INTERMEDIATE EXAMINATION -2019

(ANNUAL)

PHYSICS

Time: 3 hours and 15 minutes **Maximum Marks: 70**

Instruction for the candidates:

(1) Candidates are required to give their answer in their own words as for as practicable.
(2) Figure in the right hand margin full marks.
(3) 15 Minutes of extra time has been allowed for the candidates to read the questions carefully.
(4) This question paper is divided into two sections- **Section-A and Section-B**
(5) In **Section-A,** there are 35 **objectives types question** which are compulsory. Each carrying **1 mark.** Darken the circle with blue black pen against the correct option on OMR Sheet provided to you.
Do not use whitener/Liquid Blade/Nail on OMR Paper, otherwise the result will be invalid.
(6) **In Section-B, there II short answer type question (each carrying 2 marks), out of which any 18 questions are to be answered. Apart from this, there are 6 long answer Type questions. (Each Carrying 5 marks),** out of which **any 3** question are to be answered.
(7) Use of any electrons device is prohibited.

SECTION-A (Objective Type Questions)

Question No. 1 to 35 have four options, out of which only one is correct. You mark have to mark, your selected option, on the OMR-Sheet.

1. **The torque $\left(\vec{\tau}\right)$ experienced by a current-loop of magnetic moment $\left(\vec{M}\right)$ placed in magnetic field $\vec{B}$ is**

   (a) $\vec{\tau}=\vec{M}\times\vec{B}$ **(b)** $\vec{\tau}=\vec{B}\times\vec{M}$ **(C)** $\vec{\tau}=\frac{\vec{M}}{\vec{B}}$ **(d)** $\vec{\tau}=\vec{M}\vec{B}$

   Answer: Option (a)

2. **The susceptibility of paramagnetic substance is**
   (a) Constant **(b)** Zero
   (b) Infinity **(d**) Depends on magnetic field

   Answer: Option (a)

3. **Unit of surface charge density is**
   (a) Coulomb/metre^2 **(b**) newton/metre

(c) Coulomb/volt **(d)** Coulmb/metre

Answer: Option (a)

4. Deviation of a thin prism of refractive index n and angle of prism A is

(a) $(1-n)A$ **(b)** $(n-1)A$ **(c)** $(n+1)A$ **(d)** $(1+n)A^2$

Answer: Option (b)

5. The time in which radioactive substance becomes half of its initial amount is called

(a) Average life **(b)** Half-life

(c) Time-period **(d**) Decay constant

Answer: Option (b)

6. Which one of the following has maximum refractive index

(a) Glass **(b)** water **(c)** Iron **(d)** Diamond

Answer: Option (d)

7. Two point charges of $+10\mu c$ and $-10\mu c$ **are placed at a distance 40cm in air. Potential energy of the system will be**

(a) $2.25J$ **(b)** $2.35J$ **(c)** $-2.25J$ **(d)** $-2.35J$

Answer: Option (c)

8. The solar spectrum is

(a) Continuous **(b)** Line spectrum

(C) Spectrum of blank lines **(d)** Spectrum of blank bands

Answer: Option (c)

9. The modulation index in amplitude modulation

(a) Is always zero **(b)** Lies between 0 to 1

(c) Lies between 1 to ∞ **(d)** can never exceed o.5

Answer: Option (b)

10. Power of an electric – circuit is

(a) V.R **(b)** $V^2 \cdot R$ **(C)** $\frac{V^2}{R}$ **(d)** V^2Rt

Answer: Option (c)

11. Equivalent focal length of two lenses in contact having power -15D and +5D will be

(a) -20 cm **(b)** -10 cm **(c)** +10 cm **(d)** +20 cm

Answer: Option (b)

12. Cylindrical lenses are used to correct the eye defect called

(a) Myopia **(b)** Hypermetropia

(c) Astigmatism **(d)** Presbyopia

Answer: Option (c)

13. If +q charge is placed inside any spherical surface then total flux coming out from whole surface will be

(a) $q+\varepsilon_0$ **(b)** $\frac{q}{\varepsilon_0}$ **(c)** $\frac{\varepsilon_0}{q}$ **(d)** $\frac{q^2}{\varepsilon_0}$

Answer: Option (b)

