# UNIVERSITY OF SWAZILAND

**Faculty of Health Sciences**

**(BSC) IN ENVIRONMENTAL HEALTH**

**FINAL EXAMINATION PAPER 2005**

**TITLE OF PAPER**: ENVIRONMENTAL PHYSICS

**COURSE CODE** : EHS 402

**DURATION** : THREE HOURS

**MARKS** : 100

**INSTRUCTIONS** : ANSWER ONLY FIVE QUESTIONS.

: EACH QUESTION CARRY 20 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.**



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## QUESTION ONE:

Answer this question by clearly writing the question number and the letter of the correct answer next to it.

1. A Distinctive building block of matter is called?
(a) mixture
(b) compound
(c) isotope
(d) element

2. protons, neutrons, and electrons are all
(a) forms of energy
(b) equal in mass
(c) subatomic particles
(d) negative ions

3. the volume of an atom is mostly
(a) electron
(b) proton
(c) neutron
(d) free space

4. Isotopes differ from each other by
(a) ions
(b) protons
(c) atoms
(d) neutrons

5. A parent and a kindergartener spent a half hour picking up all the toys and placing them on the shelves and in the drawers. The next evening, most of the toys were back on the floor. The concept which best describe this observation is
(a) conservation of matter
(b) conservation of energy
(c) entropy
(d) kinetic energy

6. In order to make one plastic soda bottle, approximately 100 liters of crude oil are used (including raw materials for plastic, fuel, etc.) 100 kg of steel, 100 liters of water, and various amounts of other materials. Which of the following describes this situation?
(a) plastic bottles have a high resource productivity
(b) plastic bottles have a low material efficiency
(c) plastic bottles represent an efficient use of resources
(d) most of the matter used to manufacture plastic bottles ends up in the bottle

7. Which of the following sources of iron would be of the highest quality

(a) iron deposits on the ocean
(b) a field of spinach
(c) a large, scrape metal junkyard
(d) a one-half-mile-deep deposit of iron ore

8. Energy can be formally defined as
(a) the random motion of molecules
(b) the ability to do work and transfer heat
(c) a force that is exerted over some distance
(d) the movement of molecules

9. Scientists classify energy as either
(a) chemical or physical
(b) kinetic or mechanical
(c) potential or mechanical
(d) potential or kinetic

10. All of the following are examples of kinetic energy except
(a) a speeding bullet
(b) a stick of dynamite
(c) a flow of electric current
(d) a leaf falling from a tree

11. An example of potential energy is
(a) electricity flowing through a wire
(b) the chemical energy in a candy bar
(c) a bullet fired at high velocity
(d) a leaf falling from a tree

12. All of the following are examples of ionizing radiation except
(a) cosmic rays
(b) gamma rays
(c) microwaves
(d) X-rays

13. the relative quality of electricity is
(a) very high
(b) high
(c) moderate
(d) low

14. High-temperature industrial heat is least likely to be provided by
(a) nuclear fission
(b) concentrated sunlight
(c) dispersed geothermal energy
(d) burning natural gas

15. Which of the following involves changes of mass into energy?
(a) chemical changes
(b) energy changes
(c) physical changes
(d) nuclear changes

16. Nuclear changes are governed by
(a) the law of conservation of matter
(b) the law of conservation energy
(c) the law of conservation of matter and energy
(d) the law of entropy

17. Which of the following comparisons of nuclear fission and nuclear fusion is correct?
(a) nuclear fusion is harder to initiate than nuclear fission
(b) nuclear fusion produces less energy than nuclear fission
(c) nuclear fusion occurs in atomic bombs, whereas nuclear fission occurs in hydrogen bombs
(d) nuclear fusion occurs in nuclear power plants, whereas nuclear fission occurs in the sun

18. Which of the following is a likely product of a fusion reaction?
(a) alpha particles
(b) deuterium
(c) tritium
(d) helium

19. The fuel used in a nuclear reactor is
(a) gamma rays
(b) uranium-235
(c) alpha particles
(d) beta particles

20. A low-throughput economy would do all of the following except
(a) use energy more efficiently
(b) shift to perpetual and renewable energy sources
(c) recycle and reuse most matter that is now discarded
(d) create goods with a short life cycle to increase recycling.

**TOTAL 20 MARKS.**

## QUESTION TWO:

The current through an X-ray tube is 6 mA when the voltage is 200 000 volts. Given that the electron charge $= 1.6 \times 10^{-19}$C and mass $= 9 \times 10^{-36}$kg, calculate
(a) the number of electrons striking the target per second (5 marks)
(b) the velocity of the electrons striking the target. (5 marks)
(c) Explain how the properties of X-rays make them suitable for both medical and industrial photography. (5 marks)
(d) Outline ways in which X-rays are a danger to human health. State how operators of X-ray machines are protected from the bad effects of the rays. (5 marks)

**TOTAL 20 MARKS.**

## QUESTION THREE:

(A) Distinguish between Subsurface and surface mining. (5 marks)
(B) Briefly describe the environmental impacts of mining from its extraction, processing through to its use. (15 marks)

**TOTAL 20 MARKS.**

## QUESTION FOUR:

(A) List and describe three types of coal. (9 marks)
(B) Indicate which is preferred for burning and which is most available. (2 marks)
(C) List four advantages and five disadvantages of using coal as a fuel source. (9 marks)

**TOTAL 20 MARKS.**

## QUESTION FIVE:

(A) Describe how a nuclear fission reactor works. (5 marks)
(B) List the five major components of a light-water nuclear reactor. (5 marks)
(c) Describe the major events that lead to the Chemobyl nuclear power accident on April 26, 1986, in the former Soviet Union. (10 marks)

**TOTAL 20 MARKS**

## QUESTION SIX:

(A) Ten tins of mass 40 kg are lifted vertically through a height of 3.4 m. calculate the work done. (given that gravity is 9.8) (4 marks)
(B) State the following laws and write down their expressions.
(i) Fourier's law of heat flow (6 marks)
(ii) Newton's law of cooling (7 marks)
(C) Write down the expression used to calculate the maximum efficiency (Carnot efficiency) of heat engines. (3 marks)

**GOOD LUCK!!!!!**



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