PffP Final exam – Essay Questions 14 December 2006

Last name_____ First name_____SID_____GSI_____

Essay questions (40 pts): pick **one** and only one to answer and **circle** it. Write your essay on the other side. 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. The essay may be up to a page long. If you need to re-write your essay, ask for a new sheet.

1. Alternative energy. Recently, there has been a movement to stress energy conservation and the use of alternative energy sources other than fossil fuels. First, define what we mean by fossil fuels and discuss why are they are an attractive source of energy from the standpoint of physics and technology. Second, describe in detail two different energy alternatives, nuclear and solar power, and discuss how they work and how they compare to fossil fuel. Include advantages and disadvantages.

2. North Korea nuclear weapon. Earlier this semester, North Korea appears to have detonated a nuclear device underground. What are the plausible kinds of nuclear weapon it might have been? Describe briefly how each of the plausible weapons works. How energetic was the explosion (approximately)? Was it a complete success? Give a brief description of our method of detecting such an explosion.

3. Seeing without light. Humans typically rely on vision to interpret the world around them. However, as we have progressed, we have begun to make use of things other than the visible spectrum to help us in science, the military, and medicine. Discuss three different technologies that make use of something other than visible light and explain why they must use methods that do not use the visible spectrum.

Circle the question, and write your essay on the other side.
This side is for notes only.

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. TNT is an effective explosive primarily because it can deliver high
   ( ) energy
   ( ) power
   ( ) temperature
   ( ) potential

2. The levees of New Orleans were weak because
   ( ) concrete is not strong when cooled by contact with water
   ( ) they had thermal expansion joints, and that's where they broke
   ( ) they forgot to include thermal expansion joints
   ( ) the concrete was not sealed and it became saturated with water

3. If the Earth warms on average, but no ice melts (because it stays cold in the Arctic), then
   ( ) sea level will drop
   ( ) sea level will rise
   ( ) sea level will not change

4. One method for searching for oil underground uses
   ( ) multispectral cameras
   ( ) measurements of gravity
   ( ) detection of radioactivity
   ( ) infrared measurements

5. The most common orbit for a spy satellite is
   ( ) low
   ( ) medium
   ( ) high
   ( ) lunar (almost escape velocity)

6. Skyhook refers to a method than can be used instead of
   ( ) airplanes
   ( ) balloons
   ( ) rockets
   ( ) unmanned airplanes (drones)

7. The force of gravity between two people, standing near each other, is
   ( ) zero
   ( ) very small but not zero
   ( ) large enough to be easily measured

8. LD50 for radiation illness is about
   ( ) 300 millirems
   ( ) 300 rem
   ( ) 3 millirem
   ( ) 3 rem

9. Assassination using radioactivity has been done (as far as we know)
   ( ) often during the cold war, using plutonium
   ( ) never
   ( ) once, using polonium-210
   ( ) in World War II, to save England from attack by the Nazis

10. The radioactivity of ultrasound is usually
    ( ) zero
    ( ) not zero, but low enough to be harmless
    ( ) high, but usually worth the risk
    ( ) large enough to be very controversial

11. When satellites travel to Neptune and Pluto, the favored source of energy is
    ( ) solar light
    ( ) gasoline
    ( ) radioactivity (RTG)
    ( ) CFCs (e.g. Freon)

12. The bomb dropped on Hiroshima got its energy from
    ( ) Plutonium
    ( ) U-235
    ( ) U-238
    ( ) Hydrogen (fusion)

13. In order to obtain uranium for a bomb, Saddam Hussein built:
    ( ) Calutrons
    ( ) centrifuges
    ( ) diffusion plant
    ( ) Nothing. He never planned a nuclear bomb.

14. Most of our plutonium comes from
    ( ) nuclear reactors
    ( ) nuclear weapons
    ( ) the ground (plutonium mines)
    ( ) Gabon, in Africa

15. The most famous nuclear reactor accident in the United States was at
    ( ) China Lake
    ( ) Three Mile Island
    ( ) Chernobyl
    ( ) Yucca Mountain

16. Electrons move most easily in
    ( ) metals
    ( ) superconductors
    ( ) insulators
    ( ) semiconductors

17. Helium was once thrown away, like garbage. But US law now requires it to be saved. That's because it is needed for
    ( ) balloons
    ( ) transformers
    ( ) fuel cells
    ( ) superconductor cooling

18. Electricity will heat a wire if it has
    ( ) high voltage
    ( ) high current
    ( ) high frequency
    ( ) DC rather than AC

19. Light from a tungsten light bulb is created because
    ( ) the tungsten is heated and emits visible light
    ( ) the tungsten emits UV that is converted to visible by a phosphor
    ( ) the tungsten is put in an excited state by the electricity and it undergoes a quantum chain reaction
    ( ) the tungsten is not important. The light is emitted by the plasma in the bulb.

