Quiz 7; Phys 100 Name _____

1. (4 points) Which force is stronger between two protons separated by 10^{-15} m (about the distance between neighboring protons in an atomic nucleus), the electric or the strong force? What evidence do you have for your answer?

Answer: The strong force. At that distance the repulsion between two protons with the same electric charge is immense, but they stay together in a nucleus. So the strong force must be strong enough to overcome the electrical repulsion

2. (3 points) What does the theory of the strong nuclear force explain?

(a) *Only* the puzzle of the existence of multi-proton nuclei

(b) The fact that neutrons have no electric charge

(c) The fact that life is rare in the galaxy

(d) A wide range of facts concerning the atomic nucleus and nuclear reactions

(e) *Only* the reason that a fusion bomb is more devastating than a fission explosion.

3. (4 points) Starting with 64 grams of radon, which has a half-life of 4 days, how much will remain after 12 days?

Answer: 12 days is $12/4 = 3$ half lives. In this period, the radon will be halved three times, to $\frac{1}{2}\frac{1}{2}\frac{1}{2}64 = 8$ grams.

4. (3 points) Suppose we make the following conservative assumptions of the likelihood of life in our 400-billlion-star galaxy: 0.1% of the stars are sunlike with planetary systems, 1% of these planetary systems have one Earthlike planet, and life emerged on 1% of these Earthlike planets. In this case, on how many planets in our galaxy would life have emerged?

Answer:

$$(4 \times 10^{11})(10^{-3})(10^{-2})(10^{-2}) = 4 \times 10^{4}$$

Forty thousand.

5. (3 points) How does Neil deGrasse Tyson describe the nuclear reaction that leads to sunlight?

(a) $^{238}_{92}\mathrm{U} \rightarrow {}^{234}_{90}\mathrm{Th} + \alpha$

(b) 4H → He + energy

(c) $\mathrm{n} \rightarrow \mathrm{p} + \mathrm{e}^{-} + \bar{\nu}_e$

(d) $^{14}_{6}\mathrm{C} \rightarrow {}^{12}_{7}\mathrm{N} + \beta^{-}$

(e) $\mathrm{Co}^{*} \rightarrow \mathrm{Co} + \gamma$

6. (3 points) What is the primary source of all atomic nuclei heavier than Hydrogen and Helium in the universe?

(a) Explosions of stars, known as supernovae

(b) The big bang (origin of the universe)

(c) Gamma radiation

(d) Hydrodynamic wormhole convolutions

(e) Clouds of gas and dust at very low temperatures