UNIVERSITY OF SWAZILAND
FACULTY OF HEALTH SCIENCES
DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCE

TITLE OF PAPER	:	SUPPLEMENTARY EXAM [ENVIRONMENTAL PHYSICS I]
COURSE CODE	:	EHS 411
ACADEMIC YEAR	:	2013/2014
ALLOCATED TIME	:	2 HOURS
NO. OF MARKS	:	75

INSTRUCTIONS

1. DO NOT OPEN THIS EXAMINATION PAPER UNTIL YOU ARE INSTRUCTED TO DO SO BY THE INVIGILATOR.

2. QUESTION ONE IS COMPULSORY. CHOOSE ANY OTHER TWO QUESTIONS IN ADDITION TO QUESTION ONE [THREE QUESTIONS IN TOTAL].

3. NO FORM OF PAPER, OR ANY OTHER UNAUTHORIZED MATERIAL, SHOULD BE BROUGHT INTO THE EXAMINATION ROOM.

4. BEGIN YOUR ANSWERS TO EACH QUESTION ON A FRESH PAGE OF THE ANSWER BOOKLET. ENSURE THAT ALL PAGES OF THE ANSWER BOOKLET ARE NUMBERED ACCORDINGLY.

5. WRITE CLEARLY AND USE PROPER ENGLISH LANGUAGE GRAMMAR, OTHERWISE MARKS SHALL BE LOST FOR CARELESSNESS IN THESE ASPECTS.

QUESTION ONE [25 MARKS]

1. Neutrons are;
   a. Positively charged
   b. Negatively charged
   c. Neutral
   d. Positively charged only when heated
2. The mass of an atom is made up of;
   a. Electrons and protons
   b. protons and the electron cloud
   c. the electron cloud and electrons
   d. The nucleus
3. The atomic number;
   a. Tells us the number of positively charged protons and the equal number of negatively charged electrons outside its nucleus.
   b. Tells us the number of positively charged neutrons and the equal number of negatively charged electrons outside its nucleus.
   c. Tells us the number of positively charged atoms in the periodic table
   d. Tells us the number of neutrons that are released during fission reactions in a nuclear power plant.
4. The number of electrons is provided by;
   a. The mass number
   b. The atomic number
   c. The charge number
   d. The Avogadro's Number
5. The type of energy that powers that sun and that keeps the earth's interior molten is;
   a. Chemical energy
   b. Mechanical energy
   c. Light energy
   d. Nuclear energy
6. This type of energy results when atoms or molecules move. This is;
   a. Chemical energy
   b. Electrical energy
   c. Light energy
   d. Thermal energy
7. The type of energy that cannot be stored for long periods, nor can it be transmitted over long distances without large losses in available energy is;
   a. Mechanical energy
   b. Chemical energy
   c. Thermal energy
   d. Sound energy

8. Heat is defined as;
   a. The measure of the hotness of an object and its capacity to raise the temperature of the surrounding environment.
   b. The total kinetic energy of all the moving atoms, ions, or molecules within a given substance, excluding the overall motion of the whole object.
   c. This is the measure of the average speed of motion of the atoms, ions or molecules in a sample of matter at a given moment.
   a. The study of energy transformations.
9. Temperature is defined as;
   a. The measure of the hotness of an object and its capacity to raise the temperature of the surrounding environment.
   b. The total kinetic energy of all the moving atoms, ions, or molecules within a given substance, excluding the overall motion of the whole object.
   c. This is the measure of the average speed of motion of the atoms, ions or molecules in a sample of matter at a given moment.
   d. The study of energy transformations.
10. According to the Second Law of Thermodynamics;
   a. Whenever energy is converted from one form to another in a physical or chemical change, no energy is created or destroyed.
   b. Once the concentrated energy in a serving of food, a liter of gasoline, or a chunk of uranium is released, it is degraded to low-quality heat that is dispersed into the environment at a low temperature.
   c. This scientific law tells us that no matter how hard we try or how clever we are, we cannot get more energy out of a physical or chemical change than we put in.
   a. We can change elements and compounds from one physical or chemical form to another, but we can never create or destroy any of the atoms involved in any physical or chemical change.
11. A good example of extremophiles is;
   a. Giant tube worms
   b. Whales
   c. Dolphins
   d. Salmon
12. According to the First Law of Thermodynamics;
   a. Whenever energy is converted from one form to another in a physical or chemical change, no energy is created or destroyed.
   b. Once the concentrated energy in a serving of food, a liter of gasoline, or a chunk of uranium is released, it is degraded to low-quality heat that is dispersed into the environment at a low temperature.
   c. This scientific law tells us that no matter how hard we try or how clever we are, we cannot get more energy out of a physical or chemical change than we put in.
   d. We can change elements and compounds from one physical or chemical form to another, but we can never create or destroy any of the atoms involved in any physical or chemical change.

