

KABARAK



UNIVERSITY

UNIVERSITY EXAMINATIONS

2010/2011 ACADEMIC YEAR

FOR THE CERTIFICATE OF PRE-UNIVERSITY PHYSICS

COURSE CODE: PPHYS 011

COURSE TITLE: ELECTRICITY, MAGNETISM & MODERN PHYSICS

STREAM: SEMESTER ONE

DAY: TUESDAY

TIME: 9.00 – 11.00 A.M.

DATE: 07/12/2010

INSTRUCTIONS:

- Answer Question **ONE** and any other **TWO** Questions. Question One carries **30marks** while each of the other Two Questions carry **20marks**.
- *The following constants may be useful*

Use the following constants where necessary;

- Resistivity of copper $\rho = 1.8 \times 10^{-8} \Omega m$
- Mass of electron $m_e = 9.11 \times 10^{-34} Kg$
- Planck's constant $h = 6.63 \times 10^{-34} JS$
- Charge of electron $e = 1.6 \times 10^{-19} C$

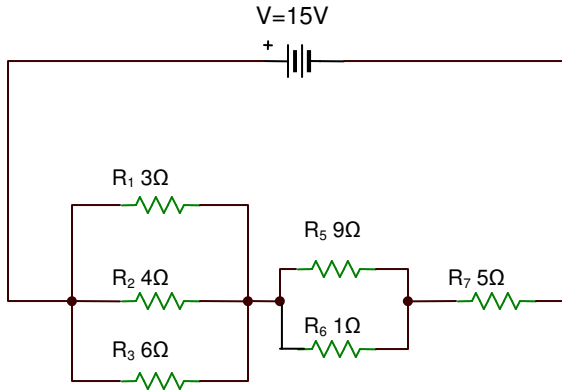
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QUESTION 1 (30 marks)

- a) Define the following terms **(3mks)**
- i). Electric current
 - ii). Resistance
 - iii). Electromotive force
- b) i) State and explain any two factors that affect the resistance of a metallic conductor. **(2mks)**
- ii) A rectangular block of copper has dimensions 2.5cm by 2.5cm by 40cm. Find the resistance of the block between the two square ends. **(2mks)**
- c) i) State Ohm's law. **(1mk)**
- ii) Three resistors of resistance 3Ω , 4Ω , and 5Ω , are connected in parallel to source of 12V supply. Calculate;
- I. Total resistance **(3mks)**
 - II. Current through the 4Ω resistor **(3mks)**
- d) State two differences between magnetic fields and electric fields **(2mks)**
- e) i) State and explain three factors that affect the magnitude of induced e.m.f. **(3mks)**
- ii) A square solenoid with 500 turns and sides 5cm by 5cm is placed in air with each turn perpendicular to a uniform magnetic flux density of 0.8T. Calculate the induced e.m.f. if the field decreases to zero in 4 seconds. **(4mks)**
- f) i) What is wave – particle duality? **(1mk)**
- ii) The speed of a particle is $180\text{Km} / \text{hr}$. Calculate its wavelength if it has a mass of 0.0025Kg **(3mks)**
- g) State three properties used to detect X-rays. **(3mks)**

QUESTION 2 (20 marks)

- a) i) State an instrument which can be used to measure current. **(1mk)**
ii) In the circuit below;



Calculate;

- I. Total resistance **(4mks)**
II. Total current **(3mks)**
III. Current through the 1Ω resistor **(3mks)**
IV. Potential across the 4Ω resistor **(3mks)**
- b) When a battery of electromotive force of 12V is connected to a load resistor of resistance 15, the terminal voltage is measured to be 10V. Find the internal resistance of the battery **(4mks)**
- c) A 1.2KW electric kettle uses a 250V mains supply. Calculate the current drawn. **(2mks)**

QUESTION 3 (20 marks)

- a) i) State two types of magnets **(2mks)**
ii) State three characteristics of magnetic field lines **(3mks)**
- b) i) State and explain two factors affecting the magnitude of magnetic force on a current carrying conductor in a magnetic field. **(2mks)**
ii) A wire carrying a current of 6.4A from left to right of page has 2m of its length in a uniform magnetic field of magnetic flux density $2.5 \times 10^{-4} T$ directed vertically into the page. Determine;
- I. the direction of force experienced **(1mk)**
II. the magnitude of the force experienced **(3mks)**

- c) i) State Lenz's law in words and give its mathematical expression. **(2mks)**
 ii) A wire of length 50cm is moved at a speed of 20m/s through a uniform magnetic field of strength 400T at an angle of 30° to the field. Calculate the e.m.f induced in the wire. **(3mks)**
- d) i) Define r.m.s. value of alternating current. **(1mk)**
 ii) A bulb in a house is rated 60W, 240V. Calculate its maximum current **(3mks)**

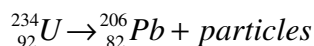
QUESTION 4 (20 marks)

- a) Differentiate between the following **(2mks)**
 i). Absorption and emission spectra
 ii). Nuclear fission and fusion
- b) i) Name the particles of an atom and state their charges **(3mks)**
 ii) A nuclide notation is written as



State what the symbols; A, Z and X stands for. **(3mks)**

- c) i) State three radiations which can be produced in a radioactive decay **(3mks)**
 ii) A radioactive element decays to form a stable nuclide according to the equation



Identify the number and type of radiations produced **(5mks)**

- d) i) Define half life a sample **(1mk)**
 ii) The half life of a certain sample is 25 minutes. Find how long it would take the sample to reduce its nuclides from 1200 to 37.5 **(3mks)**

QUESTION 5 (20 marks)

- a) Define the following as used with photo electric effect **(3mks)**
 i). Work function
 ii). Threshold frequency
 iii). Photons
- b) i) State Einstein's equation of photo electric effect. **(1mk)**
 ii) The work function of a metal surface is 5.4eV. Calculate,
 I. Threshold frequency **(3mks)**
 II. The kinetic energy of photoelectrons produced if the metal is illuminated by radiation of frequency $1.8 \times 10^{15} \text{ Hz}$. **(4mks)**
 III. The maximum velocity of photoelectrons produced **(3mks)**

- c) Explain the functions of the following in the X-ray tube **(3mks)**
- i). Extra high tension voltage
 - ii). Vacuum
 - iii). Copper cooling fins

- d) Define the following as used with X-rays and state what each depends on **(3mks)**
- i). Intensity of X-rays
 - ii). Quality of X-rays