



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR DEGREE OF:

**BACHELOR OF TECHNOLOGY IN ENVIRONMENTALS & RENEWABLE
ENERGY**

APS 4211: PRINCIPLES OF ENVIRONMENTAL PHYSICS

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2014

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Mathematical tables*
- *Scientific Calculator*

This paper consist of **FOUR** questions

Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

This paper consists of **TWO** printed pages

Question One (Compulsory)

a) (i) What is an ideal gas?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

(ii) Write down the equation of state of an ideal gas hence show that:

State what the symbols stand for

(5 marks)

b) (i) Define an electromagnetic spectrum.

(1 mark)

(ii) What is a black body radiator?

(1 mark)

c) A tungsten filament of an electric lamp has a length of 0.5m and a diameter of 6×10^{-5} m. The power rating of the lamp is 60w. Assuming the radiation from the filament to be equivalent to 80% that of a

perfect back body at the same temperature, estimate the steady state temperature of the filament
($\sigma = 5.7 \times 10^{-8} \text{ Wm}^{-2} \text{ K}^{-4}$)

(4 marks)

d) Show that the temperature T, based on a thermometric property X is given by:

$$T_{\lambda} = 273.16 \left(\frac{X}{X_{TP}} \right)$$

where X_{TP} is the value of the thermometric property at triple point.

e) (i) Define the term noise hence differentiate between sound absorption and sound insulation. **(3 marks)**

(ii) List at least FOUR sources of noise **(2 marks)**

f) Discuss how noise related ear damage and hearing loss occurs. **(5 marks)**

Question Two

a) Define the following terms:

(i) Relative humidity **(1 mark)**

(ii) Condensation **(1 mark)**

b) With the aid of diagrams, describe energy generation process from:

(i) Hot dry rock **(3 marks)**

(ii) Hot aquifers **(3 marks)**

(iii) Wind **(3 marks)**

c) (i) What is a black body? **(1 mark)**

(ii) State Stefan's Law of black body radiation **(1 mark)**

(iii) Draw graphs to show how the energy depends on wavelength in the radiation emitted by a black body. Indicate which of graph correspond to the higher temperature. **(4 marks)**

(iv) The temperature of a piece of metal is gradually increased. Discuss the variation in character of the radiation emitted. Assume the metal is a black body. **(3 marks)**

Question Three

a) Estimate the temperature of the earth assuming it is in radiation equilibrium with the sun. (Assume radius of the sun is $7 \times 10^8 \text{ m}$, temperature of the solar surface is 6000 K and distance of the earth from the sun is $1.5 \times 10^{11} \text{ m}$) **(8 marks)**

b) (i) What is global warming? **(1 mark)**

(ii) Discuss the relation between global warming and climate change **(3 marks)**

(5 marks)

c) Discuss the characteristics of alpha, beta and gamma radiation. **(8 marks)**

Question Four

- a) Discuss at least FIVE disadvantages associated with petroleum and gas processing. **(10 marks)**
- b) Name TWO globally related catastrophes, where and when they took place hence discuss their possible consequences: **(10 marks)**