

Last name _____ First name _____ SID _____

Essay questions (20 pts): pick **one** and only one to answer. Write a page or two (or whatever is appropriate) on the last sheet. Cover the important points in a clear and concise manner – as if you have only a few minutes to tell the President (or your roommate) what he needs to know. Clear, effective writing is important.

1. The idea of a chain reaction takes many forms. List some of them. (You don't have to be complete, but I would like variety.) Be sure to include some that most people consider benign. Give a sentence or two about each. Point out which chain reactions, in the hands of terrorists, could do the most harm to humans.
 2. Discuss the different kinds of nuclear weapons. What are they made from, and how do they work? What are the problems that terrorists and countries such as North Korea and Iraq would have in manufacturing such weapons?
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Short questions (1 point each, 20 points total). Read the questions carefully so that you don't misinterpret them (e.g. by missing a word such as "not").

1. Which of the following forms of radiation is *least* likely to cause cancer?
 alpha
 beta
 gamma
 microwave
2. When a bridge with length 1000 meters is warmed by 10C, the amount it expands is closest to:
 1 micron
 1 mm
 10 cm
 10 meters
3. The freezing point of water is (mark all which are correct)
 0 K
 0 F
 0 C
 32 C
4. The North Korean crisis became urgent when the U.S. accused North Korea of having
 Calutrons
 Centrifuges
 Nuclear Weapons
 Nuclear Reactors
5. The number of cancers from the Hiroshima blast is small, because:
 the bomb was uranium, not plutonium
 there has been insufficient time for cancer to develop
 the bomb emitted primarily gamma rays, and they don't cause cancer
 most people exposed to high levels of radioactivity were killed by the blast

6. 2500 people are each exposed to 10 rems whole body dose. The number of extra cancer this will induce is closest to:
- 0
 - 1
 - 10
 - 2500
7. The picture in a TV tube is created when the screen is hit by:
- phosphors
 - x-rays
 - protons
 - electrons
8. The energy from the sun comes primarily from
- the fission of uranium
 - the fission of plutonium
 - the fusion of hydrogen
 - the fission of hydrogen
9. If you start with 10,000 atoms, then after two half lives you expect to have left:
- 1250
 - 5,000
 - 2,500
 - 0
10. To measure rare but non-radioactive elements, we could use:
- a cloud chamber
 - a cathode-ray tube
 - radium
 - neutron activation
11. To have fission of every nucleus in 10 kg of plutonium would take closest to (be careful; there may be a trick here)
- 54 generations
 - 64 generation
 - 84 generations
 - 11 generations
12. Moore's Law relates most closely to:
- nuclear weapons design
 - uranium purification
 - population growth
 - electronics and computers
13. The probability of exceeding **two** standard deviations is closest to:
- 0.3%
 - 5%
 - 29%
 - 67%
14. If one million people are polled, the uncertainty is closest to:
- ± 1000
 - $\pm 10,000$
 - $\pm 100,000$
 - $\pm 333,000$
15. Helium comes from stopped
- alpha rays
 - beta rays
 - neutrons
 - fission fragments
16. The dangerous fallout from a nuclear bomb consists primarily of:
- fission fragments
 - plutonium
 - uranium
 - neutrons
17. For fusion to take place, we need:
- high temperature
 - critical mass
 - a moderator
 - neutrons
18. Nuclei are smaller than their atoms by a factor of
- 100
 - 1000
 - 10000
 - 100,000
 - 1,000,000

19. Mark all that are units of power

- electron-volt
- joule
- horsepower
- watt

20. Per *gallon*, liquid hydrogen contains

- more energy than gasoline
- less energy than gasoline
- to within 20%, about the same energy as gasoline

Use the space below and the next side (if needed) for your essay.