9. (a) Mention four (4) important properties of a semi – conductor (**04marks**)

(b) (i) Give three (3) differences between N – type and P – type semi – conducting materials. (**03marks**)

(ii) in N – P – N transistor, the collector current is 10 mA. If 90% of electrons emitted from emitter reach collector, what is the base current? (**03marks**)

(c) (i) Explain how you can use a diode as a switch (**02marks**)

(ii) The current gain for a common – emitter amplifier is 50. The collector resistance of the C – E amplifier circuit is 2KΩ and input resistance is 500Ω. If the input voltage is 0.02V, calculate the output voltage (**03marks**)

10. (a) (i) Give four (4) advantages of negative feedback in an OP – amp (**02marks**)

(ii) Calculate the value of output voltage (V_o) in the figure below, if the input voltage (V_i) IS +2V.

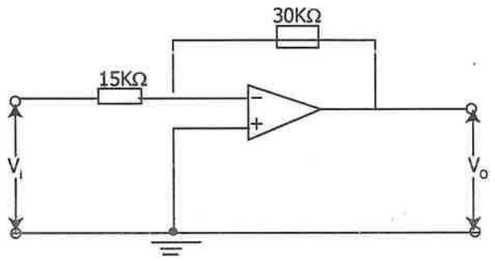


Figure 2

(b) (i) What is meant by Logic gates? (**01mark**)

(ii) Draw a truth table for the circuit in the figure below including the state at C ,D, E, F and G

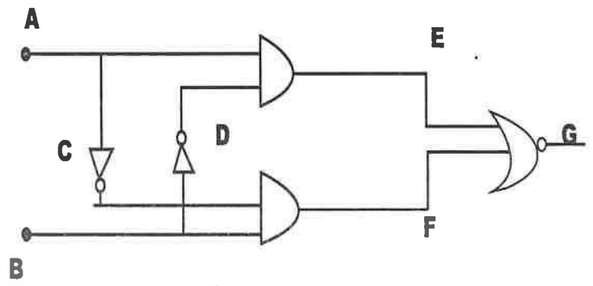


Figure 3

(c) (i) Mention three basic elements of communication system. (**03marks**)

(ii) What is meat by the term frequency deviation and carrier swing (**02marks**)

PRESIDENT'S OFFICE

REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT

DAR ES SALAAM REGION

FORM SIX MOCK EXAMINATION

PHYSICS

Code: 131

Time: 3:00 Hours Tuesday 6th February 2024 A.M

INSTRUCTIONS

1. This paper consists of **ten (10)** questions.
2. Answer **all** questions in section A and B
3. Section A carries **seventy (70)** marks and section B carries **thirty (30)** marks.
4. Marks for each question or part thereof are indicated.
5. Mathematical tables and non – programmable calculator may be used.
6. Write your **Examination Number** on every page of your answer booklets (s).
7. The following information may be useful
   (a) Acceleration due to gravity, $g = 9.8 m/s^2$
   (b) Stefan's constant, $G = 5.7 \times 10^{-8} Wm^{-2}K^{-4}$.
   (c) Density of water of water = $1000 kgm^{-3}$
   (d) Electronic charge, $e = 1.6 \times 10^{-19}C$
   (e) Pie, $\pi = 3.14$

This paper consists of 4printed pages

SECTION A (70 marks)

Answer **ALL** questions in this section

1. (a) (i) State the principle of homogenity of dimensions **(01marks)**

(ii) The equation of wave is given by

$$y = r\sin\left\{w\left(\frac{X}{\lambda} - K\pi\right)\right\}$$

Where all the symbols carry their usual meaning. What are the dimensions and units of X and K? **(02 marks)**

(b) (i) Differentiate between mistake and error. Give one example for each **(02 marks)**

(ii) The force "F" acting on an object of mass "m" travelling at velocity "V" in a circle of radius "r" is given by;

$$F = \frac{MV^2}{r}.$$

If the measurements are recorded as:
M = (3.5 ± 0.1) Kg
V = (20 ± 1) m/s
R = (12.5 ± 0.5) m;
Find the percentage error in the measurement of force **(04 marks)**

2. (a) (i) When a stone thrown on a glass window, smashes the glass window pan to pieces, but a bullet from the gun passes through making a clean hole. Ex plain **(02 marks)**

