AP 2017 Class 12 Physics

Paper-II

Time allowed: 3hours **Maximum Marks: 60**

SECTION-A **(10 × 2 = 20)**

Note: i) Answer all the questions.

ii) Each question carries two marks.

iii) All are very short answer type questions.

1. Define power of a convex lens. What is its unit.?

Ans: The power of a lens is defined as the reciprocal of the focal length. Lens power is measured in diopters (D).

2. What are the units of magnetic moments and magnetic induction.

Ans: The unit for magnetic moment in International System of Units (SI) base units is $A \cdot m_2$

the term magnetic flux density refers to the fact that B is magnetic flux per unit surface. This relationship is based on Faraday's law of magnetic induction. The SI unit measuring the strength of B is T (tesla = weber/m_2).

3. Classify the following materials with regard to magnetism.

manganese, cobalt, nickel, bismuth, oxygen and copper.

Ans: para magnetism = nickel, oxygen,

diamagnetism = bismuth, copper.

ferromagnetism = magnesium, cobalt,

4. How to you convert a moving coil galvanometer into voltmeter.

Ans: To convert a galvanometer into a voltmeter you connect a suitable high resistance in series with the coil of the galvanometer.

5. A transformer converts 200 v ac into 2000 v ac. Calculate the number of turns in the secondary if the primary has 10 turns.

Ans: Given, a transformer converts 200v ac into 2000v ac

No. of turns in secondary, if primary has 10 turns=?

$V_p = 200V$

$V_s = 2000V$

$N_p = 10$

So we used the formula,

$V_s/V_p = N_s/N_p$

$2000V/200V = N_s/10$

So, $Ns = 2000/200 \times 10$

$Ns = 100$.

6. If the wavelength of electromagnetic relation is double, what happen to the energy of proton.

Ans: When we double the wavelength in electromagnetic relation, the energy becomes half. This is proved by Quantum Theory of light proposed by Einstein, energy of a photon is equal to the product of planck's constant and frequency.

7. Write down de Broglie' s relation and explain the term within.

Ans: De-Broglie relation relates a body's momentum with its wavelength.

It is given as

$\lambda = h/p$

where.,

λ is its de-broglie wavelength

h is the plank's constant

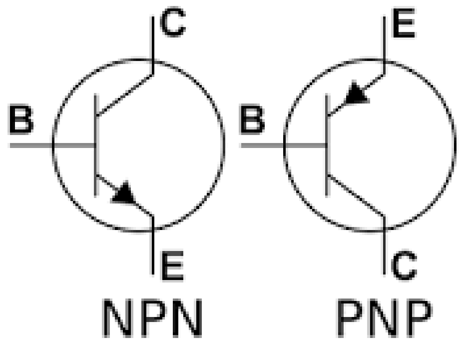
p is the moving body's momentum.

8. What is photoelectric effect.

Ans: The photoelectric effect is a phenomenon in physics. The effect is based on the idea that electromagnetic radiation is made of a series of particles called photons. When a photon hits an electron on a metal surface, the electron can be emitted. The emitted electrons are called photoelectrons.

9. Draw the circuit symbols for p-n-p and n-p-n transistors.

Ans:



10. What is modulation. Why is it necessary?

Ans: In electronics and telecommunications, modulation is the process of varying one or more properties of a periodic waveform, called the carrier signal, with a modulating signal that typically contains information to be transmitted.

Modulation allows us to send a signal over a bandpass frequency range. If every signal gets its own frequency range, then we can transmit multiple signals simultaneously over a single channel, all using different frequency ranges. Another reason to modulate a signal is to allow the use of a smaller antenna.

