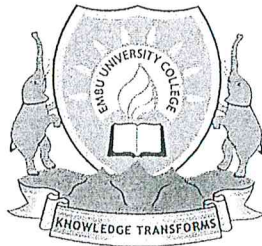


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**EMBU UNIVERSITY COLLEGE**  
(A CONSTITUENT COLLEGE OF THE UNIVERSITY OF NAIROBI)

FIRST SEMESTER EXAMINATIONS 2013/2014

FIRST YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN  
WATER RESOURCES MANAGEMENT

AEM 104: ENVIRONMENTAL PHYSICS

**DATE: DECEMBER 9, 2013**

**TIME: 2.00 – 4.00PM**

**INSTRUCTIONS:**

**Answer Question ONE and ANY Other TWO Questions.**

Constants

Acceleration due to gravity,  $g = 9.81 \text{ m/s}^2$

Density of water  $= 1 \text{ g/cm}^3$

Stefan constant is  $5.7 \times 10^{-8} \text{ Wm}^{-2}\text{k}^{-4}$

Thermal conductivity of a brick is  $0.13 \text{ WM}^{-1}\text{K}^{-1}$

**QUESTION ONE**

- a) What is air? (1mk)
- b) Give three types of ingredients of air. Explain each by composition. (6mks)
- c) Why is carbon dioxide considered a standard composition of air? (2mks)
- d) Give two applications of the following gases:-
  - i) Oxygen
  - ii) Nitrogen
  - iii) Rare gases (6mks)

- e) Explain how moisture affects air density. (2mks)
- f) What is global warming? (1mk)
- g) Explain why carbon dioxide is an important greenhouse gas. (3mks)
- h) Give 5 global warming impacts. (5mks)
- i) The terminal velocity of a steel sphere falling in a liquid is  $0.03 \text{ m/s}$ . The sphere is  $1 \text{ mm}$  in diameter and the density of the steel is  $7830 \text{ kg/m}^3$ . The density of the liquid is  $800 \text{ kg/m}^3$ . Calculate the dynamic and kinematic viscosity of the liquid. (4mks)
- j) Explain the meaning of the terms with respect to terrestrial radiation. (3mks)
- i) Sun at zenith
- ii) Absorption
- iii) Scattering
- k) A gun fires a shell of mass  $5 \text{ kg}$  in horizontal direction. The gun recoils at  $0.4 \text{ m/s}$  and its mass is  $3 \text{ tonnes}$ . Calculate the velocity of the shell. (3mks)
- l) Calculate the quantity of heat conducted through  $2 \text{ m}^2$  of a brick wall  $12 \text{ cm}$  thick in one hour if the temperature on one side is  $28^\circ\text{C}$  and on the other side is  $8^\circ\text{C}$ . (4mks)

### QUESTION TWO

- a) What is a boundary layer? (1mk)
- b) Calculate the drag force on each side of a thin smooth plate  $2 \text{ m}$  long and  $1 \text{ m}$  wide with the length parallel to a flow of fluid moving at  $30 \text{ m/s}$ . The density of the fluid is  $800 \text{ kg/m}^3$  and the dynamic viscosity is  $8 \text{ cp}$ . (4mks)
- c) Explain 3 main processes involved in hydrological cycle. (6mks)
- d) Show that the mean velocity in a pipe with fully developed turbulent flow is  $(49/60)^{1/4}$  of the maximum velocity. Assume the  $1/7^{\text{th}}$  law. (4mks)

### QUESTION THREE

- a) What is the difference between radiation and convection modes of heat flow? (2mks)
- b) Explain three ways by which water can be polluted. (6mks)
- c) The solar constant which is the energy arriving per second at the earth from the sun, is about  $1400 \text{ Wm}^{-2}$ . Estimate the surface temperature of the sun, given that the sun's radius

is  $7 \times 10^5 km$  , the distance of the sun from the earth is  $1.5 \times 10^8 km$

(5mks)

d) Explain the impact of science and technology on resources.

(2mks)

#### QUESTION FOUR

a) What is energy conservation?

(3mk)

b) Explain three ways by which energy can be conserved.

(6mks)

c) A metal sphere with a black surface and a radius  $30mm$  is cooled to  $-73^{\circ}C$  ( $200k$ ) and placed inside an enclosure at a temperature of  $27^{\circ}C$  ( $300k$ ). Calculate the initial rate of temperature rise of the sphere, assuming the sphere is a black body. (assume density of metal is  $8000 kg/m^2$ , specific heat capacity of metal is  $400 Jkg^{-1}$  and Stefan constant is  $5.7 \times 10^{-8} Wm^{-2}k^{-4}$ )

(6mks)

#### QUESTION FIVE

a) What is momentum?

(1mk)

b) Consider a body of mass  $m$  , moving with an initial velocity  $\vec{u}$  and after being subjected to a force  $\vec{F}$  the body changes its velocity to  $\vec{v}$   $m/s$  in  $t$  seconds. Show that  $\vec{F} = ma$  for the body.

(4mks)

c) A lorry of mass  $5 tonnes$  travels along a level road at  $75 kmh^{-1}$  and collides with a pickup of mass  $15 tonnes$  travelling in opposite direction at  $20 kmh^{-1}$  . After impact the lorry is seen to travel in the same direction as before with a speed of  $kmh^{-1}$  . Find the speed of the pickup

(10mks)

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