कुल पृष्ठ संख्या–32 (कवर पेज सहित)

क्रम संख्या....

3376955

माध्यमिक शिक्षा बोर्ड, राजस्थान, अजमेर

उच्च माध्यमिक परीक्षा

(परीक्षार्थी द्वारा स्वयं भरा जाना चाहिये)

Candidate's Roll No. In English

(In Figures)

(In Words) :

परीक्षार्थी का नामांक हिन्दी में

शब्दों में :

नोट :– परीक्षार्थी उपरोक्त के अतिरिक्त उत्तर पुस्तिका के अन्य किसी भी भाग में अपना नामांक नहीं लिखे।

माध्यम – हिन्दी ☐ अंग्रेजी ☑

विषय Physics

परीक्षा का दिन Friday

दिनांक 13-03-2020

नोट :– परीक्षार्थी के लिए आवश्यक निर्देश इस पृष्ठ के पिछले भाग पर उल्लेखित हैं। जिन्हें सावधानी पूर्वक पढ़ लें व पालना अवश्य करें।

परीक्षक हेतु निर्देश :– (1) परीक्षक को उपरोक्त सारणी अनुसार प्राप्तांक भरना अनिवार्य हैं, अन्यथा नियमानुसार दंडित किया जायेगा।

(2) परीक्षक उत्तर पुस्तिका के अन्दर के पृष्ठों के बायीं ओर निर्धारित कॉलम में लाल इंक से अंक प्रदत्त करें।

(3) कुल योग भिन्न में प्राप्त होने पर उसे पूर्णांक में ही परिवर्तित कर अंकित करें (उदारणार्थ : 15 ¼ को 16, 17 ½ को 18, 19 ¾ को 20)

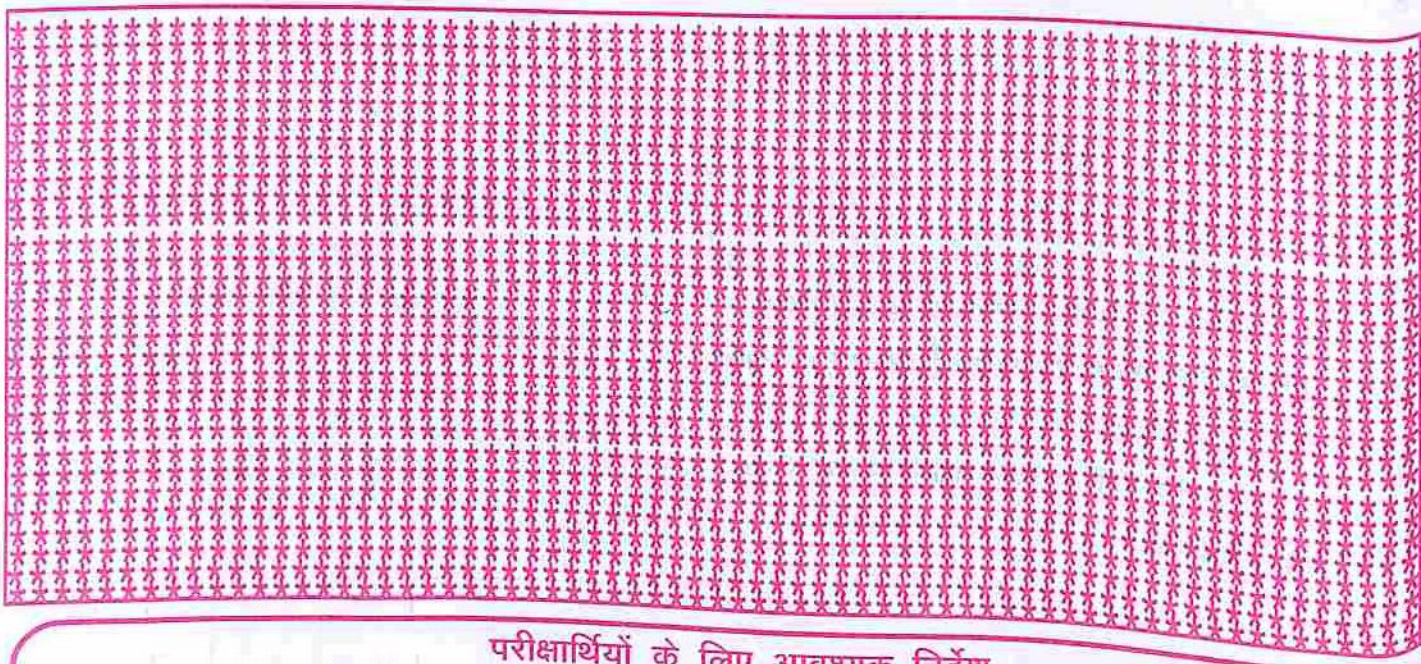
प्रश्नवार प्राप्तांकों की सारणी (परीक्षक के उपयोग हेतु)

प्रश्नों की क्रम संख्या	प्राप्तांक	प्रश्नों की क्रम संख्या	प्राप्तांक
1		19	
2		20	
3		21	
4		22	
5		23	
6		24	
7		25	
8		26	
9		27	
10		28	
11		29	
12		30	
13		31	
14		योग	
15		प्राप्त अंकों का कुल योग (Round off)	
16		अंकों में	शब्दों में
17			
18			

परीक्षक के हस्ताक्षर

संकेतांक

प्रमाणित किया जाता है कि इस उत्तर पुस्तिका के निर्माण में 58 जी.एस.एम. क्रीमवोव कागज ही उपयोग में लिया गया है। 167/2020