SECTION- B (6 × 4 = 24)

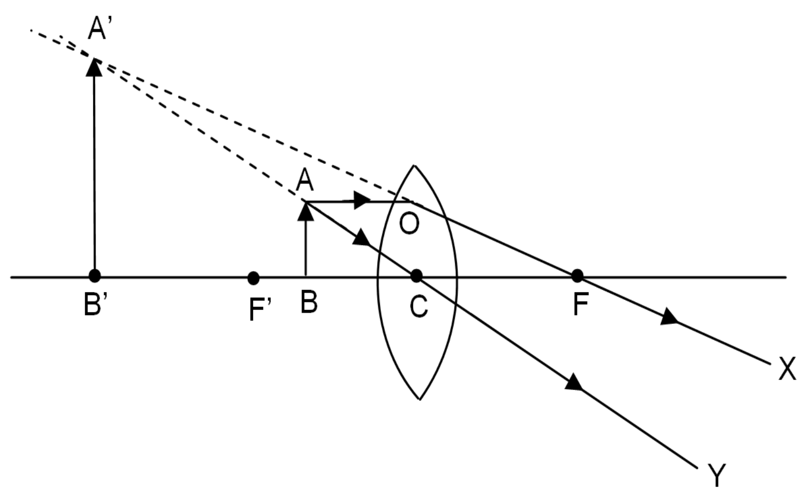
Note: i) Answer Any Six of the following questions.

ii) Each question carries four marks.

iii) All are short answer type questions

11. With a neat labelled diagram, explain the formation of image in a simple microscope.

Ans:



12. Explain Doppler effect in light. Distinguish between red shift and blue shift.

Ans: The relativistic Doppler effect is the change in frequency (and wavelength) of light, caused by the relative motion of the source and the observer (as in the classical Doppler effect), when taking into account effects described by the special theory of relativity.

When an object moves away from us, the light is shifted to the red end of the spectrum, as its wavelengths get longer. If an object moves closer, the light moves to the blue end of the spectrum, as its wavelengths get shorter.

13. derive an expression for the intensity of the electric field at a point on the axial line of an electric dipole.

Ans: (a) For points on axial line

The axial line of a dipole is the line passing through the positive and negative charges of the electric dipole.

Consider a system of charges (-q and +q) separated by a distance 2a. Let 'P' be any point on an axis where the field intensity is to be determined.

Electric field at P (EB) due to +q

$$E_B = \frac{1}{4\pi\varepsilon_0}\frac{q}{(BP)^2} along\, BP$$

$$= \frac{1}{4\pi\varepsilon_0}\frac{q}{(r-a)^2}$$

Electric field at P due to -q (EA)

$$E_A = \frac{1}{4\pi\varepsilon_0}\frac{1}{(AP)^2} along\, PA$$

$$\frac{1}{4\pi\varepsilon_0}\frac{1}{(r+a)^2}$$

Net field at P is given by

$$E_p = E_B - E_A$$

$$= \frac{1}{4\pi\varepsilon_0}\left[\frac{q}{(r-a)^2} - \frac{q}{(r+a)^2}\right]$$

Simplifying, we get

$$E_P = \frac{q}{4\pi\varepsilon_0} - \frac{4ar}{(r^2-a^2)^2}$$

$$E_P = \frac{2qr}{4\pi\varepsilon_0} - \frac{\partial}{(r^2-a^2)^2}$$

$$\left(2aq = p, K = \frac{1}{4\pi\varepsilon_0}\right)$$

$$or\ E_P = \frac{2kpr}{(r^2-a^2)^2} along\ BP$$

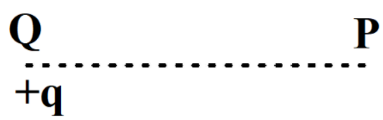
As a special case:

$$If\ 2a\,r,\ E_p = \frac{2kp}{r^3} along\ BP$$

14. Derive an expression for the electric potential due to a point charge.

Ans:

Consider a positive test charge +q is placed at point O shown below in the figure



We have to find the electric potential at point P at a distance r from point O

If we move a positive test charge q from infinity to point P then change in electric potential energy would we

$$U_P - U_\infty = \frac{qq'}{4\pi\varepsilon_0 r}$$

Electric potential a point P is

$$V_2 = \frac{U_P - U_\infty}{q} = \frac{q}{4\pi\varepsilon_0 r} \qquad (8)$$

Potential V at any point due to arbitrary collection of point charges is given by

$$V = \frac{1}{4\pi\varepsilon_0}\sum_{t-l}^{n}\frac{q_t}{r_t} \qquad (9)$$

Here we see that like electric field potential at any point independent of test charge used to define it.

