What are their names?
12. What quarks make up a proton? a neutron?
13. What quark combinations make up a π^+ meson?
14. What is the antiparticle of the electron? What is its mass?
15. What is the antiparticle of the proton? What is its mass?
16. What happens when matter and antimatter meet?
17. *The final exam will also have a questions like the following concerning the individuals who made important contributions to our current understanding of physics.*

Match the person in column A with the subject in column B that he or she is most closely associated.

A) Person	(answer)	B) Subject
a) Emmy Noether	-----	1. Wave theory of light
b) Isaac Newton	-----	2. Predicted existence of antimatter
c) Niels Bohr	-----	3. Conservation laws and symmetry
d) Paul Dirac	-----	4. Only 1 electron per quantum state
e) Ernest Rutherford	-----	5. Wave equation for particles
f) Erwin Shroedinger	-----	6. Laws of motion
g) Albert Einstein	-----	7. Law of Electromagnetic Induction
h) Wolfgang Pauli	-----	8. Atomic nucleus
i) Michael Faraday	-----	9. Theory of relativity
j) James Maxwell	-----	10. Atomic energy levels