परीक्षार्थियों के लिए आवश्यक निर्देश

1. समस्त प्रश्नों का हल निर्धारित शब्द सीमा में इसी उत्तर पुस्तिका में करना है। विशेष परिस्थिति में अतिरिक्त उत्तर पुस्तिका पृथक से उत्तर पुस्तिका भरी हुई होने पर पर्यवेक्षक एवं वीक्षक की अनुशंषा पर ही उपलब्ध कराई जायेगी।
2. प्रश्न–पत्र पर निर्धारित स्थान पर अपना नामांक लिखें।
3. प्रश्न–पत्र हल करने के पश्चात् जिस पृष्ठ पर हल समाप्त होता है, उस पर अन्त में "समाप्त" लिखकर अन्त के सभी रिक्त पृष्ठों को तिरछी लाईन से काटें।
4. निम्न बातों का विशेष ध्यान रखें अन्यथा अनुचित साधनों की रोकथाम अधिनियम के तहत कार्यवाही की जा सकेगी।
   (i) उत्तर पुस्तिका के ऊपर/अन्दर तथा प्रश्नोत्तर के किसी भी भाग में चाही गई सूचना के अलावा अपना नामांक, नाम, पता, फोन नम्बर अथवा पहचान की कोई अन्य प्रकार की सूचना आदि अंकित नहीं करें अन्यथा "अनुचित साधनों के प्रयोग" के अन्तर्गत कार्यवाही की जावेगी।
   (ii) उत्तर पुस्तिका के पृष्ठों को फाड़ें नहीं। उत्तर–पुस्तिका के मुख पृष्ठ पर अंकित संख्या के अनुसार पृष्ठ पूरे होने चाहिये। परीक्षार्थी उत्तरपुस्तिका प्राप्त करते ही पृष्ठ संख्या की जांच कर लें यदि पृष्ठ कम/अधिक या क्रम में नहीं हैं तो वीक्षक से तुरन्त बदलवा लें।
   (iii) परीक्षा केन्द्रों पर पुस्तक, लेख, कागज, केलक्यूलेटर, मोबाईल, पेजर आदि किसी भी प्रकार का इलेक्ट्रोनिक उपकरण तथा किसी भी प्रकार का हथियार आदि ले जाना निषेध हैं।
   (iv) वस्त्र, स्केल, ज्योमेट्री बॉक्स पर कुछ न लिखकर लावें। टेबुल के आस–पास कोई अवैध सामग्री नहीं होनी चाहिये, इसकी जांच कर लें।
   (v) अपनी उत्तर पुस्तिका/ग्राफ/मानचित्र आदि परीक्षा भवन से बाहर ले जाना दण्डनीय अपराध है, अतः परीक्षा समाप्ति पर उत्तर पुस्तिका वीक्षक को बिना सौंपे परीक्षा कक्ष नहीं छोड़ें।
5. उत्तरों को क्रमानुसार एक ही स्थान पर लिखें। प्रश्न क्रमांक भी सही अंकित करें, अन्यथा दण्ड स्वरूप परीक्षक को 1 अंक कम करने का अधिकार है। बीच में उत्तर पुस्तिका के पृष्ठ रिक्त न छोड़ें। गणित विषय के लिए रफ कार्य उत्तर पुस्तिका के अंतिम पृष्ठों पर करें तथा तिरछी रेखा से काटें।
6. जहाँ तक हो सके प्रश्न के सभी भाग के उत्तर, उत्तर पुस्तिका में एक ही स्थान पर अंकित करें।
7. भाषा विषयों को छोड़कर शेष सभी विषयों के प्रश्न–पत्र हिन्दी–अंग्रेजी दोनों भाषा में मुद्रित है। किसी भी प्रकार की त्रुटि/अन्तर/विरोधाभास होने पर हिन्दी भाषा के प्रश्न को ही सही माना जाये।

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1.

Ans. **Dielectric constant :-**

The factor by which electric field intensity (or electrostatic force between two charges) at a point decreases in a medium with respect to vacuum, is called dielectric constant of that medium.

$$k \text{ (dielectric constant)} = \frac{F_0}{F_m}$$

electrostatic

F_0 = force (electro) in vacuum

F_m = force (electro) in medium

electrostatic

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2.

Ans. In the meter bridge error in measurem is present due to resistances of end point and copper stripes. If balancing point is obtained near mid point, then this error can be minimized. So balancing point is obtained in the middle generally.

3.

Ans. Following two rules can be used to find the direction of magnetic field :-

(i) Right hand thumb rule

(ii) Cork-screw rule

4.

Ans. Diamagnetic substances are those substances which are slightly magnetised in the opposite direction of applied magnetising field

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and thus weakly repel the magnetising field. Their magnetic susceptibility is negative and very less than 1 in magnitude generally.

5.

Ans. The number of magnetic lines of forces passing through an area is called the magnetic flux associated with that area. It is represented by,

$$\phi_B = \vec{B} \cdot \vec{A}$$

and for closed surface,

$$\phi_B = \oint \vec{B} \cdot d\vec{A}$$

Thus, it can also be defined as surface integral of magnetic field for an area.

6.

Ans. For resonant state,

$$X_C = X_L$$

So, from the given figure, point R represents resonant state.

7.

Ans. When light ray collides with small particles in the medium (e.g. air particles), then it deviates from its path slightly, this deviation of light is called scattering of light. These particles absorb the light and re-emit it, thus causing its scattering.

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8.

Ans Davisson and Germer experiment was conducted to verify de Broglie hypothesis which stated that matter has dual nature - wave and particle. In this experiment, it was tried to check if electron can show wave nature.

9.