(ii) A bullet of mass 20g is fired horizontally into a suspended stationary wooden block of mass 380g with a velocity of 200m/s. What is the common velocity of the bullet? **(03 marks)**

(b) (i) Mention two (2) characteristics of projectile motion **(02 marks)**

(ii) If the range of a projectile is 120m and its time of flight is 4 seconds, determines the angle of projection and its initial velocity of projection given acceleration due to gravity, g = $10ms^{-2}$ **(03 marks)**

3. (a) (i) Briefly explain why does a motorbike rider bend while going through a corner? **(02 marks)**

(ii) A small mass of 1kg is attached to the lower end of a string 1m long whose upper end is fixed. The mass is rotated in a horizontal circle of radius 0.6m. If the circular speed of mass is constant, find the period of motion **(03 marks)**

(b) (i) State where the magnitude of acceleration is greatest in a simple harmonic motion (S.H.M)? **(02marks)**

(ii) The displacement of a particle from the equilibrium position moving with simple harmonic motion is given X = 0.05 sin 6t;
Where t is time in seconds measured from an instant when x = 0
Calculate the maximum acceleration of the particle **(03marks)**

4. (a) (i) Explain what will happen to the angular velocity to the rotating body if no external torque acts on a body? **(02marks)**

(ii) Derive an expression for the rotational kinetic energy of a rigid body **(03marks)**

(b) (i) State Kepler's laws of planetary motion **(01 ½ Mark)**

(ii) Neptune has two satellites, Nereid and Triton; Nereid moves in an orbit of radius 5.56 x 10^6km with period of 360 days and Triton have a period of 5.887 days. Find the radius of Triton. **(03 ½ marks)**

5. (a) A liquid cools from 70°C to 50°C in four minutes. If the surrounding temperature is 20°C, how much time will it take to cool from 50°C to 40°C? **(05 Marks)**

(b) (i) Based on Wien's displacement law, what would happen on a black body when constantry is heated **(02 marks)**

(ii) A spherical black body with a radius 12cm radiates 450W power at 500K. if the radius were doubled, what would be the power radiated? **(03 marks)**

6. (a) One gram of water becomes 1671 cm^3 of steam at a pressure of 1 atmosphere. If the latent heat of vaporization at this pressure is 2256 J/g, determine the

(i) External work done **(03 marks)**

(ii) Increase in internal energy **(02 marks)**
(Give 1g of water = $1cm^3$)

(b) (i) By using first law of thermodynamics, explain what happens to the internal energy of a gas during; isothermal expansion and adiabatic expansion **(03marks)**

(ii) On the same set of axes draw the diagram for four (4) thermodynamic processes **(02marks)**

(a) (i) Give any three source of heat energy in the interior of the earth **(03marks)**

(ii) Briefly explain how do primary waves differs from secondary waves. Give three points **(02 marks)**.

(b) (i) Discuss two (2) advantage of windbreaks to plant environment. **(02marks)**

(ii) Briefly explain the major causes of air pollution **(03 marks)**

SECTION B (30 Marks)

Answer any **two (2)** questions from this section

8. (a) (i) Distinguish between e.m.f and potential difference **(02marks)**

(ii) A silver wire of 1mm diameter carries a charge of 90 coulombs in one hour and 15 minutes. silver contains 5.8 x 10^{28} electrons per cubic metre. Calculate the drift velocity of the electrons in the wire. **(03marks)**.

(b) Calculate the currents I_1, I_2 and I_3 in the electric circuit shown in the figure 1 below

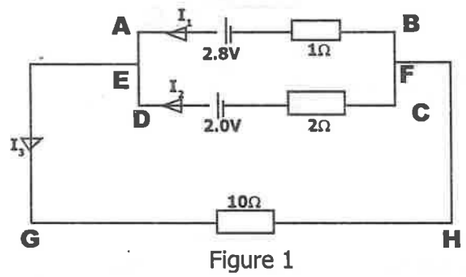


Figure 1

(c) (i) Explain if it is correct that power factor can often be improved by the use of a capacitor of appropriate capacitance in the circuit. **(02 marks)**

(ii) How much current is drawn by the primary of a transformer which steps down 220V to 22V to operate a device with an impedance of 220Ω? **(03marks)**

