REPUBLIQUE DU CAMEROUN
Paix-Travail-Patric

MINISTERE DES ENSEIGNEMENTS SECONDAIRES

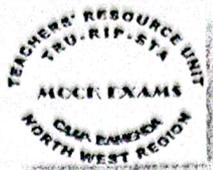CELLULE D'APPUI A L'ACTION PEDAGOGIQUE
ANTENNE RÉGIONALE DU NORD OUEST

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REPUBLIC OF CAMEROON
Peace-Work-Fatherland

MINISTRY OF SECONDARY EDUCATION

TEACHERS' RESOURCE UNIT
REGIONAL BRANCH FOR THE NORTH WEST

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GCE AL

MARCH 2025

The Teachers' Resource Unit and the Regional Inspectorate of Pedagogy in collaboration with NWAPT	SUBJECT CODE NUMBER 0780	PAPER NUMBER 2
GENERAL CERTIFICATE OF EDUCATION REGIONAL MOCK EXAMINATION	**SUBJECT TITLE** PHYSICS	
ADVANCED LEVEL		

Time Allowed: THREE hours
INSTRUCTIONS TO CANDIDATES

Mobile phones are **NOT ALLOWED** in the examination room.

Answer ALL questions

Section 1 is designed to be answered in 1 hour 30 minutes, section II in 40 minutes and section III in 50 minutes.

You are advised to divide your time accordingly.

You are reminded of the necessity for good English and orderly presentation in your answers.

In calculations. you must show all steps in your working, giving your answers at each stage.

Calculators and formulae booklets are allowed.

1. The rate, P, at which an object of cross-sectional area, A, falling through a fluid of density ρ, at a speed v, loses energy with time is given by the expression $P = \frac{1}{2} k \rho A v^x$,

   Where k is a dimensionless constant.
   a) State two reasons why the homogeneity of a physical equation does not guarantee its correctness
   b) Use the notion of homogeneity to determine the value of x   (6 marks)

2. A capacitor of capacitance C is fully charged using a battery of emf E, and then discharged through a resistor of resistance R. The graph below shows how the charge Q on the plates of the capacitor varies with time.
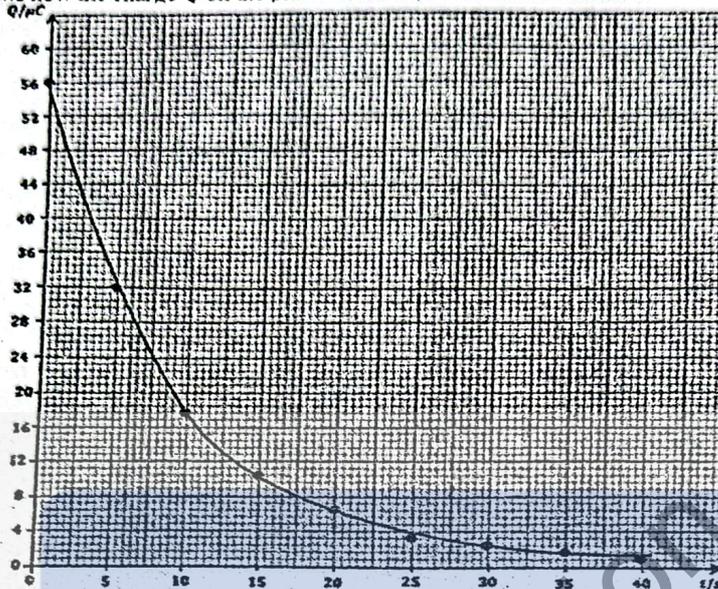
   a) Use the graph to estimate the time constant of the discharge process.
   b) Determine the initial discharge current
   c) Determine E if C = 18.8 µF   (6 marks)

