

UNIVERSITY OF SWAZILAND

Faculty of Health Sciences

(BSC) IN ENVIRONMENTAL HEALTH

SECOND SEMESTER FINAL EXAMINATION PAPER MAY 2010

TITLE OF PAPER : ENVIRONMENTAL PHYSICS11

COURSE CODE : EHS 412

DURATION : TWO HOURS

MARKS : 100

INSTRUCTIONS :

- : ANSWER ONLY FOUR QUESTIONS
- : EACH QUESTION CARRIES 25 MARKS
- : QUESTIONS ONE AND TWO ARE COMPULSARY
- : NO QUESTION PAPER SHOULD BE BROUGHT INTO NOR OUT OF THE EXAMINATION ROOM
- : BEGIN EACH QUESTION ON A SEPARATE SHEET OF PAPER

DO NOT OPEN THIS QUESTION PAPER UNTIL PERMISSION IS GRANTED BY THE INVIGILATOR

QUESTION ONE

Question one is a multiple choice. Answer by writing the letter to the correct answer besides the number of the question e.g. 26. C.

1. When Rutherford discovered the existence of a nucleus in the atom, he used a narrow beam of
 - a. Alpha particles.
 - b. Beta particles.
 - c. Neutrons.
 - d. Gamma rays.

2. Multiple nuclear fissions
 - a. Occur when two nuclei hit each other.
 - b. Require isotopes with small mass numbers.
 - c. Occur best with a small mass of isotopes.
 - d. May result in chain reaction.

3. The least expensive perpetual energy resource is
 - a. Improving energy efficiency.
 - b. Wind energy.
 - c. Biomass.
 - d. Hydrogen gas.

4. It takes at least ----- years to phase in new energy alternatives.
 - a. 20
 - b. 30
 - c. 40
 - d. 50

5. The energy source with the highest net energy ratio for space heating is
 - a. Oil.
 - b. Active solar.
 - c. Passive solar.
 - d. Electric resistance heating.

6. The fissionable fraction of the fuel in a nuclear reactor is
 - a. Uranium-235.
 - b. Uranium-238.
 - c. Uranium-239.
 - d. Plutonium-239.

7. Control rods in a reactor
 - a. Contain uranium.
 - b. Absorb neutrons.
 - c. Contain plutonium.
 - d. Reduce heat.

8. The moderator in a nuclear reactor
 - a. Releases neutrons.
 - b. Absorbs neutrons.
 - c. Reflects neutrons.
 - d. Slows down neutrons.

9. The most common moderator used in nuclear reactors is
 - a. Graphite.
 - b. Boron.
 - c. Argon.
 - d. Water.

10. If the fuel pellets in spent fuel rods are processed to remove plutonium and other very long-lived radioactive isotopes, the remaining radioactive waste should be safely stored on the order of ----- years
 - a. 10.
 - b. 100.
 - c. 1000.
 - d. 10 000.

11. Industry can reduce its energy consumption by
 - a. Switching to incandescent lighting.
 - b. Quickly venting waste heat to the environment.
 - c. Increasing recycling and reuse of materials.
 - d. Using more standard electric motors.

12. Windows designed to capture solar energy in Swaziland should face
 - a. North.
 - b. South.
 - c. East.
 - d. North.

13. The solar technology that most strongly focuses the sun's rays is the
 - a. Active solar heating system.
 - b. Solar power tower.
 - c. Nonimaging optical solar concentrator.
 - d. Solar cooker.

14. Cells that convert solar energy directly into electricity are called
- Electrosolar chips.
 - Photovoltaic cells.
 - Helioelectric units.
 - Photoelectric cells.
15. Hydroelectric plants
- Need to be shut down frequently for maintenance checks.
 - Offer low net useful energy yield.
 - Have relatively high operating and maintenance costs.
 - Help control flooding and supply a regulated flow of irrigation water to areas below the dam.
16. Which of the following is a disadvantage of hydroelectric plants?
- High pollution.
 - High construction costs.
 - High operation and maintenance costs.
 - Low functional life span.
17. Ocean thermal energy conversion
- Relies on large temperature differences between deep and surface waters.
 - Is economically competitive with other energy alternatives.
 - Is ready for deployment in suitable areas.
 - Plants would be anchored to the bottom of cold oceans in suitable sites.
18. Wind power in Swaziland
- Is an unlimited source of energy at favorable sites.
 - Requires long construction time.
 - Has a low net useful energy yield.
 - Emits moderate air pollution.
19. An advantage associated with the development and use of geothermal energy systems is that
- Carbon dioxide is the only air pollutant produced.
 - Geothermal power plants do not require cooling water.
 - Geothermal energy sources are vast, reliable, and potentially renewable for areas near reservoir sites.
 - There is no risk of harmful environmental impact.
20. Large scale funding of hydrogen research would generally be least opposed by
- Electric utilities.
 - Sustainable developers.
 - Fossil-fuel companies.
 - Automobile manufacturers.

21. What are micropower systems?
- Miniaturized photovoltaic cells.
 - Small power stations distributed throughout a region.
 - A way of transmitting electricity via microwaves.
 - Installing electrical generators in individual homes and buildings.
22. A meltdown of the reactor core would occur if
- Control rods were inserted into the core.
 - Too much coolant was lost.
 - The proportion of uranium-238 was too high.
 - The containment building developed an air leak.
23. The world's most abundant conventional fossil fuel is
- Crude oil.
 - Natural gas.
 - Biomass.
 - Coal.
24. One of the Swaziland's most dangerous occupations because of accidents and the incidence of disease is
- Public transport.
 - Building construction.
 - Surface mining of coal.
 - Subsurface mining of coal.
25. According to Amory Lovins, the easiest, fastest, and cheapest way to get more energy with the least environmental impact is to
- Improve photovoltaics.
 - Develop wind power.
 - Initiate nuclear power plants development.
 - Eliminate energy waste.

TOTAL 25 MARKS

QUESTION TWO

- Discuss the most important health and environmental consequences of our use of fossil fuels (13 marks)
- Describe how a nuclear reactor works and why reactors can be dangerous (12 marks)

TOTAL 25 MARKS

QUESTION THREE

1. What are fuel cells (2 marks)?
2. List four types of fuel cells in use today (4 marks)
3. Describe in details with the aid of a labeled diagram how fuel cells work (14 marks).
4. Describe the problems of burning biomass as a source of fuel in Swaziland (5 marks)

TOTAL 25 MARKS

QUESTION FOUR

1. Describe ten ways that you could advise the rural community you are working in as an environmental manager to conserve energy (10 marks).
2. Explain how photovoltaic cells generate electricity (8 marks).
3. Congratulations! You are appointed the environmental manager at the proposed Nuclear Power Plant to be developed at Siteki. Elaborate on how you are going to manage the radioactive wastes that will emanate from this plant. What plans do you have for the future decommissioning of the plant (7 marks)?

TOTAL 25 MARKS

QUESTION FIVE

1. What is oil shale (2 marks)?
2. Discuss the benefits and risks of oil shale development (10 marks)
3. Wind energy is close to being competitive with conventional electricity. Should we develop this energy resource in preference to nuclear power, coal, or shale in Swaziland? Advance reasons for your answer (13 marks)