

Introductory Physics: Calculus-Based

Name: _____

Homework 03.10: Nuclear Physics: Homeworks are due as posted on the course web site. Multiple-choice questions will **NOT** be marked, but some of them will appear on exams. One or more full-answer questions may be marked as time allows for the grader. Hand-in the full-answer questions on other sheets of paper: i.e., not crammed onto the downloaded question sheets. Make the full-answer solutions sufficiently detailed that the grader can follow your reasoning, but you do **NOT** be verbose. Solutions will be posted eventually after the due date. The solutions are intended to be (but not necessarily are) super-perfect and often go beyond a fully correct answer.

Multiple Choice Questions:

- Atomic nuclei are made up of:
 - protons and electrons.
 - protons and neutrons.
 - positrons and electrons.
 - positrons and neutrals.
 - ponytions and nuggets.
- The nucleus occupies _____ of the volume of an atom and has _____ of the atomic mass.
 - a small part; none
 - a small part; almost all
 - most; almost all
 - most; none
 - most; half
- Nuclei with the same number of protons, but different number of neutrons are _____ of each other.
 - isochrones
 - isotopes
 - isobars
 - isotropics
 - Isoldes
- “Let’s play *Jeopardy!* For \$100, the answer is: These isotopes of hydrogen have 1 and 2 neutrons, respectively.”
What are _____, Alex?
 - uranium-235 (${}_{92}^{235}\text{U}$) and uranium-238 (${}_{92}^{238}\text{U}$)
 - helium-3 (${}^3_2\text{He}$) and helium-4 (${}^4_2\text{He}$)
 - the deuteron (D or ${}^2_1\text{H}$) and triton (T or ${}^3_1\text{H}$)
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 - carbon (${}^{12}_6\text{C}$) and oxygen (${}^{16}_8\text{O}$)
- Nuclei are bound together by:
 - gravity.
 - the strong nuclear force.
 - the electromagnetic force.
 - the centrifugal force.
 - the weak nuclear force.
- Nuclear fusion is the _____ bonding of nuclei to form _____ nuclei.
 - chemical; larger
 - nuclear; larger
 - nuclear; smaller
 - chemical; smaller
 - gravitational; smaller
- In stellar hydrogen fusion to helium, the rest mass energy of the products is _____ less than that of the reactants. The missing rest mass energy went mostly into _____.
 - 70 %; heat energy
 - 170 %; magnetic field energy
 - 0.7 %; heat energy
 - 70 %; magnetic field energy
 - 0 %; chemical binding energy
- A mass of 1 kg is equivalent to about how much energy? Recall that the speed of light is $3.00 \times 10^8 \text{ m/s}$.
 - $8 \times 10^{16} \text{ J}$.
 - $9 \times 10^{16} \text{ J}$.
 - $9 \times 10^8 \text{ J}$.
 - $3 \times 10^8 \text{ J}$.
 - $2 \times 10^8 \text{ J}$.
- The energy emitted as electromagnetic energy from main sequence stars is supplied by the:
 - nuclear burning of helium to hydrogen.
 - nuclear burning of hydrogen to helium.
 - nuclear burning of hydrogen to carbon.
 - nuclear burning of helium to carbon.
 - chemical burning of hydrogen to carbon.
- Thermonuclear reactions happen only in a star’s core (which for the Sun is the region within about 0.25 solar radii of the Sun’s center) because only there is it _____ enough.
 - cold and dilute
 - hot and dilute
 - hot and dense
 - cold and opaque
 - fissionable
- Why don’t thermonuclear reactions happen on the surface of main sequence stars?

- a) Not hot and not dense enough. b) Too hot and too dense. c) Too green. d) Too
bad. e) Too late.