Ans Heisenberg's uncertainity principle states that it is impossible to exactly determine the accurate position and velocity of an electron simultaneously. According to it,

$$\Delta x \cdot \Delta p \geq \frac{h}{4\pi}$$

where Δx = uncertainity in position

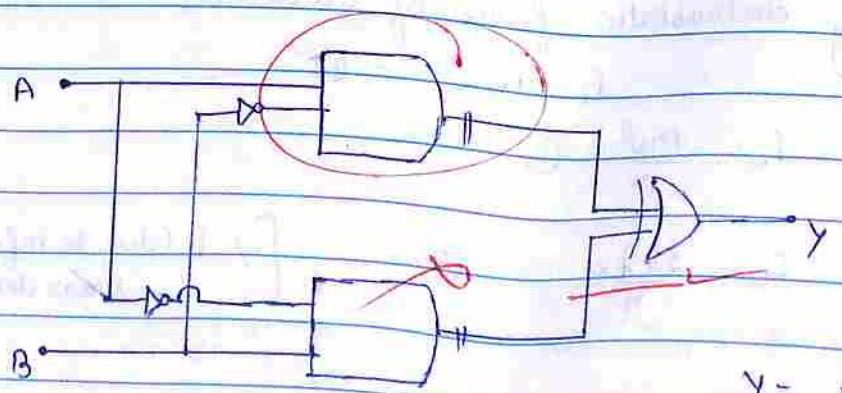
Δp = uncertainity in momentum

10.

Ans In nuclear reactor fission, energy is released due to mass defect. Coolant absorbs this energy and converts water into steam with the help of this energy. This steam is used to rotate turbine and thus produce electricity with the help of a motor.

11.

Ans



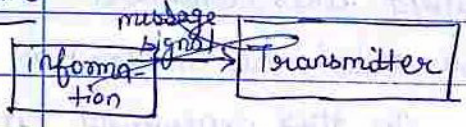
$Y = A\bar{B} + \bar{A}B$

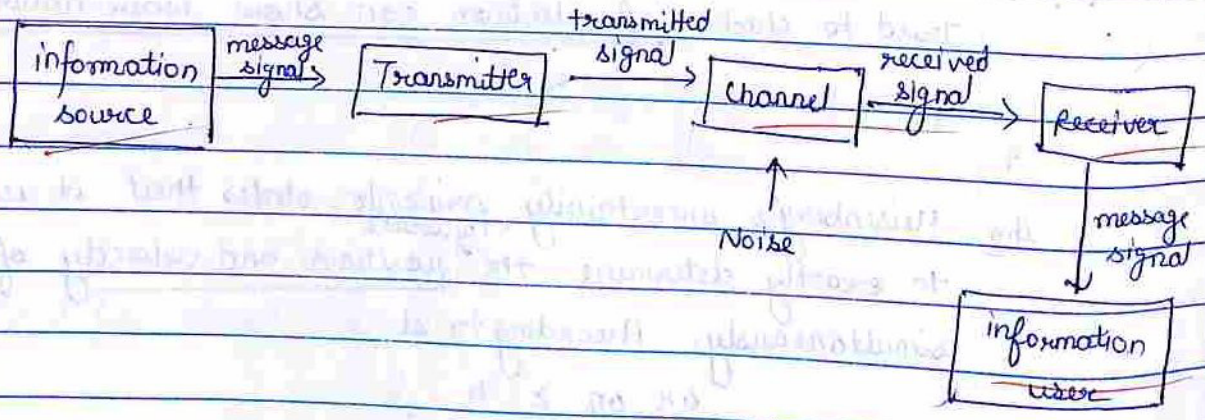
XOR Gate

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12.

Ans.





13.

Ans. Nanotechnology :-

Nanotechnology is a branch of science which deals with the study of those particles whose at least one dimension is between 1nm - 100nm. Their study is very useful as they have specific properties due to presence of very small size.

14.

Ans. In the circular path, required centripetal force is provided by electrostatic force of attraction.

$$F_c = F_e \quad \text{— (1)}$$

$$F_c = \frac{mv^2}{r} \quad \text{— (2)}$$

$$F_e = \frac{2k\lambda e}{r} \quad \text{— (3)} \qquad \left[\because E \text{ (due to infinite linear charge)} = \frac{2k\lambda}{r}\right]$$

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from eq. ①, ② and ⑤ :-

$$\frac{mv^2}{r} = \frac{2k\lambda e}{r}$$

$$\Rightarrow v = \sqrt{\frac{2k\lambda e}{m}}$$

$$v = \sqrt{\frac{2\times 9\times 10^{9}\times 10^{-6}\times 1.6\times 10^{-19}}{9\times 10^{-31}}}$$

$$v = 5.65\times 10^{7} \text{ m/sec}$$ Ans.

⇒ This is the speed of that electron

15.

Ans. emf of battery = 30 V

current drawn from battery = 7.5 A

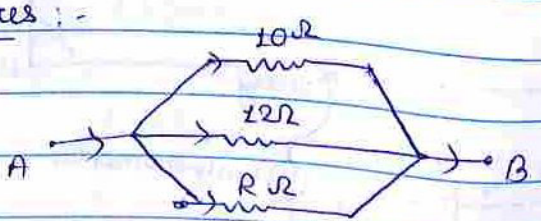
from Ohm's law, equivalent resistance of circuit :-

$$R_{eq} = \frac{V}{I}$$

$$R_{eq} = \frac{30\ V}{7.5\ A}$$

$$R_{eq} = 4\ \Omega \quad - ①$$

Resistances :-



$$\frac{1}{R} + \frac{1}{10} + \frac{1}{12} = \frac{1}{R_{eq}} \quad - ② \text{ (parallel combination)}$$

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from eq. ① & ② :-

$$\frac{1}{R} + \frac{1}{10} + \frac{1}{12} = \frac{1}{4}$$

$$\frac{1}{R} = \frac{1}{4} - \frac{1}{10} - \frac{1}{12}$$

$$R = 15\,\Omega \quad \text{Ans.}$$

This is the value of third resistor

16.