14. In earth's magnetic field B_H, if the frequency of oscillation of a magnetic needle is n, then

(a) $n \propto B_H$ **(b)** $n^2 \propto B_H$ **(c)** $n \propto B_{H^2}$ **(d)** $n^2 \propto \frac{1}{B_H}$

Answer: Option (b)

15. Light owes its colour to its

(a) Frequency **(b)** Velocity **(c)** Phase **(d)** Amplitude

Answer: Option (b)

16. The wave front due to a point source at a finite distance from the source is

(a) Spherical **(b)** Cylindrical **(c**) Plane **(d)** Circular

Answer: Option (a)

17. When two bulbs of power 60 W and 40 W are connected in series, then the power of their combination will be

(a) 100 W **(b) 2400 W** **(c) 30 W** **(d) 24 W**

Answer: Option (a)

18. In a step-up transformer, no, of turns in primary and secondary coils are N_1 and N_2, then

(a) $N_1 > N_2$ **(b)** $N_2 > N_1$ **(c)** $N_1 = N_2$ **(d)** $N_1 = 0$

Answer: Option (b)

19. With the increase on temperature the resistivity of semiconductor

(a) Increases **(b)** Decreases

(c) Remains constant **(d)** Becomes zero

Answer: Option (b)

20. The electric potential in equatorial position of an electric dipole is

(a) $\frac{1}{4\pi\varepsilon_0}\frac{p\cos\theta}{r^2}$ **(b)** $\frac{1}{4\pi\varepsilon_0}\frac{p}{r^2}$

(c) $\frac{1}{4\pi\varepsilon_0}\frac{p}{r}$ **(d)** Zero

Answer: Option (d)

21. The power factor of L-R circuit is

(a) R+WL **(b)** $\frac{R}{\sqrt{R^2+W^2L^2}}$

(c) $R\sqrt{R^2+W^2+L^2}$ **(d)** $\frac{WL}{R}$

Answer: Option (b)

22. A convex lens (n=1.5) is immersed in water (n=1.33), then it will behave as a

(a) Converging lens **(b**) Diverging lens

(c) Prism **(d)** Concave mirror

Answer: Option (b)

23. The direction of propagation of electromagnetic wave is

(a) Parallel to $\vec{B}$ **(b)** Parallel to $\vec{E}$

(c) Parallel to $\vec{B}\times\vec{E}$ **(d)** parallel to $\vec{E}\times\vec{B}$

Answer: Option (d)

24. The resistance of ideal ammeter is

(a) Zero **(b)** Very small (**c)** Very large **(d)** Infinite

Answer: Option (a)

25. The magnifying power of an astronomical telescope for normal adjustment is

(a) $-\frac{f_0}{f_e}$ **(b)** $-f_0 \times f_e$ **(c)** $-\frac{f_e}{f_0}$ **(d)** $-f_0 + f_e$

Answer: Option (c)

26. The working of dynamo is based on the principle of

(a) Heating effect of current **(b)** Electro-magnetic induction

(c) Induced magnetism **(d)** Induced electricity

Answer: Option (b)

27. In an alternating current circuit, the phase difference between curren I and voltage ϕ, then the Wattles component of current will be

(a) $I\cos\phi$ **(b)** Double **(c)** four **(d)** Same

Answer: Option (c)

28. At constant potential difference, the resistance of any electric circuit is halved, the value of heat produced will be

(a) Half **(b)** Double **(c)** four **(d)** Same

Answer: Option (b)

29. The ratio of root mean (rms) value and peak value of alternative current is

(a) $\sqrt{2}$ **(b)** $\frac{1}{\sqrt{2}}$ **(c)** $\frac{1}{2}$ **(d)** $2\sqrt{2}$

Answer: Option (b)

30. The energy of a photon of wavelength λ is

(a) $hc\lambda$ **(b)** $\frac{hc}{\lambda}$ **(c)** $\frac{hc}{c}$ **(d)** $\frac{\lambda}{hc}$

Answer: Option (b)

31. The current flowing; in a wire is 1 A. if the charge of an electron is $1.6\times10^{-19}C$, then the number of electrons flowing through the wire per second is

