



# MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

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## UNIVERSITY EXAMINATIONS 2022/2023

FIRST YEAR, FIRST SEMESTER SPECIAL/SUPPLEMENTARY EXAMINATION FOR  
DEGREE OF BACHELOR OF SCIENCE IN PUBLIC HEALTH

### HPP 3112: PHYSICS FOR HEALTH SCIENCES

DATE: AUGUST 2023

TIME: 2 HOURS

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INSTRUCTIONS: Answer Question ONE and any other TWO questions.

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#### QUESTION ONE (30 MARKS)

- a) It is observed that the equilibrium separation of the ions in KCl is  $r_0 = 2.79 \times 10^{-10}$  m.  
Calculate the electrical potential energy at this separation. (2 Marks)
- b) i. A mass of  $1200 \text{ cm}^3$  of oxygen at  $27^\circ\text{C}$  and a pressure of 1.2 atmosphere is compressed until its volume is  $600 \text{ cm}^3$  and its pressure is 3.0 atmosphere. Calculate the temperature of the gas after compression in  $^\circ\text{C}$ . (2 Marks)
- ii. At  $20^\circ\text{C}$  the pressure of a gas is 50 cm of mercury at what temperature would the pressure of the gas fall to 10 cm of mercury? (2 Marks)
- c) i. State Newton's second law of motion (2 Marks)
- ii. An elevator has a mass of 1000 kg
- d) It accelerates upwards at  $3 \text{ ms}^{-2}$ . What is the force  $T$  exerted by the cable on the elevator? (2 Marks)
- e) What is the tension  $T$  if the acceleration is  $3 \text{ ms}^{-2}$ . (2 Marks)
- f) A car goes round a flat circular track of radius 200 m at a constant speed of  $30 \text{ ms}^{-1}$ . What is its acceleration (2 Marks)
- g) i. Define the term volume Thermal expansion (2 Marks)

ii. A surveyor uses a steel measuring tape that is exactly 50.00 m long at a temperature of 20°C. The markings on the tape are calibrated for this temperature.

- a) What is the length of the tape when the temperature is 35°C. (2 Marks)
- b) When its 35°C, the surveyor uses the tape to measure a distance the value that she reacts off the tape is 35.794m what is the actual distance. (2 Marks)

### QUESTION TWO (20 MARKS)

- a) i. Define the term D.C current gain in common-Base configuration. (2 Marks)
- b) ii. In a common base configuration the value of collector current is 5.10 mA while the value of the emitter current is 5.18 Ma. calculate the value of the common base D.C current gain (2 Marks)
- c) find the value of base current if the common base D.C current gain of a transistor is 0.987 and emitter current is 10 mA. (3 Marks)
- d) i. differentiates between work function and threshold frequency. (4 Marks)
- e) ii. The threshold wavelength of a photo emissive surface is 0.45  $\mu\text{m}$ .
- a. Its threshold frequency (2 Marks)
- b. Its work function in eV (3 Marks)
- c. The maximum speed with which a photo electron is emitted if the frequency of the radiations is  $7.5 \times 10^{14} \text{ Hz}$ . (take plancics constant  $h = 6.63 \times 10^{-34} \text{ js}^{-1}$  and  $m_e = 9.11 \times 10^{-31} \text{ kg}$ ) (3 Marks)
- d. Define the term photo electric effect (1 Mark)

### QUESTION THREE (20 MARKS)

- a) i. Define the term half time (2 Marks)
- ii. The half-life of a certain radioactive element is 16 years. What fraction of the element will be remaining after 48 years. (2 Marks)
- b) i. Define the term back ground radiation (1 Mark)
- ii. Give three sources of background radiation. (3 Marks)
- c) i. Differentiate between Gamma rays and x-rays. (2 Marks)
- ii. Vvanium – 238 undergoes decay to become lead-206. Find the number of  $\alpha$  and  $p$  particles emitted in the process. (2 Marks)
- d) give nay two types of radiations (2 Marks)

- e) for a certain radioactive element, the average count rate is found to be 82 counts per second. After a time of 210 seconds, the count rate had dropped to 19 counts. The average background count rate remained constant at 10 counts per second. What is the half life of the element. (4 Marks)

#### QUESTION FOUR (20 MARKS)

- a) distinguish between Is volumetric process and an isobaric process. (4 Marks)
- b) a gas at a pressure of  $2 \text{ atm} = 2.02 \times 10^5 \text{ pa}$ . Is heated and is allowed to expand against a frictionless piston at constant pressure. If the volume change is  $0.5 \text{ m}^3$ , how much work is done by the gas. (2 Marks)
- c) i. State Boyles law? (1 Mark)
- ii. A column of air 26 cm is trapped by mercury threed 5 cm long as shown in the fig. below when the tube is inverted as in fig 6, the air column becomes 30 cm long. Determine the value of atmospheric pressure. (3 Marks)

- d) i. State the pressure law? (1 Mark)
- ii. A cylinder contains oxygen at  $0^\circ\text{c}$  and 1 atm pressure. What will be the pressure in the cylinder if the pressure rises to  $100^\circ\text{c}$
- e) The equation  $\frac{PV}{T} = K$  . is the equation of state.
- i. On what parameters does the constant 'k' depend on. (2 Marks)
- ii. The equation changes to  $\frac{PV}{T} = R$ . Under what conditions does this happen. (1 Mark)

- f) The volume  $v$  of a gas at pressure  $p$  is reduced to  $3/8V$  without change of temperature.  
Determine the new pressure of the gas. (2 Marks)
- g) Define the term isothermal process? (1 Mark)

