MAR THOMA RESIDENTIAL SCHOOL,THIRUVALLA
FIRST TERMINAL EXAMINATION 2017-18

STD XII | **PHYSICS** | **MARK:70**
Section A | **TIME:3h**
(Answer all questions)

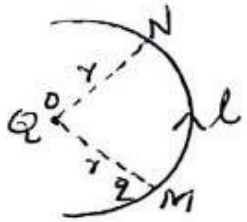
Question 1

A) Choose the correct option [5x1=5]

i) In the given figure , a charge Q is fixed. Another charge 'q' is moved along a circular arc MN of radius 'r' around it,from the point Mto the point N such that the length of the arc MN=l.The work done in the process is:

a) $\frac{1}{4\pi\epsilon_0}\frac{Qql}{r^2}$ b) zero

c) $\frac{Qq}{2\pi\epsilon_0}\frac{l}{r^2}$ d) $\frac{Qq}{2\pi\epsilon_0 r^2}$



ii)A moving electron enters a uniform and perpendicular magnetic field . Inside the magnetic field, the electron travels along:

a)a straight line b)a parabola

c)a circle c)a hyperbola

iii)A concave mirror is immersed in water . As a result,its focal length will

a)increase b)decrease c)double d)remain same

iv)A convex lens of focal length 'f' is combined with a concave lens of focal length 'f'.The power of the combination is:

a)infinity b)doubled c)halved d)zero

v)The potential required to stop the photoelectron from a metal surface is 0.54V.The maximum kinetic energy of photoelectron is:

a)0.864×10^{-19}eV b)0.54eV c)0.54J d)3.57×10^{-34}J

B)

i)Why do we prefer a potentiometer over a voltmeter for measurement of potential difference between two points.

ii)When does a moving charged particle travel undeviated in a uniform magnetic field?

iii)Maximum torque acting on an electric dipole of moment 3×10^{-29}Cm in a uniform electric field E is 6×10^{-25}Nm.Find E.

iv)What is meant by drift velocity of free electron?

v)The angular magnification of a microscope in normal use is 30.What do you mean by this statement?

vi)State the condition for achromatism.

vii)Define threshold wavelength for a metal. [7]

SECTION B

(Answer all questions)

Question 2

With reference to free electron theory, derive the relation between current and drift velocity. (2)

Question 3

How will you determine the internal resistance of a cell using a potentiometer?Draw a labelled diagram . (2)

Question 4

Draw labelled graphs to show how electrical resistance varies with temperature for:i) metallic wire ii) a piece of carbon (2)

Question 5

Three capacitors are connected in parallel across a potential difference 'V'.Obtain the expression for total capacitance.

OR

With the help of a labelled diagram,show that the balancing condition of a Wheatstone bridge is $R_1/R_2 = R_3/R_4$, where the terms have their usual meaning. (2)

Question 6

i)Name the phenomenon responsible for mirage.

ii)For the same angle of incidence,the angles of refraction in three different media A,B and C are 15° ,25° and 35° respectively.In which medium will the velocity of light be maximum? (2)

Question 7

A ray of light incident on an equilateral glass prism shows minimum deviation of 30°.Calculate the speed of light through the glass prism. (2)

Question 8

What is meant by chromatic abberation of a lens?Suggest one method to eliminate this defect. (2)

QUESTION 9

a) For each of the following , state one phenomenon or experiment which confirms
   i)particles behave likewaves
   ii)waves behave like particles

OR

b) Plot a graph of photoelectric current versus potential applied to the emitter plate.In the graph,mark saturation current and stopping potential. (2)

Question 10

Calculate the dispersive power of glass from the following data:
Refractive index of glass for red colour = 1.60, yellow colour=1.61 and for violet colour = 1.62. (2)

Question 11

The intensity of the radiation falling on a metal surface is doubled.How will it affect the following:

i)number of photoelectrons emitted

ii)maximum kinetic energy of the photoelectron (2)

Question 12

What are matter waves?Using Planck's quantum theory, obtain the equation for de Broglie wavelength. (2)

SECTION C

Question 13

Using Gauss' theorem. Obtain an expression for intensity of electric field E at a point , which is at a distance 'r' (r>R) from the centre of athin spherical shell (of radius R) carrying a charge Q. (3)

Question 14

A parallel plate capacitor is charged by a battery , which is then disconnected.A dielectric slab is now introduced between the two plates to occupy the space completely.State the effect on the following:

Capacitance of the capacitor

i) Potential difference between the plates

iii) Energy stored in the capacitor (3)