(a) 0.625×10^{13} **(b)** 6.25×10^{18} **(c)** 1.6×10^{-19} **(d)** 1.6×10^{19}

Answer: Option (b)

32. The stored energy, of a capacitor charged to 100 V, is 1 J. capacitor is

(a) $2\times10^{4}F$ **(b)** $2\times10^{4}F$ **(c)** $2\times10^{2}F$ **(d)** $1.6\times10^{19}F$

Answer: Option (b)

33. The value of angle of dip at the earth's magnetic pole is

(a) 0^0 **(b)** 45^0 **(c)** 90^0 **(d)** 180^0

Answer: Option (c)

34. The Boolean expression for NAND gate is

(a) $Y=A+B$ **(b)** $Y=A\cdot B$ **(c)** $Y=\overrightarrow{A\cdot B}$

Answer: Option (d)

35. The height of TV tower at a certain place is 245m.The maximum distance up to which its programme can be received is

(a) 245 m **(b) 245km** **(c) 56 km** **(iv) 112km**

Answer: Option (c)

SECTION-B (Non-objective Type Questions)

(Short Answer Type Question)

Question No. 1 to 18 are short answer type. Answer any 10 questions. Each question carries 2 marks.

$[10\times2=20]$

1. **Define electric flux. Write its SI unit.**

Answer: Electric flux: The electric flux through a surface held inside on electric

Field represents the total number of electric lines of force crossing the surface in a direction normal to surface.

It is the scalar or dot product of electric intensity and area vector. It is denoted by ϕ

$$d\phi=\vec{E}.\ \overrightarrow{ds}=E.ds\cos\theta$$

S.I Unit: Voltmeter or, Nm^2/Coulomb

2. Establish the relationship between electric field intensity and electric potential.

Answer: Relation between Electric field intensity and potential $E = -\frac{dV}{dr}$

Where, E=Electric intensity

$\frac{dV}{dr}$ =change in potential with distance

It is also called potential gradient. The electric field at a point is equal to the negative gradient of the electrostatic potential at that point.

3. The equivalent capacitance of three equal capacitors connected in series combination is $6\mu F$.

Answer: In series, $\frac{1}{C_s} = \frac{1}{c} + \frac{1}{c} + \frac{1}{c} ..... \frac{1}{n}$

$\frac{1}{C_s} = \frac{n}{c}$; $C_s = \frac{c}{n}$; $\sigma = \frac{c}{3}$; C=18μf

For parallel combination, $C_p = 18+18+18$; $C_p = 54\mu f$

4. Two resistors of resistance ratio 3:4 are connected in parallel. Compare the magnitude of heat produced in them.

Answer: In parallel $H \propto \frac{1}{R}$; $\frac{H_1}{H_2} = \frac{R_2}{R_1}$; $\frac{H_1}{H_2} = \frac{4}{3}$

5. What is Lorentz force?

Answer: Lorentz force: when a charged particle q moves with velocity v in magnetic field B the charged particle experience a force and it called magnetic Lorentz force. The direction of force is perpendicular to the direction of magnetic field and velocity.
The force experienced by charge particle depends on some factor. If F is the force then
$F \propto q$; $\propto$B; $\propto$V$\sin\theta$; F$\propto$qB$v\sin\theta$; F=kqB$v\sin\theta$
Here, $k = 1$; F=qB$v\sin\theta$

6. What is Shunt? Write its two uses.

Answer: Shunt: It is a wire of low resistance jointed in parallel with the circuit.
Uses of shunt.

(i) To save the coil of galvanometer.
(ii) In the conversion of galvanometer into Ammeter.

7. **Lenz's law of electromagnetic induction follows the principle of conservation of energy. Discuss it.**
   Answer: Lenz's law states when an emf is generated by change in magnetic flux according to Faraday's Law, the polarity of the induced emf is such, that it produces an current that's magnetic field opposes the change which produces it.

The negative sign used in Faraday's law of electromagnetic, indicates that the induced emf (ε) and the change in magnetic flux $(\delta\phi_B)$ have opposite signs.

$$(\varepsilon) = -N\frac{\partial\phi_B}{dt}$$

Where, (ε) = Induced emf

$\partial\phi_B$ = change in magnetic flux

N= No of turns in coil.

