JUNE 2015

SECTION I

1. (a) What is homogeneous equation?

(b) The equation P + hgp + pv2 = k is homogeneous, where P is the pressure, h is the depth, g is the acceleration due to gravity, v the velocity and k is a constant . Determine the base units of k.

(6 marks)

2. A girl swings a stone of mass 100 g at the end of a string in a horizontal circle of diameter 80.0 cm above her head. Her friend observing the action sees a shadow of the notion of the stone on a nearby wall and notice that the stone makes 150 revolutions in 5 minutes. Calculate,

(a) The frequency of the motion

(b) the centripetal force on the stone

(c) Sketch a distance- time graph for this motion of the shadow for two cycles. (6 marks)

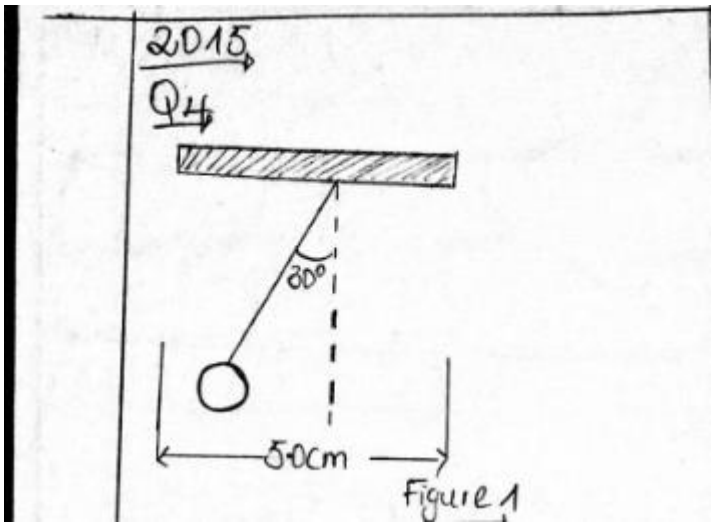
3. A quantity of steam at 1000c is passed into a 1.5 kg of pure melting ice in a highly insulated calorimeter so that the heat given out by the steam in condensing is just enough to melt the ice.

Determine:

(a) The quantity of steam passed into the ice

(b) The equilibrium temperature attained by the mixture (6 marks)

4. Figure 1 shows a small piece of spherical charged metal bob 50 g which is initially hangs vertically between two conducting plates. When a potential difference of 12.0 V is maintained across the plates the thread makes an inclined of 300 to the vertical.



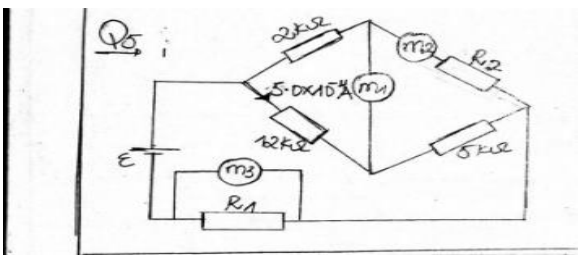
(a) Draw a free body diagram of the bob when the pd is applied

(b) Determine the charge on the bob

(5 marks)

5. Figure 2 shows how resistor may be connected in an electrical circuit. The bridge circuit is balanced when the voltmeter M2 reads 3.0 V.

Determine the



(a) readings of M1 and M2

(b) resistances R1 and R2 and E

ANSWER EITHER a, b and c or d, e and f

6. (a) (i) what is meant by a coherence light source
(2 marks)
(ii) describe how you can determine the wave length of a monochromatic light using Young's double slits. Your account should include a diagram , observation, precautions and how you will use your observation to reach a conclusion
(8 marks)
(b) a car sounding an alarm at a frequency 512Hz is approaching a stationary listener at a speed of 8 m/s.
(i)Explain why the listener has the impression that the frequency of the sound heard is varying.
(2 marks)
(ii) What is the apparent frequency of the horn as perceived by the listener? (3 marks)
(c) An object is placed 20.0cm from a thin convex lens and then a thin concave lens of focal distance 10.0 cm and perpendicularly to the principal axis in each case. Use either ray diagram or otherwise to distinguish between the images obtained in each case when the object is brightly illuminated such that light rays from the object reach the lens parallel to the principal axis.
(5 marks)

OR

d(i) Explain what is meant by a material is elastic? (2 marks)
(ii) Describe an experiment to determine Young's modulus for a copper wire. Your account should include a diagram , observations, precautions , conclusion.
(8 marks)
(e) A toy having a plastic head resting on one end a light string is stretched as shown in figure 3.
(i) Explain why there is a change in the gradient of the graph at E?
(ii) Calculate the maximum elastic potential energy of the toy-spring system
(ii) Explain what happens to the energy of the system when the load is removed and the spring regains it's original length?
(f) The kinetic theory of matter describes the behavior of a gas in terms of the properties of the molecules.
Use this theory to explain
(i) Why a gas in container at room temperature exerts pressure on the walls of the container
(ii) Why the pressure increases while more of the same gas is introduced into the same container at the same temperature

SECTION II
DATA ANALYSIS
7An experiment was performed to investigate how the resistance of the material of a wire varies with the temperature. The following data was recorded

Resistance/ohm	Temperature/^{0} c
330.0	10
340.0	20
350.0	30
360.0	40
370.0	50
380.0	60
389.0	70
400.0	80
410.0	85

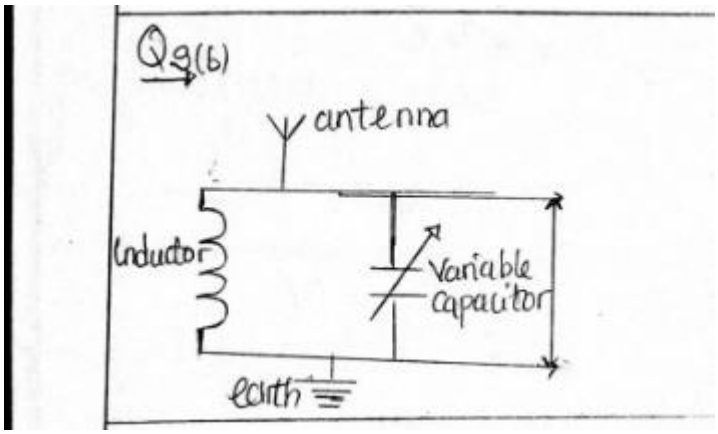
Theory suggests that the resistance of the wire is related to the temperature by the expression $R=R_0(1+\beta\emptyset)$ where R_0 is the resistance at a temperature of 0^0c and $\emptyset$ is the temperature and β is a constant
(a)Plot a suitable graph from which β and R_0 could be obtained (8 marks)
(b) Use the graph to determine the value of β and R_0 (9 marks)
(c) Say whether the material is a conductor or semiconductor (2 marks)

SECTION III
OPTIONS

ENERGY RESOURCES AND ENVIRONMENTAL PHYSICS

8 (a) State two advantages of nuclear fusion over nuclear fission as sources of energy (2 marks)
(b) Biomass, solar energy and hydroelectricity are some energy sources from which functional energy can be obtained
(i) what is meant by functional energy.
(ii) Choose any two of the above sources and briefly explain how functional could obtained from them in Cameroon (5 marks)
(c) The power derived from a wind mill is given the equation $P = \rho A v^3/2$
Where ρ is the average air density, A is the area of the blades and v is average wind speed . One such aero-generator has a blade of diameter 6.0 m. Given that the efficiency of the system is 25% at a wind speed of 13.5 m/s
(i) Calculate the power output of the aero-generato.r Assume the density of the air to be 1.2 kgm^{-3} (3 marks)
(ii) while is the efficiency of the system less than 100%? (2 marks)
(d) (i) name a substance which responsible for the depletion of the ozone layer (1 mark)
(ii) State an explain the impact of the depletion of the ozone layer on the environment (2 marks)

COMMUMICATION
9 (a) A radio station uses a carrier of frequency 200 KHz to transmit **AM** wave.The transmission consists of audio signals within frequency range 50Hz-90Hz
(i) Explain the meaning of the word of the bolded phrase
(ii) Calculate the minimum and the maximum frequency sidebands and bandwidth (4 marks)
(b) Figure 4 shows a simple turning radio circuit



(i) Explain how the turning circuit functions
(ii)Given that the coil has an inductance of 4.0 mH, calculate the value of the capacitance required to tune into the broadcast described in 9(a) above (4 marks)
(iii) What is the use of the decoder in this circuit (2 marks)
(c) (i)State three advantages which digital transmission has over analogue transmission
(ii) Explain how several telephone conversation can be transmitted at the same time along a single optical fibre (5 marks)

ELECTRONICS
10 (a) (i)What is meant by thermionic emission? (2 marks)
(ii) distinguish between n-type and p-type semiconductors (2 marks)
(b) you are given two electronic circuit of :
(i) A resistor of 500 Ω and a capacitor connected in series to 9.0 V dc supply
(ii) An inductor and a resistor of 500 Ω connected in series to 9.0 V dc supply
Sketch current-time graphs for these circuit and explain the differences between them (4 marks)
(c) (i) Explain how a transistor is used as a switch (4 marks)
(ii) state in words and in the form of truth table, the action of an Or logic gate with two inputs (3 marks)

MEDICAL PHYSICS
11 (a) (i) Draw a simple diagram of the human eye, showing clearly the parts which enable the eye to form an image of an object. (3 marks)

(ii) Name any two eye defects, explaining how each defect manifest and explain how each defect may be corrected (3 marks)

(b) X – rays and ultrasound are techniques used for parts of the human body.

(i) state one part of the body where each techniques would be suitable than the other (2 marks)

(ii) Explain why ultrasound is not likely to replace x- rays completely for medical diagnosis (3 marks)

(c) Explain how the magnetic resonance (MR) scanner produces a visual image of a cross-section of a part of the body of a patient under examination . (4 marks)

JUNE 2016

SECTION I

(1) (a) Explain why the homogeneity of a physical equation is not a sufficient condition for the correctness of a physical equation?

(b) Faradays may be stated in the form E=-L dI/dt where, E is the induced Emf, L is the inductance of a coil and di/dt is the rate of change of current. Determine the base units of L if the equation is homogenous. (6 marks)

(2) A simple pendulum of length l, has a period , T on the surface of the earth. The simple pendulum is carried to a space craft to a height of 2R , above the earth's surface where R is the radius of the earth.

Explain whether the period of the pendulum at this would increase or reduce. (6 marks)

3 (a) Distinguish between thermionic emission and the photo-electric effect

(b) An electromagnetic radiation of wavelength 6.3 x 10^{-14} m falls on a clean metal surface which has a work function of 2.25 x 10^{-14} J. Explain whether photoelectrons would be emitted or not. (6 marks)

4 (a) A transformer can not be used to run a 230 v , 100 w mains lamp directly from a 12 v car battery.

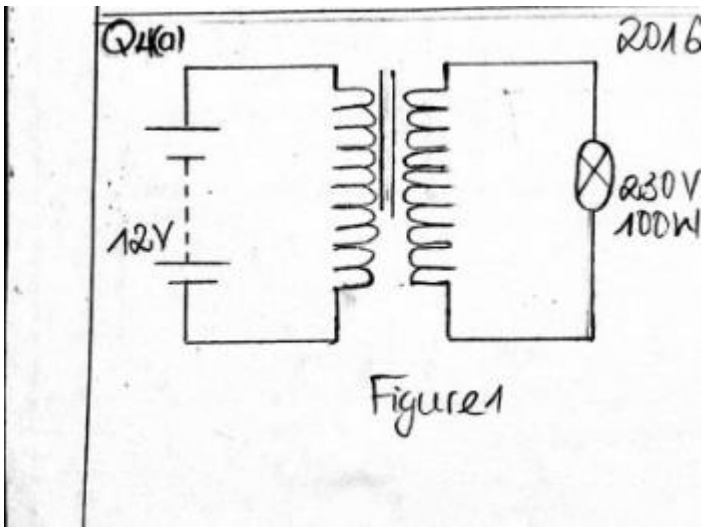


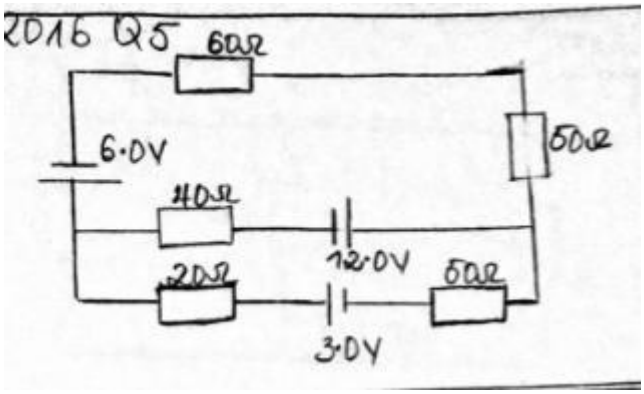
Figure 1

Suggests in terms of fields and energy while the system can not work.

