

**END OF SEMESTER EXAMINATIONS FOR THE AWARD OF DEGREE OF BACHELOR OF EDUCATION SCIENCE**

**SEPTEMBER SEMESTER 2021**

**UNIT CODE: LSPH 4204**

**UNIT TITLE: PHYSICS FOR ENERGY**

**INSTUCTIONS**

**Answer question 1 and any other two questions**

**Question 1(compulsory: 30mks)**

1. A rambler is walking up a steep hillside in January. He is wearing clothing 1 cm thick, his skin temperature is 340C and the exterior surface is close to freezing at 00C.

Determine the rate of flow of energy outwards from his body, through thermal conduction, when:

1. It is fine dry. Assume that the thermal conductivity for clothing, under dry conditions, is 0.042 Wm-1K-1. (3mks)
2. It has been raining heavily and the rambler is soaked. The thermal conductivity is now 0.64 Wm-1K-1. Assume that the walker has surface area of 1.84 m2. (3mks)
3. A person sitting reading a book releases radiant energy of between 70 and 100 W. Calculate how much energy the person is radiating. Assuming that the emissivity for the human body is 0.5, with an average surface temperature of 350C, that room temperature is 200C, and the body surface area is 1.8 m2.(4mks)
4. Jeans are inappropriate trouser-ware for strenuous outdoor pursuits in wet weather. With reference to the heat energy exchange process justify thus statement. (4mks)
5. To appreciate our environment it is necessary to understand the basic physical science that regulates its development. Explain (3mks)
6. Explain why the newton’s law of cooling does not apply to human beings (3mks)
7. Explain in details how $CO\_{2}$ and $O\_{2}$ are closely linked by the process of respiration and photosynthesis (7mks)
8. Provide a sketch of wavelength versus intensity at different temperatures of a blackbody (3mks)

**Question 2 (20mks)**

a) There are four types of radiation measured namely **source activity, exposure**, **absorbed dose** and **biologically equivalent dose**, explain how each of this is measured (8mks)

b) The following information is provided: S = 1375 W/m2, the earth is a black body, the Stefan’s constant (σ) = 5.67 x 10-8 W/m2K4 and the albedo is estimated to be 30%. On the basis of this information and following the two available earth models, calculate the mean temperature of then earth. How do the two models compare? (14mks)

**Question 3 (20mks)**

1. Given that both the sun and the earth can be considered as blackbody, the Stefan Boltzmann constant=2898 K-µm, the surface and earth temperature are 6000K and 288K respectively. Calculate the wavelength of the blackbody radiation intensity in each case. (8mks)
2. What information does the results in (a) above represent? Provide this information in a sketch of wavelength versus intensity. (5mks)
3. Consider an idealized model with a bird emitting constant sound power with intensity inversely proportional to the square of the distance from the bird. By how many dB does the sound intensity level drop when one moves twice as far away from the bird? (7mks)

**Question 4 (20mks)**

1. Estimate the amount of carbon in the atmosphere corresponding to a concentration of 360 ppm of $CO\_{2}$. Assume the total mass of air is $5.1 ×10^{18} kg$ and the density of air at s.t.p is $1.29 Kgm^{-3}$

(6mks)

1. A monochromatic green light of frequency $6×10^{14} Hz$ is produced by a laser. The power emitted is $2×10^{-3} W$
2. What is the energy of a photon in the beam (4mks)
3. How many photons pass through a particular point in the beam per second? (4mks)
4. Explain any three layers of the atmosphere (6mks)

**Question 5 (20mks)**

1. A 1 kg mass is suspended on a spring with a constant of 16 N/m. its amplitude of oscillation is 0.01 m.
2. What is the quantum number (n) associated with is energy? (2mks)
3. If n changes by 1, what is the fractional change in its energy? (4mks)
4. If the spring constant for an atom in a molecule is the same but the mass is 10-26 Kg and the amplitude is 3.25 x 10-11, what is the fractional energy change when n changes by 1? (4mks)
5. Provide the correct explanation on the black body radiation in relation to Planck’s theory. (10mks)