8. **Establish the relation between mean value and peak value of AC.**
   Answer: Relation between mean value and peak value of A.C
   The instantaneous value of A.C is

$$I = I_0 \sin wt.....(i)$$

Let this current passes through the circuit for small time dt and send the small amount of charge dq.

$$I = \frac{dq}{dt}; dq = I.dt; \quad \text{dq=I}_0 \sin wt$$

Now, charge sends by A.C in half time period.

$$q = \int_0^{T/2} I_0 \sin wt.dt = I_0 \int_0^{T/2} I_0 \sin wt.dt$$

$$q = I_0\left[-\frac{\cos wt}{w}\right]_0^{T/2} = -\frac{I_0}{w}\left[\frac{\cos 2\pi}{T}\cdot\frac{T}{2} - \frac{\cos 2\pi}{T}\cdot 0\right]$$

$$= \frac{-I_0}{\frac{2\pi}{T}}\left[\cos\pi - \cos 0\right] = \frac{-I_0 T}{2\pi}\left[-1-1\right]$$

$$q = \frac{I_0 T}{\pi}.....(ii)$$

If I_m is the mean value of A.C then $q = \text{Im}\frac{T}{2}.....(iii)$

From equation (ii) and (iii) $\text{Im}.\frac{T}{2} = \frac{I_0 T}{\pi}; \text{Im} = \frac{2I_0}{\pi}; \quad \text{Im=0.636I}_0$

Thus, mean value of A.C is equal to 0.636 times of peak value of A.C

9. What are reactance and impedance in alternative current circuit?

Answer: Reactance: when A.C circuit contains only coil (inductance) then its resistance is called inductive resistance or reactance of circuit. It is denoted by $\mathbf{X_L}$

$$X_L = WL = 2\pi FL$$

Impedence : when A.C circuit contains resistance an coil then maximum value of current.

$$I_0 = \frac{E}{\sqrt{R^2 + W^2L^2}}$$

Here, $\sqrt{R^2 + W^2L^2}$ is analogous with resistance and it is called impedence of the circuit. It is denoted by Z.

10. Write down two properties of electromagnetic wave.

Answer: Properties of Electro-magnetic wave

(i) The electromagnetic waves does not need material medium for the propagation.

(ii) The electromagnetic waves obey the principle of super-position.

(iii) Power of equivalent lens

$$P = P_1P_2 - dP_1P_2$$

Given, $P_1 = 5D$ $\quad$ P=5+4−0.1×5×4

$P_2 = 4D$ $\quad$ P=9−2

$d = 10cm$ $\quad$ P=7D

Focal length of equivalent lens $F = \frac{1}{P}$

$F = \frac{1}{7} \times 100 = \frac{100}{7}$; $\quad$ F=14.28 cm.

11. Two thin convex lens of power +5 and +4 diopter and placed co-axially at a distance 10 cm. Find the focal length of the combination.

Answer:

12. Differentiate between primary and secondary rainbow.

Answer:

Primary Rainbow		**Secondary Rainbow**	
(i)	The primary rainbow has violent colour on the inner edge and red colour on the outer edge.	**(i)**	The secondary rainbow has red colour on the inner edge and the violet colour on the outer edge.
(ii)	It is observed when internse red light in a direction on making an angle 42^0 with the line Joining the sun& the observer.	**(ii)**	The violet light is recurred by the observer in a direction making an angle 55^0 and the red light in a direction making angle 52^0 with the axis of rainbow.

13. Describe the two shortcomings of Bohr model of atom.

Answer: (i) This theory is applicable only to hydrogen – like single electron atom and falls in the case of atoms with two or more electrons.

(ii) It does not explain why only circular orbits should be chosen when elliptical orbits are also possible

14. The decay constant of a radioactive substance is 5.2×10^{-3} per year.

Answer: Half life time $T = \frac{0.693}{\lambda}$;

$T = \frac{0.693}{5.2\times10^{-3}}$;

$T = \frac{6930}{52}$; T=133.2years

15. Write truth table and Boolean expression of OR and AND get.

Answer:

Y=A+B

Y=A.B

Truth table

A	**B**	**Y**
0	**0**	**0**
1	**0**	**1**
0	**1**	**1**
1	**1**	**1**

Truth table

A	B	Y
0	0	0
1	0	0
0	1	0
1	1	1

16. Define flux of electric field on a surface.

Answer: Electric flux: The electric flux through a surface held inside on electric

Field represents the total number of electric lines of force crossing the surface in a direction normal to surface.

