Physics 1110
Energy, Environment & The Economy
Test III
June 20, 2002
NAME

Instructions: This test has the same format as before. For problems in the longer answer section show your work; your work will be checked as well as your answer. For short answer questions, pick the best answer for the multiple choice questions.

__________ is the topic of my (term paper, short oral presentation, lab project) (choose one). This topic (has, has not) been approved.

1. (2) REVIEW: If a 75 ft lb of work are done by a motor in 8.0 sec, the power of the motor in hp is \( \frac{75 \text{ ft lb}}{8.0 \text{ sec}} \left( \frac{550 \text{ ft lb}}{1 \text{ hp}} \right) = \) . Note: 1 hp = 550 ft lb/s.

The energy of elevation the definition of the physical quantity ______ while the energy of motion is the definition of the physical quantity ______.

Suppose 4 million BTU's are added to water to produce steam in a coal-fired power plant and 1.5 million BTU's of work are done. The first law efficiency of the power plant is \( \% \) and \( \% \) BTU's must be rejected to the cold reservoir.

In a neutral atom the number of protons is equal to the number of ______ in the _____.

Two isotopes of Uranium are _______ and _______.

The number of protons in the nucleus \(^{131}I\) is _______ while the number of neutrons is _______.

If 10,000 \(^{26}\text{Na}\) nuclei are found in a sample, how many remain after 3 minutes if the half life is 1 minute?

List 2 of the 3 methods whereby a radioactive substance may enter the body.

9. (5) Of the three types of nuclear radiation,

- Beta (a) the type that was later found to be an electron.
- Alpha (b) the type that carries a positive charge is _______.
- Gamma (c) the type that does damage genetically is _______.
- Gamma (d) the type that requires six inches of lead to stop is called _______.
- Alpha (e) the type requiring a piece of paper to stop it is _______.

10. (2) When radioactive Calcium is injected into the intestinal tract of a rat, the rat's body transports a radioactive atom in the body the same as it does if that atom were stable. Why? The body loses only at the # \# of electrons in their arrangement. Both stable & radioactive Ca have the same # \# of electrons, The body cannot tell the difference.

The purpose of the water in the light water reactor is two-fold: _______ it _______ and it _______.

12. (1) Define "neutron moderation."
13. (2) The concentration of $^{235}\text{U}$ that is used in fuel rod assemblies has been enriched to is about __% per cent; it becomes "spent" fuel in about __ years upon which time the concentration is about __% per cent.

14. (2) Natural background radiation is about (a) 1; (b) 10; (c) 100; (d) 1000; (e) 10,000, millirems of radiation per year. This can be compared with a medical X-Ray which averages about __ millirems.

15. (2) Of the approximately 105 nuclear power plants in operation in the United States today, about 70 of them are of the __ variety while the remainder of them are of the __ variety.

16. (1) The CEO of NSP would claim that the lifetime of a nuclear power plant is approximately (a) 25 years (b) 40 years (c) 75 years (d) 100 years

17. (1) A woman physicist who is given credit for discovering the three types of radioactive decay products is named __.

18. (1) Beware living close to a nuclear power plant! There could be a nuclear explosion like an atomic bomb! (true, false)

19. (1) A "crash program" of the United States to develop a nuclear bomb during WWII was called the __ Project.

20. (2) Of the two bombs dropped by the United States on Hiroshima and Nagasaki during WWII, one used the fissionable isotope __ while the other used the fissionable isotope __.

21. (1) The nuclear reactor at Chernobyl was not a BWR nor a PWR but instead was a __.

22. (1) According to the CEO of NSP, nuclear fuel (for an existing nuclear plant) is more expensive than coal. (true, false)

23. (1) The number of neutrons in a Uranium 238 nucleus is __.

24. (2) List two of the many major problems that went wrong at Three Mile Island.

25. (8) The approximate R-Value for the walls of a home is closest to: (a) .08 (b) .104 (c) 5 (d) 14 (e) 27 (f) 122

26. (1) A concern about nuclear waste is that it contains __ which was produced by a neutron striking $^{238}\text{U}$ atoms. This particular isotope can be "readily" extracted.

27. (1) The approximate R-Value for the walls of a home is closest to: (a) .08 (b) .104 (c) 5 (d) 14 (e) 27 (f) 122

28. (1) A type of heat transfer given off by a hot object in the form of electromagnetic waves is called __.

29. (1) A type of heat transfer through a solid without a change in shape of the solid and involves the motion of one molecule being passed on to the motion of its neighbor is called __.

30. (4) Which of the following has the smallest R-value? (a) 1 in of softwood; (b) 2 in of hardwood; (c) 1 in of styrofoam; (d) single pane glass; (e) 1 in of stone; (f) double pane glass
A type of heat transfer that results from the actual motion of the fluid material (either liquid or gas) is called **convection**.

**B. Longer Answer Questions**

1. (3) Explain what is meant by the "envelope" of a house.

2. (6) Discuss as best you can the major advantages of nuclear power and then the major disadvantages of nuclear power. (Be sure to list at least four of each.)

3. (7) Draw as best you can and explain the operation of a pressurized water reactor. Be sure to include in your diagram the fuel rods, control rods, turbine and generator, and all pumps. Also point out (a) where heat is added, (b) where work is done, and (c) where heat is removed from the water.
4. (4) What happened at Chernobyl. What kind of a reactor was this and how does it vary from the commercial reactors in the United States? List a method that people could protect themselves from the radioactive iodine that was included in the radioactive cloud that continued to move over Scandinavia and E. Europe.

5. (4) REVIEW QUESTION: Start with a 75 ft thickness of peat and draw a diagram illustrating how the other forms of coal can be formed. Supply thickness, BTU content, and the name of each form.

6. (3) Illustrate by a series of diagrams how a chain reaction could occur using a specific fissionable isotope.

7. (3) TEXT ESSAY QUESTION: Discuss from the viewpoint of the text "Air to Air Heat Exchanger" and infiltration.
8. (20) TEXT QUESTIONS: Define or briefly discuss from the viewpoint of the text the following.

China Syndrome

carbon monoxide

radon

electromagnetic radiation

photovoltaic cell

geothermal

hydroelectricity

OTEC

photosynthesis

power tower