(a)

Ans. Kirchoff's second law or loop law states that algebric sum of all emfs in a close loop is equal to sum of potential drops at all resistances in that loop.

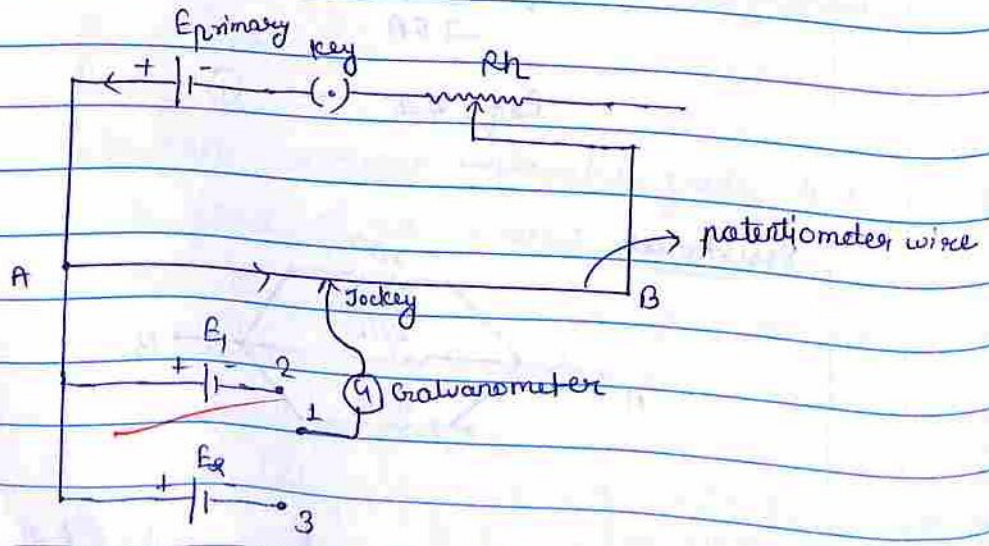
This is in accordance with law of conservation of energy.

Mathematically,

$$\Sigma \mathcal{E} = \Sigma I R$$

(b)

Ans.



Comparison of emf of two primary cells

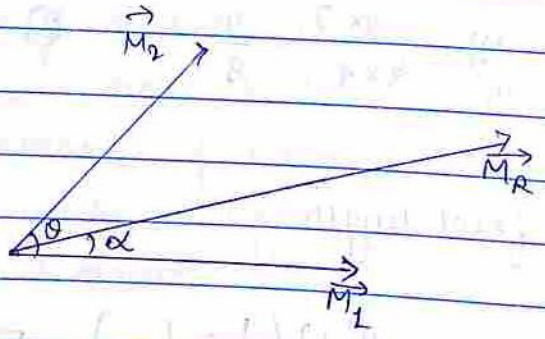
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17.

(a)

Ans.



Since magnetic moment is a vector quantity, by law of vector addition :-

$$|\vec{M}_{resul.}| = \sqrt{M_1^2 + M_2^2 + 2M_1M_2\cos\theta}$$ Ans.

(b)

Ans. Electromagnets should have narrow hysterisis curve so that energy loss due to hysterisis is minimum. Soft iron has high permeability, high retentivity, low coercivity and less hysterisis area, thus it is used as electromagnet.

18.

Ans. We know that,

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$ [lens maker's formula]

$$\Rightarrow \frac{1}{25} = (1.5 - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

$$\Rightarrow \frac{1}{R_1} - \frac{1}{R_2} = \frac{2}{25} \quad \text{— (1)}$$

After immersing in water :-

μ' becomes $\frac{\mu_g}{\mu_w}$

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$$\mu' = \frac{\mu_g}{\mu_w} = \frac{3 \times 3}{2 \times 4} = \frac{9}{8} \quad \text{— ②}$$

So new focal length :-

$$\frac{1}{f'} = (\mu' - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \quad \text{— ③}$$

from eq. ①, ② & ③ :-

$$\frac{1}{f'} = \frac{1}{8} \times \frac{2}{25}$$

$$f' = 100 \text{ cm} \quad \text{Ans.}$$

Thus, new focal length of lens is 100 cm.

19.

Ans. (i) In interference two or more light rays from different wavefronts superimpose, whereas in diffraction, various light rays from same wavefront superimpose at a point.

(ii) In interference all bright fringes have same intensity, whereas in diffraction fringes which are at more distance from central points have less intensity.

20.

Ans. Photoelectric effect cannot be explained on the basis of wave theory of light because :-

(i) As per wave theory, the energy of light wave should be distributed to all electrons of metal surface and thus, it will

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take some time for an electron to obtain energy which is equal to work function. So, there should be some time lag between incident of light and removal of electron. But actually, these two processes occur instantaneously. As soon as light is incident on metal, electron is ~~removed~~ emitted.

(ii) As per wave theory, all light rays, of whatever frequency they are, should be able to produce photoelectric effect if they are incident on a metal surface for sufficient time. But, only light rays having frequency more than a threshold frequency are able to produce photoelectric effect.