(b) (I) Discuss how the system can be adapted to function

(ii) What type of transformer does figure 1 represent (5 marks)

5 Figure 2 shows how resistors and cells may be connected in an electric circuit.



Calculate the :
(i) current flowing through the 40 Ω resistor
(ii) Voltage drop across the 80 Ω resistor (6 marks)

ANSWER a, b and c or d, e f and g
6 (a) (i) Distinguish between longitudinal and transverse waves (4 marks)
(ii) Describe an experiment to determine the speed of sound air. Your account should include a diagram , procedure observations, precautions , and conclusion. (8 marks)
(b) a source of sound whose frequency 51.6 Hz is placed in front of a flat vertical smooth wall, if a microphone is moved from the source directly towards the walls , a series of maximum and minimum values in its output are observed at equally spaced intervals.The speed of sound at room temperature is 330 m/s.
(i) Explain how this minimum positions are formed.
(ii) Calculate the separation of these minimum points
(iii) What can be done to increase the separation calculated in (ii) above (8 marks)
(d) Explain why the specific capacities are either measured at constant pressure or at constant volume while this is not required for solids and liquids. (4 marks)
(e) Describe an experiment to determine the specific heat capacity of liquid. Your account should include a diagram , procedure, observations, precautions and conclusion. (8 marks)
(f) In terms of molecular behavior explain,
(i) How liquids are similar to gases but different from solids
(ii) how solids are similar to liquids but different from gases. (4 marks)
(g) A highly lagged compound bar 25.0 cm long is made from a copper bar 15.0 cm joined to an aluminum bar of equal cross sectional area. The free end of the copper is maintained at 100^0c while that of aluminum maintained at 0^0c. Calculated the temperature of each of the bars under steady state, given that the ratio of the thermal conductivities of copper to aluminum is 15:7. (4 marks)

SECTION III
DATA ANALYSIS
7 Table 1 shows the force, F , between two charged particles in a substance. The force is given by the equation $^2/r^24$. In order to confirm the relationship the following data was recorded for various values of F and r, the distance between the charged particles. Q = 4.4 x 10^{-4}C.

F/N	1.0	1.5	2.0	2.5	3.0	4.0	4.5	5.0	6.0
r/nm	355.1	297.5	258.2	230.3	210.8	182.6	172.0	163.3	.149.0

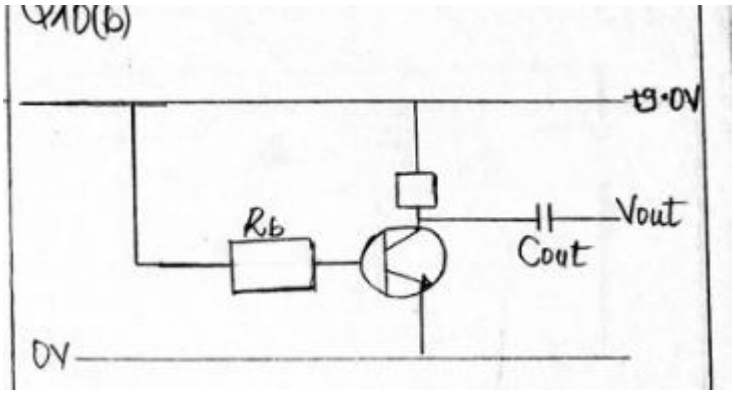
Table 1
(a) Plot a suitable graph from which could be determined (10mark)
(b) (i) Find the slop S of the graph
(ii) what does the S represent?
(iii) Calculate a value of (8 marks)
(c) What will be the nature of the forces if the experiment was conducted of higher dielectric constant? (2 marks)

SECTION III
ENERGY RESOURCES AND ENVIRONMENTAL PHYSICS

8 (I) What do you understand by finite and renewable energy sources? (2 marks)
(ii) Given that the mean distance of the earth from the sun is 1.5×10^{11} m and the power of the sun is 4×10^{26} W, calculate a value for the solar constant. (4 marks)
State the assumption that you have made in your calculation.
(b) Describe the process by which electrical energy could be obtained from the following sources of energy.
- Geothermal energy
- Wind energy (5 marks)
(c) (i) Discuss the consequences on humanity of the destruction of the ionosphere layer.
(ii) Explain ways by which the ionosphere can be protected from destruction. (4 marks)

COMMUNICATION
9 (a) (i) Draw a basic block diagram of a mobile telephone handset. (3 marks)
(ii) Compare the use of the optical and the copper cable in the transmission of information in terms of
Security
Noise
Signal attenuation (6 marks)
(b) (I) What is the meaning of the following abbreviation
- SIM
- SMS (4 marks)
(c) Explain how a radio receiver works. (2 marks)

ELECTRONICS
10 (a) Explain why a piece of pure silicon may not conduct electricity at 0^0c but would conduct at 80^0c. (4 marks)
(b) A capacitor , an ammeter, and an Ac power source are connected in series and the reading on the ammeter noted. The capacitor and the ammeter and disconnected and connected to a Dc power source.The reading is also noted. Will the ammeter readings in the two cases be similar or different? Explain (4 marks)
Figure 3 is an amplification circuit using an NPN transistor in the common emitter mode. The base is current 25A when the output V_0 is 6.0 v for a current gain of 60.



Calculate:
(i) The base resistance R_b (2 marks)
(ii) The value of R_l (3 marks)
(iii) Explain the use of the capacitor C_{out} (3 marks)

MEDICAL PHYSICS
11 (a) (I) Draw a simple structure of the ear and describe how the ear functions. (4 marks)
(b) (i) Name two light sensitive receptors in the human eye.
(ii) By the reference to refraction at the cornea and the lens, draw a diagram showing how the rays from a distant object form a blurred image in the eye.
(iii) A patient suffering from long sight has a near point which is 1.5 m from his eyes, determine the type of lens that this patient should use to correct this defect. (8 marks)
(c) Explain the principle of operation for obtaining the ECG waveform. How is it useful in diagnosing heart problems?
(8 marks)

JUNE 2020

SECTION I

1. The power, P, obtainable from a wind turbine may be give by $P = KL^2 Pv^3$

Where L = length of the blades, p = Air density and v = wind speed

(a) What is a homogenous equation?

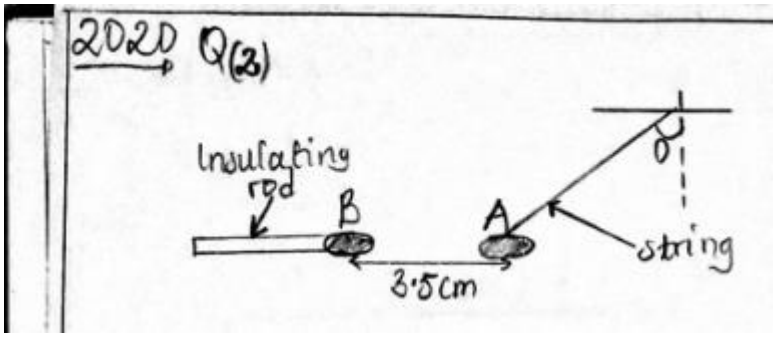
(b) Determine the base units of the constant K.

(c) State two shortcoming of using homogeneity to check the correctness of a physical equation.

(6marks)

2. in figure 1, a charge metal sphere (A) is hung from an insulating string . Another charged sphere (B) on an insulating rod is then place close to A as shown .

The charge on A is +5.0 nC while that on B is -4.0 nC.

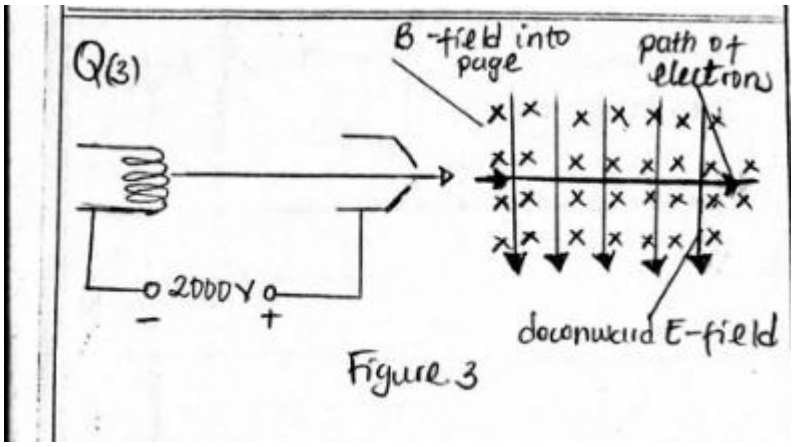


(a) Draw the two spheres and show the electric field pattern around them.

(b) Determine the magnitude of the electric force between them.

(c) What is the value of the angle if sphere A has a mass of 4.5×10^{-5} kg? (7 marks)

3. Figure 2 shows part of a system used to eject and accelerate electrons.



(a) State the phenomenon of emission of electrons from a sufficiently heated surface.

(b) Determine the speed with which the electrons leave the anode .

(c) Upon leaving the anode, the electrons enter into a region of cross magnetic and electric fields as shown in figure 3. If the intensity of the electric field is 7.5×10^4 V/m, calculate the flux density of the magnetic field if the electrons passed through the cross field undeflected as shown in figure3. (7 marks)

4. Figure 4 shows the fringe pattern obtained on a screen from Young's double-slits experiment to measure the wavelength of a monochromatic light from a source.

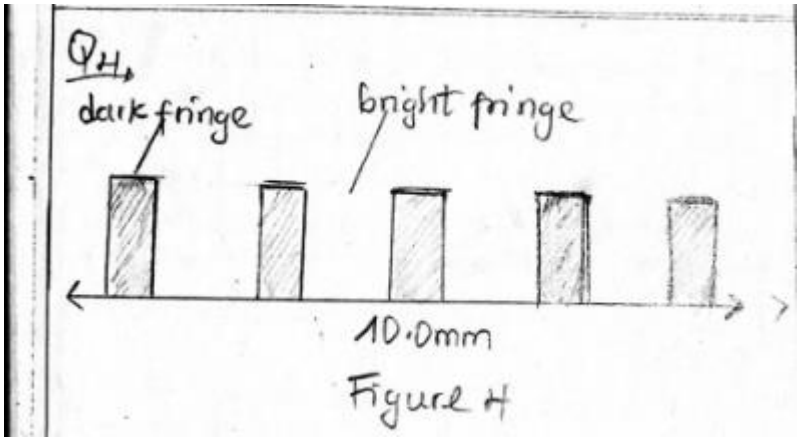


Figure H

(a) Explain the meaning of the underlined word.
(b) Determine the fringe separation.
(c) If the distance from the double slits to the screen is 2.5 m while the separation of the double slits is 0.50 mm, determine the wavelength of the light from the source. (5 marks)

5. strontium-89 has a <u>half-life of 84 days.</u>
(a) Explain the meaning of the underlined phrase.
(b) A laboratory prepares a strontium-89 source. 21 days after preparation , its activity is measured to be 7.4×10^6 Bq. What is the activity of the source at the time of preparation. (5 marks)

ANSWER EITHER a, b and c OR d, e and f

6. (a) (i) State the first the first law of thermodynamics (2 marks)

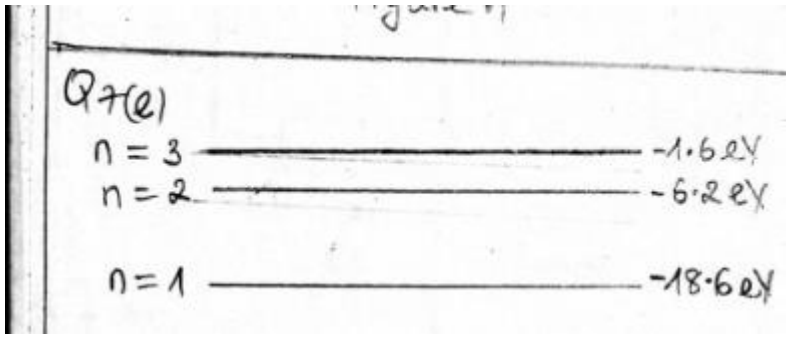
2.00 kg of water has a volume 2.00×10^{-3} m^3 when in the liquid state at 100^0C. When the water is completely changed from liquid to vapour at 100^0C, under a constant atmospheric pressure of 1.01×10^5 Pa, the volume increase to 3.38 m^3.
(ii) How much work is done against the atmosphere as the water changes to vapour?
(iii) What is the change in the internal energy of the water during vaporization? (8 marks)
(b)the graph in figure shows how tensile stress varies with tensile strength for two metallic wires, copper and steel. Study the two graphs and answer the question that follows. The stress is applied until the material breaks, in each case

(i) Write down the breaking tensile stress of each of the material.
(ii) Which of the material is more ductile? Explain your answer
(iii) Determine the Young's modulus of each of the material. (8 marks)
(c) (i) state any two assumptions of the kinetic theory used to derive equation . $P=1/3pc^{2.}$
(ii) What is the name given to $c^{2.}$ (4 marks)

OR

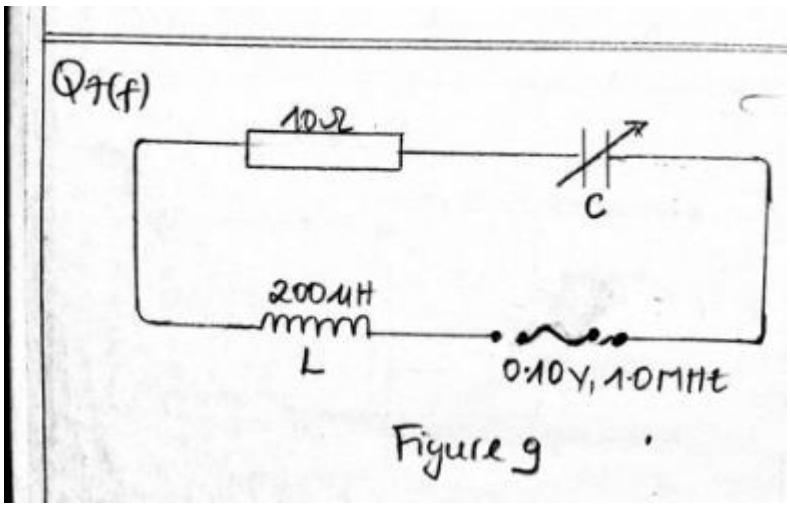
(d) (i) what do you understand by the electromotive force of a cell?
In an experiment to determine the internal resistance of a battery, the current through a battery was made to vary with the voltage across a variable resistor as shown in figure 7.
Use the graph in figure 7 to determine

(ii) the internal resistance of the battery
(iii) The emf of the battery (7 marks)
(c) The three lowest energy level s of an atom are shown in figure 8 below.



