6-336

APR/MAY-2022

GOVERNMENT OF KARNATAKA
DEPARTMENT OF PRE-UNIVERSITY EDUCATION
II YEAR P.U.C. ANNUAL EXAMINATION

Answer Book Sl. No.
1274805

MAY/JUNE - 2021

MAIN ANSWER BOOK

Please read the instructions overleaf before filling in

Register No. of the Candidate					
4	0	7	1	5	6

Subject Code : 3 3 Subject : PHYSICS

Enter the Serial Number of Map / Graph sheet

No. of pages used in		Total No. of pages used
Main Answer Book	Additional Answer Book	
18		18

Certified that the entries made by the Candidate are found to be correct

10/5/22.

Signature of the Invigilator with date

FOR THE USE OF EXAMINERS ONLY

Marks awarded

Part / Question No.	1	2	3	4	5	6	7	8	9	10	Total Marks
	1	0	1	0	0	1	1	1	0	1	06
	11	12	13	14	15	16	17	18	19	20	
	1	0	1	1	1	1	1	1	0E	0	10
	21	22	23	24	25	26	27	28	29	30	
	0E	2	2	0	0	0	03	0	3	3	13
	31	32	33	34	35	36	37	38	39	40	
	3	0	0	0E	3	5	5	0	0	4E	16
	41	42	43	44	45	46	47	48	49	50	
	5	5	0	5	0	5	0	0	0	0	24
	51	52	53	54	55	56	57	58	59	60	
	61	62	63	64	65	66	67	68	69	70	
	71	72	73	74	75	76	77	78	79	80	
											69

Grand Total in words	Sixty Nine	Grand Total in Figures	69

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INSTRUCTIONS TO CANDIDATES

1. Write your register number Correctly on the space provided on the Facing Sheet of the Answer book and the top left side of Additional Answer book if any. Over writing should be attested by the Room Invigilator.
2. Write answers in both sides of the sheet using BLUE/BLACK ink or ball point pen.
3. Obtain Additional Booklets, Graph sheets, Mathematical table from the Invigilator if required. Enter the serial numbers of all the Additional Booklets used.
4. Intimate disorders if any, in the Main Answer book/ Additional Booklet to the invigilator.
5. Indicate the Correct question number in the margin.
6. Obtain the permission of the Invigilator for change of PEN / INK.
7. All rough work should be made on a particular page with the heading ROUGH WORK and cross it.
8. Do not write in the margin and leave any page UNUSED except at the end of answers.
9. No Candidate is permitted to leave the examination hall within 30 minutes from the commencement of the examination. Any candidate who leaves after 30 minutes will not be allowed again to the examination hall.
10. If you want to make any request to the Room Invigilator, just stand up to attract his / her attention. Do not shout or leave your place. The invigilator will come to you.
11. During the examination if the candidate wants to go out, for urination etc., same may be informed to the invigilator. While going out, the Answer paper, Question paper etc., should be handed over to the room invigilator for safe custody.
12. After completion, just stand up & inform the same to the Room Invigilator who in turn will collect the papers and gets your signature on the diary maintained by the invigilator.
13. The following misdeeds will attract disciplinary action and criminal prosecution.
    a) Breach of silence.
    b) Use of books, notes, manuscripts, etc., pertaining to the subject in the examination hall.
    c) Talking or signalling to other Candidate.
    d) Candidates copying from the answer books of the other candidates or from other source.
    e) Sending of answer books or additional Booklets or question paper out of the examination hall.
    f) Impersonation.
    g) Taking the answer books or additional Booklet received for writing the answers out of the examination hall during or after the examination.
    h) Tearing or insertion to the answer books and the additional answer book if any.
    i) Writing an appeal or request to the valuator in the answer book.
    j) Mobile Phones, pagers are strictly prohibited in the Examination Hall.
    k) Simple calculators can be used, Scientific calculators allowed only for Statistics paper.
14. After completion of writing, Count the No. of pages used and fill the columns provided on the facing sheet of the main answer book.
15 Candidates suffering from infectious diseases are not allowed to sit in the examination hall.
16. Candidate should strike off the subject which is not applicable.
17. Invigilator should put an END SEAL with his/her signature on the next page of the answer booklet where a student ends his/her writing.