It is the scalar or dot product of electric intensity and area vector. It is denoted by ϕ

$$d\phi = \vec{E}.\ \ \vec{ds} = E.ds\cos\theta$$

S.I Unit: Voltemeter or, Nm^2/Coulomb

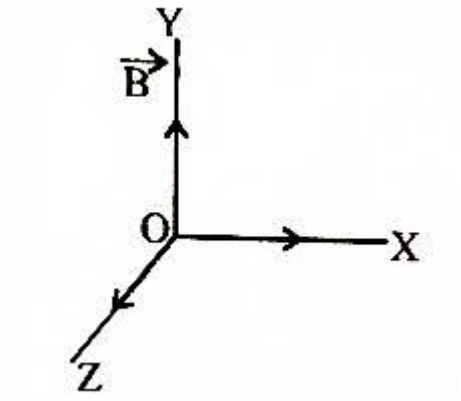
17. Velocity of light in medium A is v and velocity of light in medium B in 2v. If refractive index of medium A is μ_A and refractive indent of medium B is μ_B, then what will be the value of $\frac{\mu_A}{\mu_B}$?

Answer: $\mu = \frac{velocity \text{ of light in first medium}}{velocity \text{ of light in second medium}}; \frac{\mu_B}{\mu_A} = \frac{v}{2v} = \frac{1}{2}$

$$\frac{\mu_B}{\mu_A} = \frac{1}{2}$$

18. In a vertically upwards magnetic field $\vec{B}$, a positively charged particle is projected horizonally eastwar. What will be the direction of force on the particle?

Answer: The Lorentz force acts upon this particle



$F = qBv\sin\theta$

Here, $\theta = 90^0$; F=qBvsin90^0 F=qBv

The force it's along Z= axis.

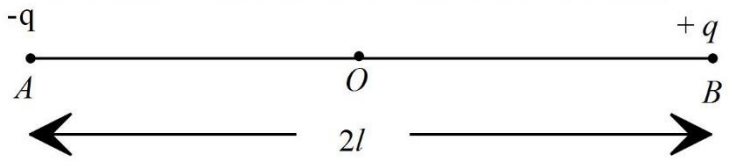
Long Answer Type Questions.

Question Nos. 19 to 24 are Long Answer Type Question. Each Question carries 5 marks. Answer any 3 questions.

$3\times5=15$

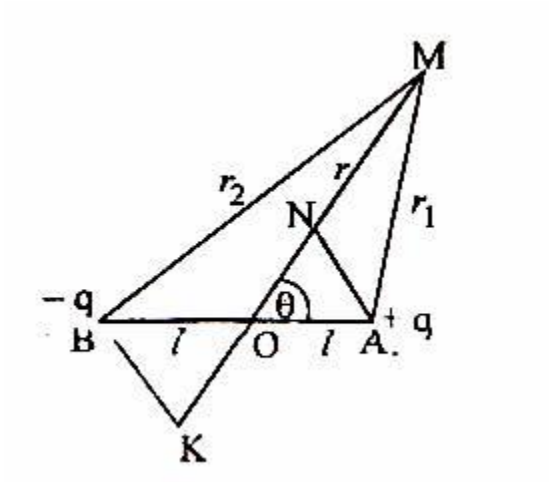
19. What is Electrical dipole? Find an expression for electric potential any point due to an electric dipole.

Answer: Electric dipole: when two charge equal in magnitude but opposite in nature placed very near to each other then it is called electric dipole.



Expression for electric potential at a point due to an electric dipole:

Let AB is a electric dipole. M is the point at the distance r from its middle point O and at this point expression for electric potential is to be determined.



$\angle MOA = \theta$, The distance of point M from +q and –q charge is r_1 and r_2 respectively.

Electric potential at point M due to dipole.

$$V = \frac{1}{4\pi\varepsilon_0}\cdot\left[\frac{1}{r_1} - \frac{1}{r_2}\right]$$

Draw perpendicular AN and BK from A and B on OM and produced Om respectively.

