



MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

SUPPLEMENTARY EXAMINATION FOR

DIPLOMA IN ELECTRICAL ENGINEERING

DIPLOMA IN BUILDING AND CIVIL ENGINEERING

SCU 100: PHYSICS

DATE: SUPPLEMENTARY

TIME: 2:00 – 4:00 PM

INSTRUCTIONS: Answer question ONE and any other TWO questions

SECTION A

QUESTION ONE (30MARKS)

- a) State Young's Modulus and derive its quantitative expression. (6 marks)
- b) A length of copper of square cross-section measuring 0.1 mm by 0.1 mm is stretched by a tension of 100 N. Calculate the tensile stress in Pa. (5 marks)
- c) Distinguish between distance and displacement. (2 marks)
- d) Derive the second equation of linear motion. (3 marks)
- e) A body is projected vertically upwards and reaches a height of 900 m. Calculate its initial velocity. ($g = 9.81 \text{ m}^{-2}$) (3 marks)
- f) Define specific heat capacity. (2 marks)
- g) A copper vessel of mass 0.1 kg has specific heat capacity 390 J kg^{-1} . Calculate its heat capacity. (2 marks)

- h) Two resistors $2\ \Omega$ each are connected in parallel to a 10 V battery of internal resistance $2\ \Omega$ and a switch.
- Draw a diagram of the circuit.
 - Calculate the current in the circuit. (7 marks)

SECTION B

QUESTION TWO (20MARKS)

- Derive an equation for the range when a body is projected at an oblique angle (θ). (5 marks)
- Show that the range is achieved when the angle of projection is 45° . (4 marks)
- Explain the type of force a body experiences when moving round a circular path. (2 marks)
- A body of mass 0.1 kg is whirled round a horizontal circle of radius 1.5 m with a constant speed of 12 ms^{-1} . Calculate its centripetal force. (3 marks)
- An object is fired with a velocity of 40 ms^{-1} at an angle of 50° to the horizontal. Calculate its:
 - Vertical velocity
 - Horizontal velocity (6 marks)

QUESTION THREE (20 MARKS)

- Distinguish between a scalar and a vector quantity and give one example in each case. (4 marks)
- Derive the first equation of linear motion. (4 marks)
- A body accelerates from a velocity of 20 ms^{-1} to 30 ms^{-1} in 5 second.
 - Draw a velocity-time graph for the motion
 - From the graph determine its acceleration.
 - Determine the distance covered over 5 seconds. (10 marks)
- A body moving at 10 ms^{-1} accelerates at 2 ms^{-2} in 20 seconds. Calculate the distance covered over the period of time. (2 marks)

QUESTION FOUR (20 MARKS)

- a) Name the three forms of energy transfer. (3 marks)
- b) Define the following terms.
- i) Molar heat capacity
 - ii) Specific heat capacity
 - iii) Latent heat (6 marks)
- c) The temperature of 200 g of a certain metal is raised to 80°C and then placed in 100 g of water at 20°C . If the final steady temperature rises to 28°C , calculate the specific heat capacity of the metal. (Specific heat capacity of water = $4200 \text{ J kg}^{-1}\text{K}^{-1}$) (3 marks)
- d) An electric kettle which produces energy at a rate of 3000 W contains 0.8 kg of water. It takes 200 seconds to heat the water from 10°C to 100°C

Calculate

- i) Heat Produced by the Kettle
- ii) Heat taken in by water (8 marks)

QUESTION FIVE (20 MARKS)

- a) State Ohm's Law (3 marks)
- b) Derive an expression for the resistance of three conductors connected in series. (5 marks)
- c) A 12 V car battery is connected to three resistors, 3Ω each. The three resistors are connected in parallel and then connected to a 4Ω resistor in series.
- i. Draw the circuit diagram
 - ii. Calculate the total resistance
 - iii. Determine the current in the circuit (12 marks)