Last name_____ First name_____SID_____

Essay questions: pick **one** and only one to answer. Write a page or two (or whatever is appropriate) in your blue book about it. The essay is worth 20 points.

1.A friend says, "I'd never want to live near a nuclear power plant. They are full of uranium and plutonium, and can blow up like an atomic bomb." You respond, "I don't want to live near one either, but your facts are wrong." Explain your point of view. (If you do *want* to live near one, explain that too.)

2. In newspaper articles, the words "power" and "energy" are often confused. Explain the difference, and give several examples to make the difference as clear as possible.

3. A nuclear chain reaction and a polymerase chain reaction seem to be very different, yet they both use the term "chain reaction." Explain why, and give examples of how both chain reactions are used.

Brief questions (worth 1 point each, 20 points total)

1. A hybrid automobile uses:
        ( ) gasoline and methane
        ( ) batteries and solar
        ( ) batteries and gasoline
        ( ) methane fuel cells and hydrogen fuel cells

2. the power that is present in one square meter of sunlight is about
        ( ) 1 horsepower
        ( ) 100 horsepower
        ( ) 377 horsepower
        ( ) 10,000 horsepower

3. Moore's law refers to
        ( ) DNA fingerprinting
        ( ) the population explosion
        ( ) nuclear explosions
        ( ) computers

4. Which of the following is NOT produced in a nuclear reactor?
        ( ) neutrons
        ( ) fission fragments
        ( ) plutonium
        ( ) uranium

5. Compared to gasoline, the energy in a battery (for the same weight) is approximately:
        ( ) the same
        ( ) the battery has 10x as much energy
        ( ) the battery has 10x less energy
        ( ) the battery has 1000x less energy

6. If a meteor moves twice as fast, it's kinetic energy
      ( ) is unchanged
      ( ) is a factor of squareroot 2 larger (i.e. a factor of about 1.4)
      ( ) is a factor of two larger
      ( ) is a factor of four larger

7. The energy than can be released from uranium is greater than that in TNT by a factor
      of about:
      ( ) 10
      ( ) 1000
      ( ) 1,000,000
      ( ) 1,000,000,000

8. Most of the mass of the atom is in the
      ( ) electron
      ( ) the nucleus
      ( ) the electricity

9. If the half life of an atom is 2 years, then after 6 years, the amount remaining
      is about:
      ( ) 50%
      ( ) 25%
      ( ) 16.67%
      ( ) 12.5 %

10. The easiest kind of "atomic bomb" to make is made from:
      ( ) U-235
      ( ) U-238
      ( ) Plutonium
      ( ) Hydrogen

11. . Below I give pairs of numbers. Put a check mark next to a pair if the second number
      is within 1 standard deviation of the first. Note: you may (or may not) have to
      check more than one pair.
      ( ) 9 and 11
      ( ) 9 and 7
      ( ) 1,000,000 and 1,000,900
      ( ) 2 and 8

12. At an airport, which of the following is not done to people who pass through
      security: Check all that are not done.
      (You may have to check more than one.)
      ( ) metal detector
      ( ) xray
      ( ) plastic knife detector

13. The descendants of Thomas Jefferson were identified via
    ( ) iridium abundance
    ( ) radioactivity
    ( ) Mathus' relation
    ( ) PCR

14. Nuclear power plants in Canada, called "Candu" reactors, use what kind of uranium?
    ( ) natural uranium
    ( ) uranium enriched to about 3% U-235
    ( ) uranium enriched to about 80% U-235
    ( ) uranium enriched to nearly 100% U-235

15. iridium was the key to understanding the dinosaurs' death because:
    ( ) it is highly radioactive
    ( ) it is very toxic
    ( ) it is abundant in the crust of the earth
    ( ) it is abundant in asteroids and comets

16. The reason that fuel cells are not yet used for automobiles is that
    ( ) they produce less energy per gram than does gasoline
    ( ) there is no good source of hydrogen gas to power them
    ( ) they produce too much toxic waste
    ( ) there is not yet a good way to store the hydrogen

17. If we were to get all our electricity by buying flashlight batteries, the cost would be:
    ( ) about 10 cents per kilowatt hour
    ( ) about a dollar per kilowatt hour
    ( ) a few thousand dollars per kilowatt hour
    ( ) nearly a million dollars per kilowatt hour

18. If 10,000 events are observed, the one-standard deviation variation expected is about:
    ( ) 10
    ( ) 30
    ( ) 100
    ( ) 300

19. To explode most of the nuclei in a bomb, the number of generations required is
    approximately:
    ( ) 23
    ( ) 64
    ( ) 85
    ( ) 6 x10^{23}

20. The most dangerous material in a nuclear meltdown consists of
    ( ) fission fragments
    ( ) plutonium
    ( ) neutrons
    ( ) deuterium