



MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

**FIRST YEAR SECOND SEMESTER SUPPLEMENTARY EXAMINATION FOR
BACHELOR OF SCIENCE (ENVIRONMENTAL AND RESOURCE CONSERVATION
ERC 106: PHYSICAL SCIENCE FOR NATURAL RESOURCES**

DATE: 27/9/2019

TIME: 8:30 -10:30 AM

INSTRUCTIONS:

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

- a) State the law of conservation of mass and energy. (4 marks)
- b) Describe how solar and tidal energy is obtained to produce electricity. (4 marks)
- c) Define the following terms;
 - i) Transverse wave
 - ii) Frequency
 - iii) Diffraction
 - iv) Wavelength (4 marks)
- d) Define matter and give 4 states of matter. (5 marks)
- e) Identify any three applications of force in our day to day lives. (3 marks)
- f) Using mathematical expressions, state Charle's and the Ideal gas laws of gases. (4 marks)
- g) Calculate the force on a body whose mass is 21 kg and being dragged at a velocity of 6m/s for 4 seconds. (4 marks)
- h) Define the following terms; (2 marks)
 - (i) Absolute zero
 - (ii) Entropy

QUESTION TWO

- a) Define a wave (2 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) State the three Newton's laws of motion (6 marks)

QUESTION THREE

- a) Provide the SI units for measuring the following quantities. (4 marks)
 - (i) Speed
 - (ii) Weight
 - (iii) Mass
 - (iv) Force
- b) While writing its equation, State Boyles' law (2 marks)
- c) The gas in a used oil can is at a pressure of 103atm 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) Describe the operational principle of a refrigerator. (6 marks)

QUESTION FOUR

- 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)

$$T_{\frac{1}{2}} = \frac{0.693}{\lambda}$$

Where the terms have their usual meaning

- c) How long does it take for 70% of a sample of radon to decay? Half-life of radon is 3.8days. (5 marks)
- d) Giving two examples each, differentiate between renewable and non-renewable forms of energy. (4 marks)
- e) Identify five disadvantages of non-renewable forms of energy. (5 marks)

QUESTION FIVE

- a) State the three laws of thermodynamics (6 marks)
- b) Differentiate between spontaneous and non-spontaneous processes (4 marks)
- c) A 1.0 Liter volume of air initially at 4.5 atm of pressure is allowed to expand isothermally until the pressure is 1.0 atm. It is then compressed at constant pressure to its initial volume and lastly is brought back to its original pressure by heating at constant volume. Draw the process on a pressure-volume (PV) system, including numbers and labels for the axes. In liters, determine the final volume. (6 marks)
- d) Define radioactivity and name the three types of radioactive emission. (4 marks)