(i) Determine the minimum energy in joules require to eject an electron initially in the lowest energy from the atom.
(ii) Assuming that the energy level, n, is associated with energy k/n^2, determine the energy of the level n=4 in electron/volts.
(iii) determine the wavelength of the electromagnetic radiation emitted when an electrons makes a quantum jump from the level n=3 to the level n=2. Name the region of the electromagnetic spectrum in which this radiation is found.
(7 marks).

(f) Figure 9 shows a 200 inductor, a 10Ω resistor and a variable capacitor connected in series with a 0.10 v (r.m.s value), 1.0 MHz supply. The inductor has an inductance of 200 .



At resonance, determine
(i) The capacitance of the variable capacitor
(II) the current flowing through in the circuit
(iii) The voltage across the inductor
(iv) The voltage across the capacitor. (6 marks)

SECTION II
DATA ANALYSIS
7. In an experiment to determine how the current , I , in a circuit comprising a capacitor and a resistor in series varies with time , t, a student obtain the following results.

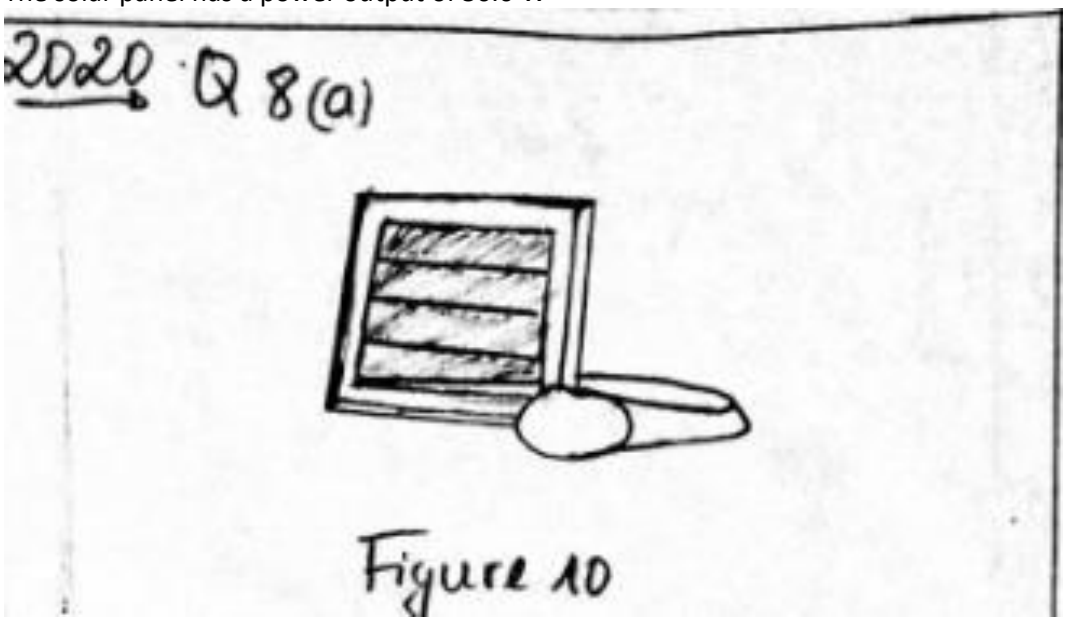
Time,t/s	I/ A
10	46.7
40	38.5
70	32.2
100	26.8
130	22.3
160	18.5
190	15.5
220	12.9
250	10.8

280	9.1
310	7.7

The current in the circuit is related to time by the equation $I = I_0 e^{-t/\beta}$ where I_0 and β are constants.
(a) Plot a suitable graph that can be used to determine the value of I_0 and β (10 marks)
(b) Use your graph to determine the value of I_0 and β (8 marks)
(c) What is the physical significant of β (2 marks)

SECTION III

ENERGY RESOURCES AND ENVIRONMENTAL PHYSICS
8. (a) Figure 10 shows a photovoltaic plate used to light a bulb in a certain house hold.
The solar panel has a power output of 50.0 W



(i) If the efficiency of the panel is 30%, determine the power input into the photovoltaic plate.
(ii) Above the earth's atmosphere, the solar constant is 1.4 kWm^{-2} . However, only 40% of this power per unit area reaches the earth . Estimate the area of the solar panel in figure 10.
(iii) Explain why solar energy is referred to as renewable source of energy. (6 marks)
(b) (i) What is the ozone layer?
(ii) Name a substance which is responsible for the depletion of the ozone layer and explain how this substance contributes to the depletion of the ozone layer.
(iii) State two effects of the depletion of the ozone layer on life on earth. (6 marks)
(c) (i) Give two reasons why Cameroon lies more on hydroelectricity power plates for the supply of electricity instead of fusil fuels.
(ii) Give one example of a green source of energy. (3 marks)

COMMUNICATION
9. (a) Figure 11 shows a light signal entering into an optical fibre

Q 9(a)

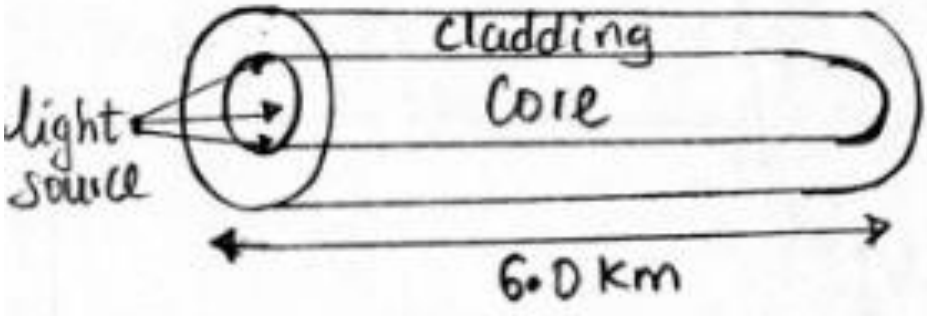


Figure 11

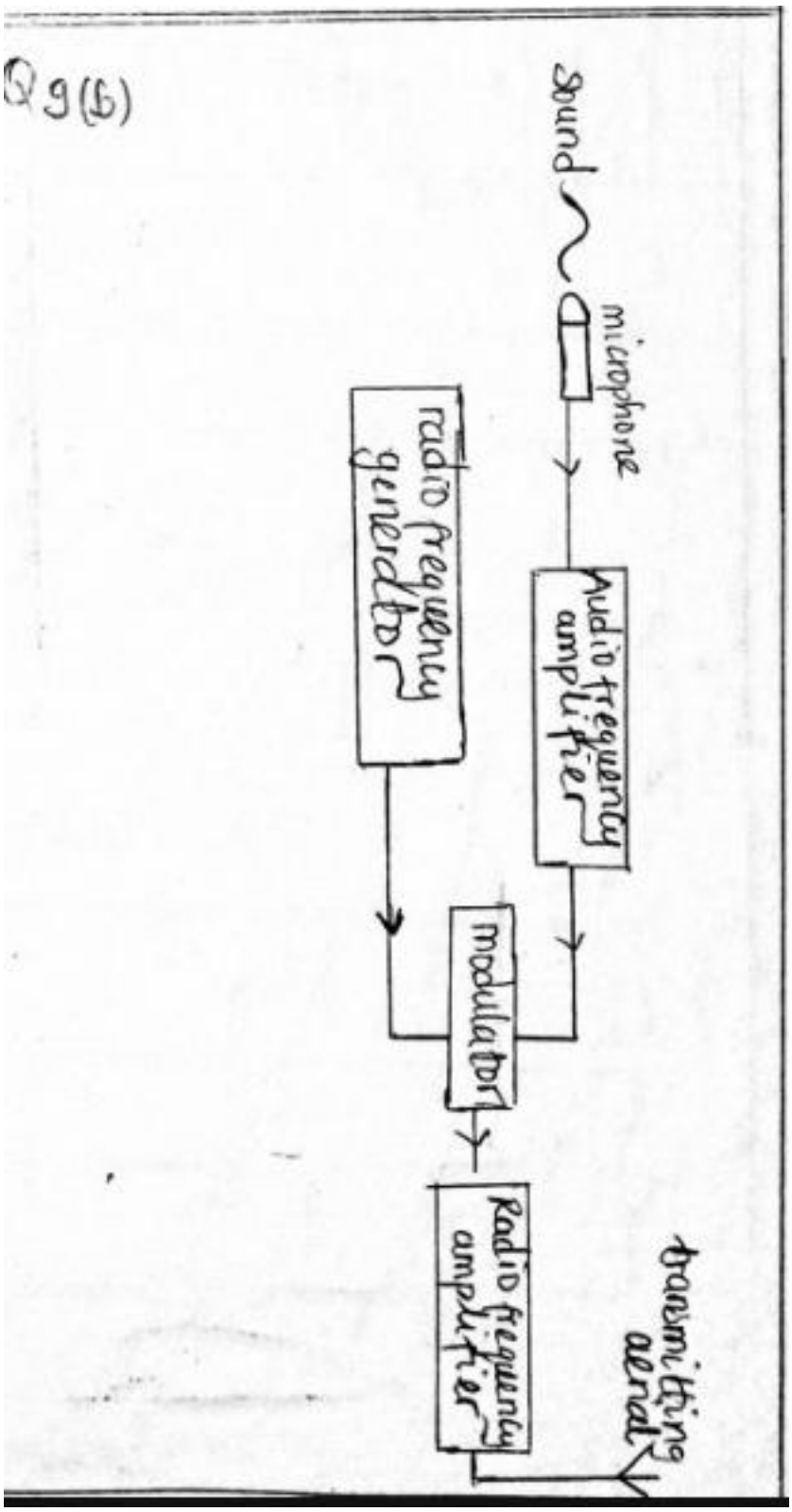
A pulse of light is emitted by switching on the source for 1.0 s.
The light is emitted in many directions as shown. The critical angle at the core/cladding boundary is 59^0 and the length of the fibre is 6.0 km. The refractive index is 1.50.

(i) State two advantages that optical fibres have over copper cables in telecommunication.

(ii) Some light from the source will travel down the fibre for its entire length.
Determine how long it takes to travel the length of the fibre.

(iii) What is the refractive index of the cladding? (6 marks)

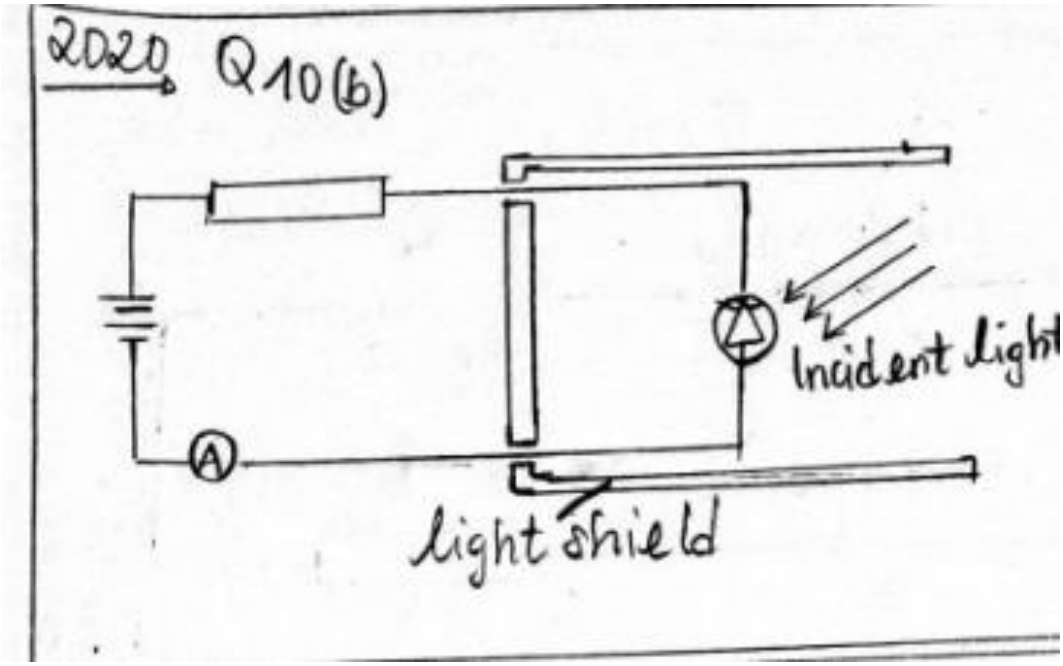
(b) Figure 12 shows the block diagram of a simple radio transmitter.



