



KISII UNIVERSITY
UNIVERSITY EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE AWARD OF THE
DEGREE OF BACHELOR OF SCIENCE IN BIOMEDICAL SCIENCES
FIRST SEMESTER, 2021/2022
(FEBRUARY - JUNE, 2022)

BMED 317: BASIC BIOPHYSICS

STREAM: Y3 S1

TIME: 3 HOURS

DAY: THURSDAY, 2:00 – 5:00 P.M.

DATE: 12/05/2022

INSTRUCTIONS

- 1. Do not write anything on this question paper.*
- 2. Answer question ONE and any other TWO questions.*

QUESTION ONE

- a) With the help of a diagram describe a black body is [3 marks]
- b) State and explain Planck's quantum hypothesis [3 marks]
- c) Explain the First law of thermodynamics (3 marks)
- d) In the compression stroke of a gas engine the work done on the gas by the piston is 120kJ/Kg and the heat rejected to cooling water is 90 kJ/Kg. Calculate the change of specific internal energy stating whether it is a gain or a loss. [3 marks]
- e) Calculate the de Broglie wavelength for an electron whose speed is 2.5×10^8 ms^{-1} . [3 marks]
- f) Based on the Bohr's model of the atom, explain the equation
$$hf = E_2 - E_1$$
[3 marks]
- g) Explain the application of sedimentation in biological research. [3 marks]
- h) Distinguish between enthalpy and entropy. [3 marks]

i) Differentiate between lamina flow and turbulent flow. [3 marks]

j) Light of frequency 5.25×10^{14} HZ is made to strike a surface whose work function is 3.5ev. Show that photoelectric effect will not take place. (**$h = 6.6 \times 10^{-34} \text{Js}$**) [3 marks]

QUESTION TWO (20 MARKS)

a) Discuss the role of synapses in the human sensory system [10 marks]

a) Write short notes about:

(i) Simple diffusion [3marks]

(ii) Facilitated diffusion [4 marks]

(i) Active transport [3marks]

QUESTION THREE (20 MARKS)

a) Define stochastic and deterministic effects of ionising radiation, giving an example of each effect. [5 marks]

b) Define and describe consequential late effects in normal tissues after radiation therapy [5 marks]

c) List the treatment factors that can affect the development of a consequential late effect. [5 marks]

d) Distinguish between strong and weak forces found in the biological systems. [5 marks]

QUESTION FOUR (20 MARKS)

a) Using relevant equations show how the sedimentation velocity method works. [10 marks]

b) Explain isoelectric focusing. [10 marks]

QUESTION FIVE (20 MARKS)

(a) Distinguish between isotones and isotopes [2 marks]

(b) Write a decay equation for the following;

(i) Sodium 24 (^{24}Na) decaying to give Magnesium 24 (^{24}Mg) by emitting a β -particle (Z for Na = 11) [2 marks]

(ii) Radium-226 (^{226}Ra) decaying to radon-222 (^{222}Rn) by an emission of an alpha by an emission of an alpha particle (Z for Ra = 88) [2 marks]

(c) i) What is half of half life of a radioactive substance? [1 mark]

ii) Starting from the fact that the rate decay of radioactive nuclide is

$$dN/N = - \lambda dt,$$

where N_0 is the original number of nuclide, dN is the change in the number of nuclide and λ is rate of decay of nuclide, show that at a time = $t_{1/2}$ for a decaying sample of nuclides,

$$\lambda = 0.693 / t_{1/2} \quad [4 \text{ marks}]$$

iii) Calculate the fraction of a radioactive sample that decays in 5 days if the substance has a half-life of 2.5 days [4 marks]