13. Extremophiles obtain their energy through;
    a. A process in which certain organisms (mostly specialized bacteria) extract inorganic compounds from their environment and convert them into organic nutrient compounds without the presence of sunlight.
    b. A complex process that occurs in the cells of most living organisms, in which nutrient organic molecules such as glucose ($C_6H_{12}O_6$) combine with oxygen (O_2) and produce carbondioxide (CO_2), water (H_2O) and energy.
    c. Complex process that takes place in the cells of green aquatic plants.
    d. A form of cellular respiration in which some decomposers get the energy they need through the breakdown of glucose (or other nutrients) in the absence of oxygen.
14. A good example of low quality energy is;
    a. Heat dispersed in the atmosphere
    b. Electricity
    c. Chemical energy stored in coal
    d. Chemical energy stored in gasoline
15. According to the Law of Conservation of Matter;
    a. Whenever energy is converted from one form to another in a physical or chemical change, no energy is created or destroyed.
    b. Once the concentrated energy in a serving of food, a liter of gasoline, or a chunk of uranium is released, it is degraded to low-quality heat that is dispersed into the environment at a low temperature.
    c. This scientific law tells us that no matter how hard we try or how clever we are, we cannot get more energy out of a physical or chemical change than we put in.
    d. We can change elements and compounds from one physical or chemical form to another, but we can never create or destroy any of the atoms involved in any physical or chemical change.
16. Isotopes have the ;
    a. Same atomic number but a different mass number
    b. Same mass number but different atomic number
    c. Same number of electrons in the electron cloud but different number of subatomic electrons
    d. Same atomic number and same mass number
17. Isotopes are identified by attaching their;
    a. Atomic numbers to the name or symbol of the element
    b. Charge numbers to the name or symbol of the element
    c. Valence number to the name or symbol of the element
    d. Mass numbers to the name or symbol of the element
18. The type of energy that is routinely produced from chemical energy (through coal, natural gas, oil, and wood), mechanical energy (moving water or wind) and nuclear energy is;
    a. Nuclear energy
    b. Mechanical energy
    c. Sound energy
    d. Electrical energy

19. The type of energy that is commonly used in machines or mechanism is;
    a. Nuclear energy
    b. Chemical energy
    c. Mechanical energy
    d. Potential energy
20. The type of energy that may be converted into other energy forms, such as thermal or mechanical, or used directly, as in radios, TVs, computers, etc is;
    a. Nuclear energy
    b. Electrical energy
    c. Mechanical energy
    d. Sound energy
21. The type of energy that may be transmitted over long distances is;
    a. Electrical energy
    b. Light energy
    c. Thermal energy
    d. Nuclear energy
22. An alpha particle is;
    a. An electron
    b. A helium ion
    c. An ionized nucleus
    d. Non-ionizing radiation
23. The beta particle is;
    a. An electron
    b. A helium ion
    c. An ionized nucleus
    d. Non-ionizing radiation
24. Every time a reaction release a beta particle;
    a. The atomic number remains unchanged but the atomic mass increases by 1
    b. The atomic mass remains unchanged but the atomic number increases by 1
    c. The charge number remains unchanged but the atomic valence increases by 1
    d. The atomic valence remains unchanged but the atomic charge increases by 1
25. Every time a reaction releases an alpha particle;
    a. The atomic charge decreases by 4 and the atomic mass by two
    b. The atomic mass value decreases by 4 and the atomic valence by two
    c. The atomic number decreases by 4 and the atomic mass by two
    d. The atomic mass value decreases by 4 and the atomic number by two

QUESTION TWO [25 MARKS]

1. A private company, called Shell Oil, is drilling the ground in order to extract the recently discovered oil in Piggs Peak. From the surface up to a depth of about 10m, there are no rocks hindering the drilling process; however after this depth, a lot of rocks are encountered. This same area, where drilling is taking place, is said to have once been a very huge lake, into which rainwater from the surrounding mountains drained, some two million years ago. Using your knowledge of the three major types of rocks;
   a. State the most likely type of these rocks [2].
   b. Explain why you chose the type of rocks that you stated in question 1 (a) above [4].
2. Much of Western Europe's airspace was closed for more than a week about six decades ago, due to multiple volcanic eruptions in Iceland. The eruptions also lead to the destruction of vast expanses of virgin forests as thick layers of magma covered the land. Recently, a group of geologist embarked on a survey to establish the most prevalent type of rocks in the area that was covered by magma. Using your knowledge of the three major types of rocks;
   a. State the most likely type of rocks that will be found here [2].
   b. Explain why you chose the type of rocks that you stated in question 2 (a) above [4].
3. The city of Manzini has a large population of about 5 million people. In order to deal with waste generated from the countless households and industrial operations, the Municipal Council operates a state-of-the-art landfill and an incinerator, in which about 30 tons of waste is buried and 20 tons burned respectively. As a result of these two waste management facilities, Manzini is a very clean city (i.e. there is no refuse on streets, there are no illegal dumps and waste is collected daily and dumped in the landfill or incinerator). Using your knowledge of the laws of energy, answer the following questions;
   a. As far as the laws of energy are concerned, Manzini is a city that is developing sustainably and managing waste in an environmentally sound manner [2].
      1) True
      2) False
   b. Describe your reasons for choosing either true or false in question 3 (a) above [4].
   c. State in full the law of energy that is applicable to the scenario given in question 3 above [3].
4. The Lubombo Mountains area, in the south of Swaziland is a volcanically active region, and as a result there are often a number of eruptions every five years. A number of lakes in the western areas of Swaziland are generally more acidic compared to those that are found in the south, and this is blamed on volcanic eruptions. Describe how the lakes in the west are affected [4].