Since, charge are very near to each other in electric dipole.

So, $r_1 = OM - ON; \quad r_1 = r - l\cos\theta$

Similarly $r_2 = r + l\cos\theta$

Putting the value of r_1 and r_2 in equation (1)

$$V = \frac{1}{4\pi\varepsilon_0}\cdot q\left[\frac{1}{(r - l\cos\theta)} - \frac{1}{(r + l\cos\theta)}\right]$$

$$V = \frac{1}{4\pi\varepsilon_0}\cdot q\left[\frac{r + l\cos\theta - r + l\cos\theta}{(r - l\cos\theta)}\right]$$

$$V = \frac{1}{4\pi\varepsilon_0}\cdot\left[\frac{q\cdot 2l\cos\theta}{(r_2 - l^2\cos^2\theta)}\right]$$

Where $(P = q\cdot 2l)$ Electric dipole moment

$l^2\cos^2\theta << r^2$ so, $l^2\cos^2\theta$ can be neglected

$$V = \frac{1}{4\pi\varepsilon_0}\frac{P\cos\theta}{r^2}$$

20. State and explain Kirchhoff's law's. Applying this law, obtain the balanced condition of Wheatstone bridge.

Answer: : It states that in any closed part of an electrical circuit, the algebraic sum of the emf is equal to the algebraic sum of the products of the resistance and current flowing through them. It is also called loop rule. This law is based upon the law of conservation of energy.

Wheatstone bridge: It is one of the accurate arrangements for measuring an unknown resistance. It is based on the principle of Kirchhoff's law.

Four resistance P, Q, R and S are connected to form a quadrilateral of galvanometer and a tapping key k_1 (called galvanometer) are connected between points B and D as shown in the figure.

Applying Kirchhoff's second law, for closed pas ABDA in the circuit

$$I_1P + I_g\cdot g - (I - I_1)S = 0$$

Where g is the resistance of galvanometer

In the balanced state $I_g = 0$

$$I_1P + O \cdot g - (I - I_1)S = 0$$
$$I_1P = (I - I_1)S$$
$$\frac{P}{S} = \frac{I - I_1}{I_1} \text{.....}(i)$$

Applying Kirchhoff's law in closed part BDCB

$$I_g \cdot g + (I - I_1 + I_g)R - (I_1 - I_g)Q = 0$$
$$O + (I - I_1)R - I_1Q = 0$$
$$(I - I_1)R = I_1Q$$
$$\frac{Q}{R} = \frac{I - I_1}{I_1}$$

From equation (i) and (ii) $\frac{P}{S} = \frac{Q}{R}$; $S = \frac{P}{Q} \cdot R$

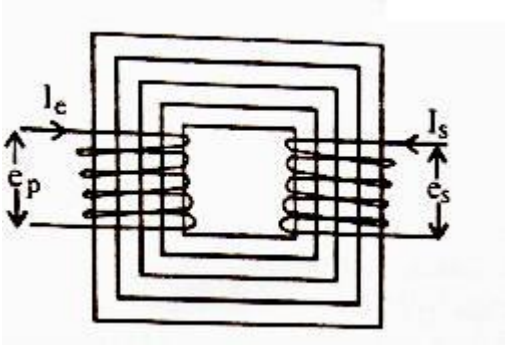
Hence, unknown resistance cab be calculated.

21. Describe the principle, construction and working of a transformer.

Answer: Transformer

Principle: It is based on the principle of mutual induction.

Construction: A simple transformation consists of two coils called the primary and secondary which are insulated from each other and would on a common soft iron laminated are.



The alternating voltage to be transformed is connected to the primary while the load is connected to the secondary. In a set-up transformer, the primary coil consists of a few of thick insulated copper wire and the secondary consists of a large number of turns of thin insulated copper wire while consists of a large number of turns of thin insulated copper wire the case is reverse in step down transformer.

Theory: On applying the alternating voltage to the primary an alternating current flows in the coil. An alternating magnetic flux is then set up in the core which gets linked with both primary and secondary.