DAR ES SALAAM REGION
FORM SIX MOCK EXAMINATION
2024
CODE 131/1 PHYSICS 1
MARKING SCHEMES

1 (a) (i) Principle of homogeneity of dimensions states that "The dimensions of fundamental quantities (mass, length and time) are the same in each and every term on either side of the physical relation". (01)

(ii) Given

$$y = r \sin\left[\omega\left(\frac{x}{v} - k\pi\right)\right]$$

$$\frac{\omega x}{v} - \omega k\pi = M^0 L^0 T^0 \quad (00\tfrac{1}{2})$$

$$\frac{\omega x}{v} = M^0 L^0 T^0$$

$$\frac{T^{-1} x}{LT^{-1}} = M^0 L^0 T^0 \quad (00\tfrac{1}{2})$$

$$x = L$$

Dimension of x is L and its unit is metre. $(00\tfrac{1}{2})$

$$[\omega k\pi] = M^0 L^0 T^0 \quad (00\tfrac{1}{2})$$

$$k = \frac{M^0 L^0 T^0}{T^{-1}} \quad (00\tfrac{1}{2})$$

$$k = T$$

Dimension of k is T and unit is second $(00\tfrac{1}{2})$

(b) (i)

Mistake	Error
is any the wrong way of doing something, Eg. Wrong calibration of measuring instrument (01)	is the minimum deviation of the measured value from the actual value Eg. zero error. (01)

Pg 1 of 23

1(b)(ii) $F = \frac{mv^2}{r}$ applying ln both sides

$\ln F = \ln\left(\frac{mv^2}{r}\right)$

$\ln F = \ln m + \ln v^2 - \ln r$ differentiating throughout (01)

$\pm \frac{\Delta F}{F} = \pm \frac{\Delta m}{m} + \pm \frac{2\Delta V}{V} + \pm \frac{\Delta r}{r}$ error is always maximized (01)

$\pm \frac{\Delta F}{F} = \pm \frac{0.1}{3.5} + \pm 2\left(\frac{1}{20}\right) + \pm\left(\frac{0.5}{12.5}\right)$ (01)

$\Delta F/F = \frac{59}{350} = 0.16857$

Percentage error

$\pm \frac{\Delta f}{F} \times 100\% = 16.587\%$ (01)

2 (a) (i) The velocity of a stone is less than that of a bullet fired from a gun. Due to its low speed, it remains in contact with window pane for a longer time and the motion is shared by the whole of the window pane. A bullet due to its speed remains in contact with window pane for such a small time. As such it makes a small hole in the window pane. (02)

(ii) Data.

$m_1 = 20g$

$u_1 = 200 m/s$

$m_2 = 380g$

$u_2 = 0 m/s$

$v = ?$

From principle of conservation of linear momentum.

$m_1u_1 + m_2u_2 = (m_1 + m_2)v$ (00½)

$v = \frac{m_1u_1 + m_2u_2}{m_1 + m_2}$ (00½)

but $u_2 = 0$

$v = \frac{20 \times 200 + 380 \times 0}{20 + 380}$ (00½)

$v = \frac{4000}{400}$

$v = 10 m/s$.

∴ The velocity (v) $= 10 m/s$. (01½)

Pg 3 of 23

2(b)(i) - It is a two dimensional motion
- Its motion is affected by force of gravity alone (01)
- Air resistance is negligible (01)

(ii) From

$$R = \frac{U^2 \sin 2\theta}{g} \quad \text{---(i)} \quad (00\tfrac{1}{2})$$

$$T = \frac{2U \sin\theta}{g} \quad \text{---(ii)} \quad (00\tfrac{1}{2})$$

$$T^2 = \frac{2U^2 \sin^2\theta}{g^2} \quad \text{---(iii)} \quad (00\tfrac{1}{2})$$

$$R = \frac{2U^2 \sin\theta \cos\theta}{g} \quad \text{---(iv)}$$

Dividing (iii) and (iv) gives $\frac{T^2}{R} = \frac{2\tan\theta}{g}$ (00½)

$$\frac{4^2}{120} = \frac{2\tan\theta}{10}$$

$$\tan\theta = \frac{4^2 \times 10}{120 \times 2}$$

$$\tan\theta = \left(\frac{16}{24}\right)$$

$$\theta = \tan^{-1}\left(\frac{16}{24}\right)$$

$$\theta = 33.69^\circ$$

Using equation (ii), $T = \frac{2U\sin\theta}{g}$

$$4 = \frac{2U \sin 33.69}{10}$$

$$U = 36.1 \text{ m/s} \quad (01)$$

Pg 4 of 23

3 (a)(i) In order to balance centripetal force with centrifugal force (02)

(ii) Data.