QUESTION THREE [25 MARKS]

1. Giving one example for each, distinguish between high quality energy and low quality energy [6].
2. How much work is done when a mass of 9000g is lifted through a vertical height of 2150mm. Consider the force of gravity to be 9.80m/s² [3].
3. Distinguish between intrusive and extrusive igneous rocks [4].
4. Define desertification and state any two processes that speed up desertification [4].
5. For a long time, coal has been widely used to provide heat and electricity. It is currently burned in power plants to generate about 42% of the world's electricity. Figure 1 shows a simple coal-fired power plant. Study the figure carefully and fill the blanks below by stating the relevant letter [8].

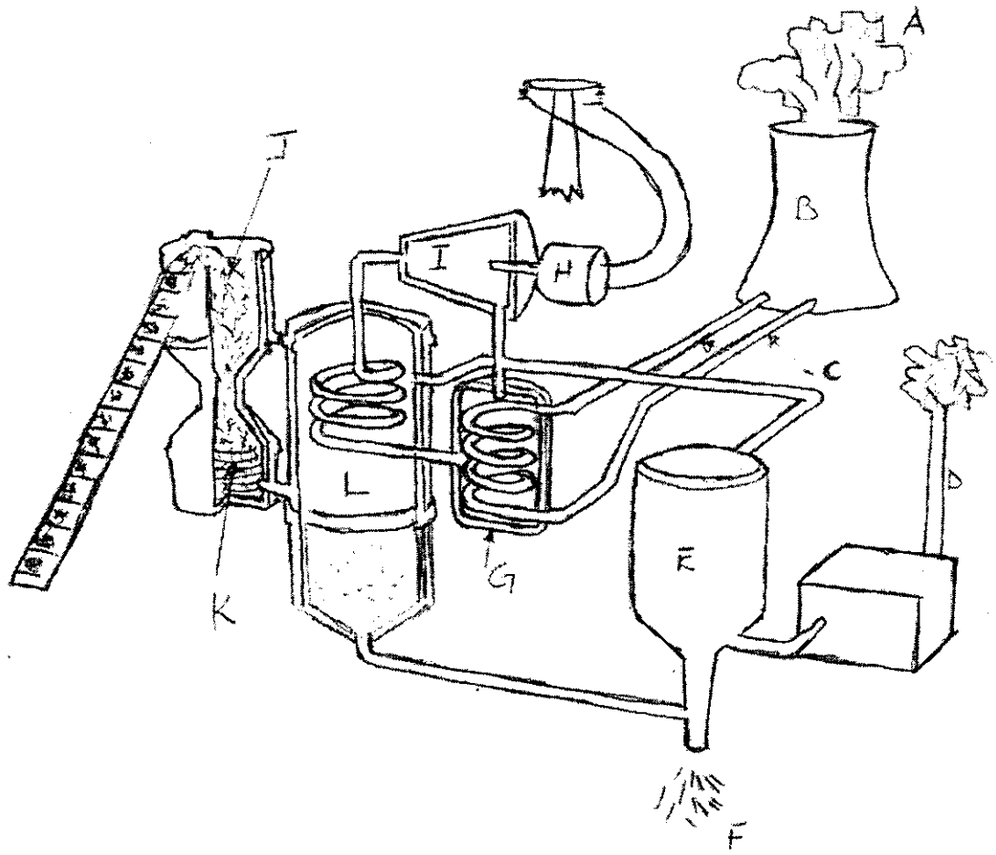

Figure 1: A simple diagram of a coal-fired power plant (Miller and Spoolman 2012).

a. Toxic ash disposal _____
b. Turbine _____
c. Waste Heat _____
d. Pulverizing mill _____
e. Cooling loop _____
f. Boiler _____
g. Stack _____
h. Generator _____

QUESTION FOUR [25 MARKS]

1. Beginning in the 80s, scientists concluded that about 40 – 50% of the ozone layer over Antarctica is destroyed during the Antarctic spring and early summer (September – December), when sunlight returns after the dark Antarctic winter. Using your knowledge of the processes that make Antarctica vulnerable to ozone destruction, describe;
   a. The role of ice crystals in the processes that lead to ozone destruction [3].
   b. The role of the returning of sunlight and summer in the processes that lead to ozone destruction [3].
2. Using your knowledge of the impacts of acid deposition, explain how a village located at the base of a forested mountain, in an area that receives up to 5m of snow each winter, may have to be abandoned [4].
3. What is a polar vortex? [2].
4. Discuss any two benefits of natural ozone to life on earth [4].
5. Discuss the two major ways by which exposure to ionizing radiation can damage cells in the body [4].
6. What are the three main factors determining the extent of effects of ionizing radiation? [3]
7. What is the purpose of heating shale oil before sending it by pipeline to refining industries? [2]