Let n_p and n_s be the number of turns of wire in primary and secondary coil, ϕ_p and ϕ_s are magnetic flux linked with primary and secondary coil at any instant then.

$$\frac{\phi_s}{\phi_p} = \frac{N_s}{N_p}\phi_p$$

Differentiating both side w.r.t then $\frac{d\phi_s}{dt} = \frac{N_s}{N_p}.\frac{d\phi p}{dt}$

According to faraday law of electro-magnetic inductions

$$e_s = -\frac{d\phi_s}{dt};\ \mathrm{e}_p = -\frac{d\phi}{dt};\ \mathrm{e}_s = \frac{N_s}{N_p}.e_p; \frac{e_s}{e_p} = \frac{N_s}{N_p}$$

Then ratio $\frac{N_s}{N_p} = K$

For no. loss of energy, Output-power=Input power $e_s I_s = e_p I_p$

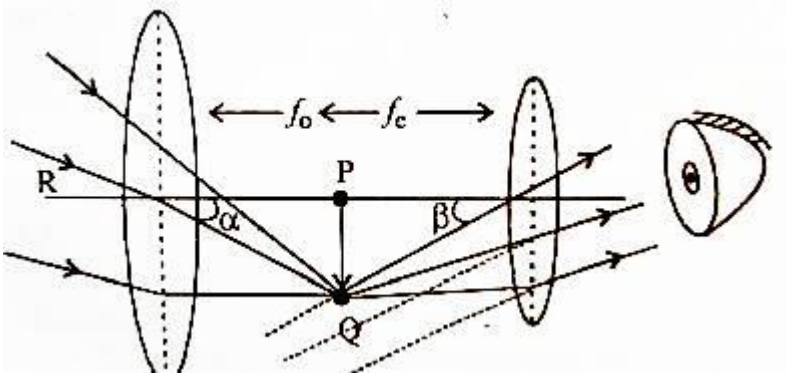
$$\frac{e_s}{e_p} = \frac{I_p}{I_s}$$

22. With neat diagram describe the construction and working of an astronomical telescope and find its magnifying power.

Answer: Astronomical Telescope: It is an optical instrument which is used to see heavenly bodies.

Construction: An Astronomical telescope consists of two lens system. The lens which is kept towards object is called lens or objective and the lens which is kept towards eye is called eye lens. The distance between two lens is adjusted by rack and pinion arrangement.

(i) When final image is formed at Infinity: when a parallel beam of light rays from distant object falls on objective then its real and inverted image PQ is formed on the side of the objective.



Now eye lens is so adjusted that PQ lies at the focus of eye lens, then final image is formed at infinity.

Magnifying power of astronomical telescope

$$M = \frac{Angle \text{ subtended final image at the eye}}{Angle \text{ substended by object at the eye}};\ \text{M}=\frac{\beta}{\alpha}$$

The value of β and α are very small so,

$$\beta = \tan\beta;\ \alpha=\tan\alpha;\ \text{M}=\frac{\tan\beta}{\tan\alpha};\ \ \text{M}=\frac{\frac{PQ}{EP}}{\frac{PQ}{OP}}=\frac{PQ}{EP}\times\frac{OP}{PQ}$$

$$M = \frac{OP}{EP};\ \ \text{M}=\frac{f_0}{f_e}$$

(ii) When the final image is formed at least distance of district vision.

In this position eye lens is so adjusted that PQ lies between optical centre and focus of eye lens then final image is formed at the least distance of district vision.

Magnifying power of Astronomical telescope

$$M = \frac{Angle \text{ subtended final image at the eye}}{Angle \text{ substended by object at the eye}};\ \text{M}=\frac{\beta}{\alpha}$$

The value of β and α are small so, $\beta = \tan\beta;\ \ \alpha=\tan\alpha$

$$M = \frac{\tan\beta}{\tan\alpha};\ \ \text{M}=\frac{\frac{PQ}{EP}}{\frac{PQ}{OP}}=\frac{PQ}{EP}\times\frac{OP}{PQ};\ \text{M}=\frac{f_0}{f_e}.....(i)$$

By lens formula $\frac{1}{-v_e}-\frac{1}{-u_e}=\frac{1}{f_e};\quad \frac{1}{u_e}=\frac{1}{f_e}+\frac{1}{v_e};\quad \frac{1}{u_e}=\frac{1}{f_e}+\frac{1}{D}$

Putting the value of $\frac{1}{v_e}$ in equation.

