

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

**FIRST YEAR EXAMINATION FOR THE AWARD OF DEGREE OF
BACHELOR OF ARTS CRIMINOLOGY AND SECURITY STUDIES**

PHYS 107: SCIENCE AND TECHNOLOGY

STREAMS: BA (CRSS)

TIME: 2 HOURS

DAY/DATE: TUESDAY 5/07/2016

11.30 AM – 1.30 PM

INSTRUCTIONS:

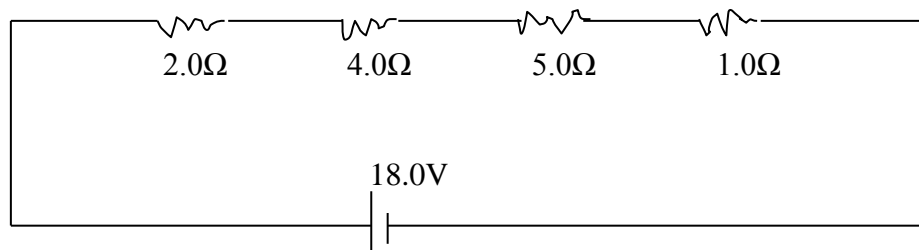
Answer Question One which is Compulsory and any other Two Questions

Speed of light = $3.0 \times 10^8 m/s$

$\epsilon_0 = 8.85 \times 10^{-12} C^2/N.m^2$

Question One (30 Marks) – Compulsory

- (a) A student weighs 637N
- (i) What is her mass on earth where $g = 9.8N/kg$ [2 marks]
 - (ii) What is her mass on the moon where $g = 1.8N/kg$ [2 marks]
 - (iii) What will be her weight in Jupiter where $g = 16.2N/kg$ [2 marks]
- (b) A parallel plate capacitor has an area of $A = 2.4 \times 10^{-4}m^2$ and a plate separation distance of $d = 1.2 \times 10^{-3}m$. Find its capacitance. [3 marks]
- (c) Four resistors are arranged as shown below. Find the current if the emf of the battery is 18.0V [3 marks]



- (d) Differentiate between
- (i) Input and output devices of a computer giving examples in each. [3 marks]
 - (ii) RAM and ROM memories [2 marks]
- (e) State the THREE Newton' laws of motion. [6 marks]
- (f) A brick is thrown from the top of a building at an angle of 30° to the horizontal with an initial speed of 20m/s. if the brick is in flight for 4s how tall is the building? [3 marks]
- (h) A ball has initial velocity of 15m/s along the x axis and starting at $t_0 = 0$ receives an acceleration of $4.0m/s^2$ in the y-direction.
- (i) What is the position of the ball 3.00s after t_0 ? [2 marks]
 - (ii) What is the velocity of the ball at that time? [2 marks]

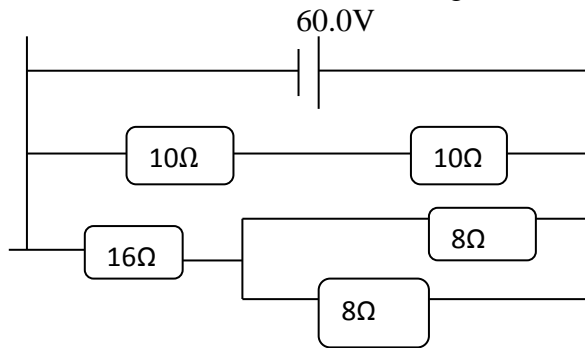
QUESTION TWO (20 MARKS)

- (a) Find the amount of energy stored in an $8.0\mu F$ capacitor when it is connected across a 120.0 battery. [3 marks]
- (b) An electric heater is operated by applying a potential difference of 120V to a nichrome wire of total resistance 6Ω . Find the current carried by the wire and the power rating of the heater. [4 marks]
- (c) What is the resistance of a 6.0m length wire whose radius is 0.321mm and resistivity is $1.5 \times 10^{-6} \Omega\text{-m}$ [4 marks]
- (d) A tractor pulls a loaded wagon on a level road with a constant force of 540N. If the total mass of the wagon and the contents are 270 kg. what is the wagon acceleration? (Ignore any frictional forces.) [4 marks]
- (e) Distinguish between weight and mass giving their SI units. [3 marks]
- (f) List 4 storage devices of a computer. [2 marks]