$L = 1m$

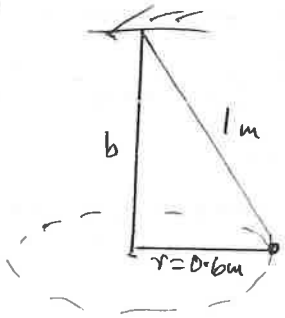
$r = 0.6m$

$T = ?$

From

$T = 2\pi\sqrt{\frac{l\cos\theta}{g}}$ (00½)

Consider figure below.



(00½)

From

Pythagorus theorem

$c^2 = a^2 + b^2$

$b^2 = c^2 - a^2$

$b^2 = 1^2 - 0.6^2$

$b^2 = 1 - 0.36$

$b = \sqrt{1 - 0.36}$

$b = \sqrt{0.64}$

$b = 0.8m$ (00½)

Then $T = 2 \times 3.14\sqrt{\frac{1 \times 0.8}{9.8}}$ (00½)

$T = 1.79$ sec

∴ Period $(T) = 1.79$ sec (01)

3 (b)(i) At maximum displacement, the magnitude of acceleration is greatest.

i.e. $a = -\omega^2 x$ then $a_{max} = -\omega^2 A$

where A = Amplitude. (02)

(ii) Given

$x = 0.05 \sin 6t$

$a_{max} = ?$

From the given equation

$A = 0.05\,m$ and $\omega = 6\,rads^{-1}$ (01)

From

$a_{max} = -\omega^2 A$ — — (00½)

$a_{max} = 6^2 \times 0.05$ — — (00¼)

$\therefore a_{max} = 1.8\,m/s^2$ (01)

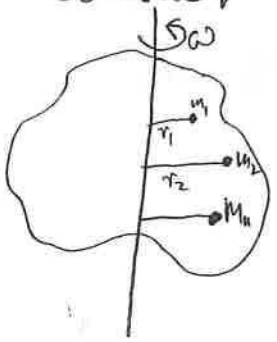
4 (a) (i) If no external torque acts on a body ($\tau = 0$), then angular momentum remains conserved.

i.e. $I\omega$ = constant. (02)

As in rotational motion, the moment of inertia (I) of the body can change due to the change in position of the axis of rotation, the angular speed may not remain conserved. However, if the position of axis of rotation also remains fixed, the angular speed remains conserved.

(ii) Derivation of rotational K.E of rigid body

Consider figure below



— — — (odd)

From $K.E = \frac{1}{2}mv^2$ — — (odd)

but $v = \omega r$

$K.E = \frac{1}{2}m(\omega r)^2$

$K.E = \frac{1}{2}m\omega^2 r^2$ — — — (odd)

Pg 7 of 23

4. For first particle.

$K.E_1 = \frac{1}{2} m_1 \omega^2 r_1^2$ — — — (00½)

For seconds particle.

$K.E_2 = \frac{1}{2} m_2 \omega^2 r_2^2$

For nth particle.

$K.E_n = \frac{1}{2} m_n \omega^2 r_n^2$

Total K.E;

$K.E = K.E_1 + K.E_2 + - - - + K.E_n$ — — (00½)

$K.E = \frac{1}{2} m_1 \omega^2 r_1^2 + \frac{1}{2} m_2 \omega^2 r_2^2 + - - - + \frac{1}{2} m_n \omega^2 r_n^2$

$K.E_R = \frac{1}{2} \omega^2 (m_1 r_1^2 + m_2 r_2^2 + - - - + m_n r_n^2)$

$\sum m r^2 = I$.

$K.E_r = \frac{1}{2} I \omega^2$ — — — — — (00½)

where I = moment of inertia

ω = angular velocity

$K.E_r$ = rotational Kinetic energy.

hence derived

(b) (i) Kepler's first Law states that "All planets revolve in an elliptical orbit with the sun being the foci" (00½)

Kepler's second law states that the line joining the sun and planet sweeps out equal area and equal time. (00½)

Kepler's third law states that "The square Period time of planet is directly proportional to the cube of their mean distance". Pg 8 of 23 (00½)

4(b)(ii) Given.