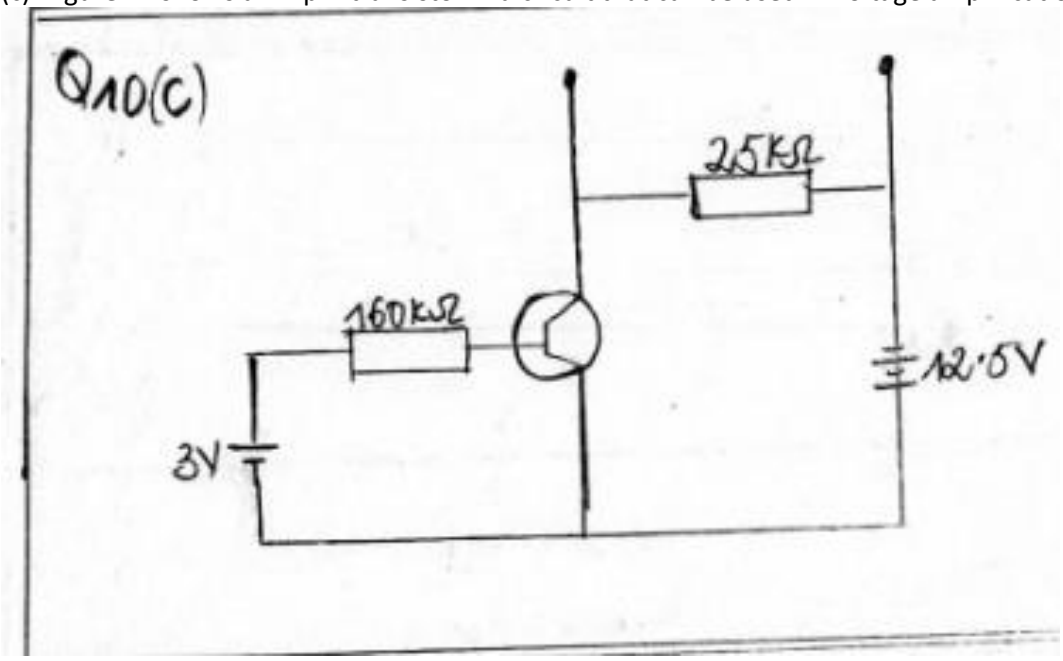
(i) State the function of the microphone and the modulator.
(ii) Briefly Explain the difference between amplitude modulation (A.M) and frequency modulation (F.M).
(iii) State one advantage that each of F.M and A.M has over the other. (6 marks)
(c) State three advantages of digital transmission over analogue transmission. (3 marks)

ELECTRONICS

10. (a) (i) Explain why the electrical conductivity of a semiconductor increases as temperature increases?
(ii) Use the band theory to distinguish between the electrical properties of wood, silicon and copper. (5 marks)
(b) Figure 13 diagram shows a photodiode in circuit.



(i) Explain the meaning of dark current of a photodiode . What is the order of magnitude of this current?
(ii) What is the effect of increasing the light intensity on the diode? Explain (4 marks)
(c) Figure 14 shows an n-p-n transistor in a circuit that can be used in voltage amplification.



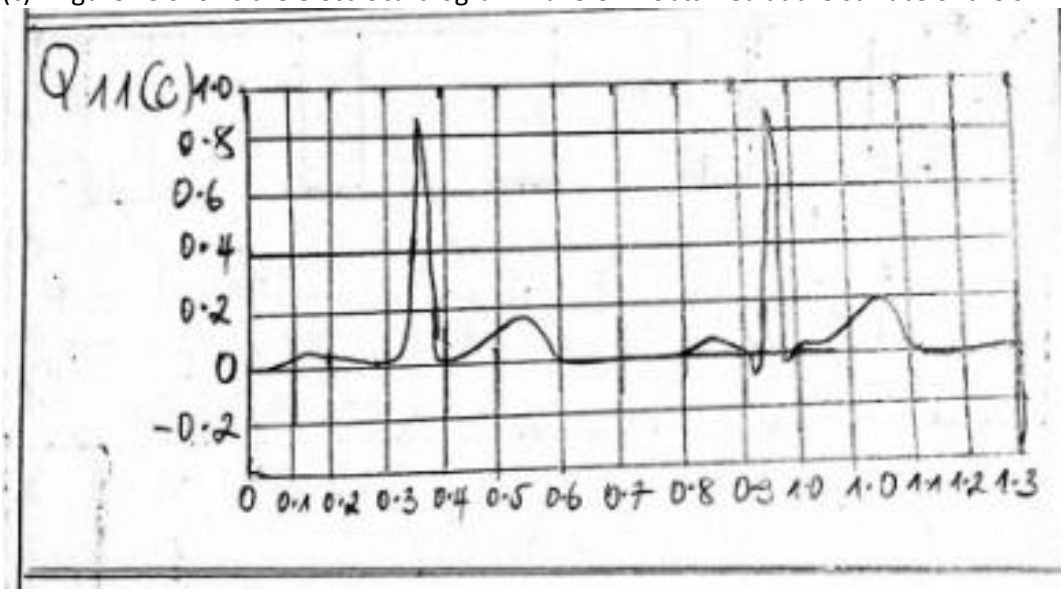
The base-emitter voltage, V_{BE} = 0.7 v and current gain (f_{FE}) = 1000.
(i) determine the base current and the collector current.
(ii) What is the operating point of the above transistor? (6 marks)

MEDICAL PHYSICS
11. (a) (i) Why is it necessary to use a gel where the ultrasonic probe is placed?
(ii) state, with respect to the medical diagnosis, one advantage that
X-rays has over ultrasound imaging
Ultrasound imaging has over x-ray

(b) (i) Describe the changes that occur to a human eye when the eye changes from focusing a distant object to focusing a near one, both objects being viewed under bright light.
(ii) A patient's eye is said to be astigmatic. State the effect of astigmatism on the image produced by the defective eye, its cause and the shape of the lens used for correction.
A patient's near point is located 210 cm from his eyes.
(iii) What type of eye defect is the patient suffering from?

(iv) Use diagrams to explain the type of lens needed to correct this defect so that the patient should be able to read a book placed 25 cm from his eyes. (7 marks)

(c) Figure 15 shows the electrocardiogram waveform obtained at the surface of the skin of a patient.



From the ECG waveform, determine the pulse rate per minutes. (3 marks)

JUNE 2022

SECTION I

l. The energy generated per unit time by a wind turbine is given by the equation E = —pAKv3N where p is the air density, A is the area swept by the blade, v is the wind velocity, K is the coefficient of performance and N is the generator efficiency.

(a) Explain with the help of an example homogeneity of a physical equation is not a sufficient condition for the correctness of the equation.

(b) Determine the base units of K. (6 marks)

2. An electric circuit is made by connecting in series a resistor of resistance 80 Q, an inductor of inductance 0.4 Hand a capacitor of capacitance 125 BF to an alternating power source of Vrms = 220 V and frequency 50 Hz.

State any one use of such a circuit in daily life.

Calculate the impedance, Z, and the root mean square value of the current in the circuit.

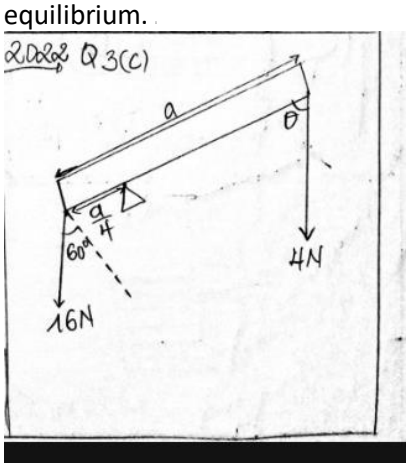
Calculate the resonant frequency fo, and the current in the circuit at resonance. (6 marks)

3. (a) What is meant by "the moment of a force"?

(a). What is meant by "the moment of a force"?

(b). State one condition necessary for a body to be in equilibrium on a plane.

(c). Figure I shows a uniform plank of weight 6 N and length a, inclined at am-angle 0. Calculate given that the system is in equilibrium.



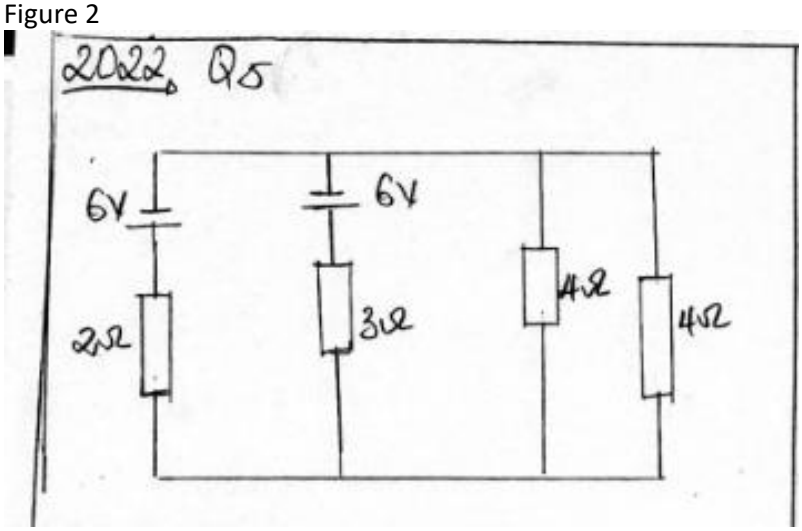
(b) A solenoid of 500 turns and diameter 10 cm is made from a conducting wire of diameter d =lmm. If there are no spaces between the turns, calculate the,

(i) total length of the coil needed for the solenoid.

(ii)current that must flow in the turns to produce a field strength of 0.15 T at the centre of the solenoid. iii) flux linking the turns of this solenoid when it is supplied with the current calculated.

5. Figure 2 shows a circuit diagram.

Figure 2



Determine the size of the current through the 3 Q resistor. (5 marks)

ANSWER EITHER a, b, and c OR d, e, and f

6 (a)Distinguish between transverse and longitudinal waves, stating an example of each type of wave. (4 marks)

(b) Describe an experiment to determine the speed of sound in free air. Your account should include a diagram, procedure, precautions, observation and conclusion. (8 marks)

(c) (i) Define simple harmonic motion (2 marks)

(ii) A small mass M is attached to the free end of helical spring on a smooth horizontal table. The other end of the spring is fixed. The mass is pulled through a distance of 5.0 cm from its initial rest position and then released so that it vibrates with a frequency of 30 Hz. If the spring constant is 10 N m-l , show that the motion is simple harmonic and calculate the mass M. (4 marks)

(iii) State an example of a critically damped system and its application in daily life. (2 marks)

(d) (i) Distinguish between the specific heat capacity and the specific latent heat of a substance. (2marks)

(ii). Explain why the specific latent heat of vaporisation is higher than the specific latent heat of fusion for the same substance. (2 marks

(e)Describe an experiment to determine specific latent heat of fusion of ice. Your account should include a diagram, procedure, precautions, observation and conclusion. (8 marks

(f)(i) State Newton's law of universal gravitation. (2 marks)

(ii) The expression for gravitational potential energy, U, of a mass m, at a height h above the surface earth is U = GMm/R+h where M is the mass of the earth, R is the radius of the earth and G is the universal gravitational constant. Show that when m is near the surface of the earth, the expression simplifies to U= mgh. (3 marks)

(iii)Calculate the b least amount of kinetic energy of a space craft of mass 1500 kg must have in order to be able to escape from the earth's surface. (3 marks)

SECTION II

DATA ANALYSIS

In an experiment to determine the radius of curvature r, of a convex lens, the lens is used to form images of an object on a screen. The image distance v from the lens is found for each object distance u from the lens and recorded on table l :

v/m	I .00	0.50	0.27	0.22	0.18	0.15	0.14	0.12
u/m	0.1 1	0.13	0.17	0.20	0.25	0.36	0.50	I .00

Table I

u and v are related by the equation $1/u + 1/v = A$ ----------1

where A is a constant and is related to r by the equation $A = \frac{2}{r}$ ----------2

(a) Use equation I to plot a suitable graph from which the value of A can be obtained. (13 marks)

Determine the value for A and hence r. (5 marks)

What is the significance of A? (2 marks)
SECTION III

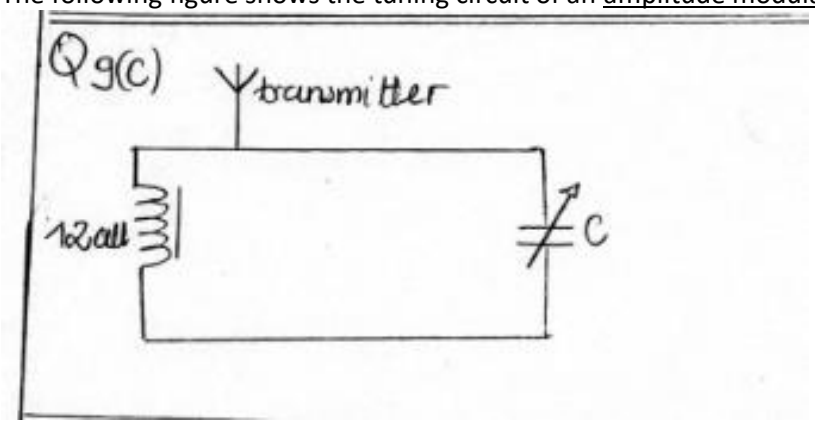
ENERGY RESOURECES AMD ENVIRONMENTAL PHYSISCS
8. a) The following diagram describes the energy flow sequence in the main components of a hydroelectricpower plant.