3. A student focuses light from two light sources P and Q on a wall as shown below. P and Q are derived from the same primary source.
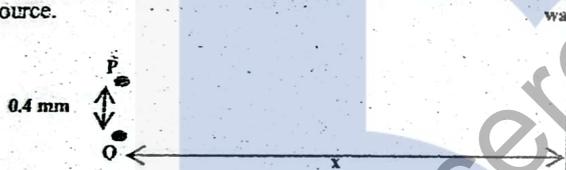
   a) State two conditions that must be fulfilled for the interference pattern on the wall to be observable
   b) P and Q are sources of green light of wavelength 480 nm and 20 bright fringes on the wall are found to be 25.6 mm apart. Assuming that the conditions in (a) above are met, determine how far the wall is from the sources P and Q
   c) State and explain what difference would be observed if the green light sources are replaced by blue light sources. (6 mks)

4. a) State the conservation law from which Kirchhoff's second law derived.
   b) The diagram below shows how a student connected some electrical components in a circuit.
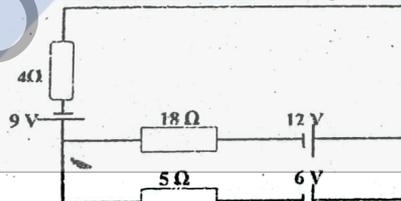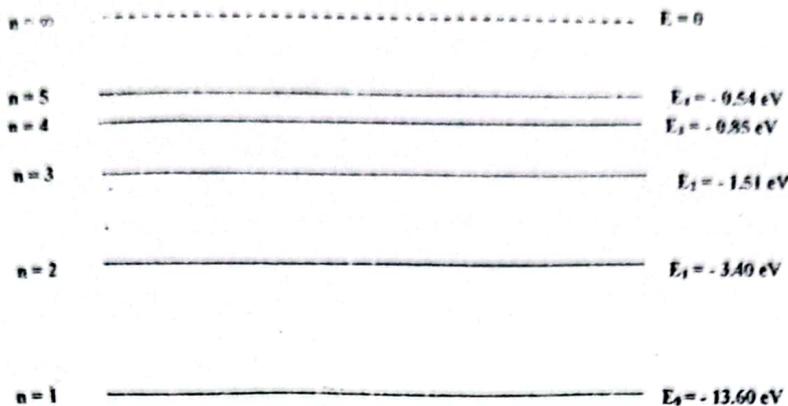

   Determine the current through each resistor   (6 marks)

5. A girl stands at the edge of a veranda, holding an 80 cm long string with a mass of 200 g at its lower end which is 3 m above the ground. She then whirls the object at an increasing speed with her hand as the centre of the circle. Given that the maximum tension which the string can withstand is 62 N,
   a) Determine the speed of the object when the string breaks.
   b) What will be the kinetic energy of the mass just before it strikes the ground?   (6 marks)

6. Answer EITHER 6 (a), (b) and (c) OR 6 (d), (e) and (f).
   EITHER 6 (a), (b) and (c)
   a) You are provided with a roll of copper wire, a micrometer screw gauge, a metre rule, a millimetre scale, a vernier scale and different standard masses. Describe an experiment which you would carry out to determine the Young modulus of copper.
   Your account should include a diagram, procedure, observations, conclusion and a precaution taken.   (8 marks)
   b) i) State the observations of the photoelectric effect which contradict the wave theory of electromagnetic radiation.
   ii) The diagram below shows the energy levels of a hydrogen atom. To which energy level will an electron at the n = 5 level drop if it emits a photon of wavelength 434.4 nm?

$n = \infty$ .... $E = 0$

$n = 5$ _____ $E_5 = -0.54$ eV
$n = 4$ _____ $E_4 = -0.85$ eV

$n = 3$ _____ $E_3 = -1.51$ eV

$n = 2$ _____ $E_2 = -3.40$ eV

$n = 1$ _____ $E_1 = -13.60$ eV

(6 marks)

c) i) Which observation in the alpha scattering experiment led to each of the following conclusions?
- The positive charge in an atom is concentrated somewhere and not evenly distributed within the atom.
- The nucleus of an atom is very tiny compared to the size of the atom

ii) Given the following nuclear masses
deuterium ($_{1}^{2}H$) = 2.014 u, molybdenum ($_{42}^{97}Mo$) = 96.9060 u, technetium ($_{43}^{97}Tc$) = 96.9063 and that the mass of a neutron is 1.008 u. Show that the nuclear reaction below cannot occur spontaneously.