For continuous charge distributions summation in above express in will be replaced by the integration.

$$V = \frac{1}{4\pi\varepsilon_0}\int\frac{dq}{r} \qquad (10)$$

Where dq is the differential element of charge distribution and r is its distance from the point at which V is to be calculated.

15. State and explain biot savart law.

Ans: Biot savart law- it is the law which shows the relationship between the magnetic intensity, current and distance from point to wire. It is defined as the magnetic intensity at any point in the magnetic field due to steady current in long straight wire is directly proportional to current and inversely proportional to distance of a point to the wire.

16. current in a circuit falls from 5.0 A to 0.0 A in 0.1s. if an average emf of 200 v induced, give an estimate of the self - inductance of the circuit.

Ans:

$$Change\,in\,current\;dI = 5 - 0 = 5A$$

$$dt = 0.1S$$

$$e_{av} = 200V$$

$$e = L\frac{dI}{dt}$$

$$\therefore 200 = L\left(\frac{5}{0.1}\right) \Rightarrow L = \frac{200}{50}$$

$$= 4H$$

17. Explain the different types of spectral series in a hydrogen atom.

Ans: Five spectral series identified in hydrogen are

1. Balmer Series

2. Lyman Series

3. P aschen Series

4. Brackett Series

5. P fund Series

1. Balmer series:

In 1885, when Johann Balmer observed a spectral series in the visible spectrum of hydrogen, he made the following observations:

- The longest wavelength is 656.3 nm
- The second longest wavelength is 486.1 nm
- And the third is 434.1 nm
- Also, as the wavelength decreases the lines appear closer together and weak in intensity
- He found a simple formula for the observed wavelengths:

$$\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$$

Where λ is the wavelength

R is the Rydberg's Constant and n can have any integral value.

Further, for n = ∞, you can get the limit of the series at a wavelength of 364.6 nm. Also, you can't see any lines beyond this only a faint continuous spectrum. Furthermore, like the

Balmer's formula, here are the formulae for the other series:

2. Lyman Series

$$\frac{1}{\lambda} = R\left(\frac{1}{1^2} - \frac{1}{n^2}\right)$$

Where λ is the wavelength

R is the Rydberg's Constant and n can have any integral value

3. P aschen Series

$$\frac{1}{\lambda} = R\left(\frac{1}{3^2} - \frac{1}{n^2}\right)$$

Where λ is the wavelength

R is the Rydberg's Constant and

n can have any integral value

4. Brackett Series

$$\frac{1}{\lambda} = R\left(\frac{1}{4^2} - \frac{1}{n^2}\right)$$

Where λ is the wavelength

R is the Rydberg's Constant and n can have any integral value

5. P fund Series

$$\frac{1}{\lambda} = R\left(\frac{1}{5^2} - \frac{1}{n^2}\right)$$

Where λ is the wavelength

R is the Rydberg's Constant and n can have any integral value

18. Describe have a semiconductor diode is used as a half wave rectifier.

Ans: PN junction diode as rectifier

The process in which alternating voltage or alternating current is converted into direct voltage or direct current is known as rectification. The device used for this process is called as rectifier. The junction diode has the property of offering low resistance and allowing current to flow through it, in the forward biased condition. This property is used in the process of rectification.

Half wave rectifier

A circuit which rectifies half of the a.c wave is called half wave rectifier.

