Kajal vati.

MANAVA BHARATI

INDIA INTERNATIONAL SCHOOL

MID TERM EXAMINATION (2015-16)
CLASS – XII   PHYSICS

TIME : 3 HOURS   MAX.MARKS:70
GENERAL INSTRUCTIONS:

- All questions are compulsory.
- There are 26 questions in total.
- Q.No.1-5 carry one mark each. Q.No. 6-10 carry two marks each. Q.No.11-22 carry three marks each. Q. No.23 is a value based question and carries 4 marks. Q.N0.24-26 carry five marks each.
- Use of calculators is not permitted. You may use the following values of physical constants wherever necessary:

$C = 3 \times 10^8$ m/s $h = 6.63 \times 10^{-34}$ Js $e = 1.6 \times 10^{-19}$ C

$\mu_0 = 4\pi \times 10^{-7}$ TmA^{-1} $1/(4\pi\varepsilon_0) = 9 \times 10^9$ Nm^{2}C^{-2}

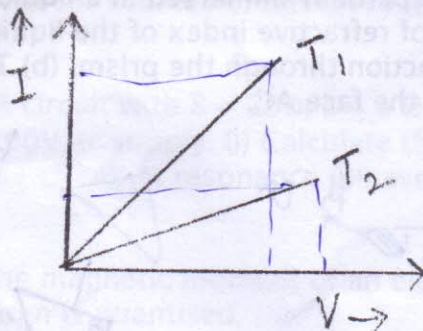$m_e = 9.1 \times 10^{-31}$ kg $m_p = 1.673 \times 10^{-27}$ kg $m_n = 1.675 \times 10^{-27}$ kg

1.   The field lines of a negative point charge are as shown in the figure. Does the kinetic energy of a small negative charge increase or decrease in going from B to A? Justify.
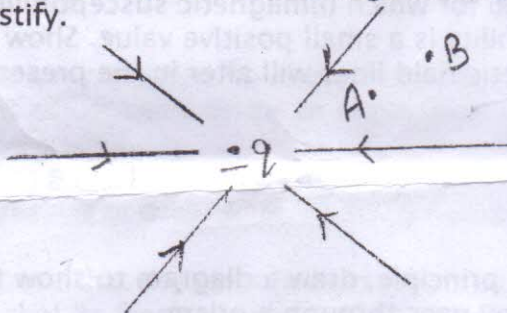

2.   I-V graph for a metallic wire at two different temperatures T1 and T2 are as shown in fig. Which of the two temperatures is lower and why?

$R = R_0(I - \alpha T I)$

3.   A small magnet is pivoted to move freely in the magnetic meridian. At what place on earth's surface will the magnet be vertical?

4.   Why does a metallic piece become very hot when it is surrounded by a coil carrying high frequency alternating current?

5. Name the electromagnetic waves which (i) are produced when fast moving electrons are stopped by a metal target (ii) are used in aircraft navigation.

6. Plot a graph showing the variation of coulomb force (F) versus $(1/r^2)$, where r is the distance between the two charges of each pair of charges : $(1\mu c, 2\mu C)$ and $(2\mu C, -3\mu C)$. Interpret the graphs obtained.

7. (a) Define the term potential gradient of a potentiometer. Obtain an expression for the potential gradient in terms of resistivity of the potentiometer wire.
(b) Fig. shows a long potentiometer wire AB having a constant potential gradient. The null points for the two primary cells of emfs E1 and E2 connected in the manner shown are obtained at a distance of $l1 = 120cm$ and $l2 = 300cm$ from the end A. Determine the ratio E1/E2 .
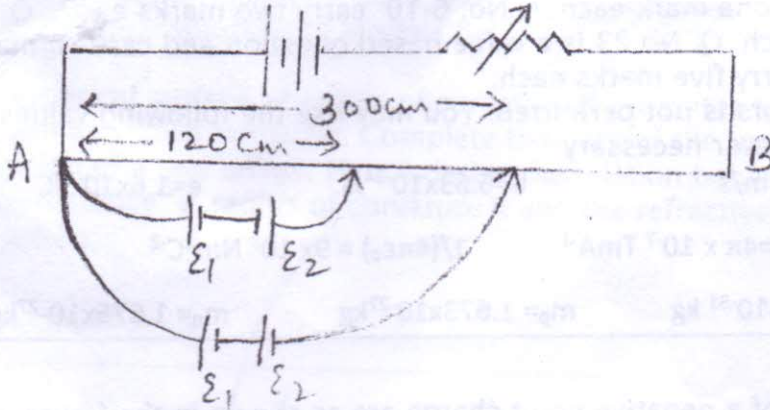
8. Identify the class of magnetic material for which (i)magnetic susceptibility is a small negative value (ii) magnetic susceptibility is a small positive value. Show diagramatically , how uniform magnetic field lines will alter in the presence of the above materials.