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PART - D

IV.

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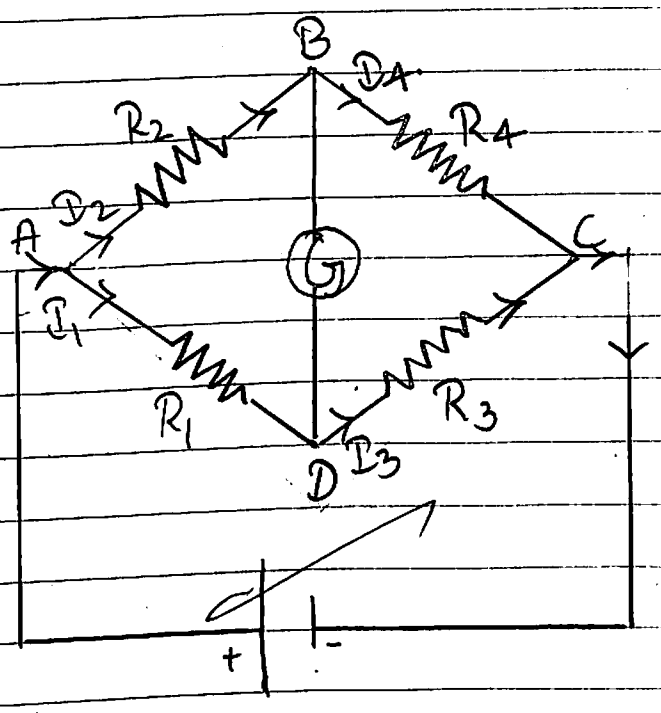

The given network is said to be wheatstone network.

From the figure.

In the loop ADBA,

applying Kirchoff's loop rule

$$-I_1R_1 + 0 + I_2R_2 = 0$$

$$\Rightarrow \underline{I_1R_1 = I_2R_2} \rightarrow (1)$$

In the loop BDCA

applying Kirchoff's loop rule.

$$I_3R_3 + 0 - I_4R_4 = 0$$

$$\text{Or} \Rightarrow \underline{I_1R_3 = I_2R_4} \text{ (Since } I_1 = I_3, I_2 = I_4) \rightarrow (4)$$

6

6

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Dividing equation (1) by (2) we get

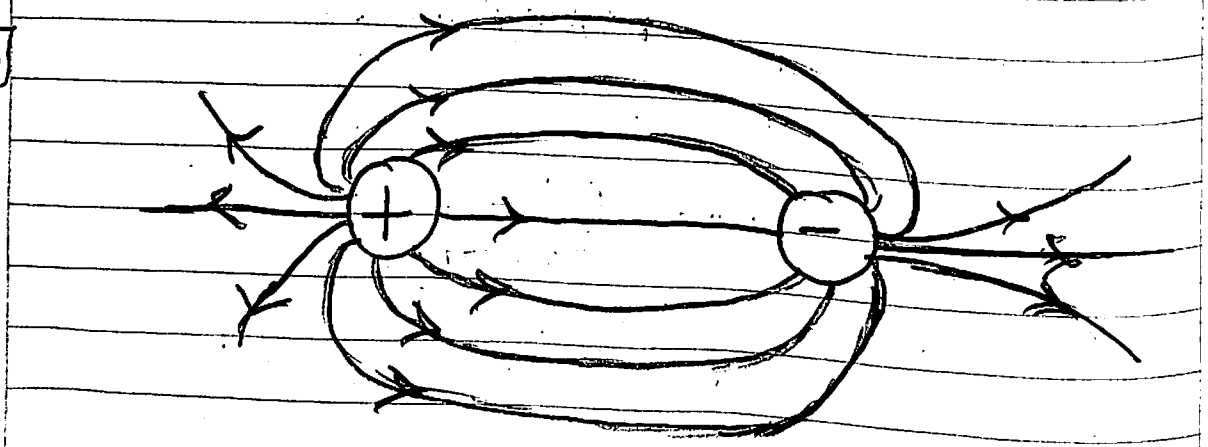
$$\frac{I_1 R_1}{I_1 R_3} = \frac{I_2 R_2}{I_2 R_4}$$

