**SOUTH EASTERN KENYA UNIVERSITY**

**UNIVERSITY EXAMINATIONS 2016/2017**

**FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF**

**SCIENCE**

**ESM 103: PHYSICS OF THE ENVIRONMENT**

**13TH DECEMBER, 2016**

**INSTRUCTIONS TO CANDIDATES**

**TIME: 8.00-1.00A.M**

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This paper consists of FIVE questions.

Answer question **ONE** and any other **TWO** questions.

Question **ONE** carries 30 mark while the other **TWO** questions carry 20

marks each

Use the following constants where necessary

Coulomb’s Constant *ke* 8.99109 *N*.*m*2 / *C* 2

Permittivity of free space *o* 8.851012*C* 2 / *N*.*m*2

Permeability of free spaceo *4**10**7* H */* m

Proton mass m p *1.67**10**27* kg

Electron mass *me* 1.671031*kg*

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**QUESTION 1 [30 MARKS] (COMPULSARY)**

a) The surface of the sun has a temperature of approximate 5800K to a good

approximation we may treat the sun as a black body.

i.

ii.

What is the peak intensity wavelength λmax?

What is the total radiated power per unit area?

-3

[3 marks]

[3 marks ]

b) Define the term radioactivity

c) Explain how helium – neon laser works

d) Explain the concept of green house effect

[1 marks]

[4 marks]

[4 marks]

e) State two reasons why solar energy is the most preferred source of renewable energy

[2 marks]

f) Using a well labelled sketch explain the composition of the vertical atmosphere

[6 marks]

g) State two important functional roles of water vapour in the atmosphere on the planet

earth

h) Explain how Orographic uplift mechanism leads to cloud formation

i) State the plank`s wien`s law

**Question 2 [20 marks]**

a. Using a well labelled diagram describe the Michelson interferometer

[2 marks]

[3 marks]

[2 marks]

[8 marks]

b. State and explain two major environmental concerns associated with radiations

[2 marks]

c. Write down the formula used in calculation of sensitivity of unknown pyranometer

[2 marks]

d. Describe the operation of UV spectrophotometer and UV spectrometer

[8 marks]

**Question 3 [ 20 marks]**

a. A radioactive element has an initial count rate of 2,400 counts per minute on a scaler.

The count rate falls to 300 units per minute in 30 hours,

i.

Calculate the half-life of the element

[2 marks]

ii.

If the initial number of atoms in another sample of the same element is

6.0 × 1020, how many atoms will have decayed in 50 hours?

[ 3 marks]

b. using a well labelled diagram explain how Geiger muller tube detects radioactive

radiation

[ 6 marks]

c) 24*He* is the most abundant isotope of helium. Its mass is 6.6447x 10-27kg. What is

i.

ii.

iii.

The mass defect?

The binding energy of the nucleus in joules?

The binding energy of the nucleus in electron volts?

[4 marks]

[3 marks]

[2 marks]

**Question 4 [20 marks]**

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(Take Wien`s constant = 2.90\*10 m.k)

a. State the first law of thermodynamics

b. Define the following terms as used in thermodynamics

[2 marks]

[4 marks]

i.

ii.

iii.

iv.

Surrounding

Process

Open system

Isolated system

c. Describe three ways how heat is transferred in the environment

[9 marks]

d. State three predicted effects of green house effect [3 marks]

e. State two forces acting on a parcel of air. [2 marks]

**Question 5 [20 marks ]**

a) Estimate the intensity of light emitted from the surface of the sun in the wavelength

range 600nm-605nm, if the temperature of the sun T=5800K. (planks intensity

distribution

function

is

*I* ( )

2*hc* 2

*hc*



,h=6.626\*10-34**J.s.**

c=3\*108ms-

1

’k=1.381\*10-23J/K) [8 marks]

b) From the planks radiation law, show that



 *I* ( )*d*

0

2 5 *k* 4

2 3

*T* 4 .

Use



0 *e ax* 1 *dx* 240 *a*

4

[8 marks]

c) The wavelength (λ) at the peak of a spectral distribution for a black body at 4300K is

674nm. At what temperature would the peak be at 420nm.

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[4 marks]

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15*c h*

1 2

*x* 3