21. The power factor ---------- of coil.

Ans: we know that,

$$\text{power factor } (\cos\theta) = \frac{R}{Z}$$

A coil has inductance and resistance

so, $Z = \sqrt{X_L^2 + R^2}$

given, $\cos\theta = 0.707 = \frac{1}{\sqrt{2}}$

$$\therefore \frac{1}{\sqrt{2}} = \frac{R}{\sqrt{X_L^2 + R^2}}$$

$$\Rightarrow X_L^2 + R^2 = 2R^2$$

$$X_L = R \quad \text{— (1)}$$

Now, frequency is doubled

as, $X_L = 2\pi f L$

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X_L is also doubled

$\therefore X_L' = 2X_L$

~~$X_L^2 = 2R \cdot R$~~

~~$X_L' = 2R$~~ — (2)

new impedance ⇒

$$Z = \sqrt{(2R)^2 + R^2}$$

$$Z = \sqrt{5}R$$

So new power factor :-

$$\cos\theta' = \frac{R}{\sqrt{5}R} = \frac{1}{\sqrt{5}}$$

$$\cos\theta' = 0.446$$

So, new power factor is 0.446 Ans.

22.

Ans. $^{235}_{92}D \xrightarrow{\alpha \text{ decay}} D_1 \xrightarrow{\beta^- \text{ decay}} D_2 \xrightarrow{\alpha \text{ decay}} D_3 \xrightarrow{\gamma \text{ decay}} D_4$

$D_1 = {}^{231}_{90}D_1$

$D_2 = {}^{231}_{91}D_2$

$D_3 = {}^{227}_{89}D_3$

$D_4 = {}^{227}_{89}D_4$

So atomic number of D_4 is 89

and mass number of D_4 is 227 Ans.

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23.

Ans. **Intrinsic semiconductor :-**

A semiconductor in which no impurity is present or practically concentration of impurity is less than 1 impure atom per 10^8 semiconductor atoms, then this type of semiconductor is known as intrinsic semiconductor.

It behaves as perfect insulator at 0 k temperature and has very low conductivity at room temperature.

eg. Pure Si semiconductor.

Extrinsic semiconductor :-

A semiconductor which is doped with pentavalent or trivalent impurity is called extrinsic semiconductor. This type of semiconductor has some conductivity even at 0 k and very large conductivity in comparison to intrinsic semiconductor at room temperature.

eg. Ge doped with As impurity

24.

Ans. We know that modulation index is given as :-

$$\mu = \frac{A_m}{A_c}$$

or $$\mu = \frac{A_{max} - A_{min}}{A_{max} + A_{min}}$$

$$\mu = \frac{10V - 2V}{10V + 2V}$$

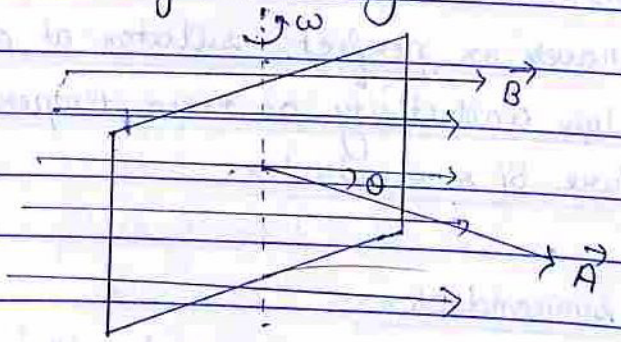
$$\mu = \frac{8V}{12V} \Rightarrow \mu = 0.66 \quad \mu = 0.67 \quad \text{Ans.}$$

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⇒ Thus the modulation index is 0.67 Ans.

25.

Ans. — For obtaining given relation, we consider a rectangular coil (having N turns) of area A rotating in a uniform external magnetic field with angular velocity ω.



If coil starts rotating with initial angle $\theta = 0°$, then at any time t, θ is given as :-

$$\theta = \omega t \quad - (1)$$

Magnetic flux through the coil at this t time is :-

$$\phi_B = NBA \cos\theta \quad - (2)$$

from eq. (1) & (2) :-

$$\phi_B = NBA \cos\omega t \quad - (3)$$

We know that,

$$e = -\frac{d\phi_B}{dt}$$

$$e = -\frac{d}{dt}(NBA\cos\omega t)$$

$$e = NBA\omega \sin\omega t \quad - (4)$$

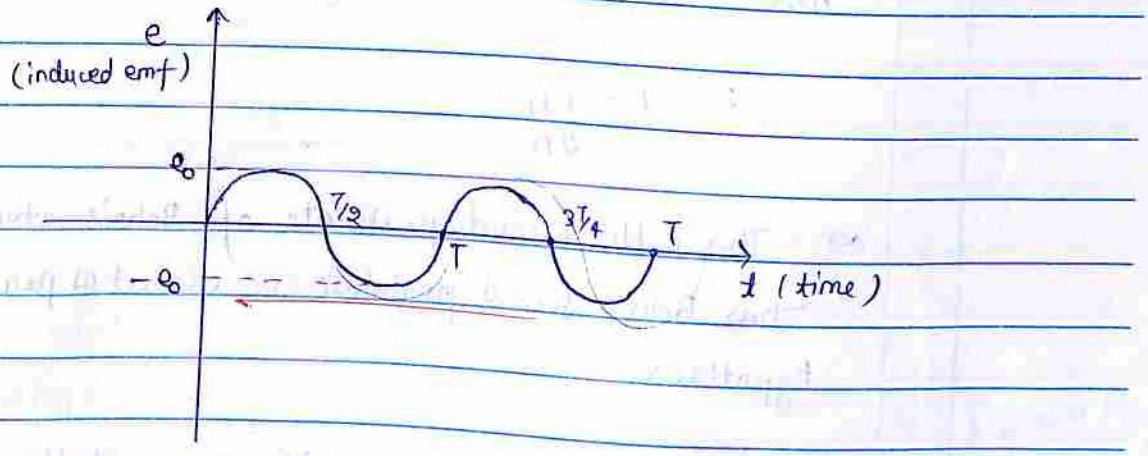
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if $NBA\omega = e_0$, eq. ④ becomes

$$\boxed{e = e_0 \sin\omega t}$$

Graph between e and t :-

Since e is a sine function of ωt, the graph will be sinusoidal.



