

Last name _____ First
name _____ SID _____

Choose one essay question from list A and one from list B. Put your name on three pages: the top page for A, for B, and for C (the multiple choice questions).

Essay question A (20 pts): "The trouble with most folks isn't their ignorance, it is knowing so many things that aren't true." Pick **one** and only one of the next two questions 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 (or your roommate) what he needs to know. Clear, effective writing is important.

1. President Bush has announced that the United States will develop a "hydrogen economy." Describe what this means. What mistaken ideas do some people have about such an economy? How will hydrogen be used?

OR

2. Radioactivity is widely feared, and misunderstood. Discuss the real dangers, and the ones that are myths. Describe historical events that illustrate your points.

Essay question B (20 pts): pick **one** and only one of the next two questions 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 (or your roommate) what he needs to know. Clear, effective writing is important.

3. Pick several important/interesting examples of physics principles used in national defense. Describe how understanding weapons technology helps us to know what weapons are most likely to be developed by terrorists and other potential adversaries.

OR

4. Why the electricity from the wall is AC rather than DC? Describe what important physics principles go into making the choice, Describe how this happened historically, and what you think might happen in the future.

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C. Short questions (1 point each, 40 points total). Read the questions carefully so that you don't misinterpret them (e.g. by missing a word such as "not").

1. A political poll says that it has an error of plus or minus 3%. That is based on:

- The doubling rule
- The square-root rule
- Moore's law
- Information theory

2. The age of the universe is approximately:

- 14×10^6 years
- 14×10^7 years
- 14×10^8 years
- 14×10^9 years

3. Dark energy makes the Universe

- slow down
- speed up
- expand
- maintain constant size

26. Fuels used in today's nuclear reactors include (mark all that are correct):

- U-235
- U-238
- Plutonium
- Tritium

5. The source of energy in the sun is most similar to that in

- a fission bomb
- a hydrogen bomb
- matter-antimatter annihilation
- a hybrid engine

6. In the Big Bang theory,

- the Earth is at the center of the Universe
- the Earth is near the center of the Universe
- the center of the Universe is not known
- there is no center to the Universe

7. A "Stop" sign is bright when you shine the headlamps of your car. It most likely is covered with:

- fluorescent paint
- phosphorescent paint
- tritium
- small glass spheres

8. We measure that a particle travels at the speed of light. (Be careful; only one answer is correct.) We conclude:

- its energy is infinite
- it violates Special Relativity
- its energy is zero
- its rest mass is zero

9. Diamonds are pretty because in them

- light travels very slowly
- light travels very fast
- there is color dependent absorption
- light velocity depends on color

10. The advertising slogan "Whiter than white" means that the material:
- emits IR
 - emits visible light
 - absorbs IR
 - emits UV
11. Infrared radiation can (check all that apply):
- help snakes locate prey
 - create ozone
 - cause cancer
 - cause sunburn
12. Fiber optics are used instead of radio for communication because:
- light has more power
 - light is cheaper
 - light has a higher frequency
 - light travels faster
13. Mark all that are units of power
- horsepower
 - watt
 - electron-volt
 - joule
14. Which of the following forms of radiation is *least* likely to cause cancer?
- gamma
 - microwave
 - alpha
 - beta
15. Helium comes from stopped
- alpha rays
 - beta rays
 - neutrons
 - fission fragments
16. The freezing point of water is (mark all which are correct)
- 0 K
 - 0 F
 - 0 C
 - 32 C
17. If a healthy teenager runs quickly up a flight of stairs, he is using about
- 0.001 horsepower
 - 0.01 horsepower
 - 0.1 horsepower
 - 1 horsepower
18. A "heat seeking" missile actually aims itself towards
- infrared light
 - ultraviolet light
 - visible light
 - radio waves
- 19.. Ozone depletion is caused by (check all that are correct)
- CFCs
 - carbon dioxide
 - fossil fuels
 - cosmic rays
20. A tree keeps dew from forming because:
- it absorbs starlight
 - it keeps air from rising
 - it emits infrared radiation
 - it blocks the clouds
21. In a tungsten light bulb, most of the energy goes into
- visible light
 - red light
 - ultraviolet light
 - infrared light
22. JDAMS make use of
- laser guidance
 - infrared guidance
 - radar guidance
 - GPS guidance
23. Waves tend to bend in the direction that
- wave velocity is slower
 - wave velocity is faster
 - is upward
 - is downward

24. Mark ALL that are true:
- thunderclouds rise to the ozone layer
 - the sound channel is near the ozone layer
 - even without fossil fuels, the atmosphere acts as a greenhouse
 - the greatest ozone depletion is over Antarctica
25. When going downhill, a hybrid automobile
- turns all the extra energy into heat
 - uses 1/4 to 1/2 as much fuel
 - uses electric power only
 - recharges the batteries
26. A large electric power plant produces about
- 1,000 watts
 - 1,000,000 watts
 - 1,000,000,000 watts
 - 1,000,000,000,000 watts
27. Sound, going through a doorway will spread more if
- the doorway is narrow
 - the doorway is wide
 - spreading is independent of the width
28. cancer is most likely to be cause by
- infrared radiation
 - microwave radiation
 - ultraviolet radiation
 - white light
29. The radiation from Chernobyl that killed thousands came from
- neutrons
 - cosmic rays
 - tritium
 - fission fragments
30. The number of people who died of cancer from the Hiroshima nuclear bomb is closest to (careful; possibly a trick question)
- 500
 - 5,000
 - 50,000
 - 150,000
31. Identify which are the particles that pass easily through the Earth:
- cathode rays
 - x-rays
 - neutrons
 - neutrinos
32. A piece of glass feels cool to the touch because
- it cools itself by infrared radiation
 - it conducts heat rapidly from your skin
 - glass remains cooler than room temperature
 - it is an illusion because glass is smooth
33. To make a black hole, we need
- high mass in a small radius
 - high mass in a large radius
 - low mass in a small radius
 - extremely dense material in any radius
34. The P and S waves arrive two seconds apart. The epicenter distance is:
- 2/5 of a mile
 - 1 mile
 - 5 miles
 - 10 miles
35. In frequency, an octave is a factor of
- 2
 - 4
 - 8
 - 16

36. When a radioactive rock travels near the speed of light
- its mass gets greater and there are fewer decays
 - its mass gets greater and there are more decays
 - its mass gets less and there are fewer decays
 - its mass gets less and there are more decays
37. Ordinary magnetism is created by
- moving magnetic monopoles
 - stationary charges
 - electric current
 - stationary magnetic monopoles
38. Electricity will heat a wire if it has
- high voltage
 - high current
 - high frequency
 - DC rather than AC
39. One horsepower is approximately equal to
- 1 watt
 - 20 watts
 - 1 kilowatt
 - 1 megawatt
40. The wavelength of visible light is closest to:
- 1 mm
 - 1 micron
 - 10^{-8} cm
 - 10^{-13} cm