Copy and complete the diagram.
(ii)In one hydroelectric power plant, the height of the reservoir above the tail race is 56 m. The average water discharged at the spiral casing every second is 150 cm . Determine the power output from the turbine if its efficiency is 72%.
(iii)Distinguish between fossil fuels and bio-fuels. (7 marks)
b) Large scale industrial energy production could be achieved through the fusion of small nuclei in which energy is released.
(i) State one advantage nuclear fusion has over nuclear fission as a means of large-scale energy production?
The following equation shows a typical fusion reaction.

$$^{2}_{1}H + ^{3}_{1}H \longrightarrow ^{4}_{2}He + ^{1}_{0}n + \Delta E$$

(ii)Calculate the energy, AE , that is released.
(Mass of $_1{}^2$H =2.015 u, mass of ^{3}H= 3111 = 3.017 u, mass of $_1{}^4$H = 4.004 u, mass of ^{1}n =1.009 u)
(iii) Given that the mass of I mole of deuterium is 2.0 g, how much energy is released per kilogram of deuterium fuel?
(5 marks)
c) (i) Explain the meaning of greenhouse effect.
(ii) Describe a method that can be used to reduce one of the consequences of greenhouse effect. (3 marks)

COMMUNICATION
a) For minimum distortion of the information signal, the maximum allowed frequency of deviation in FM transmission is ±75 kHz. A high-quality FM radio station in Cameroon contains audio signals varying from 50 Hz to 15 kHz.
What do you understand by bandwidth?
Determine the bandwidth of the above radio station.
A bandwidth of 15 MHz is available for FM transmission in this country. How many radio stations can be broadcasted within this band simultaneously without any interference if the maximum audio frequency bandwidth is 15 kHz? (6 marks)
(i) State the functions of the following as used in telecommunication
– Encoder
Demodulator Base station
(ii) State two differences between mobile telephone handset and a commercial radio transmitter like that of CRTV. (5 marks)
The following figure shows the tuning circuit of an <u>amplitude modulation</u> radio transmitter.



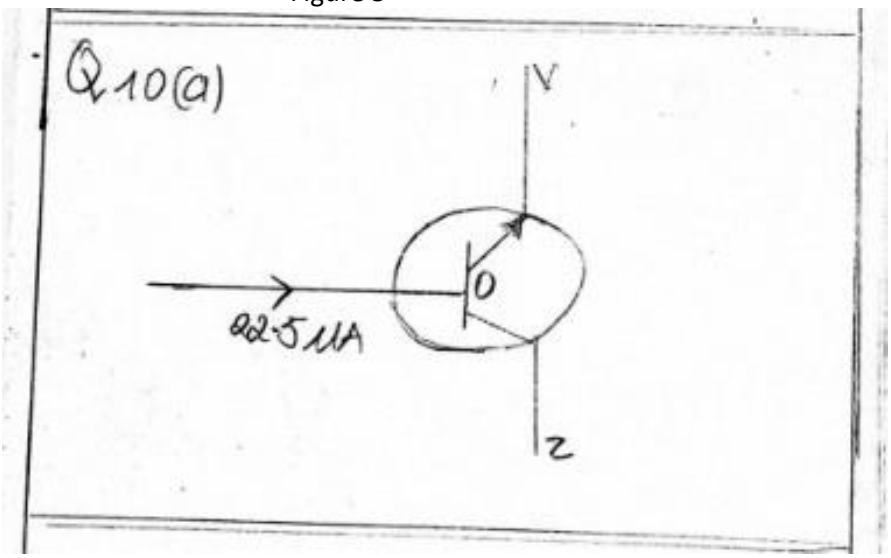
(i) Explain the meaning of the underlined phrase.
(ii) When the capacitor is set at 2.7 pF, a handset clearly picks the signals from this radio station. What is its transmitting frequency? (4 marks)

ELECTRONICS
a) The transistor shown in figure 5 is part of a circuit in which the transistor is connected in thE

common-emitter mode.

Figure

x Figure 5



The transistor has a d.c. gain of 100.

(I)Explain the meaning of the underlined phrase.

(II)If the base current in the circuit is 22.5 11A, determine the collector and emitter currents. (5 marks)

(b) The table below shows the band gap for a number of materials,

Material	carbon	Gallium arsenide hos hide	Silicon	Germanium
Band ya /eV	5.3	1.8	1.1	0.7

Using the values given in the table

(i) Suggest a simple explanation why carbon is an insulator.

Light emitting diodes (LEDs) emit light when electrons in the conduction band drop into holes in the valence band.

(ii) Determine the wavelength of the electromagnetic radiation emitted when electrons in gallium arsenide phosphide fall from the conduction band to holes in the valence band.

(iii)Hence explain why gallium arsenide is used in making LEDs. (6 marks)

i) How is a p-n junction formed?

(ii) Explain how a depletion layer arises at a p-n junction. (4 marks)

MEDICAL PHYSISCS

. a) An endoscope contains two bundles of optical fibres.

(ii) Name the two bundles. For each bundle state clearly the arrangement of the fibres and explain its purpose in the operation of the endoscope.

(ii)Each fibre has a core surrounded by cladding. Calculate the critical angle at the core — cladding interface of a fibre. (Refractive index of core and cladding equal 1.60 and 1.55respectively). (6 marks)

b) (i) Draw a simple diagram of the human eye, labelling clearly the features of the eye

- Responsible for bending of light
- On which images are formed – Letting light into the eye

(ii) Describe clearly the changes that will occur to the eye if a person moves from bright light into dim light. (5 marks)

c) (i) What is the full meaning of MRI?

(ii) State two advantages MRI has over conventional X-ray imaging.

(iii) State one disadvantage of using MRI in medical diagnosis. (4 marks)

JUNE 2018

SECTION I

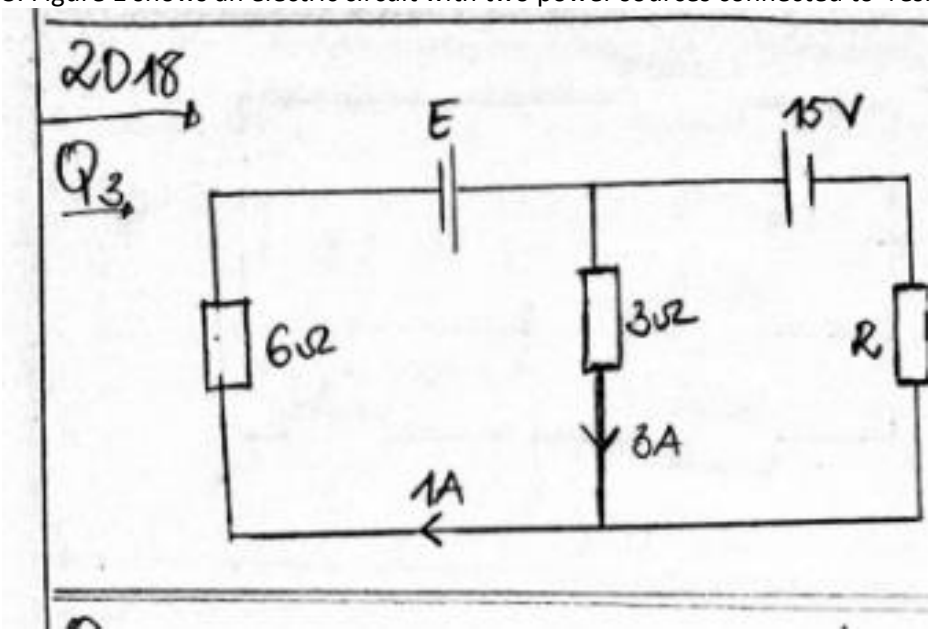
1. (a) State Netwon's law of gravitation and coulomb's law

(b) bring out two ways in which the force experience in gravitation field may differ from the force experience in the electric field. (6 marks)

2. A simple oscillating pendulum has amplitude0.05 m and period 2.0 s.

(a) Calculate the velocity of the displacement of the pendulum if y=Asinwt. Sketch a graph of acceleration, a, against time t for a complete oscillation. Note $A=-w^2y$ (6 marks)

3. Figure 1 shows an electric circuit with two power sources connected to resistors



Determine

(a) The current through R

(b) The value of R

(c) The emf, E

4. (a) What is meant by photoelectric effect

(b) Briefly outline three observations of the photoelectric effect which can not be explained by classical physics.(5 marks)

5. (a) State the conditions necessary for a body to be equilibrium on a plane.

(b)

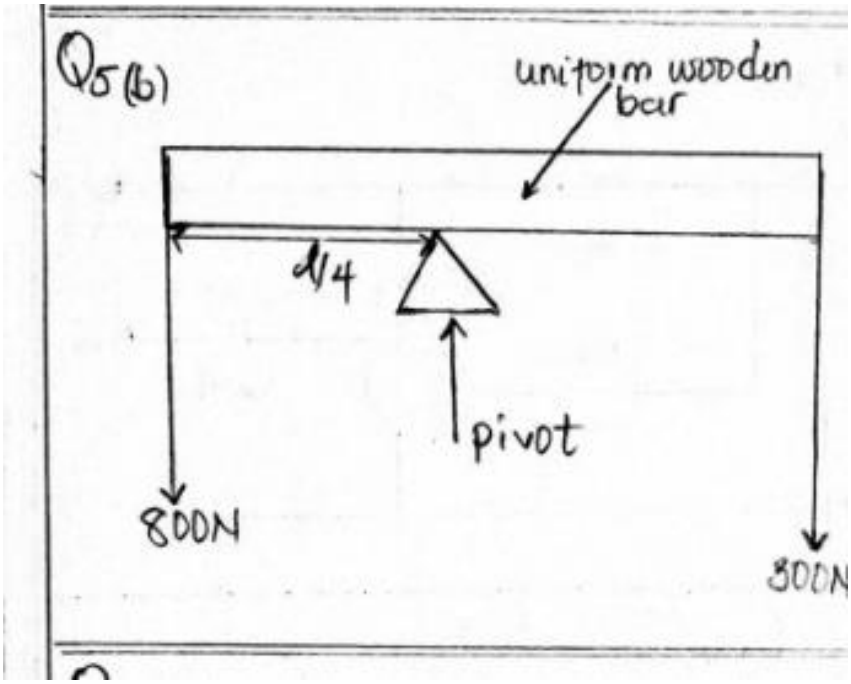


Figure shows a uniform wooden bar of length, l, in equilibrium. Determine the weight of the bar. (7 marks)

ANSWER EITHER a, b and c OR d , e and f

6. (a) (i) Use examples to explain and how waves are classified. (8 marks)

(b) Describe an experiment to measure the speed of sound in air. Your account should a diagram, procedure, precaution, observations, and how the observations are used to obtain a conclusion. (8 marks)

(c) As an ambulance sounding a siring approaches a control point, the frequency of the siring is measured to be 350 Hz and as it passes and moves away the frequency is presumed to be 320Hz. Explain why there is this difference and calculate the speed of the ambulance given the speed of sound in air is 340 m/s (4 marks)

(d) From the kinetic theory of ideal gas, the pressure, P, of a fixed mass of an ideal gas trapped in a container is given by $P = 1/3pc^{2-}$, where c^{2-} is the mean square speed of the gas particles.

(i) State the assumptions used to derive the equation . (2 marks)

(ii) Hence derive the equation. (4 marks)

(e) Describe an experiment to determine the specific latent heat of vaporization of water. Your account should a diagram, procedure, precaution, observations, and how the observations are used to obtain a conclusion. (8 marks)

(f) 8.0 kg of a hot liquid A initially at 90^0c are mixed with 3.0 kg of water initially at 22^0c in an insulated container. If the specific capacity of the liquid A is half that of water. Determine

(i) The equilibrium temperature reached by the system.