20. SOSUS refers to
    ( ) a method of spying on submarines
    ( ) a system designed to detect Russian nuclear tests in the atmosphere
    ( ) a law that states computer power doubles every 18 months
    ( ) a method for detecting earthquakes from distant nuclear explosions

21. When I walk away from you, the sound of my voice
    ( ) doesn't change frequency
    ( ) has a lower frequency
    ( ) has a higher frequency

22. A Stinger Missile can be launched by one person to attack an airplane or helicopter. It detects its target by
    ( ) radar
    ( ) sonar (sound)
    ( ) infrared
    ( ) x-rays

23. Stealth bombers are not detected by radar because
( ) they don't reflect the radar back to the radar transmitter, but bounce it into other directions
( ) they emit their own radar, and that confuses the enemy
( ) they absorb the radar and convert it to infrared
( ) they travel so fast that they reach their targets before the radar signal can alert the enemy

24. Windburn is caused primarily by
( ) UV radiation from the Sun
( ) IR radiation from clouds
( ) friction of wind on the skin
( ) visible light scattered from clouds

25. A PET scan gives an image of
( ) radioactivity introduced in the body
( ) calcium (mostly in bones)
( ) hydrogen in the body
( ) sound waves in the body

26. The gas that absorbs UV radiation in the high atmosphere (stratosphere) is
( ) ozone
( ) CFCs (e.g. Freon)
( ) radon
( ) carbon dioxide

27. Global warming over the past 100 years has been approximately
( ) 1 C
( ) 4 C
( ) 10 C
( ) 17 C

28. The photoelectric effect is important for all of the following EXCEPT
( ) Xerox machines
( ) solar cells
( ) digital cameras
( ) transistor amplifiers

29. Waves bend towards the side where the velocity is fastest. This is true
( ) only for sound
( ) only for sound and light
( ) for all waves
( ) for no waves. Waves bend towards the side that is slowest.

30. Land fill is dangerous because
( ) it increases the amplitude of earthquake waves
( ) it often contains radioactive radon gas
( ) it is highly conductive, so it is often struck by lighting
( ) it emits gases that increase Greenhouse warming

31. Lasers are NOT used for
( ) generating light for computer screens
( ) igniting controlled thermonuclear fusion
( ) sending telephone signals through fiber optics
( ) operating on human eyes

32. Which of the following would give the highest number of bits per second?
( ) Red light
( ) blue light
( ) infrared light (IR)
( ) yellow light

33. Solar power, per square meter, is closest to
( ) 1 watt
( ) 1 megawatt
( ) 1 gigawatt
( ) 1 horsepower

34. Solar power may find a practical use
( ) for spy airplanes
( ) for automobiles
( ) for trucks
( ) for submarines

35. The greatest energy per gram comes from
( ) batteries
( ) U-235
( ) gasoline
( ) meteors

36. Glass feels cooler than plastic because
( ) it absorbs less heat from the room
( ) it emits strongly in the infrared
( ) plastic absorbs strongly in the infrared
( ) it conducts heat better

37. Blood molecules in your heart move with a velocity of (careful; I don't mean the velocity of the blood)
( ) about 1 cm per second
( ) about 1 foot per second
( ) about 1000 feet per second
( ) about 186,000 miles per second

38. When an object moves faster,
( ) its mass increases and its length shortens
( ) its mass increases and its length increases
( ) its mass decreases and its length shortens
( ) its mass decreases and its length increases

39. When we look at the Sun, we see it the way it was
( ) about 1 second ago
( ) about 8 minutes ago
( ) about 3 hours ago
( ) about 4.3 years ago

40. This year's Nobel Prize in physics was given for
( ) measurements of microwave radiation from space
( ) the discovery of WIMPs and MACHOs
( ) the discovery of "Dark Energy"
( ) the discovery that the Universe is expanding