UNIVERSITY OF SWAZILAND

Faculty of Health Sciences

(BSC) IN ENVIRONMENTAL HEALTH

SECOND SEMESTER FINAL EXAMINATION PAPER 2009

TITLE OF PAPER	:	ENVIRONMENTAL PHYSICS II
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

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

2. 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.

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

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

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

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

7. 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.

8. A meltdown of the reactor core would occur if
    a. Control rods were inserted into the core.
    b. Too much coolant was lost.
    c. The proportion of uranium-238 was too high.
    d. The containment building developed an air leak.

9. The world's most abundant conventional fossil fuel is
    a. Crude oil.
    b. Natural gas.
    c. Biomass.
    d. Coal.

10. One of the Swaziland's most dangerous occupations because of accidents and the incidence of disease is
    a. Public transport.
    b. Building construction.
    c. Surface mining of coal.
    d. Subsurface mining of coal.

11. According to Amory Lovins, the easiest, fastest, and cheapest way to get more energy with the least environmental impact is to
    a. Improve photovoltaics.
    b. Develop wind power.
    c. Initiate nuclear power plants development.
    d. Eliminate energy waste.

12. 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.

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

14. 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.

15. Cells that convert solar energy directly into electricity are called
    a. Electrosolar chips.
    b. Photovoltaic cells.
    c. Helioelectric units.
    d. Photoelectric cells.

16. Hydroelectric plants
    a. Need to be shut down frequently for maintenance checks.
    b. Offer low net useful energy yield.
    c. Have relatively high operating and maintenance costs.
    d. Help control flooding and supply a regulated flow of irrigation water to areas below the dam.

17. Which of the following is a disadvantage of hydroelectric plants?
    a. High pollution.
    b. High construction costs.
    c. High operation and maintenance costs.
    d. Low functional life span.

18. Ocean thermal energy conversion
    a. Relies on large temperature differences between deep and surface waters.
    b. Is economically competitive with other energy alternatives.
    c. Is ready for deployment in suitable areas.
    d. Plants would be anchored to the bottom of cold oceans in suitable sites.

19. Wind power in Swaziland
    a. Is an unlimited source of energy at favorable sites.
    b. Requires long construction time.
    c. Has a low net useful energy yield.
    d. Emits moderate air pollution.

20. An advantage associated with the development and use of geothermal energy systems is that
    a. Carbon dioxide is the only air pollutant produced.
    b. Geothermal power plants do not require cooling water.
    c. Geothermal energy sources are vast, reliable, and potentially renewable for areas near reservoir sites.
    d. There is no risk of harmful environmental impact.

21. Large scale funding of hydrogen research would generally be least opposed by
    a. Electric utilities.
    b. Sustainable developers.
    c. Fossil-fuel companies.
    d. Automobile manufacturers.

22. What are micropower systems?
    a. Miniaturized photovoltaic cells.
    b. Small power stations distributed throughout a region.
    c. A way of transmitting electricity via microwaves.
    d. Installing electrical generators in individual homes and buildings.

23. 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.

24. 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.

25. The least expensive perpetual energy resource is
    e. Improving energy efficiency.
    f. Wind energy.
    g. Biomass.
    h. Hydrogen gas.

TOTAL 25 MARKS

QUESTION TWO

1. List eight components of crude oil that are separated during its fractional distillation. (8 marks).
2. Explain how energy could be produced in the future by nuclear fusion and point out some of the envisaged advantages and disadvantages (12 marks).
3. One of the proposed new nuclear reactors is the *pebble bed modular reactor.* Advance the reasons why scientists and nuclear physicists oppose the idea. (5 marks).

TOTAL 25 MARKS

QUESTION THREE

1. What is energy efficiency? (1 mark)
2. Motivate seven ways that you would advice residents of Mbabane city to use to save energy in the existing buildings (21 marks).
3. List four disadvantages of using water to generate electricity in Swaziland (4 marks).

TOTAL 25 MARKS

QUESTION FOUR

1. Write the complete (symbol) and balanced (atomic numbers, mass numbers, and moles) equation of the fission of uranium-235 by a neutron. (10 marks)
2. Complete the properties of the three nuclear emissions in the table below under the indicated themes (15 marks)

Property	Alpha particles	Beta particles	Gamma rays
Nature			
Penetration			
Magnetic and electric fields			
Ionization of gases			
Cloud chamber			

TOTAL 25 MARKS

QUESTION FIVE

Explain how one can tap energy from the following sources be sure to also include their advantages and disadvantages.

a. Wind power (12 marks)
b. Geothermal power (13 marks)

TOTAL 25 MARKS