(ii) The ratio of the change of temperature of the liquid A to that of water when equilibrium temperature is reached. (6 marks)

SECTION II

DATA ANALYSIS

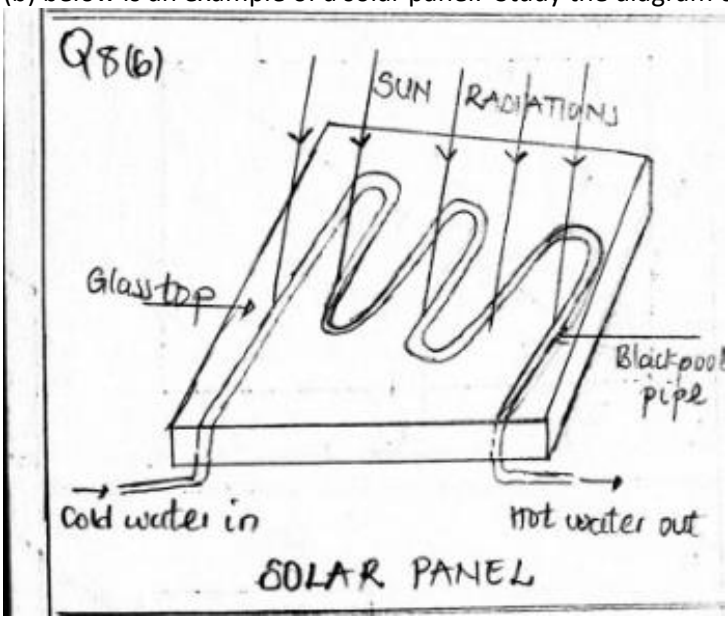
7. The equation $P=P_0e^{-kh}$ is called the law of atmospheres. It shows how the atmospheric pressure varies with height above sea level. K is a constant given by $k = g/P_0$ where p is the density of air standard temperature and pressureand the g is the gravitational field strength. Table 1 which follows gives some values of height above sea level and their corresponding atmospheric pressures P.

Height/km	Pressure/10^4 Nm^{-2}
9.6	4.346
11.7	2.691
18.0	1.094
28.1	0.221
34.9	0.0993

40.0	0.0602
44.8	0.173
51.0	0.138

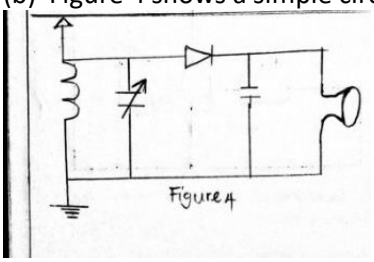
(a) Plot a suitable graph from which the values of k could be determine. (10 marks)
(b) Determine the values of k, P_0, and hence p. (8 marks)
(c) What is the pressure at a height of 65 km above sea level. (2 marks)

SECTION III
OPTION I
ENERGY RESOURCES AND ENVIRONMENTAL PHYSICS
8 (a) (i) A small container ship called " THE ACHUKA" meds to enter and berth a port in Cameroon. What does the captain of the ship need to know about the weather in the locality in which the port is located?
(ii) Explain how weather forecast can be done from a distant. (6 marks)
(b) below is an example of a solar panel. Study the diagram carefully and the questions



Explain why the panel should have the following features
(i) The pipe are blackened
(ii) The top of the panel is covered with glass
(iii) The walls are highly insulated and blackened. (3 marks)
(c) (i) draw a cross section of a hydroelectric power plant
(ii) explain the energy changes that takes place in the plant (6 marks)

Option 2
COMMUNICATION
9. (a) (i) Name four functions of a mobile phone. (6 marks)
(ii) State the meaning of the following words SMS, MMS and SIM
(b) Figure 4 shows a simple circuit of a radio receiver. Using A to E identify the component that best fits the following



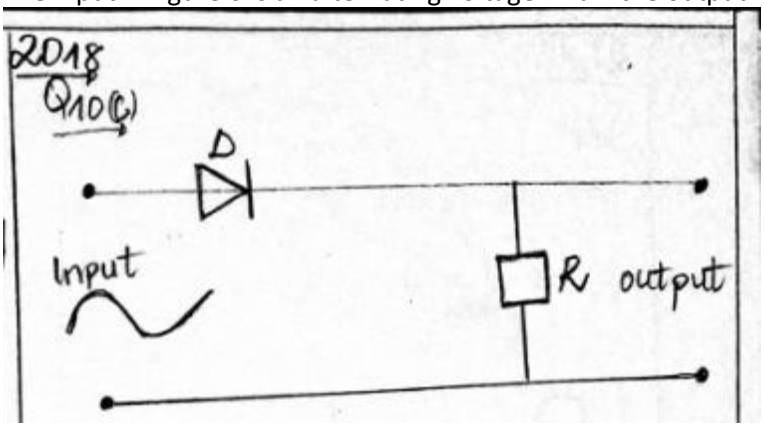
(i) Which part of the radio has all the transmitted signals

(ii) which component is used to select a particular signal
(iii) Which component is used to remove the radio signal
(iv) The component that generates input signals into the radio receiver. (6 marks).

Option 3
ELECTRONICS
10.

(a) With the help of the band theory only distinguish between an insulator and a semiconductor. (4 marks)
(b) (i) Draw a circuit diagram that can be used to obtain the results in the graph in figure 5 .
(ii) Use the graph in figure 5 to plot another graph of collector I_c against base current I_b obtain the current gain from the transistor.
(iii) Explain the term thermal runaway. (9 marks)

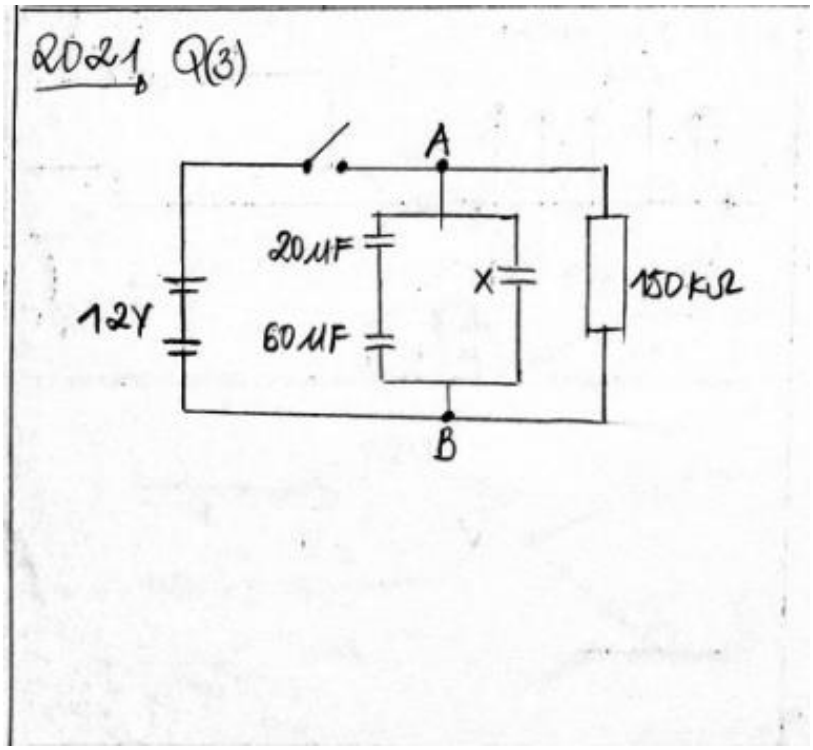
The input in figure 6 is an alternating voltage. Draw the output voltage for the circuit. (2 marks)



Option 4
MEDICAL PHYSISCS
11. (a) (I) Draw and describe the basic structure of the human ear.
(ii) Consider the ear to be a pipe closed at one end and the length of the human auditory canal is approximately 28 mm. if the velocity of the sound in air is 340 m/s then what is the frequency of the fundamental note in the ear?
(iii) The ossicles in the ear act as levers. What does that mean? (10 marks)
b. Optical fibres are considered to be a major break through in many fields of study including medicine.
(i) State the concept under which optical fibre is very useful.
(ii) Draw a ray diagram of a step index fibre. Describe the function of each part
(iii) Describe an application of optical fibre in medicine. (5 marks)

JUNE 2021
SECTION 1
1 a. The force per unit length , F, between two current carrying conductors kept a distance , a, apart in vacuum is suggested by an engineering physicist to be given by $F = (I_1 I_2)/2a$. Where is the permeability of vacuum, I1 and I2 are the current in the conductor. Determine whether the equation is homogenous or not.
b. state with the aid of example why an equation can be homogenous but incorrect. (6 marks)

2. State an explain how the electrical resistance of each of the following will be affected by an increase in temperature
a. Pure semiconductor
b. metal wire
3. Figure 1 shows how three capacitors are connected in a circuit. One of the capacitors has an unknown capacitance, X. given that the total charge stored on the capacitance is 155 C with the switch closed and the potential difference between A and B is 120 V.



a. Calculate the
(i) Total capacitance in the circuit
(ii) value of x
(iii) potential difference across the 60 capacitor.
The supply is disconnected and the capacitors discharged through 150 kΩ resistor. Calculate the time taken for the potential difference between A and B to fall to 6. 0 v

4. A force 40 N acts on a body at angle 110^0 to another force of 50 N acting on the same body. Calculate the resultant force acting on the body. (5 marks)

5. two narrow slits which are closed to each other are illuminated with **coherent monochromatic light**.
a. (i) Give the meaning of the underlined words.
(ii) Explain why a pattern of fringes is observed on a screen placed at some distance from the slits.
b. In one such experiment, light of wavelength 500 nm gives fringes separated consecutively by 2.5 mm . If the creen is 1.55 m from the slits , what is the distance between the slits. (7 marks)

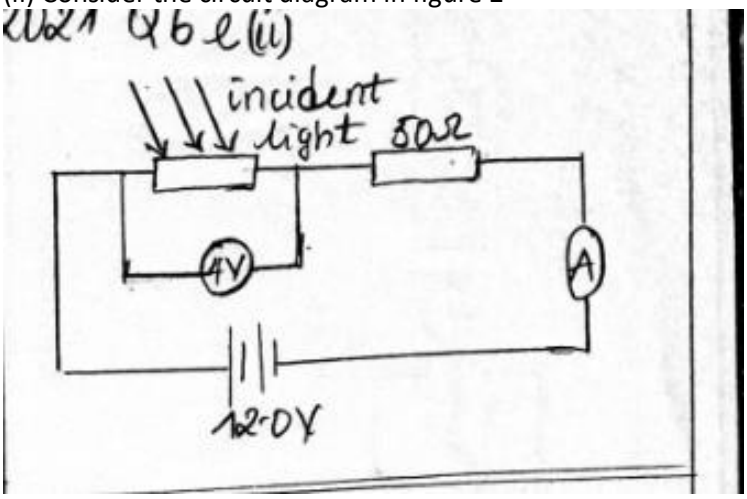
ANSWER EITHER a, b and c OR d, e and f
6. a. (i) what is work function
(ii) Describe an experiment to determine plank's constant. Your account should a diagram, procedure, precaution, observations, and how the observations are used to obtain a conclusion. (8 marks)
b. (i) State the laws of electromagnetic induction (4 marks)
(ii) A coil of area 25 m^2 with 100 turns is placed at right angle to the magnetic field 3 x 10^{-3} T. Calculate the magnetic flux linkage in the coil (2 marks)
c. (i) Calculate the period of the rotation of the moon round the earth if the mean radius of the moon is 3.0 x 10^8 m.
(ii) State one difference between the magnetic force and the gravitational force. (6 marks)

OR
d. (i) Define specific latent heat of vaporization

(ii)) Describe an experiment to determine the specific latent heat of vaporization of water. Your account should a diagram, procedure, precaution, observations, and how the observations are used to obtain a conclusion. (8 marks)

e. (i) state Kirchoff's laws of electric circuit

(ii) Consider the circuit diagram in figure 2



Determine the reading of the ammeter when light of constant intensity falls on the light dependent resistor(LDR) and the voltmeter reads 4 v. (2 marks)

f. (I) calculate the quantity of solar energy which can be captured by a photovoltaic plate measuring 6.0 m by 2.0m if the solar constant is 1.4 Wm^{-2}. (2 marks)

(ii) Why can all this energy not be converted into electrical energy? (1 mark)

SECTION III

DATA ANALYSIS

8.The current, I, through a certain electrical device is related to the potential difference, V, across its terminal by the equation $I = I_0 e^{-ev/2\beta T}$

Where , e is the electronic charge, t is the temperature at which the current is flowing and equals to 298 K and β is a constant.

The following results were obtained using the device.

$I/x10^{-2}A$	$V/x10^{-2}V$
29.2	2.9
25.9	3.5
23.0	4.1
20.8	4.6
19.2	5.0
17.6	5.5
15.7	6.0
14.2	6.6
13.1	7.0

SECTION III

OPTIONS

OPTION 1

ENERGY RESOURCES AND ENVIRONMENTAL PHYSICALS.