$$_{1}^{2}H + _{42}^{97}Mo \longrightarrow _{43}^{97}Tc + 2_{0}^{1}n$$

OR 6 (d), (e) and (f)

d) You are provided with a clamp and stand, a small metal sphere with a hook, a long thread, a metre rule and a stop watch. Describe an experiment you would carry out to determine the magnitude of the acceleration due to gravity. Your account should include a diagram, procedure, observations, conclusion and a precaution taken. **(8 marks)**

e) i) Define the term "ampere"
The diagram below shows an 8 cm long copper wire AB of mass 3.5 g placed on a pair of iron rods on a piece of cloth stretched horizontally. The rods are connected to a battery and the set-up is subjected to a uniform vertical magnetic field of flux density 0.6 T directed upward.

magnetic field
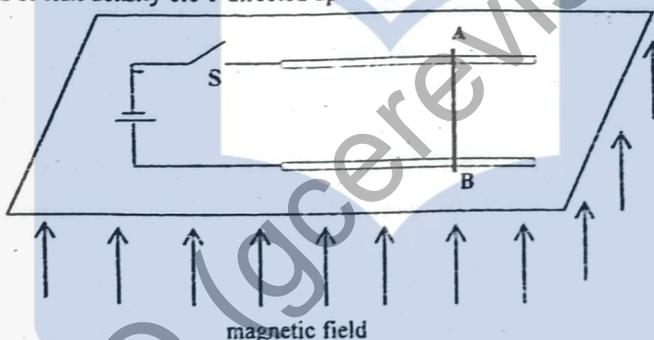
ii) State what would be observed when the switch S is closed.
iii) In order to keep AB stationary when S is closed, each of the loose ends of the iron rods must be raised through a height of 4.2 cm. Determine the current through AB **(6 marks)**

f) A coil has an inductance of 1.5 H and resistance R. When the coil is connected in series with a 530 Ω resistor and an ac source of 240 V (rms) and frequency 50 Hz, the rms current in the circuit is 310 mA
i) Determine R
ii) What is the voltage across the coil? **(6 marks)**

7. In a resonance tube experiment, sound from a signal generator is directed into a resonance tube using a small loudspeaker. The second resonance length (l) is determined for different sound frequencies (f). The results are show below.

f/Hz	250	420	500	620	780	840	970	1160
l/cm	97.3	58.0	48.6	39.1	31.1	28.8	24.9	20.8

f and l are known to be related by
$$3v = 4f(l + a),$$
where v is the speed of sound in air and a is a constant.
a) Plot a suitable graph from which v and a can be obtained. (12 marks)
b) Determine the values of v and a (6 marks)
c) What is the physical significance of a? (2 marks)

OPTIONS

OPTION 1: ENERGY RESOURCES AND ENVIRONMENTAL PHYSICS

8. a) Define the following giving one example of each
    i) functional energy
    ii) energy farming
Briefly explain why the sun is a renewable energy source although we cannot replace the energy given out by the sun
                                                                                                                (5 marks)
    b) A geothermal scheme is an important energy source in some countries.
       i) State two advantages of a geothermal scheme over hydroelectric power
       ii) Copy and complete the energy flow diagram below of a geothermal scheme by indicating what X, Y and Z stand for.
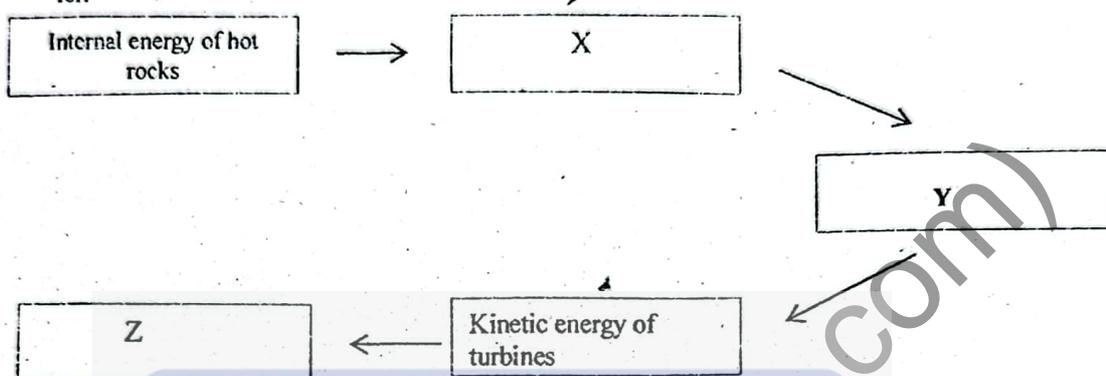

