



MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

FIRST YEAR SECOND SEMESTER EXAMINATION FOR
BACHELOR OF ENVIRONMENTAL AND RESOURCE CONSERVATION)
ERC 106: PHYSICAL SCIENCES FOR NATURAL RESOURCES

DATE: 7/5/2019

TIME: 8.30-10.30 AM

INSTRUCTIONS TO CANDIDATES

Answer **QUESTION ONE** and **ANY OTHER TWO** questions.

Question 1 carries **30** marks and the others carry **20** marks each

YOU MAY NEED TO USE;

$g=9.8\text{m/s}^2$, Universal gas constant, $R= 8.31\text{J}/(\text{mol}\cdot\text{k})$, $1\text{atm}=1 \times 10^5$ Pascals

QUESTION ONE (30 MARKS)

- a) State the law of conservation of mass. (2 marks)
- b) State the law of conservation of energy (2 marks)
- c) Define the following terms;
 - i. Longitudinal wave
 - ii. Frequency
 - iii. Wavelength (4 marks)
- d) Define matter and give 4 states of matter. (5 marks)
- e) What is a radioactive material? (2 marks)
- f) Identify any three applications of force in our day to day lives. (3 marks)
- g) Describe the properties of an ideal gas. (2 marks)
- h) Calculate the force on a bag of maize whose mass is 89 kgs and being dragged at a velocity of 6m/s for 4 seconds. (4 marks)
- i) Define the following terms; (6 marks)
 - i. Distance
 - ii. Spontaneous process
 - iii. System
 - iv. Surrounding
 - v. Absolute zero
 - vi. Entropy

QUESTION TWO (20 MARKS)

- a) Describe a wave. (4 marks)
- b) While giving examples, differentiate between the two types of mixtures. (4 marks)
- c) Differentiate between mechanical and electromagnetic waves. (4 marks)
- d) A heat wave traveling at 4m/s sweeps across a sandy area. Its frequency is measured to be 60Hz. Calculate its wavelength. (4 marks)
- e) Differentiate the properties of an oscillations and a wave. (4 marks)

QUESTION THREE (20 MARKS)

- a) Provide the SI units for measuring the following quantities. (4 marks)
 - i. Speed
 - ii. Weight
 - iii. Mass

iv. Force

- b) While writing their equations, State Boyle's and Gay-Lussac's laws. (4 marks)
- c) The gas in a used oil can is at a pressure of 1.03atm at 25°C. If the can is thrown onto a fire, what will the pressure be when temperature reaches 928°C? (4 marks)
- d) A helium party balloon, assumed to be a perfect sphere, has a radius of 31cm. At room temperature (25°C), its internal pressure is 1.08 atm. Find the number of moles of helium in the balloon. (4 marks)
- e) How many moles of air are in an inflated basketball? Assume that the pressure in the ball is 171 kPa, the temperature is 20°C, and the diameter of the ball is 30.0 cm. (4 marks)

QUESTION FOUR (20 MARKS)

- a) Giving two examples each, differentiate between renewable and non-renewable forms of energy. (4 marks)
- b) Identify four advantages of renewable forms of energy. (4 marks)
- c) Describe the generation of electricity from solar and wind energy (8 marks)
- d) As an environmentalist, which measures should be done to ensure energy is available as a resource for many generations? (4 marks)

QUESTION FIVE (20 MARKS)

- a) Define the term "half-life" of a material. (2 marks)
- b) Show that the half-life of a material is given by; (4 marks)
$$T_{\frac{1}{2}} = \frac{0.693}{\lambda}$$
- c) How long does it take for 60% of a sample of radon to decay? Half-life of radon is 3.8days. (4 marks)
- d) State the three laws of thermodynamics (6 marks)
- e) Define radioactivity and name the three types of radioactive emission. (4 marks)