8 a. Differentiate between renewable energy sources and non- renewable energy sources giving one example of each

b. For a wind mill, the kinetic energy per unit time , $P = 1/2r^2pv^3$

where r is the radius of the blades, p is the density of air and v the speed of the wind. The diameter of the blades of an aero-generator of the mill is 4 m. What is the power output of the wind will on a day when air has a density of 1.2 kgm^{-3} and the wind blowing with a velocity of 144km/h. If the efficiency of the wind mill is 25%? (3marks)

c. (i) Draw an energy flow diagram of a hydroelectric power plant. (3 marks)

(ii) State on environmental problem that arises from the construction of a hydroelectric power plant. (1 mark)

d. (i) Explain what is meant by global warming

(ii) State and explain one effect of global warming on human being. (4 marks)

OPTION 2

COMMUNICATION

9. a. Differentiate between

(i) Digital and analogue signals (6 marks)

(ii) Encoding and decoding.

b. Optical fibres are increasingly used in modern day communication. Write down two advantages of optical fibre communication over other communication system. (2 marks)

c. Draw a labeled diagram of a simple circuit. (2 marks)

d. A communication channel is characterized by a bandwidth that determine the volume of information it can transmit in given time.

(i) Define the underlined words

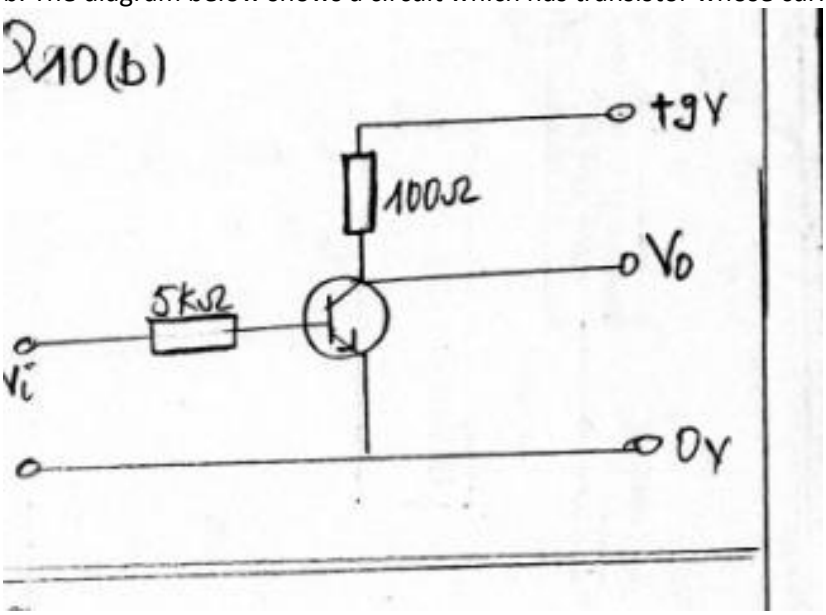
(ii) A radio station uses a carrier frequency of 200kHZ to transmit an AM wave. The transmission consists of audio signals within a frequency range 50kHZ-90kHZ. Calculate the minimum frequency sideband and bandwidth. (3 marks)

OPTION 3

ELECTRONICS

10. a. Draw the circuit symbol and the truth table of an OR gate. (4 marks)

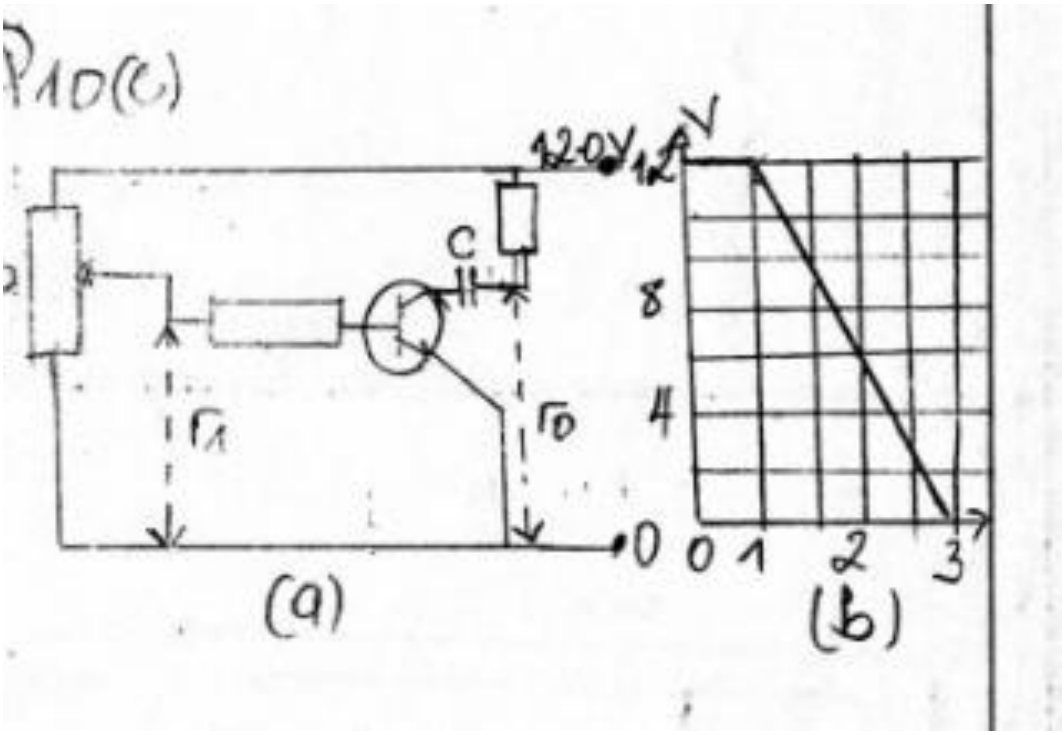
b. The diagram below shows a circuit which has transistor whose current amplification , h_{fe} is 100.



(i) For a base/emitter voltage of 0.7 v , calculate the base current and the emitter current when the input voltage, V is 2.0V. (2 marks)

(ii) What is the output voltage, V_0 (2 marks)

c. Figure 4(a) shows a transistor circuit in the CE arrangement. The input voltage (V_i) is varied using a potential divider, P, The corresponding output voltage (V_0) is shown graphically in figure 4(b)For this circuit to be used as an alternative voltage amplifier the input voltage must be fixed ata suitable value by adjusting P



(i) What is the suitable value for this switch input voltage, explain your answer.
(ii) What is the use of the capacitor C.
d. Sinusoidal alternating voltage of amplitude 3.5v is superimposed on this fixed voltage.
(i) What will be the amplitude of the output voltage. (7 marks)
(ii) Explain how the above set up can be used as an electronic switch

OPTION 4
MEDICAL PHYSICS
11. a (i) Draw a simple diagram of the human ear. (4 marks)
(ii) Name one factor that causes hearing to deteriorate (2 marks)
b. MRI is one of known invasive diagnostic images
(i) Write the full meaning of MRI (1 mark)
(ii) Write down two advantages and two disadvantages of MRI (4 marks)
c. (i) during ultrasonic probe a girl is often apply on the sport where it is performed? Explain why this is done
(ii) Explain why ultrasound is not likely to replace X-rays completely in medical diagnosis (4 marks)

JUNE 2019

SECTION I

(One hour)

Answer all questions

1. The capacitance (C) between two parallel metal plates is given by $C= \varepsilon_0 A/d$ where ε_0 is the permittivity of the air, A is the area of overlap of the plates, and d is the plates separation.
    a) Show that the equation above is homogenous.
    b) If the area of overlap of the plates of capacitor whose plates are separated by 1.25×10^{-6}m is $1.64\times10^{-4}cm^2$, what is its capacitance?

(6marks)

2. Distinguish between solid and liquid in terms of the following properties.
   I. Molecular arrangements
   II. Intermolecular forces

(6marks)

3. Two protons A and B each of mass 1.70×10^{-27}kg are separated by a distance a of 1.00×10^{13}m.
   a) Draw a diagram showing the forces acting on the protons
   b) Calculate the ratio of the electric force to the gravitational force between the proton

(6marks)

4.

a) State two conditions for a constructive interference pattern to be observed between two sources of light?
b) A parallel beam of light of wavelength 559nm is incident normally on a diffraction grating having 600 lines per mm. Determine the maximum number of orders possible (5marks) 5. Figure 1 shows a circuit diagram containing 4 resistors and a battery of emf,ε=4.40V.

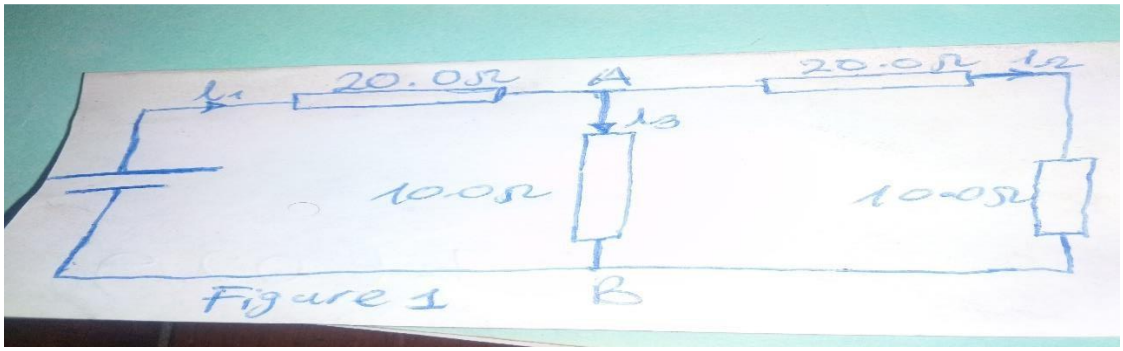


Figure 1

Determine:

a) The currents I_1, I_2, and I_3.
b) The potential difference across AB.

(7marks)

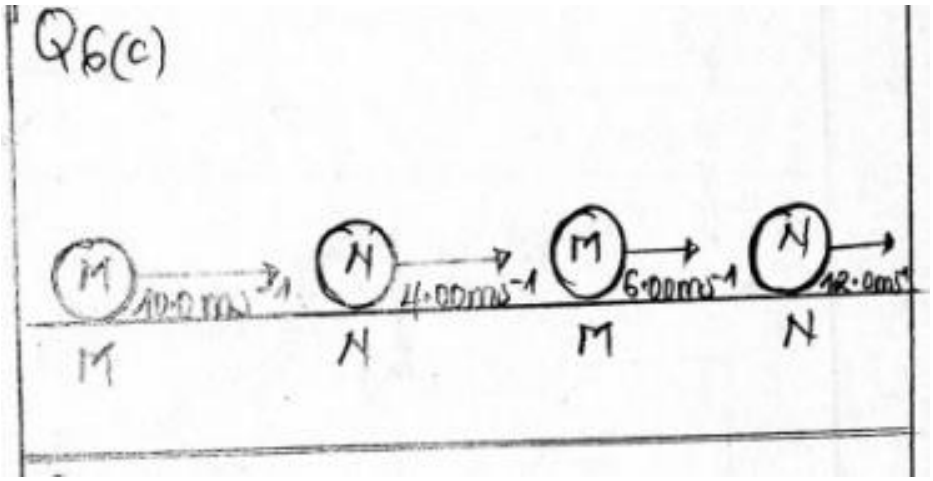
Answer EITHER 6(a), (b) and (c) OR 6(d), (e) and (f).

EITHER 6 (a), (b) and (c)

6.

a) State the zeroth and first laws of Thermodynamics (4marks)
b) Describe an experiment to determine the Specific Heat Capacity of copper. Your account should include a diagram, procedure, precautions, observations and conclusion.
(8marks)
c) Figure 2 shows a ball M of mass 0.800kg moving with a velocity of $10.0ms^{-1}$ that collides head-on with a ball N of mass 0.4kg moving with a velocity of $4.00ms^{-1}$. After the collision M acquire a velocity of $6.00ms^{-1}$ while N acquires a velocity of $12.0ms^{-1}$

d)



I. Show that the collision obeys the law of conservation of linear momentum.

II. Define an elastic collision and determine whether this collision is elastic or inelastic.

(8marks)

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

6.

(d)

I. Define photoelectric effect. (2marks)

II. State two experimental observations with regards to photoelectric effect which classical physics could not explain (4marks)

(e) Describe an experiment to determine Planck's constant. Your description should include a diagram, procedure, precautions, observations and a conclusion. (8marks)

(f) A certain element has a work function of 1.90eV. Determine:

I. Its threshold wavelength;

II. The maximum kinetic energy of the emitted electrons when the element is illuminated by light of wavelength 4.50×10^{-7}m; and

III. The stopping potential of this element

(6marks)

SECTION II (30minutes)

DATA ANALYSIS

7. A student investigate the variation of potential difference (V) and the current (I) through a semiconductor diode and obtained the following results:

$I/\times10^{-4}A$	V/mV
0.004	255
0.016	315
0.036	345
0.089	385

0.182	410
0.552	455
0.903	475
1.400	495
1.820	505
2.230	515

Table1

The equation relating I and V is

$I = I_0 e^{\beta V}$ …….. (1) Where I_0 and β are constants.

