

MID TERM EXAMINATION

Class 12 - Physics

Time Allowed: 3 hours

Maximum Marks: 50

Section A

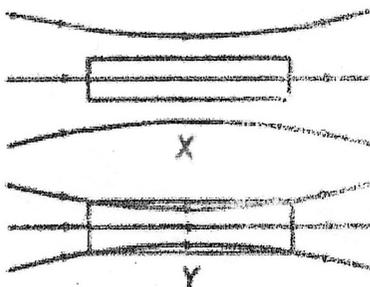
1. Electrostatic forces are much stronger than gravitational forces. Give one example. [1]
2. Charges of  $+1.0 \times 10^{-11} \text{C}$ ,  $-2.0 \times 10^{-11} \text{C}$ ,  $+1.0 \times 10^{-11} \text{C}$  are placed respectively at the corners B, C and D of a rectangle ABCD. Determine the potential at the corner A. Given  $AB = 4 \text{ cm}$  and  $BC = 3 \text{ cm}$ . [1]
3. Write two special characteristics of the wire of an electric heater. [1]
4. A proton is moving along positive X-axis in the presence of uniform magnetic field along negative Y-axis. What is the direction of the force acting on it?  $(-Z)$  [1]
5. Classify the following into dia and para magnetic substances: aluminium, copper, water, mercury, oxygen, hydrogen.   

D	D	P	D	D
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 [1]
6. Can two magnetic lines of force intersect? Justify your answer. [1]

Section B

7. a. Obtain the expression for the torque  $\vec{\tau}$  experienced by an electric dipole of dipole moment  $\vec{p}$  in a uniform electric field  $\vec{E}$ . [2]  
 b. What will happen if the field were not uniform?  
 c. What would happen if the external field  $\vec{E}$  is increasing  
 i. parallel to  $\vec{p}$  and  
 ii. anti-parallel to  $\vec{p}$ ?
8. Two identical cells of emf 1.5 V each joined in parallel provide supply to an external circuit consisting of two resistances of  $17 \Omega$  each joined in parallel. A very high resistance voltmeter reads the terminal voltage of cells to be 1.4 V. Calculate the internal resistance of each cell. [2]
9. (1) How does angle of dip change as line goes from magnetic pole to magnetic equator of the earth? [2]  
 (2) A uniform magnetic field gets modified as shown in the figure below, when two specimens X and Y are placed in it. Identify whether specimens X and Y are diamagnetic, paramagnetic or ferromagnetic.

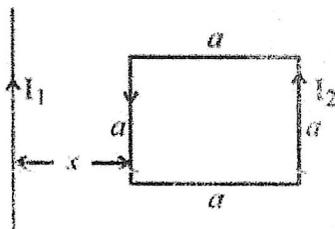


10. An iron ring having 500 turns of wire and a mean diameter of 12 cm carries a current of 0.3 A. The relative permeability of iron is 600. What is the magnetic flux density in the core? What is the magnetisation field intensity? What part of the flux density is due to the electronic loop currents in the core? [2]

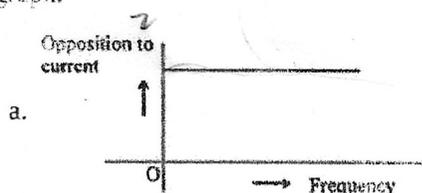
11. For more free downloads visit [www.learncartoon.com](http://www.learncartoon.com) or [www.learncartoon.com](http://www.learncartoon.com) of 200 sites in one click. A rectangular coil of size  $0.3 \text{ m} \times 0.1 \text{ m}$  is rotating in a magnetic field of induction  $0.005 \text{ Wb m}^{-2}$  with a frequency of revolution 1800 rpm about an axis normal to the field. Calculate the maximum value of induced emf. [2]
12. The primary coil having  $N_p$  turns of an ideal transformer is supplied with an alternating voltage  $V_p$ . Obtain an expression for the voltage  $V_s$  induced in its secondary coil having  $N_s$  turns. Mention two main sources of power loss in real transformers. [2]
13. Show, by giving a simple example, how EM waves carry energy and momentum. [2]
14. State Maxwell equations. [2]

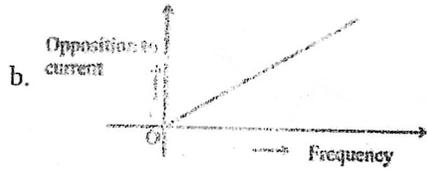
### Section C

15. a. Define electric flux. Write its SI unit. [3]  
 b. Using Gauss' law, prove that the electric field at a point due to a uniformly charged infinite plane sheet is independent of distance from it.  
 c. How is the field directed if  
 i. the sheet is positively charged?  
 ii. negatively charged?
16. A small sphere of radius  $r_1$  and charge  $q_1$  is enclosed by a spherical shell of radius  $r_2$  and charge  $q_2$ . Show that if  $q_1$  is positive, charge will necessarily flow from the sphere to the shell (when the two are connected by a wire) no matter what the charge  $q_2$  on the shell is. [3]
17. a. Three resistors  $2\Omega$ ,  $4\Omega$  and  $5\Omega$  are combined in parallel. What is the total resistance of the combination? [3]  
 b. If the combination is connected to a battery of emf 20 V and negligible internal resistance, determine the current through each resistor, and the total current drawn from the battery?
18. The coil of a galvanometer consists of 250 turns of fine wire wound on a  $2.0 \text{ cm} \times 1.0 \text{ cm}$  rectangular frame. It is suspended in a uniform radial magnetic field of strength 2,000 G. A current of  $10^{-4} \text{ A}$  produces an angular deflection of  $30^\circ$  in the coil. Find the torsional constant of its suspension. [3]
19. a. Define mutual inductance and write its S.I. unit. [3]  
 b. A square loop of side  $a$  carrying a current  $I_2$  is kept at a distance  $x$  from an infinitely long straight wire carrying a current  $I_1$  as shown in the figure. Obtain the expression for the resultant force acting on the loop.



20. i. The graphs (a) and (b) represent the variation of the opposition offered by the circuit element to the flow of alternating current with frequency of the applied emf. Identify the circuit element corresponding to each graph. [3]

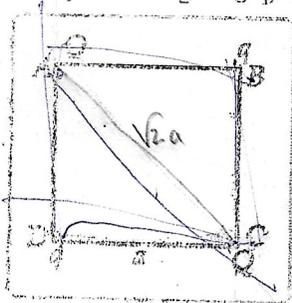




- ii. Write the expression for the impedance offered by the series combination of the above two elements connected across the AC sources. Which will be ahead in phase in this circuit, voltage or current?

**Section D**

21. Four point charges  $Q, q, Q$  and  $q$  are placed at the corners of a square of side  $a$  as shown in the figure. [5]



Find the

- i. Resultant electric force on a charge  $Q$ ; and
  - ii. Potential energy of this system.
22. a. Draw the schematic sketch of a cyclotron. Explain the shape of the path on which charged particle moves when the particle is accelerated by it. [5]
- b. To convert a given galvanometer into a voltmeter of ranges  $2\sqrt{3} V$  and  $\frac{V}{2}$  volt, resistances  $R_1, R_2$  and  $R_3$  ohm respectively, are required to be connected in series with the galvanometer. Obtain the relationship between  $R_1, R_2$  and  $R_3$ .