    c) i) A house is powered by 6 solar panels each measuring 120 cm by 75 cm. Given that the efficiency of the solar system is 38 %, and that the solar constant is 1.25×10^3 Wm^{-2}, determine the power supplied to the home.   **(5 marks)**

OPTION 2: COMMUNICATION

9. a) Briefly explain why a mobile phone
       i) is described as a transceiver
       ii) is also called a cell phone   **(4 marks)**
    b) i) Draw a block diagram of a simple radio transmitter system
       ii) State two reasons why there is a massive shift by broadcasters from analogue to digital transmission   **(6 marks)**
    c) i) What is meant by "heterodyning" as used in radio transmission?
       ii) A super heterodyne receiver has an intermediate frequency of 11.5 MHz and covers the signal frequency range 86.0 MHz to 107.5 MHz Over what frequency range should the local oscillator be tuned?   **(5 marks)**

OPTION 3: ELECTRONICS

10. a) Use the band theory to explain why
       i) Copper is a good conductor of electricity
       ii) Germanium is a poor electrical conductor at 5°C but is a good electrical conductor at 80°C   **(4 marks)**
    b) For security reasons, an alarm is to be triggered if the gate of a house is left open at night.
       i) What is the simplest logic gate that can be used to control the alarm?
       ii) Briefly describe the inputs and the output of the logic gate for proper functioning of the alarm   **(4 marks)**
    c) The figure below shows an NPN transistor in the common-emitter mode. The base current is 20 μA when the output voltage is 5.4 V for a current gain of 65. The base-emitter voltage is 0.6 V
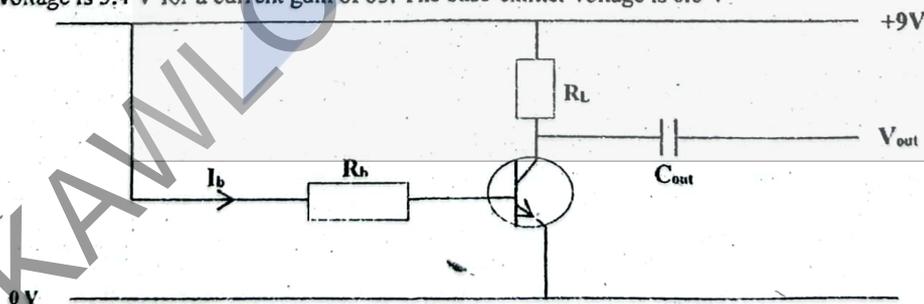
       i) What is the function of C_{out}?
       ii) Determine R_b
       iii) Determine R_L **(7 marks)**

OPTION 4: MEDICAL PHYSICS

11. a) A nurse measures the blood pressure of a patient and records it as $\frac{120}{80}$ mmHg. What name is given to each of these figures and what does it represent?   **(4 marks)**
    b) State
    (i) one advantage of X-rays over ultrasound echography
    (ii) one advantage of ultrasound echography over X-rays in medical imaging.
    (iii) one way in which a CT scan differs from both an X-ray image and an ultrasound image.   **(5 marks)**
    c) i) The far point of a defective eye is located at a distance of 480 cm from the eye. If the defect is to be corrected using a lens placed 1.5 cm, determine the power of the lens.
    ii) Draw a ray diagram to show how the lens corrects the eye defect.   **(6 marks)**

END