9. Show that the magnetic energy required to build up the current I in a coil of self inductance L is given by $(½)LI^2$

10. What is a wave front? Using Huygens principle, draw a diagram to show the behaviour of plane wave fronts as they pass through a prism.

11. A ray of light is incident normally on the face AB of a right-angled glass prism of refractive index = 1.5. The prism is partially immersed in a liquid of unknown refractive index. (a) Find the value of refractive index of the liquid so that the ray grazes along the face BC after refraction through the prism. (b) Trace the path of the rays if it were incident normally on the face AC.
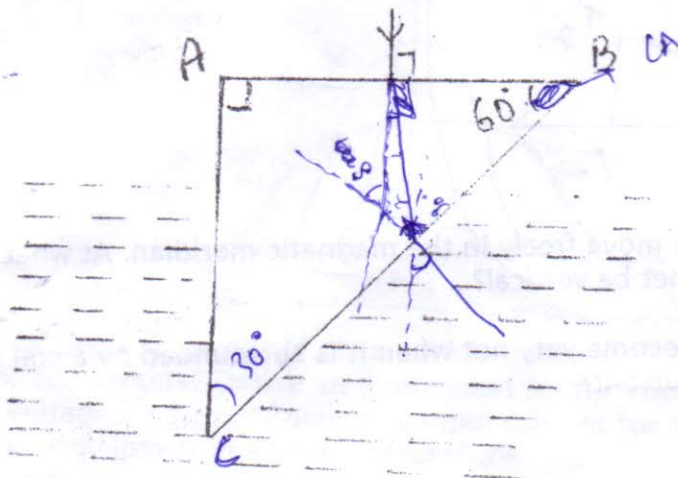
12. Calculate the potential difference and the energy stored in the capacitor C_2 in the circuit shown in the fig. Given that the potential at A is 90V , $C_1=20\mu F$,$C_2=30\mu F$, $C_3=15\mu F$.

A ⊢⊣C_1⊢⊣C_2⊢⊣C_3⊣⏚
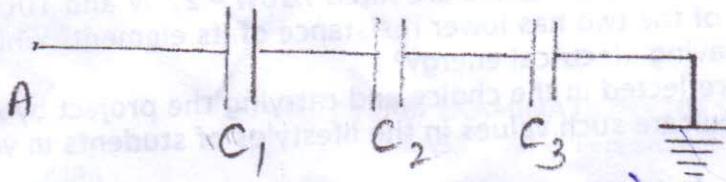
13. Define the term 'drift velocity'. Hence derive an expression for current and current density in terms of relaxation time.

14. Deduce a condition for constructive and destructive interference in Young's double slit experiment.

15. A galvanometer of resistance G is converted into a voltmeter to measure up to V volt by connecting a resistance R_1 in series with the coil. If a resistance R_2 is connected in series with it, then it can measure up to V/2 volt. Find the resistance, in terms of R_1 and R_2 , required to be connected to convert it into a voltmeter that can read up to 2V volt. Also find the resistance G of the galvanometer in terms of R_1 and R_2.

16. An alternating voltage $V=V_0\sin(wt)$ is applied to a series LCR circuit and the current is $I=I_0\sin(wt+\phi)$. Deduce an expression for the average power dissipated over a cycle.

17. Draw a ray diagram to show image formation by a compound microscope in near point adjustment. Write an expression for the magnifying power.

18. Derive an expression for self inductance of a long air cored solenoid of length 'l', cross-section area 'A' and having number of turns 'N'.

19. Suppose that the electric field amplitude of an electromagnetic wave is $E_0=120N/C$ and that its frequency is $v=50$ MHz. Find an expression for E and B. Assume that the wave is propagating in the x-direction.

20. What are coherent sources of light? Prove Snell's law of refraction using Huygens wave theory.

21. A series LCR circuit with R = 20Ω, L = 4 H , C = $(1/\pi)^2$ μF is connected to a variable frequency 200V ac supply. (i) Calculate the resonating frequency. (ii) peak value of current in the circuit at resonance (iii) average power transferred to the circuit in resonance.