(a) Plot a suitable graph from which β and I_0 could be obtained. (11marks)

(b) Determine the values for the constants β and I_0 (8marks)

(c) What is the physical significance of I_0? (1mark)

SECTION III (1hour)

OPTIONS

Answer any two questions from the four options

OPTION 1: ENERGY RESOURCES AND ENVIROMENTAL PHYSICS

8.

a) with the aid of an example, explain the meaning of each of the terms:

I. Functional energy sources;

II. Secondary energy sources

(4marks) (b) Explain consequences of global warming on:

I. Human health

II. The environment

(4marks)

(d) state three factors on which the amount of solar radiation in any part of the world depends

(3marks)

(e) Natural uranium contains 0.7% Uranium-235. When Uranium 235 atom undergo fission, 200MeV of energy is released. Calculate:

I. The number of U-235 nuclei contained in 1.00kg of natural uranium;

II. The cost to be paid to an electricity company such as ENEO, if electrical energy is sold at the rate of 60frs per unit when the U-235 content in 1.00kg completely undergoes fission and all the energy released is converted to electrical energy

(4marks)

(Total 15marks)

OPTION2: COMMUNICATION.

9. (a) Draw the diagram of a simple ratio receiver. (4marks)

(b) (i) Briefly explain the difference between FM and AM transmission. (3marks) (ii) A turning circuit contains an inductor of inductance 12.7Mh. If a capacitor of capacitance 2.00μF is connected to the circuit, calculate the frequency to which the circuit is tuned.

(3marks) (c) (i) State two physical quantities that can be varied in order to capture a particular ratio using a mobile phone.

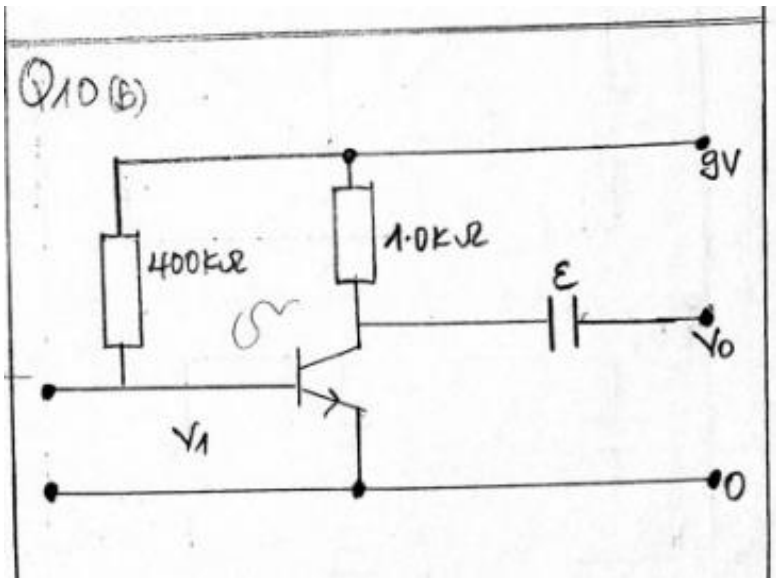
(ii) State and explain two uses of cell phones.

OPTION3: ELECTRONICS

10. (a) (i) Distinguish between intrinsic and extrinsic semiconductors. (4marks)

(ii) With the aid of diagrams explain the band theory. (3marks)

(b) Figure 3 shows a simple amplifier circuit.



When the Collector-emitter Voltage is between +1V and +9V, the Collector Current is $60I_B$, the base- emitter voltage is 0.7V.

(i) Identify the type of amplifier (ii) Calculate the base current; and (iii)The voltage gain.

(6marks)

(c)Complete the functions of a diode and a capacitor in an electric circuit (2marks)

(Total 15marks)

OPTION4: MEDICAL PHYSICS

11. (a) Compare X-rays and ultrasound in medical diagnosis (4marks)

(b) A person's near point is 100cm. Explain using a diagram how the defect can be corrected. (4marks)

(c) (i) Draw a simple labelled diagram of the human heart (4marks)

(ii) states any three functions of the heart. (3marks)

(Total 15marks)

SECTION I

One hour

Answer all Questions

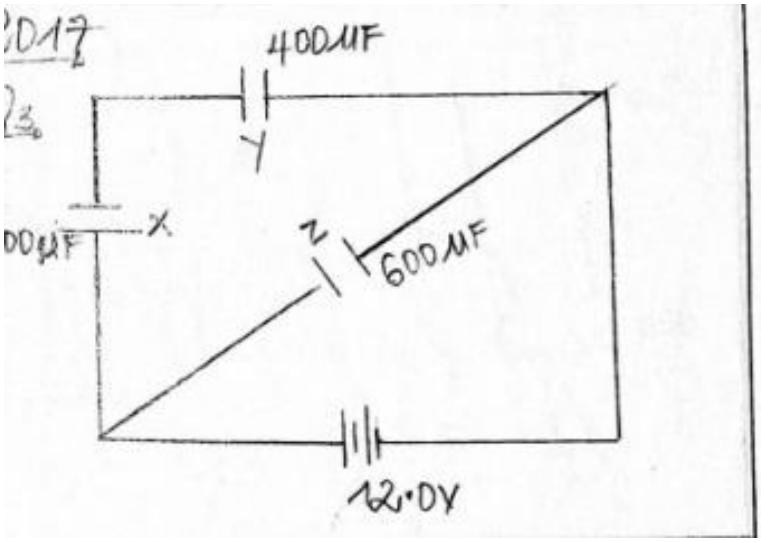
1. The energy stored in an air filled parallel plate capacitor whose area of overllap is 'A' is given by the equation E==== , where d is the separation between the plates, V, is the potential difference across the plates and E0, is the permittivity of free space. Show that this equation is homogenous.

(6 marks)

2. An object is placed 30.0cm from a converging lens of focal length 15.0cm and 30.0cm from a diverging lens of the same focal length s the convergong lens. Calculate the magnifications of the lenses and describe the images formed by the:
   (i) Converging lens
   (ii) Diverging lens relative to the objects.

(6 marks)

3. Figure 1 shows how capacitors, X,Y and Z are connected to a battery in an electric circuit.

4. 

Calculate

   (a) Voltage across the capacitor Y
   (b) Energy stored in the capacitor X

(6 marks)

5. (a) Explain what is meant by wave-particle duality.
   (b) Estimate the de Broglie 's wave length for an electron emitted by thermionic emission into a vacuum from a hot cathode and accelerated by a p.d of 3.0 * 10^4V. (7 marks)

6. (i) Forces maay generally be classified as **contact forces** or **action at a distance forces.** Explain the meaning of the phrases in bold.
   (ii) Give an example of each tyoe of force in 5(i).

(5 amrks)

Answer EITHER 6(a),(b) and (c) OR 6(d),(e) and (f).

EITHER 6(a),(b) and (c)

7.

(a) Distinguish between and ideal gas and a real gas. (4 marks)

(b) One form of the equation for an ideal gas is PV = nRT……(i)

Where P is the pressure of the gas, V if the volume occupied by the molecules, n, is the number of moles, R is the molar gas constant and T is the absolute temperature of the gas. Another expression relating pressure for an ideal gas is

P = 1/3pc2……(ii)

Where p is the density and c is the speed of a molecule.

(i) State the four assumptions of the kinetic theory of matter used to derive equation (ii) (4 marks)

(ii) By considering the equations for the ideal gas, show how the average kinetic energy is related to the absolute temperature.

(c) (i) State the second law of thermodynamics (2 marks)

(ii) A system delivers an amount of heat Qh to an engine which does mechanical work, W, and release Q0 to the atmosphere. Considering the first law of thermodynamics, use the symbols Qh, Qo and W to work out an expression for the efficiency of the engine. (4 marks)

(iii) Explain why the efficiency is less the 100%. (2 makrs)

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

(d) (i) Compare a moving coil instrument and an oscilloscope as current measuring devices. (2 marks)

(ii) Why is a.c system preffered to d.c system for long distance transmission of electrical energy? (2 marks)

(e) A thin wire of mass 5.0g is wounded round a dry piece of wood to produce several turns and the ends joined together. When a powerful bar magnet is swiftly moved over the coil in an interval of 0.3s the wire burns out.

(i) Explain why the wire burns out.

(ii) State and explain what can be done to reduce the time for the wire to burn

(iii) A wire burns out when a minimum current of 5.0A flows in it data a pd of 150V. If the temperature of the wire changes by 80°C, estimate the specific heat capacity of the wire (4 marks)

(f) A coil of inductance 50H , a capacitor of 200uF and a resistor of 1k(ohm) are connected in series to a signal generator.

(i) Write down the equation for the impedance of the circuit. (1 mark)

(ii) Determine the frequency of the a.c signal which allows for a maximum potential difference across the resistor. (3 marks)

(iii) Expalin why the potential across the resistor is maximum at this frequency. (3 marks)

SECTION II (30 minutes)

DATA ANALYSIS

8. IN n experiment to determine the properties of a car battery, various loads were connected to its terminals in a closed circuit. A record of the different potentials difference, V, across each load and the corresponding current , through the battery was recorded as displayed in the table 1 below.

V/V	16.6	15.2	12.0	8.6	7.8	6.6	5.2	3.8
I/mA	4.0	8.0	16.8	26.4	28.8	32.0	36.0	40.0

Table 1

Theory holds that the potential difference , V, and the current I, vary according to the equation E = V + Ir. Where E and r are the electromotive force and internal resistance of the battery , respectively.

(a) Plot a suitable graph from which E and r could be obtained. (7 marks)

(b) Determine the values of E and r. (10 marks)

(c) Would you expect this source to deliver power more efficiently when connected to a 200(ohm) or 2000(ohm) resistor? Explain. (3 marks)

SECTION III (1 hour)

OPTIONS

Answer any two questions from the four options

OPTION 1; ENERGY RESOURCES AND ENVIRONMENTAL PHYSICS

9. (a) (i) Distinguish between renewable and non renewable energy sources giving example of each (4 marks)

(ii) A solar panel delivers power of 2.0kW when the rays of the sun fall on it. If the solar constant is 1.2*10^3 Wm-2 and its efficiency if only 40%, calculate the area of the solar panel. (3 marks)

(b) (i) Explain why Cameroon cannot rely completely on the solar energy for its energy needs

(ii) Draw an energy flow diagram for an energy scheme in which wood is burnt to produce electrical energy. (4 marks)

OPTION 2: COMUNICATION.

10. (a)(i) Draw a block diagram of a radio system. (4 marks)

(ii) A station is broadcasting on a frequency of 92.5MHz. Determine the capacitance of the capacitor which should be associated with an inductor of 1.25*10^-9H to receive this station. (3 marks)

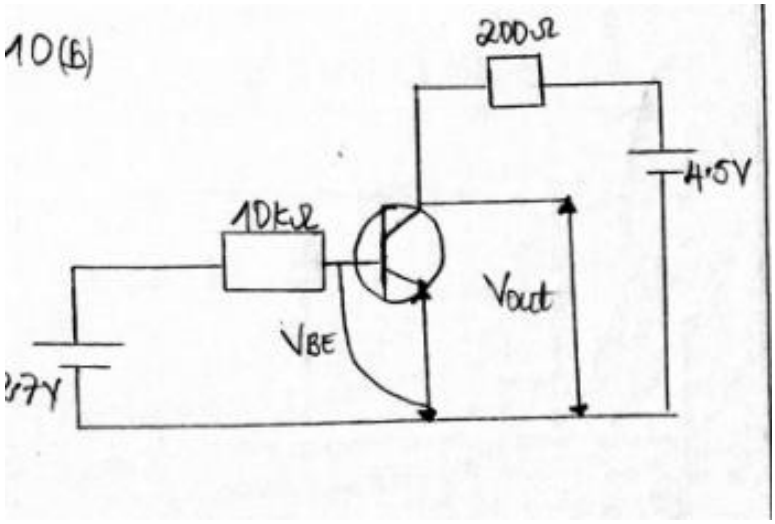
(b)(i) Compare analogue and digital systems as means of transmitting information.

(ii) Discuss the problems and the advantages for Cameroon changing from analogue to digital transmission in the near future. (5 marks)

OPTION 3: ELECTRONICS

11. (a) State in words and in the form of a truth table the actions of the following gates.
    (i) AND
    (ii) OR
    (iii) NAND
    (b) Figure 2 shows a transistor circuit operating in the common emitter mode with a current gain of 60 and VBE of 0.7V.

Calculate the output voltage V_o (9 marks)



OPTION 4: MEDICAL PHYSICS

12. (a) Explain using ray diagram how a normal eye focuses an images of an object on the retina. (5 marks)

(b) A doctor notices that one of her patients can see clearly some text when it is near but will see the same text appearing blurred when moved further away. Explain how such a defect can be corrected using a named lens. (4 marks)

(c) select a non-ionizing imaging technique and explain how it is used in medical diagnosis. (6 marks)