$$\Rightarrow \boxed{\frac{R_1}{R_3} = \frac{R_2}{R_4}}$$

at this condition the reading in the galvanometer shows zero deflection

$$\therefore \boxed{\frac{R_1}{R_3} = \frac{R_2}{R_4}}$$ is the balancing condition of wheatstone bridge.

36]



The lines which represent the electric field and the tangent to each point in the line gives the direction of the electric field. These lines are called the electric field lines.

* Electric field lines are parallel in uniform and far away distance.

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general properties:

* Electric field lines do not form any closed loop.
* Electric field lines arise from positive terminal and end at negative terminal
* No two electric field lines intersect.
* tangent to each point on the electric field gives the direction of the electric field.

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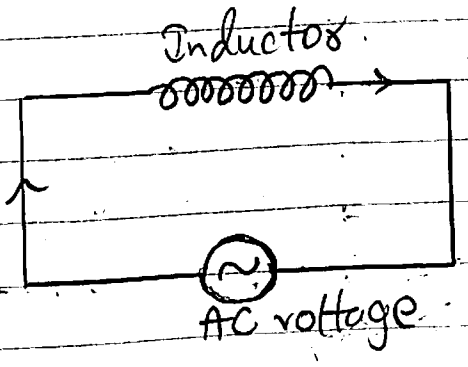
(vi).

40] Ans



Let an inductor be connected to an a.c source,
its inductance be L
Let $V = V_m \sin \omega t$ be an instantaneous voltage. → (1)

applying Kirchoff's loop rule we get.

$$V - L\frac{dI}{dt} = 0.$$

5

$$\Rightarrow v_m \sin\omega t = L\frac{di}{dt}$$

$$\frac{di}{dt} = \frac{v_m}{L}\sin\omega t$$

integrating on both sides we get

$$i = \frac{v_m}{L}\int \sin\omega t$$

$$i = -\frac{v_m}{L}\left[\frac{\cos\omega t}{\omega} + \text{constant}\right]$$

Here constant over a cycle is equal to zero.

$$i = +\frac{v_m}{L\omega}\left[-\cos\omega t\right]$$

$$i = \frac{v_m}{L\omega}\left[\sin\left[\omega t - \frac{\pi}{2}\right]\right]$$

$$\boxed{i = i_m \sin\left[\omega t - \pi/2\right]} \rightarrow (2)$$

where $\boxed{i_m = \frac{v_m}{L\omega}}$

From (1) and (2), we get that current lags the voltage by $\pi/2$ in an AC circuit containing a pure inductor.

