

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 this sheet. Cover the important points in a clear and concise manner – as if you have only a few minutes to tell the President, your roommate, or your parent, what that person needs to know. Clear, effective writing is important.

1. Describe the two ways in which radiation can hurt people. What are the prejudices and other mistaken ideas that people think are true but aren't. Give examples from two historical events. Give relevant numbers if you remember them; if you don't, make good guesses (and state that they are guesses).
 2. Many people are surprised when they learn that an asteroid explodes when it hits the Earth. Why does this happen? Explain by describing the physics of explosions. Give examples of the wide range of phenomena that lead to explosions. Include numbers, when relevant.
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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. There is little hydrogen in the Earth's atmosphere because
 - it combined with oxygen to make water
 - it is too heavy, and it sunk to the core
 - it had sufficient velocity to escape gravity
 - it was all burned into helium
2. Iran is in trouble for having an illegal
 - Calutron
 - diffusion plant
 - centrifuge
 - nuclear bomb
3. After three half lives, the radioactivity is reduced
 - to one half
 - to one eighth
 - not at all
 - to three halves
4. A Pu bomb has fewer generations than a U-235 bomb because in each generation it
 - emits more neutrons
 - releases more energy
 - has more fission fragments
 - has a shorter half-life
5. Moore's Law concerns
 - nuclear weapons
 - population
 - biological doubling
 - computers
6. Molecular motion stops at
 - 0 K
 - 0 C
 - 0 F
 - 32 F
7. The purpose of a "breeder" reactor is to manufacture lots of
 - U-235
 - tritium
 - Sr-90
 - Plutonium
8. Radioactivity in drinking alcohol is there because of
 - cosmic rays making C-14
 - nuclear reactor leakage
 - uranium in the ground
 - potassium-40 in the ground
9. The most dangerous part of fallout comes from
 - alpha particles
 - Plutonium
 - Uranium
 - fission fragments
10. One horsepower is approximately equal to
 - one kilowatt
 - one kilowatt-hour
 - one kilojoule
 - one quad
11. Smart rocks are
 - asteroids that threaten life
 - a future source of energy
 - an idea for hitting ballistic missiles
 - a method of radioactive dating

12. Which of the following has the lowest orbit?
- weather satellite
 - spy satellite
 - GPS
 - TV satellite
13. An airplane can detect oil in the ground from:
- its lack of radioactivity
 - its emitted hydrocarbons
 - its weaker gravity
 - its effect on air resistance
14. Rail guns are not used for astronauts because
- they are inefficient
 - they would crush the astronaut
 - such high velocities aren't needed
 - they are limited to the speed of sound
15. At an altitude of 200 km, the downward force of gravity on an Earth satellite is
- the same as on the surface of the Earth
 - a little bit weaker
 - zero
 - a little bit stronger
16. DNA "fingerprinting" is done with
- PCR
 - K-40
 - C-14
 - neutron activation
17. The linear hypothesis relates to
- population growth
 - radiation illness
 - cancer from radiation
 - price of computers over time
18. Battery energy, compared to gasoline, is about
- 2.4 times greater
 - 100 times less
 - a million times less
 - a different kind of energy, so it can't be compared
19. A refrigerator operating in a room
- warms the room
 - cools the room
 - has no effect on the room
 - removes water vapor from the room
20. When a gas is heated, we expect the speed of sound in that gas to
- stay the same
 - increase
 - decrease
 - depends on the gas