Fig shows the circuit for half wave rectification. The a.c voltage (Vs) to be rectified is obtained across the secondary ends S_1 S_2 of the transformer. The P-end of the diode D is connected to S_1 of the secondary coil of the transformer. The N-end of the diode is connected to the other end S_2 of the secondary coil of the transformer, through a load resistance R_L. The rectified output voltage V_{dc} appears across the load resistance R_L.

SECTION –C (2 × 18 =16)

Note: i) Answer **any two** of the following questions.

ii) Each question carries 8 marks.

iii) All are long answer type questions

19. Explain the formation of stationary wave in an air column enclosed in open pipe, derive the equation for the frequency of the harmonics produced. An open organ pipe 85 cm long is sounded. If the velocity of sound is 340 m/s. what is the fundamental frequency of vibration of air column.

Ans: The air at the closed end is not free to vibrate. Hence a node is formed at the closed end. Air at the open end is free to vibrate with maximum amplitude and antinode is formed at the open end. This is the simplest mode of vibration of an air column closed at one end and is called the fundamental mode.

Each harmonic frequency (fn) is given by the equation fn = n. ... Rearranging this equation leads to f1 = fn / n. So using the fifth harmonic frequency (f5) or the third harmonic frequency (f3), the first harmonic frequency can be calculated.

The fundamental frequency of vibration of the air column is 118.2 Hz.

Explanation:

Given that,

length l = 70 cm

Velocity of sound = 331 m/s

We know that,

The fundamental frequency of closed organ pipe is

$f=v/4l$ .....(I)

Where, v = velocity of sound

l = length

Put the value of equation (I)

$f = 331/4 \times 70 \times 10 \times 2$

$f = 118.2$ Hz

Hence, the fundamental frequency of vibration of the air column is 118.2 Hz.

20. State Kirchhoff's law for an electric network. using these laws deduce the condition for balance in a Wheatstone bridge.

Ans: Kirchhoff's 1st Law: Kirchhoff's first law define as in a circuit, the algebraic sum of the current, which is meeting at any junction or terminal is equal to zero.

Hence, we know that by Kirchhoff's law: The current which entering in a terminal = Current leaves the terminal.

Kirchhoff's 2nd Law: It is applicable for the conservation of energy at any closed circuit.as V=IR Kirchhoff's voltage law is define as for the algebraic sum for product of current & resistance in any closed circuit is equal to the algebraic sum of electromagnetic force (emf) or $\left(\sum v = 0\right)$

Wheatstone Bridge is an electrical circuit, which is used for the accurate measurement of the resistance of a conductor.

In figure P, Q and R known three resistor and X is unknown resistance. A cell E connected across two junctions A and C and a galvanometer G between the junctions B and D adjusting P and is known values. R is varied such that the current though the galvanometer is zero. So, the galvanometer shows null defection and at this condition.

$$\frac{P}{Q} = \frac{X}{R}$$

This is called the balance condition of Wheatstone bridge. At such condition, junction B and D are at the same potential.

21. What is radioactivity? State the law of radioactive decay. Show that radioactive decay is exponential in nature.

they half-life of radium is 1600 years. how much time does 1 g of radium take to reduce to 0.125 g?

Ans: Radioactive decay is the process by which an unstable atomic nucleus loses energy by radiation, such as an alpha particle, beta particle with neutrino or only a neutrino in the case of electron capture, or a gamma ray or electron in the case of internal conversion.

the radioactive decay law states that the probability per unit time that a nucleus will decay is a constant, independent of time. ... The radioactive decay of certain number of atoms (mass) is exponential in time. Radioactive decay law: N = N.e – λt. The rate of nuclear decay is also measured in terms of half-lives.

The half-life of radium is 1600 years. Then it's full life is 3200 years. The to talk time taken for reducing = 0.875×3200 = 2800 years. Hence, the total time taken to 1gram radium to reduce to 0.125 g radium is 2800 years.