

Last name _____ First _____ SID _____ GSI _____

Essay questions (20 pts): pick **one** and only one to answer; **circle** the one you choose. Write a page **on the back of this sheet**. This side is for your personal notes only. 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*. If English is not your first language, state so at the top of your essay. If you need to re-write it, ask for a new copy of this page.

1. Some people think that earthquakes are just shaking ground, but in fact, they behave as waves. What kind of waves? Which are fastest, and which are the most dangerous? How do we locate the "epicenter"? Why can "land fill" be a dangerous place to build a house? What do earthquakes tell us about the insides of the Earth?

2. The "energy gap" is key in several technologies that are important in the world today. Describe briefly why there is an energy gap. (One or two sentences at most.) Name three different technologies that depend on it. (Try to be as diverse as possible, i.e. don't name three technologies that are very similar to each other.) Describe how each of these technologies makes use of the energy gap to provide important capabilities.

Circle the essay question you chose.

This page is for name and notes only.

The essay should be on the next page.

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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. Permanent magnets get their magnetism from
 - magnetic monopoles in the electron
 - the motion of electrons as they go in circles around the nucleus
 - the spin of electrons
 - magnetic monopoles in the nucleus
2. Xerox machines use
 - the conduction band
 - NMR
 - lasers
 - the photoelectric effect
3. A useful device for turning AC into DC is:
 - a CCD
 - a diode
 - a transistor amplifier
 - a superconductor
4. Which particle is not a wave?
 - photon
 - electron
 - nucleus
 - they all are waves
5. The mercury gas inside a fluorescent bulb emits
 - UV
 - IR
 - red, green, and blue light
 - white light
6. Rail guns may be useful because they
 - can shoot projectiles faster
 - use less energy than other guns
 - don't require an energy source
 - apply high voltage to the target
7. Europeans use 220 volts rather than 120 because
 - it doesn't "blink" as much
 - it is less expensive to make
 - it not as dangerous
 - is requires less copper in house wires
8. Edison executed an elephant to
 - show it is a humane way to kill
 - show transformers could create high voltage
 - show why DC should be used instead of AC
 - get more people to come to his movie theaters
9. Small but high fidelity earphones are made possible by which technology?
 - fiber optics
 - lasers
 - samarium cobalt (and other rare earth) magnets
 - high voltage

More questions on next page.

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10. Project Mogul, in Roswell, was designed to detect
- crashed pilots
 - submarines
 - distant airplanes
 - nuclear explosions
11. An "octave" means the frequency changes by a factor of
- 2
 - 4
 - 8
 - 30 to 100
12. A mirage forms when light
- bounces off water
 - bounces off a hot surface
 - bends upward in a gas
 - has the red color absorbed
13. The most important reason that fiber optics cables are useful is:
- light can carry high power
 - light has high frequency
 - light is easily turned to sound
 - light doesn't weigh much
14. To make a good image of the ground, it is important for a spy satellite to:
- have a large diameter lens or mirror
 - have a high orbit
 - use long wavelength light
 - be a retroreflector
15. The C in "CAT scan" stands for:
- Carbon
 - Calcium
 - Cycled
 - Computer
16. The ozone layer is important because it blocks
- IR
 - UV
 - visible light
 - x-rays
17. When you shine your headlights on a Stop Sign, it "lights up" because it's surface has:
- small batteries
 - solar cells
 - fluorescent paint
 - small spheres
18. MRI is used to detect
- hydrogen
 - carbon
 - calcium
 - lead
19. Our bodies emit a lot of
- visible light
 - microwaves
 - UV
 - IR
20. It is feared that greenhouse warming will come from
- CFCs
 - the burning of coal
 - the burning of hydrogen
 - nuclear emissions