22. Show that the magnetic moment of an electron going around the nucleus in a hydrogen atom is quantised.

23. Amit carries out a physics project on electric energy consumption and the electricity bill for some houses near his residence. The survey also includes the list of electrical appliances regularly used in different houses and the general awareness and precautions observed by families to save electrical energy and excessive expenditure incurred on payment of electricity bills. The findings of his study were

shared with the residents as well as his classmates. He highlighted the importance of saving electrical energy and explained how the consumption can be minimised. Answer the following questions based on the above information:

(i) Two different electric irons A and B are rated 750W – 220V and 1000W – 220V respectively. Which of the two has lower resistance of its element? Which of the two will you prefer for saving electrical energy?

(ii) What values are reflected in the choice and carrying the project by Amit?

(iii) How will you inculcate such values in the lifestyles of students in your school?

24. (a) Using Gauss law, derive an expression for electric field at any point due to an infinite sheet of charge having charge density ' $+\sigma$ '.

(b) An electric dipole of length 10cm having charges $\pm 6 \times 10^{-3}$ C, placed at 300 with respect to a uniform electric field, experiences a torque of magnitude $6\sqrt{3}$ Nm. Calculate the magnitude of electric field. (3+2)

25. (a) A spherical surface of radius of curvature R separates a rarer and a denser medium as shown in the fig. Complete the path of the incident ray, showing the formation of a real image. Hence derive the relation between object distance 'u', image distance 'v' radius of curvature R and the refractive indices μ_1 and μ_2 of the two media.
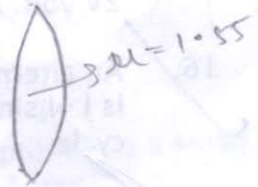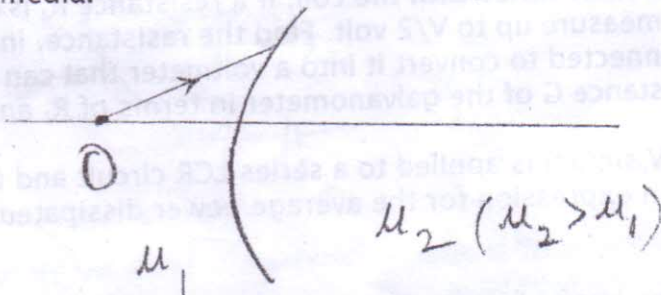
(b) Double convex lenses are to be manufactured from a glass of refractive index 1.55, with both faces of the same radius of curvature. What is the radius of curvature required if the focal length is to be 20cm? (3+2)

26. (a) Three students X, Y, Z performed an experiment for studying the variation of alternating currents with angular frequency in a series LCR circuit and obtained the graphs shown below. They all used a.c. sources of the same r.m.s. value and inductances of the same value. What can we (qualitatively) conclude about the
(i) capacitance value used   (ii) resistance values used ?
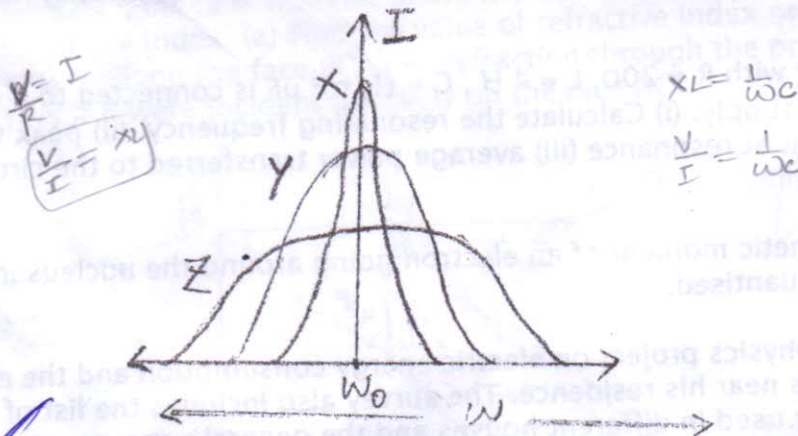
(b) On what principle does a transformer work? What are the two types of transformers? Derive an expression for the ratio of its (i) output voltage to input voltage (ii) output current to input current for an ideal transformer. Mention any two energy losses in an actual transformer. (2+3)