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 tells you that in 30 years we will all be driving automobiles powered by solar energy. You say to him, "It's hard to predict 30 years ahead. But let me give you a more likely scenario." Describe what you would say. Back up your predictions with relevant facts and numbers whenever they would strengthen your analysis.

2. Describe the different ways that radioactivity to measure the ages of different objects. Give as much detail as you can. Include such things as what is meant by the "age" of an object.

3. Discuss the danger that a terrorist organization might build an "atomic bomb" to use against the United States. Support your discussion with relevant facts about the ease or difficulty of building such a weapon.

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

Iridium was important in the book "Nemesis" because:
    ( ) It killed the dinosaurs
    ( ) It is radioactive
    ( ) It is rare in the Earth's crust
    ( ) It is rare in extraterrestrial objects

25 Sieverts will kill how many people from cancer, on average?
    ( ) 1
    ( ) 25
    ( ) 50,000
    ( ) It depends on the number of people who are exposed

After three half lives, the amount of radioactive material is reduced to:
    ( ) half of its original amount
    ( ) one third
    ( ) one quarter
    ( ) one ninth
    ( ) one eighth

Next to each of these mark whether it is a unit of energy (E) or power (P)
    horsepower   _____
    kilowatt-hour _____
    watt   _____
    calorie   _____

The California Energy Crisis (which then didn't happen) was expected because of
       ( ) low power capacity
       ( ) low energy reserves
       ( ) expected cold weather
       ( ) contracts that required us to export power

The C-14 in your body was
       ( ) left over from the creation of the solar system
       ( ) created by cosmic rays
       ( ) residual radiation from the Chernobyl accident
       ( ) a consequence of potassium-40 decay

Moore's Law addresses the doubling of
       ( ) DNA molecules
       ( ) Electronic circuits
       ( ) fissions in a chain reaction
       ( ) viruses

The World Trade Center collapsed because of
       ( ) the heat from the fire
       ( ) the force of exploding fuel
       ( ) the impact of the airplane
       ( ) explosives carried by the terrorists

Volcanic heat comes from
       ( ) chemical explosions taking place deep in the earth
       ( ) explosions of nuclei taking place deep in the earth
       ( ) the enormous weight of the earth pressing down
       ( ) we don't know the origin

The bomb that Saddam Hussein of Iraq was planning on building was to be a
       ( ) plutonium bomb
       ( ) uranium bomb
       ( ) hydrogen bomb
       ( ) an Oak Ridge bomb

The kinetic energy of a typical 1 gram meteor is approximately equal to the energy of
       ( ) 10 grams of TNT
       ( ) 100 grams of TNT
       ( ) 1/100 grams of TNT
       ( ) 10 grams of gasoline

"Smart Rocks" are considered for
       ( ) geologic dating
       ( ) ballistic missile defense
       ( ) nuclear power
       ( ) solar power

Mark each name that refers to the Hiroshima bomb (more than one might be correct):
( ) atomic bomb
( ) fission bomb
( ) nuclear bomb
( ) plutonium bomb

A typical neutron will travel how far through "solid" material before it hits a nucleus?
( ) several centimeters
( ) several kilometers
( ) only a few microns
( ) through the entire earth

Two identical potassium-40 nuclei
( ) will decay after exactly the same time
( ) could easily decay at times that differ by a billion years
( ) will probably decay within 5730 years of each other, but it could be longer
( ) will not decay unless they absorb a neutron

The polymerase chain reaction is
( ) used in weapon design
( ) important for identifying victims of the World Trade Center
( ) a major source of energy
( ) a key concept in the electronics industry

Our velocity around the sun is approximately
( ) 30 km per second
( ) about the same as the velocity of sound
( ) close to the speed of light
( ) 1000 miles per hour

The critical mass
( ) is the same for uranium and plutonium
( ) is a few grams for uranium
( ) depends on whether the plutonium is compressed
( ) is approximately a ton for plutonium

At an airport security station, prior to the terrorist events,
( ) almost every person is x-rayed
( ) only carry-on luggage is x-rayed
( ) you walk through a device that looks for explosives
( ) special "sniffers" detect most (but not all) plastic knives

The probability that the number of events will deviate from the expected value by twice the square root, is approximately
( ) 1%
( ) 5%
( ) 33%
( ) 50%