$T_t = 5.887$ days

$T_N = 360$ days

$r_N = 5.52 \times 10^6$ km

$r_t = ?$

From 3rd kepler's law.

$T^2 = kr^3$ ← ——— (00/h)

For Nereid, $T_N^2 = kr_N^3$ - - - - (i) - (00/h)

For Triton, $T_t^2 = kr_t^3$ - - (ii) - (00/h)

dividing (ii) by (i)

$$\frac{T_t^2}{T_N^2} = \frac{r_t^3}{r_N^3} \quad \text{——— (00/h)}$$

$$r_t = \left[\left(\frac{T_t}{T_N}\right)^2 \cdot r_N^3\right]^{1/3}$$

$$r_t = \left(\frac{5.887}{360}\right)^{2/3} \times 5.52 \times 10^6 \quad \text{— (00/h)}$$

$r_t = 3.58 \times 10^5$ km.

∴ The radius of Triton $= 3.58 \times 10^5$ km.

(01)

5 (a) From.

$$mc\frac{d\theta}{dt} = KS(\theta - \theta_R) \quad \text{---(01)}$$

From 70°C to 50°C, $mc\left(\frac{70-50}{4}\right) = KS\left(\frac{70+S}{2} - 20\right)$ ---(i) (01)

From 50°C to 40°C

$$mc\left(\frac{50-40}{t}\right) = KS\left[\left(\frac{50+40}{2}\right) - 20\right] \quad (01) \quad \text{---(ii)}$$

Dividing ~~the two~~ equations.

$$\frac{t \times 20}{4 \times 10} = \frac{40}{25} \quad \text{---} \quad \text{---} \quad (ok)$$

$\therefore t = 3.2$ minutes. (01)

(b) (i) Using Wien's displacement law

$$\lambda \propto \frac{1}{T}$$

Therefore, when black body is constantly heated its wavelength will be shifting on decreasing and its black colour slightly changes to brown. (02)

(ii) From $E = A\delta T^4$, but $A = 4\pi r^2$

$$E = 4\pi r^2 \delta T^4 \quad \text{----} \quad (ok)$$

initially $r = 12\text{cm} = 0.12\text{ m}$

$T = 500K$, $E = 450W$

$$450 = 4\pi \times (0.12)^2 \times \delta \times (500)^4 \quad \text{---(i)}$$

Finally $r = \frac{0.12}{2} = 0.06$ m. (ok)

Pg 10 of 23

5(b)(ii) $T = 500 \times 2 = 1000\text{N}$

Then:

$E = 4\pi \times (0.06)^2 \times \delta \times (1000)^2$ ---(ii) (00½)

Dividing (ii) by (i):

$\frac{E}{450} = \frac{4\pi \times (0.06)^2 \delta \times (1000)^4}{4\pi \times (0.12)^2 \times \delta \times (500)^4}$ (00½)

$\frac{E}{450} = 4$

$\therefore E = 1800\text{W}$ (00½)

Pg. 11 of 23

6(a) Data.

Volume of water, $V_w = 1 cm^3$

Volume of steam $V_s = 1671 cm^3$

Pressure, $P = 1 atm = 1.013 \times 10^5 Nm^{-2}$

Latent heat of vaporization, $L_v = 2256 J/g$

1 g of water $= 1 cm^3$.

(i) $dW = ?$

(ii) $dU = ?$.

(i) From.

$$dW = P(V_s - V_w) \quad \text{--- (ook)}$$

$$dW = 1.013 \times 10^5 (1671 - 1) \times 10^{-6} \quad \text{--- (ook)}$$

$\therefore dW = 169.171 J$ --- (01½)

(ii) From 1st law of thermodynamics

$$dQ = dU + dW. \quad \text{--- (ook)}$$

$$dU = dQ - dW.$$

$$dQ = mL_v = 1g \times 2250 J/g.$$

$dQ = 2256 J$. --- (ook)

$$dU = 2256 - 169.171 \quad \text{--- (ook)}$$

$dU = 2086.83 J$

$\therefore$ Increase in internal energy

$(dU) = 2086.83 J$ (01)

Pg 12 of 23

6 (b)(i) In isothermal process, temperature remains constant so that, heat supplied to a system is equal to zero.