QUESTION THREE (20 MARKS)

- (a) Find the capacitance if energy of 0.0224 J is realize when the capacitor is connected across an 80-V battery. [3 marks]

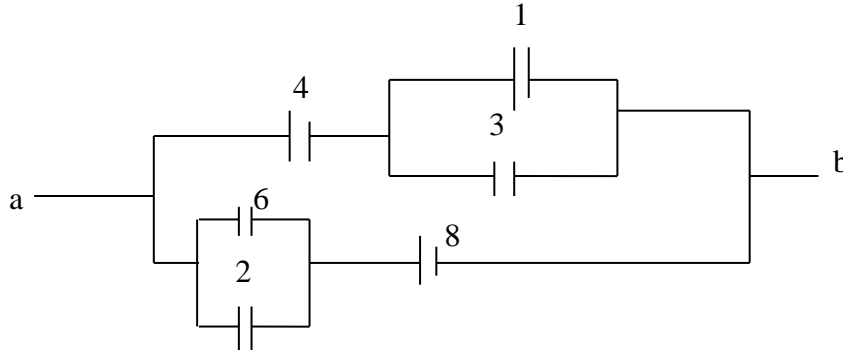
- (b) In the circuit drawn below determine (Neglect the internal resistance of the battery)



- (i) Equivalent resistance in the circuit. [3 marks]
- (ii) Current flowing in the circuit [2 marks]
- (iii) Power provided by the circuit. [2 marks]
- (c) An electric heater is operated by applying a potential difference of 240V to a nichrome wire of total resistance 6Ω. Find the current carried by the wire and power rating of heater. [4 marks]
- (d) Vector A has a magnitude of 8.0 m in a direction 45° below the +x-axis, B which has an x-component of +2.0m and a y-component of +4.0m.
- (i) Sketch the vectors as accurately as you can using xy coordinates. [3 marks]
- (ii) Find a vector C so that $A+B+C$ equals a vector D that has a magnitude of 6.0 m in the +y direction. [3 marks]

QUESTION FOUR (20 MARKS)

- (a) A light bulb is rated a 120 V and 30W. The bulb is powered by a 120.0V direct power supply. Find
- (i) The current in the bulb and its resistance. [3 marks]
- (ii) How much does it cost per 30 days to light a 30W light bulb for 10 hours daily if electricity cost is ksh.21.65 per kilowatt-hour? [5 marks]
- (b) Explain briefly FOUR security related uses of the members of the electromagnetic spectrum. [4 marks]
- (c) Find the equivalent capacitance between a and b for the combinations of capacitors shown below all values are in μF . [4 marks]



- (d) Give 4 applications of cctv in enhancing security. [4 marks]

QUESTION FIVE (20 MARKS)

- (a) A projectile was fired from top of a cliff of 400m high. The initial velocity is 100m/s at an angle of 40° to the horizontal. Neglecting air resistance, calculate:
- (i) The greatest height reached [4 marks]
 - (ii) The range [3 marks]
- (b) A parallel plate capacitor has plates with dimensions 2cm x 4cm separated by 3mm. the plates are connected across a 24V battery. Determine the:
- (i) Capacitance of the capacitor [3 marks]
 - (ii) Magnitude of the charge of each plate. [3 marks]
- (c) List two types of optical and two magnetic storage devices in computers. [4 marks]
- (d) A computer data acquisition card, inserted into the expansion slot in its motherboard has a resistance of 250Ω and operated by 12V power supply terminal. Calculate the current flowing through it and explain use of the mother board. [3 marks]
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