26.

Ans. Bohr's second postulate states that electron can revolve in only those orbits for which angular momentum is an integral multiple of $\frac{h}{2\pi}$. This can be proved by De Broglie hypothesis.

⇒ According to De Broglie, matter has dual nature. So, an electron also behaves as a wave.

→ So for a stable standing wave to be produced in an orbit,

$$n\lambda = 2\pi r \quad \text{— (1)} \qquad (n = \text{positive integer})$$

where λ = De Broglie wavelength of electron.

r = radius of orbit

we know that,

$$\lambda = \frac{h}{mv} \quad \text{— (2)}$$

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From equation ① & ② :-

$$\frac{nh}{mv} = 2\pi r$$

or $$mvr = \frac{nh}{2\pi}$$

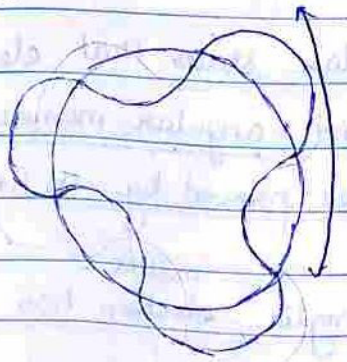
mvr = angular momentum (L)

$$\therefore L = \frac{nh}{2\pi}$$

⇒ This is the second postulate of Bohr's atomic theory. Thus Bohr's second postulate is correct as per De Broglie hypothesis.

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For an electron revolving in 3rd orbit, stationary wave model will be :-



revolution of electron in $n = 3$

27. What is P-N junction ------- working also.

Ans. P-N junction diode :-

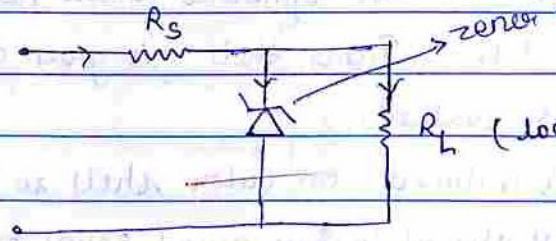
A semiconductor composed of a p-type semiconductor connected with an n-type semiconductor is called p-n junction diode. The connection should be in atomic crystal

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level. So by attaching a p-type semiconductor with an n-type semiconductor, p-n diode cannot be formed.

⇒ At the junction, a depletion layer is present which prevents flow of majority charge carriers.

Zener diode as voltage regulator :-



Working :-

⇒ Zener diode is connected in parallel to load resistance in reverse biasing to control the voltage fluctuation in load resistance. When source voltage becomes more than permissible voltage across load resistance, then breakdown of zener diode takes place, which decreases resistance of circuit thus increasing the current and thus additional voltage is consumed at R_s itself and voltage across load resistance is regulated.

28. What is capacitor - - - - - - - necessary diagram.

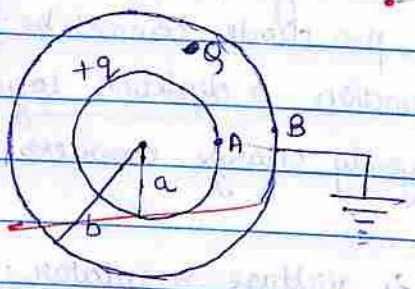
Ans. Capacitor :-

Capacitor is a device which is used to store charge and electrical energy by decreasing the potential at a plate without changing its charge and keeping other dimensions constant and thus increasing its capacity to store charge.

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Capacitance of spherical capacitor :-



where (Q → negative)

Two concentric metallic spherical shells having radii a and b (b > a) are taken. Inner shell is given a charge +q and outer shell is earthed.

* A charge is induced on outer shell so that the potential of outer shell should become zero (equal to earth's potential)

In this condition V at B = 0

$$V_B = 0$$

$$V_{B(inner)} + V_{B(outer)} = 0$$

$$\Rightarrow \frac{kq}{b} + \frac{kQ}{b} = 0$$

$$\therefore Q = -q \quad \text{— (1)}$$

Thus, induced charge on outer shell is $-q$.

Now, potential difference across two shells :-

$$V_{AB} = V_A - V_B$$

$$\because V_B = 0$$

$$\therefore V_{AB} = V_A \quad \text{— (2)}$$

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$$V_A = V_{A(inner)} + V_{A(outer)}$$

$$V_A = \frac{kq}{a} + \frac{kQ}{b}$$

$$Q = -q$$

$$\therefore V_A = \frac{kq}{a} - \frac{kq}{b} \quad \text{— (3)}$$

from eq. (2) & (3) :-

$$V_{AB} = kq\left(\frac{b-a}{ab}\right)$$

$$V_{AB} = \frac{q}{4\pi\varepsilon_0}\left(\frac{b-a}{ab}\right) \quad \text{— (4)}$$

from the definition of capacitance,

$$C = \frac{q}{V}$$

$$\therefore C = \frac{q_{inner}}{V_{AB}}$$

$$\Rightarrow C = \frac{q}{V_{AB}}$$

$$V_{AB} = \frac{q}{4\pi\varepsilon_0}\left(\frac{b-a}{ab}\right) \quad \text{(from eq. (4))}$$

$$\therefore C = \frac{q\,4\pi\varepsilon_0(ab)}{q(b-a)}$$

$$\boxed{C = \frac{4\pi\varepsilon_0 ab}{b-a}}$$ Ans.

