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

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

INSTRUCTIONS

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

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

3. 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.

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

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

QUESTION ONE [25 MARKS]

1. With regard to acid mine drainage, the chief pollutant and the cause of damage in receiving streams is;
   a. H_2S
   b. H_2SO_4
   c. CO_2
   d. CH_4
2. With regard to impacts to wildlife, the type of metal extraction that is likely to result to higher animal mortality is;
   a. Subsurface mining
   b. Surface mining
   c. Heap leaching
   d. Dredging
3. The dirtiest of all fossil fuels is;
   a. Oil
   b. Natural gas
   c. Anthracite coal
   d. Coal
4. The primary reason that coal is a relatively cheap way to produce electricity is that;
   a. In terms of pollution, it is the cleanest of all energy resources.
   b. It is the only energy resource for which there are a range of pollution control devices and technologies.
   c. Most of its environmental and health costs are not included in the market price of electricity from coal-burning power plants.
   d. It has the highest heat content compared to all other energy resources.
5. Petrochemicals is a term that means;
   a. Diesel and petrol
   b. Products of crude oil distillation
   c. Natural gas, crude oil and diesel
   d. All flammable chemicals
6. Flaring;
   a. Refers to the burning of natural gas that is usually found in remote places where no natural gas pipelines are built.
   b. Refers to chemical processes that are used to improve fuel combustion in vehicle engines.
   c. Refers to the use of high-tech methods in the extraction of energy resources from the ground.
   d. Refers to the improvement of the operation of smokestacks in coal-fired power plants.
7. Conventional natural gas is normally found;
   a. Immediately below reservoirs of crude oil
   b. Deep in the earth's crust, especially because natural gas is much more heavier than crude oil
   c. Very close to the surface
   d. Above most reservoirs of crude oil

8. The most destructive form of surface mining is;
   a. Contour mining
   b. Strip mining
   c. Mountaintop removal
   d. Area strip mining
9. The major component of natural gas is;
   a. CH
   b. CH_2
   c. CH_3
   d. CH_4
10. The most toxic component of natural gas is;
   a. HS
   b. H_2S
   c. H_3S
   d. H_4S
11. The pollution of streams with sediment is particularly a serious problem in;
   a. Placer mining
   b. Contour mining
   c. Area strip mining
   d. Subsurface mining
12. The loss of biologically important features like organic matter, water holding capacity, mycorrhizal propagules is associated with;
   a. The use of energy resources
   b. The processing of energy resources
   c. Extraction of energy resources
   d. The transportation of energy resources
13. The soil and rock overlying a useful material deposit is known as;
   a. Spoil
   b. Overburden
   c. Waste
   d. Tailings
14. Since it cannot effectively be stored, it requires a conversion device at the point of use. This is;
   a. Sound energy
   b. Chemical energy
   c. Light energy
   d. Electrical energy
15. The most commonly used, most easily stored and most conveniently transported energy form is;
   a. Sound energy
   b. Chemical energy
   c. Electrical energy
   d. Mechanical

16. Several common fuels – wood, coal, oil, petroleum, etc, all contain;
    a. Mechanical energy
    b. Chemical energy
    c. Light energy
    d. Nuclear energy
17. The useful operating life of a nuclear power plant is estimated to be
    a. 20-30 years
    b. 30-40 years
    c. 40-50 years
    d. 50-60 years
18. In nuclear power plant decommissioning, covering the reactor with reinforced concrete is practiced in;
    a. Mothballing
    b. Immediate dismantling
    c. Entombment
    d. Cask storage
19. Nuclear energy production (uranium mining; transportation to processing and purification plants; production of fuel pellets, fuel rods, fuel assemblies, etc) is less expensive compared to decommissioning of old power plants.
    a. I fully agree
    b. I do not agree
    c. Energy production and dismantling are equally expensive
    d. Energy production is more expensive only when there are accidents, otherwise it is far less expensive than dismantling.
20. Permanent safe storage facilities for nuclear waste are presently;
    a. Available under the ocean
    b. Not available
    c. Available under mountains
    d. Available in former underground mine sites
21. The main purpose of a nuclear power plant is;
    a. To enable nuclear fusion
    b. To concentrate uranium
    c. To boil water
    d. To enable nuclear fission
22. High level radioactive waste;
    a. Gives off small amounts of ionizing radiation for a short time and large amounts for a long time.
    b. Gives off large amounts of non-ionizing radiation for a long time and small amounts for a short time.
    c. Gives off large amounts of ionizing radiation for a short time and small amounts non-ionizing radiation a long time.
    d. Gives off large amounts of ionizing radiation for a short time and small amounts for a long time.

23. One of the chief environmental threats that are associated with even the best of nuclear power plant is;
    a. Release of huge quantities of radioactive emissions during normal power production
    b. Possibility of perishing of aquatic species
    c. SO_2 emissions
    d. Respiratory problems, especially amongst nuclear power plant employees
24. Due to the many problems that are associated with nuclear power production, the rate at which new nuclear power plants are constructed has dropped to approximately;
    a. 15 – 20 per year worldwide
    b. 10 – 15 per year worldwide
    c. 0 – 5 per year worldwide
    d. 5 – 10 per year worldwide
25. An example of subatomic particles are;
    a. Alpha particles
    b. Beta particles
    c. Neutrons
    d. Atoms

QUESTION TWO [25 MARKS]

1. Figure 1 is a schematic representation of the main processes that take place during electricity production in a nuclear power plant. Study the diagram carefully and answer the questions that follow.