OR

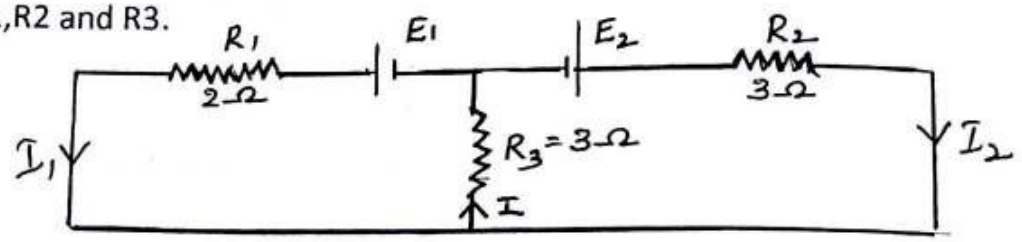
a) Write an expression for intensity of electric field in:

i) Axial position

ii) Broad side on position of an electric dipole in terms of length(2l), dipole moment(p) and distance(r).[derivation not required] . What is the ratio these two intensities E_1:E_2 for a short electric dipole.

Question 15

State Kirchoff's laws.In the circuit shown E_1=17V, E_2=21V, R_1=2Ω,R_2=3Ω,R_3=3 Ω .Using the above law,find the current flowing through the resistors R1,R2 and R3.



(3)

Questin 16

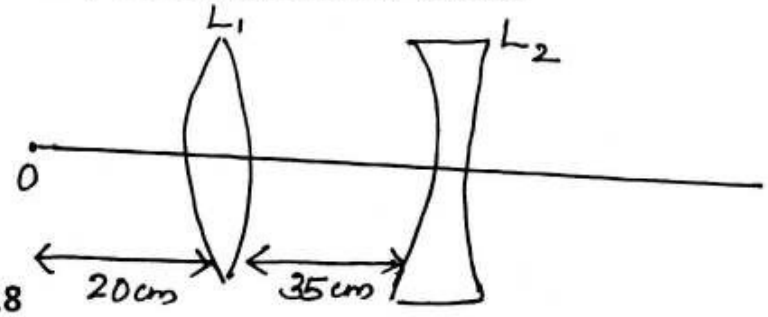
a) Derive 1/f= 1/u +1/v ,for a spherical mirror, where the symbols have their usual meaning.

OR

b) Obtain the expression for refraction at a single convex spherical surface separating two media having refractive indices n1 and n2 ie, a relation between u,v,n1,n2,and R. (3)

Question 17

An illuminated object O is kept 20cm from a thin convex lens L1 of focal length 15cm as shown in figure. A thin diverging lens of focal length 25cm is kept coaxially with the first lens and 35cm from it.Find the position of the final image formed by this combination of lenses.



(3)

Question 18

i) Define work function of a metal.

ii) Write down Einstein's photoelectric equation.

iii) Calculate the work function of sodium metal in eV, if photoelectric threshold wavelength is 5400A°. (3)

Question 19

i) Calculate the de Broglie wavelength of an electron moving with an energy of 100eV.

ii) Which one will have greater de Broglie wavelength: An electron or a proton under the same potential difference.Explain. (3)

SECTION D

Question 20

a) A galvanometer with a coil of resistance 100Ω and a scale having 100 divisions has a current sensitivity 25μA/div. How will you convert it into an ammeter of range 0-5A?

b) Two point charges Q1=400μC and Q2=100μC are kept fixed, 60cm apart in vacuum. Find the intensity of the electric field at mid point of the line joining Q1 and Q2 .

c) A charged oil drop weighing 1.6×10^{-15}N is found to remain suspended in a uniform electric field of intensity 2×10^{3}N/C. Find the charge on the oil drop.

OR

a) An electric dipole of moment $\vec{P}$ is placed in a uniform electric field $\vec{E}$ with its axis inclined to the field. Write down the expression for the torque $\vec{\tau}$ experienced by the dipole in vector form. Show diagrammatically how the dipole should be kept in the electric field so that the torque acting on it is: i) maximum ii) zero

b) Define emf of a cell in terms of work done in moving a charge through the cell. Then obtain the expression emf = I(R + r) using Joule's law. (5)

Question 21

a) Draw a labelled ray diagram of an image formed by a compound microscope in normal adjustment method. Derive an expression for its magnifying power.

OR

b) Draw a neat labelled ray diagram to show the refraction of a ray of light through a glass prism. Hence derive the equation $n = \frac{\sin\left(\frac{A+\delta_m}{2}\right)}{\sin(A/2)}$, where the symbols have their usual meaning. (5)

Question 22

a) i) Draw a graph to show the variation of stopping potential with the frequency of incident radiation. Explain, how will you determine: i) Planck's constant ii) threshold frequency and iii) work function using this graph.

ii) Light of wavelength 3000A° falls on a metal having work function 2eV. Calculate the maximum kinetic energy of the photoelectron emitted.

OR

c) (i) State any four properties of photon.

(ii) A proton and an alpha particle are accelarated through the same potential difference. Compute the ratio of their de Broglie wavelengths.

(iii) Draw a graph showing the variation of de Broglie wavelength with the linear momentum of the particle. (5)