This is the capacitance of a spherical capacitor.

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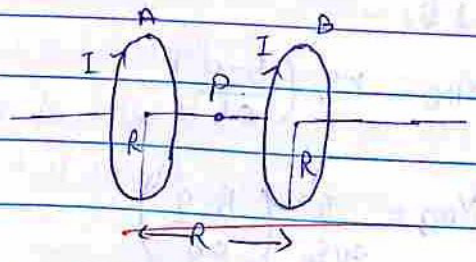
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29. What is Helmholtz - - - - - - - - - graph also.

Ans. **Helmholtz coils :-**

Helmholtz coils consist of two identical circular coils carrying same current in same direction, placed coaxially and their centres separated by a distance equal to their radius.

⇒ The use of Helmholtz coil is that it generates a uniform magnetic field in between both coils for a little distance.



Helmholtz coils

point P is at axial position for both coils

$$\vec{B}_P = \vec{B}_{PA} + \vec{B}_{PB}$$

Since P is equidistant from both coils and current in them is also same, so $\vec{B}_{PA} = \vec{B}_{PB}$

$$\vec{B}_P = 2\vec{B}_{PA}$$

$$B_P = 2B_{PA} \quad \text{— (1)}$$

for coil A, point P is at its axis at a distance $\frac{R}{2}$.

We know that,

$$B = \frac{\mu_0 I r^2}{2(r^2+x^2)^{3/2}}$$ (for any axial point)

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Putting $x = \frac{R}{2}$

$$B_{PA} = \frac{\mu_0 I R^2}{2\left(R^2 + \frac{R^2}{4}\right)^{3/2}}$$

$$\Rightarrow B_{PA} = \frac{4\mu_0 I R^2}{5\sqrt{5} R^3}$$

$$B_{PA} = \frac{4\mu_0 I}{5\sqrt{5} R} \quad - (2)$$

from eq. ① & ② :-

$$B_P = \frac{8\mu_0 I}{5\sqrt{5} R} \quad - (3)$$

Magnetic field generated by each coil at its centre,

$$B_C = \frac{\mu_0 I}{2R} \quad - (4)$$

eq. ③ divided by eq. ④ :-

$$\frac{B_P}{B_C} = \frac{16}{5\sqrt{5}}$$

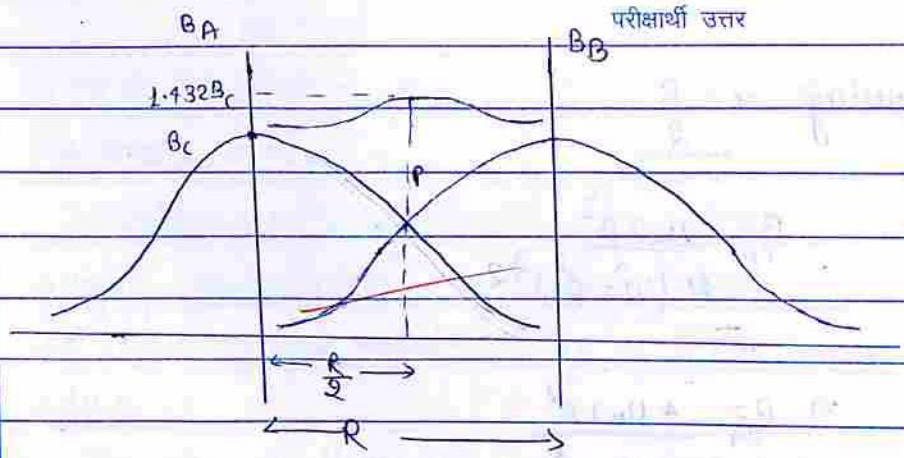
$$B_P = \frac{16}{5\sqrt{5}} B_C$$

$$\boxed{B_P = 1.432\, B_C}$$ Hence proved

⇒ Graph of magnetic field due to Helmholtz coils :-

P.T.O.

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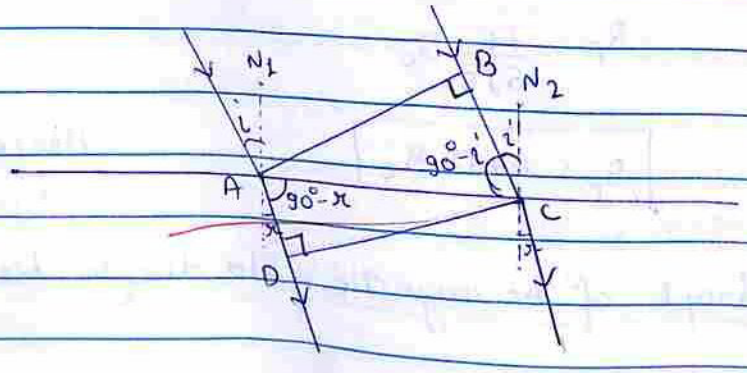
30. What is wavefront - - - - - - - - - ray diagram.

Ans.

Wavefront :-

Wavefront is the locus of all those points which are oscillating with same phase. From a source, when light rays emerge, then by joining points on those rays which are in same phase, a wavefront is obtained. Wavefronts are perpendicular to light rays.
eg. For a linear source wavefront is in the form of concentric cylinders.

Laws of refraction on the basis of Huygen's wave theory :-



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⇒ AB and DC are two wavefronts on two light rays. Since particles on wavefronts must be in phase. So time taken by light ray to go from A to D must be equal to time taken in going from B to C.