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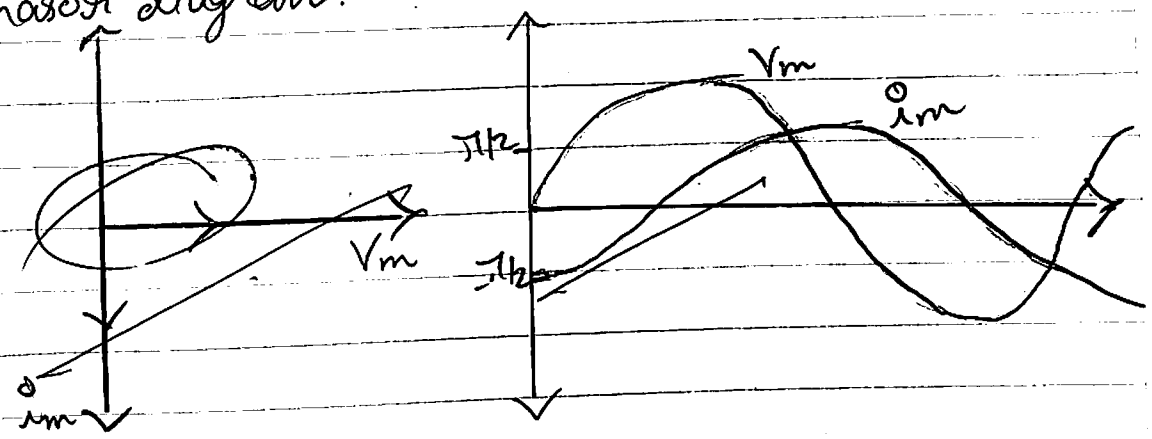
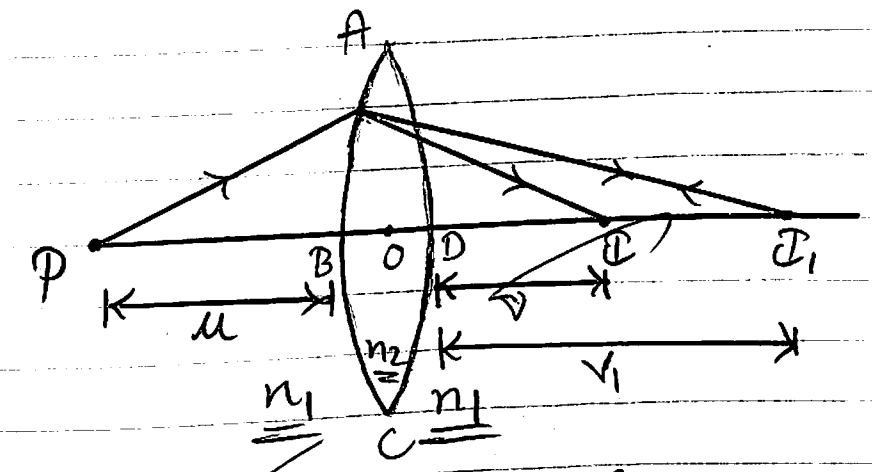
phasor diagram.



4J.



* Consider a thin convex lens ABCD
  let the object be P
  * the image I_1 is formed due to the refracting surface ABC
  * I_1 acts as a virtual image for the surface ADC to form a final imge at I.
* let refractive index outside the lens be n_1 and inside the lens be n_2.
  * $u \rightarrow$ Object distance
    $v_1 \rightarrow$ image I_1 distance
    $v \rightarrow$ final image distance from the pole.

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In the refracting surface ABC, we get

$$\frac{n_1}{-u} + \frac{n_2}{v_1} = \frac{R_2 - R_1}{v_1} \longrightarrow (1)$$

Similarly in the refracting surface ADC,

$$\frac{n_2}{-v_1} + \frac{n_1}{v} = \frac{R_1 - R_2}{n_2} \longrightarrow (2)$$

or $$\frac{n_2}{-v_1} + \frac{n_1}{v} = \frac{-(R_2 - R_1)}{-n_1}$$

adding (1) and two (2) we get,

$$\frac{n_1}{-u} + \frac{n_1}{v} = \left[\frac{(R_1 - R_2)}{n_2}\right] - \left[\frac{(R_1 - R_2)}{n_1}\right].$$

$$\Rightarrow n_1\left[\frac{1}{v} - \frac{1}{u}\right] = (R_1 - R_2)\left[\frac{1}{n_2} - \frac{1}{n_1}\right]$$

$$\Rightarrow \boxed{\frac{1}{v} - \frac{1}{u} = (n_{21} - 1)\left[\frac{1}{R_1} - \frac{1}{R_2}\right]}$$

is the required formula.

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42] The minimum energy needed by the
Ans electron to emit from the metal surface is defined as the photoelectric work function. [ϕ_0]

Experimental observations of photoelectric effect.