From 1st law of thermodynamics

$$Q = \Delta U + P\Delta W$$

Since $\Delta U = n C_v \Delta T$

$$nC_v \times (0) = 0$$

Hence $Q = \Delta W$.

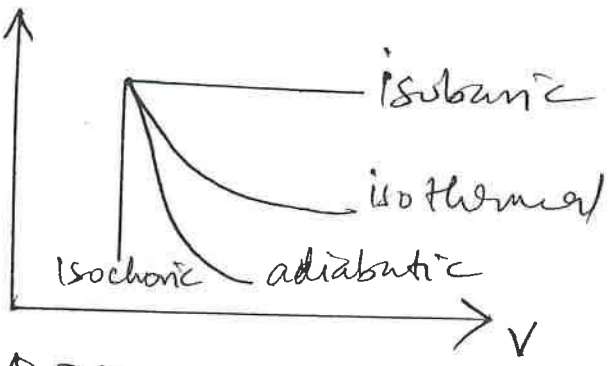
Therefore, in isothermal process, internal energy is constant and heat supplied to the gas is equal to the work done by the gas. (01½)

In adiabatic process, no heat is supplied to system, no heat enters or leaves the system ie. $Q = 0$.

$$\Delta U = -\Delta W$$

As the gas expand adiabatically, work is done by the gas and its internal energy of the gas is equal to the work done by the gas. (01½)

(ii)



02

Pg 13 of 23

7 (a) (i) Three sources of heat energy

- Some of the heat may have been left over from the formation of the earth.
- decay of radioactive elements which occur naturally in the rock, radiation emitted by elements is absorbed in the surroundings and appear as heat.
- The gravitational work done in assembling and compacting a body from small pieces is large and would appear as heat. (03)

(ii)

Primary waves	Secondary waves
(i) is longitudinal wave	(i) Is transverse wave
(ii) Involves Compression	(ii) Involves Shearing and rotation of materials
(iii) It can travel in all states of matter	(iii) It travels only in Solids
(iv) It has high speed	(iv) It has low Speed.

(02)

Pg 14 of 23

7 (b) (i) ~~Advantages~~ of windbreaks

- It increases the yields of crops by preventing excessive loss of water by plant through transpiration. (01)
- It improves the crops ~~spray~~ spraying activities (01)

(ii) *Causes of air pollution.

- Burning of vegetation. (01)

Burning of forest introduces dusts and harmful gases in the atmosphere.

- Harmful gases from industries.

Industries produce the harmful gases ie. CO_2, SO_2 in the atmosphere. (01)

- Burning of fuels

The fuel such as coil, coke and refined gases when burnt introduce the harmful gases in the atmosphere. (01)

8 (a) (i) t.m.f is the p.d across terminals of the cell when it is delivering no current but p.d is the one across the terminals of cell when it is delivering to current.

(02) mark

(ii) Data.

$d = 1mm$, $r = \frac{d}{2} = \frac{1mm}{2} = 0.5mm = 0.5 \times 10^{-3} m$

$q = 90C$.

$t = 1hr\ 15min = (75 \times 60)\ sec$

$n = 5.8 \times 10^{28}$ electrons/m^3

$e = 1.6 \times 10^{-19} C$.

$V_d = ?$.

from.

$V_d = \frac{I}{nAe}$ ~~ook~~ (01 mark)

but $A = \pi r^2$

$I = \frac{Q}{t}$

$V_d = Q/t / n e \pi r^2$ ---- ~~ook~~ (01 mark)

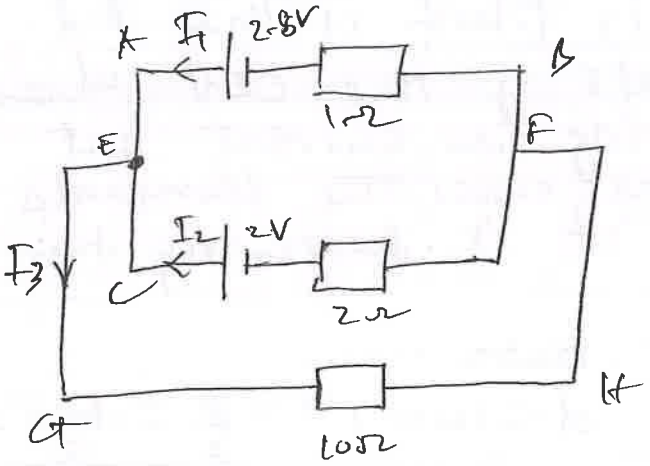
$V_d = 90 / 75 \times 60 / 5.8 \times 10^{28} \times 1.6 \times 10^{-19} \times 3.14 (0.5 \times 10^{-3})^2$