$\therefore t_1 = t_2 = t$ — ①

⇒ $AD = \frac{c}{\mu} t_1$ and $BC = c t_2$ [speed of light in medium $= \frac{c}{\mu}$]

or $AD = \frac{c}{\mu} t$ and $BC = ct$ — ②

In $\triangle ABC$ ⇒

$\cos(90° - i) = \frac{BC}{AC}$

$\sin i = \frac{BC}{AC}$ — ③

In $\triangle ADC$ ⇒

$\cos(90° - r) = \frac{AD}{AC}$

$\sin r = \frac{AD}{AC}$ — ④

dividing eq. ③ by eq. ④ :-

$\frac{\sin i}{\sin r} = \frac{BC}{AD}$ — ⑤

from eq. ② and ⑤ :-

$\frac{\sin i}{\sin r} = \frac{ct}{\frac{ct}{\mu}}$

$\boxed{\frac{\sin i}{\sin r} = \mu}$

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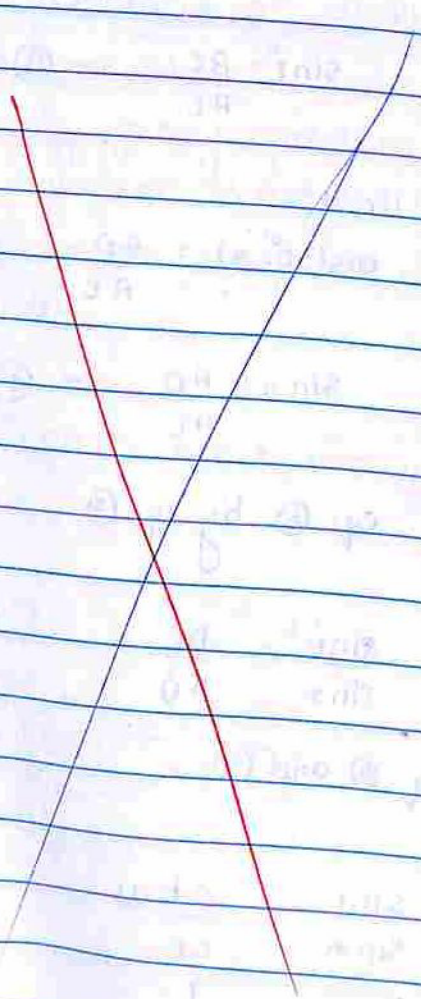
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This is the Snell's law of refraction which is proved by Huygen's wave theory of light.

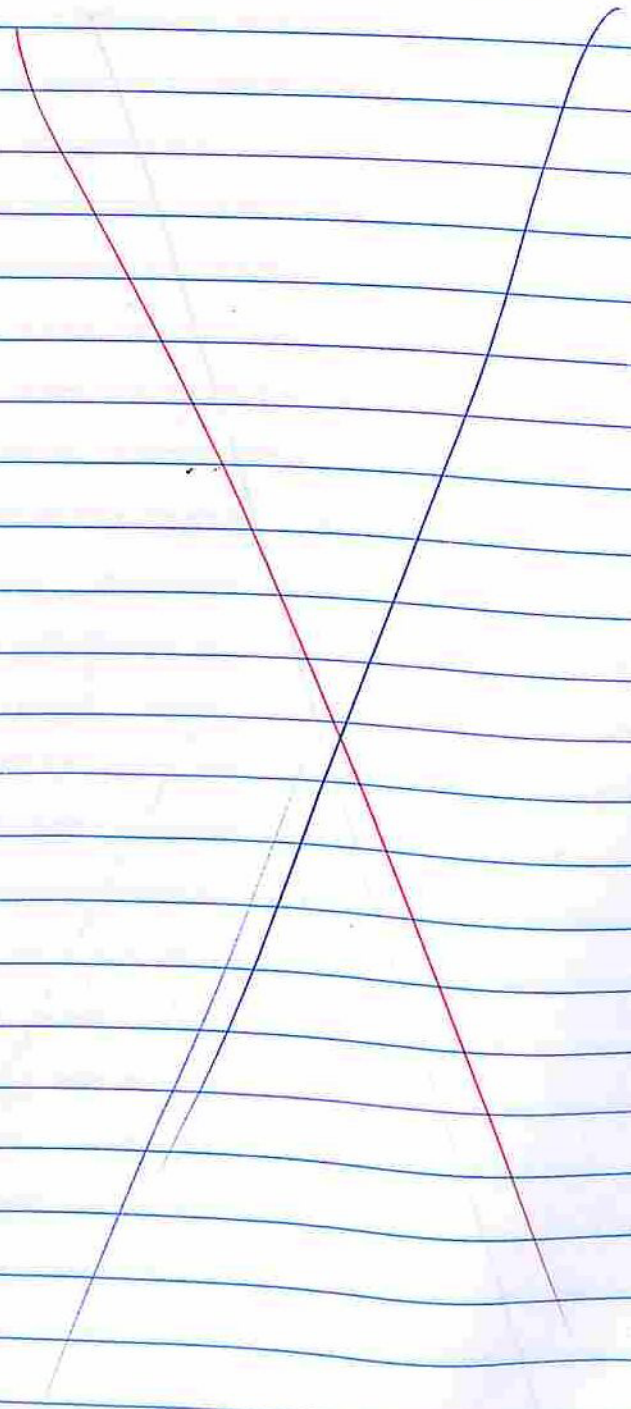
⇒ From the figure, it is also clear that incident ray, normal and refracted ray, all lie in same plane.

⇒ Thus laws of refraction are verified by Huygen's wave theory of light.

THE END



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