* for a given metal and frequency above the threshold frequency, the photoelectric emission and the number of photoelectrons emitted depends on the intensity.
* The saturation current is dependent on intensity but stopping potential is independent of intensity for a given frequency.
* no photoelectric emmision takes place below a certain frequency called the threshold frequency. [ν_0]
* the stopping potential and the kinetic energy of the emitted electoons depends on the frequency but not on intensity.
* photoelectric effect is an instantaneous process.

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(V1)

46] From the given circuit diagram

$\mathcal{E}_1 = 4V$; $r_1 = 1\Omega$

$\mathcal{E}_2 = 2V$; $r_2 = 1\Omega$

external resistance $R = 7\Omega$

W.K.T $\boxed{\mathcal{E}_{eff} = \dfrac{\mathcal{E}_1 r_2 + \mathcal{E}_2 r_1}{r_1 + r_2}}$

$\mathcal{E}_{eff} = \dfrac{4(1) + 2(1)}{1+1}$

$\mathcal{E}_{eff} = \dfrac{6}{2} \Rightarrow \boxed{3V}$

5

internal resistance

$\boxed{r_{eff} = \dfrac{r_1 r_2}{r_1 + r_2}}$

$r_{eff} = \dfrac{(1)(1)}{1+1} \Rightarrow \boxed{0.5\ \Omega}$

W.K.T current $\boxed{I = \dfrac{\mathcal{E}_{eff}}{R + r_{eff}}}$

$I = \dfrac{3}{7+0.5} \Rightarrow \dfrac{3\ A}{7.5}$

~~$I = 0.5\ A$~~ $\Rightarrow$ $\boxed{I = 0.4\ (N)}$

49] given that

$d = 1mm = 10^{-3}m$

violet light $(\lambda_1) = 400nm = 400 \times 10^{-9}m$

$D = 1m.$

5

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W.K.T $\boxed{\beta = \frac{\lambda D}{d}}$

* for wavelength λ_1 [violet light]

$$\beta_{violet} = \frac{\lambda_1 D}{d}$$

$$\beta_{violet} = \frac{400 \times 10^{-9} \times 1}{10^{-3}}$$

$$\boxed{\beta_{violet} = 400 \times 10^{-6}\ m}$$

$$= \boxed{4 \times 10^{-4}\ m}$$

* for wavelength λ_2 [Red light]

$\lambda_2 = 700nm = 700 \times 10^{-9} m.$

$$\beta_{Red} = \frac{\lambda_2 D}{d}$$

$$\beta_{Red} = \frac{700 \times 10^{-9} \times 1}{10^{-3}} \Rightarrow \boxed{7 \times 10^{-4}\ m}$$

$\Rightarrow$ The percentage change in fringe width.

$$\frac{4 \times 10^{-4}}{7 \times 10^{-4}} \times 100$$

$$\Rightarrow \boxed{57.14\%}$$

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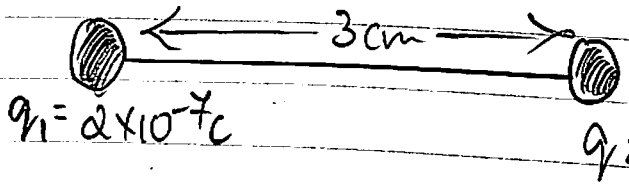
Ans 44] given that $q_1 = 2\times10^{-7}C$

$q_2 = 3\times10^{-7}C$

$r = 3cm = 3\times10^{-2}m.$



W.K.T $F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}$

$F = \frac{9\times10^9 \times 2\times10^{-7}\times3\times10^{-7}}{(3\times10^{-2})^2}$

$F = \frac{54\times10^{-5}}{9\times10^{-4}}\ N$

$F = 6\times10^{-1}\ N$

$\boxed{F = 0.6N}$

5 * when the distance between them is doubled

$r' = 6cm \Rightarrow 6\times10^{-2}m.$

$F' = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{(r')^2}$

$F' = \frac{9\times10^9 \times 2\times10^{-7}\times3\times10^{-7}}{(6\times10^{-2})^2}$

$F' = \frac{54\times10^{-5}}{36\times10^{-4}}\ N$

$F' = 1.5\times10^{-1}\ N$

$\Rightarrow \boxed{F' = 0.15N.}$

5

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4	0	7	1	5	6

PART-C

27] Drift velocity of electrons in a conductor in terms of their relaxation time.