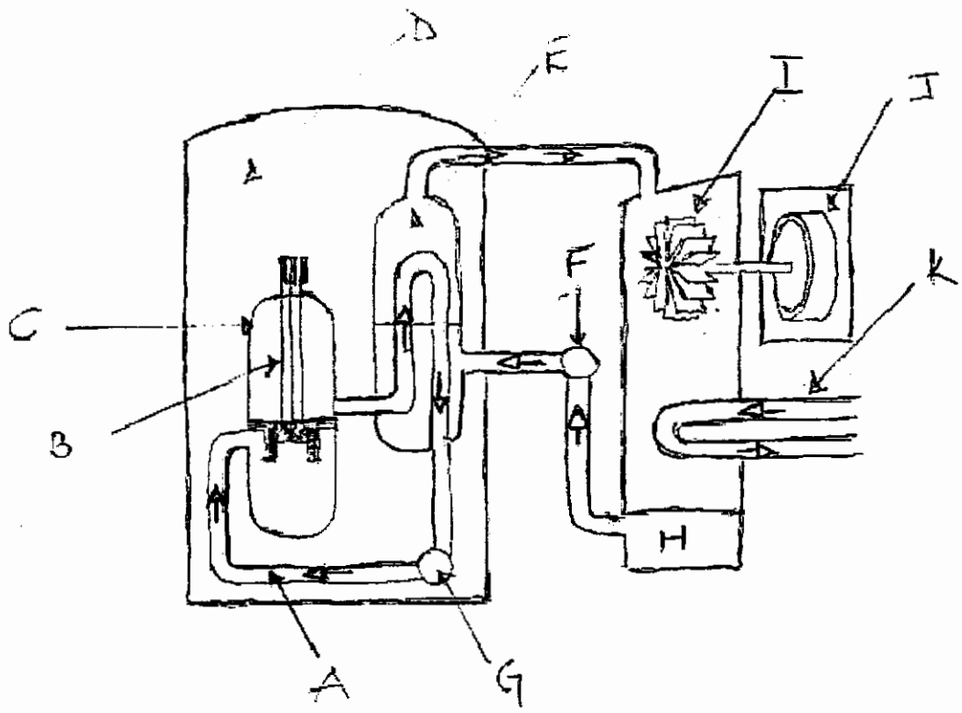

Figure 1: Pressurized water nuclear reactor (Cunningham and Cunningham 12th edition, chapter 19).

1.1 The letters A to K stand for the following parts (in no particular order); containment structure, hot water, generator, pressurized water reactor, condenser, steam generator, pump, water, turbine, fuel rods. Using this list, identify the parts represented by letters [11]

A _____
B _____
C _____
D _____
E _____
F _____
G _____
H _____
I _____
J _____
K _____

2. Figure 2 below shows the changing fortunes of nuclear power. Study the diagram carefully and answer the questions that follow.

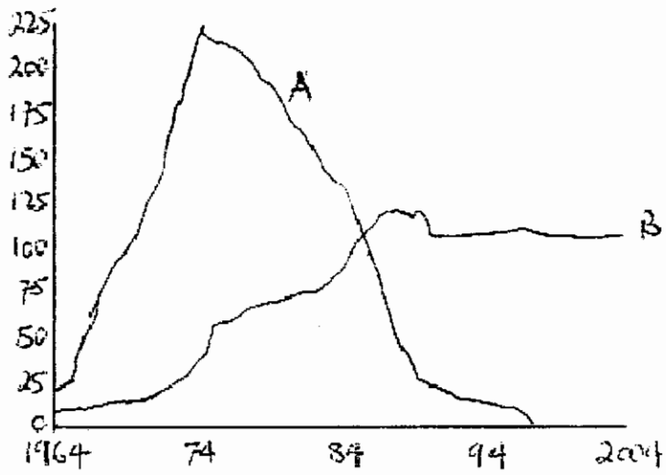

Figure 2: The changing fortunes of nuclear power (Cunningham and Cunningham, 12th edition, chapter 19).

2.1 State the graph that shows nuclear plants that are on order for construction [1].

2.2 State the graph that shows nuclear plants that are currently in operation [1].

3. Public opinion about nuclear power has fluctuated over the years. One of the reasons for these fluctuations is nuclear power plant accidents. State any three major nuclear power accidents [3].
4. State;
   a. Any three examples of low-level nuclear waste [3]
   b. Any two examples of high level nuclear wastes [2]
5. State the most dangerous mining technique and describe at least three reasons that makes this technique more dangerous [4]

QUESTION THREE [25 MARKS]

1. Describe the placer mining technique [3].
2. Describe the mountaintop removal mining technique [3].
3. What do you understand by acid mine drainage? [3]
4. Describe the heap leach mining technique [3].
5. Describe black lung disease? [3]
6. In mineral extraction and processing, what is smelting? [2]
7. What is a mineral resource? [3]
8. The burning of coal is associated with the release of a lot of toxic metals. State any five such toxic metals [5].

QUESTION FOUR [25 MARKS]

1. Thermal shock is one problem that is often experienced in places where industries, such as nuclear power plants, are constructed next to water bodies. What do you understand by thermal shock? [2]
2. How does thermal shock occur? [3]
3. The absorption of infrared radiation by atmospheric gases, and prevention of this energy from escaping into outer space results in the warming of the lower atmosphere, making it conducive for life to occur. Why is this process referred to as a greenhouse effect? [3].
4. The distillation of crude oil leads to the production of a number of raw materials, which are used to manufacture a range of finished products. State any four finished products [4].
5. State the two types of ash that are produced during the combustion of coal in coal-driven power and industrial plants [2].
6. Describe any two disadvantages of coal gasification [4].
7. Greatly increased use of synfuels could worsen two of the world's major current environmental problems. What are these problems? [2]
8. During the extraction of natural resources, important features that support vegetation are normally removed. State any three such features [3].
9. Methane absorbs 23 times as much energy per gram as CO_2 does. However, why is CO_2 ranked as the major greenhouse gas? [2]