

Last name _____ First
name _____ SID _____

Choose one essay question from list A and one from list B. Circle the ones you chose. 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): Answer one of the following two questions:

A1. Many people use the terms “greenhouse effect” and “ozone layer” interchangeably as though they address the same issue. Explain the differences between the greenhouse effect and the ozone layer. Why is the greenhouse effect and ozone layer in the news from time to time and what is it that people have to be concerned about?

OR

A2. Some people think solar energy is the answer to our future energy needs. Others think it has no future. What can it be used for, and what can't it be used for? Describe the possibilities. Will it be used for automobiles? Compare it to other sources of energy.

Essay question B (20 pts): pick **one** and only one of the next two questions to answer.

B1. Define and explain 4 methods discussed in class that are used for medical imaging. What are the differences in function and use for each? Don't forget to explain the physics behind the technique!

OR

B2. Lasers are one of the most widely used technological inventions of the 20th and 21st centuries. What is a laser? How does it work? What properties does laser light possess and how are these properties useful? Give examples of devices that use lasers in your answer.

Last name _____ First name _____ SID _____

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. Mark ALL of the following list that are NOT laws of thermodynamics:
 - Absolute zero cannot be reached
 - Heat energy can be extracted without temperature differences
 - Energy is conserved
 - Objects in contact tend to reach the same temperature
2. Sound travels the fastest through
 - air at 0 C
 - air at 20 C
 - water at 0 C
 - granite
3. If you shoot a bullet horizontally, and simultaneously drop a bullet, which will hit the ground first?
 - the dropped bullet
 - the shot bullet
 - both at the same time
 - not enough information to tell
4. Absolute zero is
 - 0 Fahrenheit
 - 0 Celsius
 - 0 Kelvin
 - 0 Centigrade
5. "Fast Breeder Reactors" have a danger in addition to those found in ordinary nuclear reactors: they
 - produce more waste
 - use uranium rather than plutonium
 - can explode with much greater energy than TNT
 - produce very high voltage electricity
6. Which of the following statements about the ozone layer is NOT true?
 - the location of the ozone layer is tropopause
 - the ozone layer causes thunderstorms to spread laterally
 - ozone is destroyed by chlorine (Freon and other CFCs)
 - ozone layer absorbs infrared radiation
7. Stealth bombers are undetected by radar, in part because of
 - low heat emission
 - their high speed
 - they are made of translucent materials
 - absence of corner reflectors
8. The absolute temperature of the Earth is approximately what fraction of that of the surface of the sun?
 - 1/10
 - 1/20
 - 1/100
 - 1/1000
9. The invention of this object in WWII saved England from invasion:
 - lasers
 - atomic bomb
 - magnetron
 - sofar spheres
10. An octave is a change in frequency by a factor of
 - 2
 - 8
 - 10
 - square-root of 2

11. Which of the following is a result of diffraction?
- light bends when entering water
 - light focuses to a point through a lens
 - light passes through an opening and is spread out in different directions
 - light from a star changes its frequency because the star is moving
12. Power can be measured in all of the following units EXCEPT:
- Calories per second
 - horsepower
 - watt
 - quad
13. The “China syndrome” refers to:
- the Chinese population bomb
 - nuclear melt down
 - nuclear explosion
 - a computer virus
14. If you are exposed to 500 rems of gamma rays radiation you will:
- have slight or no short-term illness
 - have 50% chance death if untreated within 60 days
 - be incapacitated immediately
 - Have a 50% chance of contracting cancer
15. After you are exposed to 1 rem of radiation, your chance of dying from cancer is approximately (hint: this may be a trick question):
- 1/2500
 - 1/500
 - 1%
 - 20%
16. The photoelectric effect is important for all of the following EXCEPT:
- digital cameras
 - Xerox machines
 - solar cells
 - Polaroid sunglasses
17. Which of the following is best for seeing the calcium in bones?
- x-ray
 - MRI
 - PET scan
 - EEG
18. Magnetism always comes from
- stationary charge
 - moving charge
 - neutrons
 - neutrinos
19. Hybrid engines are more efficient, in part because
- they use solar cells to boost power
 - they can get energy from electric outlets
 - they convert hydrogen to electricity
 - they can recover energy when slowing down
20. The age of the universe is approximately:
- 14×10^6 years
 - 14×10^7 years
 - 14×10^8 years
 - 14×10^9 years
21. The effects of special relativity must be taken into account for
- semiconductor chips
 - GPS
 - lasers
 - MRI

22. The "Curie temperature" is the temperature at which:
- molecular movement stops.
 - fusion takes place in the sun
 - magnetism disappears from iron
 - fission takes place in a bomb
23. Which of the following contains more energy in one gram?
- bullet (at speed of sound)
 - TNT
 - butter
 - computer battery
24. Escape velocity refers to the velocity required to:
- leave the surface of the Earth
 - to orbit around the earth
 - to reach the moon
 - to travel forever away from the earth
25. What type of wave was used to determine that the center of the Earth has a liquid region?
- S waves
 - P waves
 - L waves
 - Waves weren't used
26. A sound wave is a:
- transverse
 - sheer
 - longitudinal
 - secondary
27. Pit vipers and mosquitoes can sense:
- UV radiation
 - IR radiation
 - Gamma rays
 - Microwaves
28. Which of the following don't follow the doubling rule; mark all that apply.
- spread of computer virus
 - spread of wild rabbits in Australia
 - epidemic of bubonic plague
 - illness from anthrax
29. The "most powerful" telescope in the world at the Keck observatory uses what to focus light?
- computers
 - a lens
 - a mirror
 - It doesn't focus light
30. About how many generations does it take for a uranium bomb to fission all atoms:
- 8
 - 80
 - 10^{23}
 - 2^{80}
31. Which of the following is not true about hydrogen as a fuel source:
- it provides 3 times the energy of gasoline per gram
 - it provides 3 times less energy per gallon than gasoline
 - it is abundant on earth in its free form and can be mined for fuel
 - hydrogen generating plants create pollution
32. 1 Sievert is equal to
- 100 rem
 - 50 rem
 - 1000 rem
 - none of the above
33. When a gas is heated, the velocity of the molecules in the gas
- stays the same
 - increases
 - decreases
 - depends on the gas
34. Which of the following is most toxic?
- plutonium (swallowed)
 - botulism toxin (swallowed)
 - plutonium dust (breathed in)
 - uranium (on the skin)

35. 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
36. Plutonium-239 is manufactured from
- tritium
 - deuterium
 - strontium
 - uranium
37. The original name for the microwave oven was?
- convection oven
 - radar range
 - radio oven
 - microwave
38. Antimatter is used in
- CAT scan
 - PET scan
 - MRI
 - none of the above
39. An example of a heat pump is:
- the sun
 - gasoline engine
 - infrared lamp
 - refrigerator
40. Most old people have poor vision because:
- they lost rods
 - they lost cones
 - their cornea became opaque
 - their lens became less flexible