Let the intial velocity $v_0 = 0$ at $t_1 = 0$

and $t = \tau$ [Relaxation time]

and W.K.T $\boxed{a = -\frac{eE}{m}}$

where $e \rightarrow$ charge of electron
$E \rightarrow$ electric field
$m \rightarrow$ mass of the electron.

W.K.T $v = v_0 + at$

$\therefore v_d = 0 + a[\tau]$

$v_d = -\frac{eE\tau}{m}$

Or $\boxed{|v_d| = \frac{eE\tau}{m}}$ is the required expression.

28] Three properties of ferromagnetic substances are:

→ The magnetic field lines inside the material of ferromagnetic substances are large in number than number of magnetic field lines outside the material.

P.T.O→.

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→ ferromagnetic substances are greatly/highly magnetized in the direction of magnetic field when an external magnetic is applied.

→ The magnetic susceptibility is high and positive in ferromagnetic substances

→ The susceptibility is inversely proportional to the extra temperature above the critical temperature.

i.e.,

$$\chi \propto \frac{1}{T - T_c}$$

30] Ans Advantages of eddy currents are

* Eddy current causes electromagnetic damping effect
* Eddy current is applied in magnetic braking in trains
* Used in induction stoves, furnaces etc.,

35]

Intrinsic semiconductor	Extrinsic semiconductor
→ pure form of semiconductor	→ semiconductor doped with impurities
→ number of holes are equal to the number of free electrons	→ number of holes and free electrons are unequal
→ relatively less in conducting	→ conducts more than intrinsic semiconductor

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3] The three sources of energy loss in an actual transformer are:
→ Magnetic flux leakage.
→ hysterisis loss.
→ leakage due to eddy currents.

3] Mass defect: the difference between the [Δm] sum of the masses of the nucleons and the rest mass in a nucleus is called the mass defect.

binding energy: The energy required to remove the constituents of a nucleus is called as nucleon binding energy

(9) E

Relation:

binding energy = $\Delta m C^2$ ⇒ $E_b = \Delta m c^2$
or $E_b = 931 Me\Delta m$

PART-B

(11) 16] (1) Polar molecules: The molecules ~~where the~~ in which the centres of its constituent atoms are seperated by some distance. It posses permanent.

(7)

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4	0	7	1	5	6

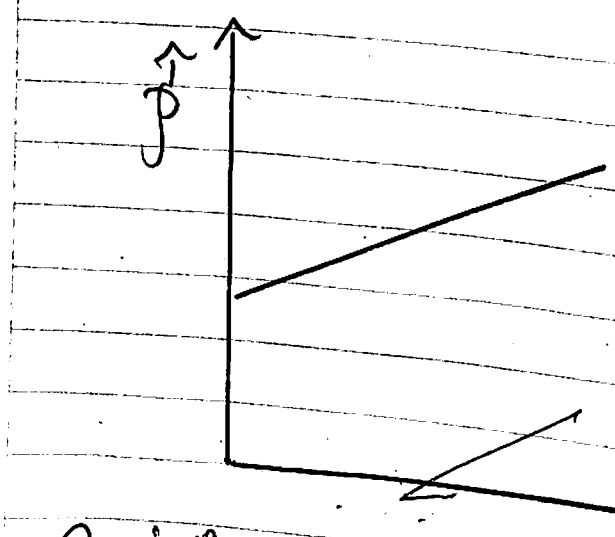
dipole moment even in the absence of external electric field.