$V_d = 2.74 \times 10^{-6} m/s$

$\therefore$ Drift velocity $(V_d) = 2.74 \times 10^{-6} m/s$

(01) mark

8 (b)



00 1/2

At E

$I_1 + I_2 = I_3$ --- (i) (KCL) (01)

For loop AEGHFBA

$-10I_3 - 1I_1 + 2.8 = 0$

$10I_3 + I_1 = 2.8$ --- (ii) (KVL) (01)

For loop CEGHFDE

$-10I_3 - 2I_2 + 2 = 0$ (KVL)

$-10(I_1 + I_2) - 2I_2 + 2 = 0$

$5I_1 + 6I_2 = 1$ --- (iii) (01)

On solving (i) & (iii)

$I_1 = 0.425A$ (00½)

$I_2 = 0.1875A$ (00½)

$I_3 = 0.2375A$ (00½)

8 (c) (i) Power factor = R/Z

many A-C machines have inductive reactance. A capacitance of appropriate value reduces the net resistance so that Z approaches R. (02)

(ii) Given

$E_p = 220V$, $I_p = ?$

$E_s = 22V$, $Z = 220\Omega$

$I_s = \frac{E_s}{Z} = \frac{22}{220} = 0.1A$.

Power input = power output. (01)

$I_p E_p = I_s E_s$ ——— (01)

$I_p = \frac{I_s E_s}{E_p} = \frac{0.1 \times 22}{220}$

$\therefore I_p = 0.01A$ ——— (01)

9(a) Properties of Semiconductors.

- conductivity increases with increase in temperature.
- There is a small energy gap between valence band and conduction band.
- Their electrical conductivity lies between that of insulators and conductors.
- They can sometimes act as conductors and insulators (04)

(b)(i) Differences between n-type and P-type.

N-type	P-type.
- obtained by adding pentavalent impurity to a pure semiconductor	- obtained by adding trivalent impurity to a pure semiconductor
- An extra electron is provided and the impurity added are called donor atoms	- An extra hole is created and the impurity atoms are called acceptor atoms
- Electrons are majority charge carriers ie. $n_e >> n_h$.	- holes are majority charge carriers ie. $n_h >> n_e$

(03) (06)

9c(ii) Given:

$\beta = 50$

$R_C = 2k\Omega$, $R_B = R_i = 500\Omega$

$V_i = 0.02V$

voltage gain of CE

$A_V = \beta \frac{R_C}{R_B}$ ——— (00½)

$\frac{V_o}{V_i} = \beta \frac{R_C}{R_B}$ ——— (00½)

$V_o = \beta \frac{R_C V_i}{R_B}$ ——— (00½)

$V_o = \frac{50 \times 2 \times 10^3 \times 0.02}{500}$ ——— (00½)

$\therefore V_o = 4V$ (01)

10 (a) (i) Four advantages of negative feedback

- The distortion of the output voltage is less
- It increases the range of frequency
- It reduces noise.
- The voltage gain is predictably to be high. (04)

(ii) Data:

$R_f = 30k\Omega$

$R_i = 15k\Omega$

$V_i = 2V$.

$V_o = ?$

From

$V_o = \left(\frac{-R_f}{R_i}\right) V_i$ ——— (00½)

$V_o = \left(\frac{-30}{15}\right) \times 2$ ——— (00½)

$V_o = -4V$.

∴ The output voltage $(V_o) = -4V$ (01)

(b) (i) Logic gate is the electronic circuit that has one or more inputs but has only one output (01)

(ii) TRUTH TABLE.

A	B	C	D	E	F	G
0	0	1	1	0	0	1
0	1	1	0	0	1	0
1	0	0	1	1	0	0
1	1	0	0	0	0	1

(03)

10 (C) (i) Three basic elements of Communication System are; Transmitter, Channel and receiver (03)

(ii) Frequency deviation is the total variation in frequency from the lowest to the highest point. (01)

Carrier swing is equal to twice the frequency deviation of FM signal. (01)