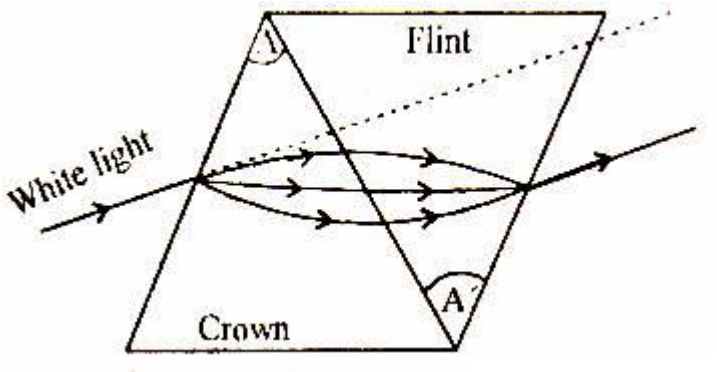
$$M = f_0\left(\frac{1}{f_e}+\frac{1}{\partial}\right);\quad \text{M}=\frac{f_0}{f_e}\left[1+\frac{f_e}{D}\right]$$

23. What is Dispersive power? Find the necessary condition for obtaining deviation without dispersion by two thin prisms.

Answer: Dispersive power: The dispersive power of a material for any two colours may be defined as the ratio of the angular dispersion for these two colours to the deviation suffered by mean light. It is denoted by ω.

$$\omega = \frac{(\mu_v - \mu_r)}{(\mu - 1)}$$

Deviation without Dispersion: Two prism crown glass an flint glass prism are taken whose refracting angle are A and 1 respectively.



Let μ_v, μ_r, μ and μ'_v, μ'_r, μ' are repractive indices for violet, red and mean colour of crown glass and flint glass prism respectively.

The angular dispersion produced by crown glass prism.

$$\delta_v - \delta_r = (\mu_v - \mu_r) A$$

Angular dispersion produced by flint glass prism $\delta'_v - \delta'_r = (\mu'_v - \mu'_r) A'$

The combination does not produce any dispersion.

$$(\delta_v - \delta_r) + (\delta'_v - \delta'_r) = 0$$
$$(\mu_v - \mu_r) A + (\mu'_v - \mu'_r) A' = 0$$
$$(\mu_v - \mu_r) A = -(\mu'_v - \mu'_r) A'$$
$$\frac{A}{A'} = -\frac{(\mu_v - \mu_r)}{(\mu'_v - \mu'_r)} \text{.....}(i)$$

Negative sign indicates that refracting angle of prism are in opposite direction. The combination of prism which satisfies the above condition is called achromatic combination of prism. If the white light passes through such combination then only deviation is produced.

$$\sigma = \delta + \delta'; \quad \sigma = (\mu - 1) A + (\mu' - 1) A'; \ \text{D} = (\mu - 1) A \left[1 + \frac{(\mu' - 1) A'}{(\mu - 1) A} \right]$$

Putting the value of $\frac{A}{A'}$ in above equation

$$(\mu - 1) A \left[1 + \frac{(\mu' - 1)}{(\mu - 1)} \cdot \frac{(\mu_v - \mu_r)}{(\mu'_v - \mu'_r)} \right]; \quad \text{D} = (-1) A \left[1 - \frac{\omega}{\omega_1} \right]$$

24. Explain with the help of a labelled diagram the working of a transistor as an oscillator.

Answer: An oscillator circuit consisting of an amplifier circuit, tuned circuit in the collector and an inductive coupling for feedback. The emitter junction is forward biased while the collector junction is reverse biased. The coil L_1 and L_2 are would on the same core so that they are inductively coupled through their mutual inductance.

Working of a transistor as an oscillator- The transistor transfers the resistance, it is called as transistor.

There exists an input circuit with a small source of power and a small resistance and an output circuit with a high resistance and moderately large source of power.

In the input circuit, whenever there is a small change in current, there is an amplified variation of current in output circuit, mainly because the resistance are transferred.

The amplified output current also oscillates with respect to the input, when the input current is made to oscillate by applying a signal to the input terminal.