Ex: H_2O

(a) Non polar molecules: The molecules in which the centres of the constituent atoms lie coincide are called non-polar molecules. It does not posses any dipole moment.

Ex: CO_2

17. (a) Nichrome.



* Resistivity increases with the increase in absolute temperature.

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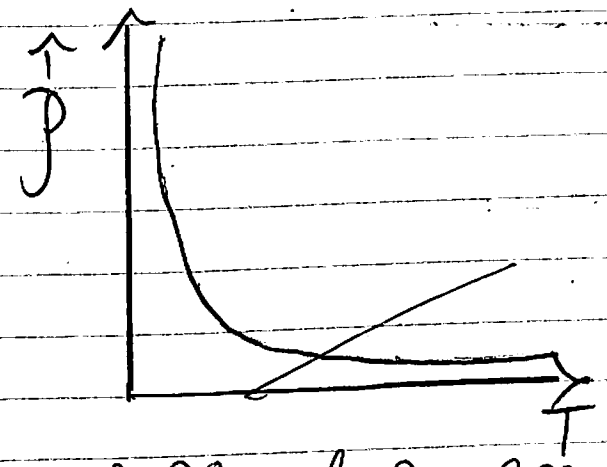
(b) silicon (semiconductor).



Resistivity decreases with ~~decr~~ increase in absolute temperature.

18] given that

$\mathcal{E} = 10V$

$dI = 0 - 25mA$

$dI = -25mA$

W.K.T $\mathcal{E} = -\frac{dI}{dt} L$

$10 = 25.(L)$

~~$L = 0.5$ Hm~~ $\Rightarrow$ $L = 0.4$ Henry

22] Two uses of polaroids:

* Used to produce and detect plane polarized light
* Used in sunglasses to reduce glare.
* Used in photographic films as filters.
* Used to view three dimensional pictures.

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19] Ans The AC generator works on the ~~point~~ principle of voltage produced due to the change in magnetic flux. The AC generator consists of a coil with 'n' turns placed perpendicular to two permanent magnets. The coil is rotated externally and the magnetic field inside the generator causes change in magnetic flux, and thus the Emf is induced. 1

The current generated by the ~~alte~~ AC generator is called alternating current because it periodically reverses its direction.

23] The path of light associated with waves are called de-broglie waves. * Dual nature of electrons was verified by Davison and Germer experiment. 2

21] (a) The sun below the horizon emits rays which undergo successive refraction in the atmosphere and appears as the sun have already risen before the ~~sun~~ actual sunrise. 2

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(b) The white light from the sun undergo successive refraction in the dense atmosphere and the constituents of white light having shorter wavelengths gets scattered the most, such as blue. Thus the sky appears blue in colour.

PART-A.

1] Electroscope.

2] The product of magnitude of the identical charge and the distance between them is called electric dipole moment.

identical

3] The current in the circuit is directly proportional to the potential difference across two ends of a conductor given that the temperature and all the other physical dimensions are kept constant

$V \propto I$

$\Rightarrow \boxed{V = IR}$

6] The angle between the magnetic meridian and geographical meridian at a place is called magnetic declination at a place on the Earth

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4	6	7	1	5	6

7] Law of conservation of energy.

8] W.K.T $\omega_0 = \frac{1}{\sqrt{LC}}$

$\Rightarrow \nu_0 = \frac{1}{2\pi\sqrt{LC}}$

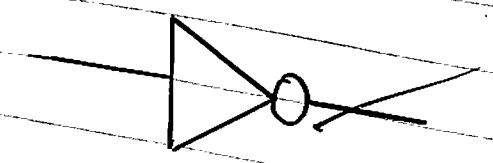
10] X-rays.

11] The two sources of light which have zero or constant phase difference are called coherent sources.

12] The resolving power of the telescope decreases.

14] Silicon.

15]



NOT-gate

13] The amount of energy required to remove an electron from the outermost of an atom is called as ionization energy.

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