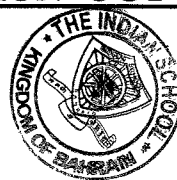


THE INDIAN SCHOOL, KINGDOM OF BAHRAIN
SECOND TERMINAL EXMINATION- OCT 2017.

STD: XII
SUBJECT: PHYSICS



MARKS: 70
TIME: 3 HOURS

General Instructions:

- All questions are compulsory. There are 26 questions in all.
- This question paper has five sections: section A, section B, section C, section D, section E,
- Section A contains **five** questions of **one** mark each; Section B contains **five** questions of **two** marks each, Section C contains **twelve** questions of **three** marks each; Section D contains **one** value based question of **four** marks and Section E contains **three** questions of **five** marks each.
- There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all the three questions of five marks weightage. You have to attempt only one of the choices in such questions.
- Please write down the serial number of the question before attempting it.
- You may use the following values of physical constants where ever necessary:
Permittivity in free space (ϵ_0) = 8.85×10^{-12} F/meter
Permeability in free space (μ_0) = $4 \pi \times 10^{-7}$ T m A⁻¹
Mass of electron (m_e) = 9.1×10^{-31} kg.
Velocity of Light (C) = 3×10^8 m/sec
Plank's Constant (h) = 6.626×10^{-34} J. Sec
Mass of Proton (m_p) = 1.67×10^{-27} kg
Charge on electron or proton (e) = 1.6×10^{-19} C
Avogadro's number (N) = 6.023×10^{23}
- Use of calculators is not permitted. However, you may ask log table, if necessary.

SECTION -A

- Find the condition under which the charged particles moving with different speeds in the presence of electric and magnetic field vectors can be used to select charged particles of a particular speed.
- Nichrome and copper wires of same length and same radius are connected in series. Current 'I' is passed through them. Which wire gets heated up more? Justify your answer.
- How does the angle of minimum deviation of a glass prism vary, if the incident violet light is replaced by red light? Give reason.
- Identify the electromagnetic waves whose wavelengths vary as
(a) $10^{-12} \text{ m} < \lambda < 10^{-8} \text{ m}$
(b) $10^{-3} \text{ m} < \lambda < 10^{-1} \text{ m}$
- An ac source of voltage $V = V_0 \sin \omega t$ is connected to an ideal inductor. Draw graphs of voltage 'V' and current 'I' verses ωt .

SECTION B

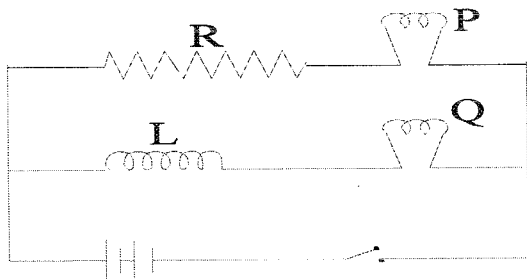
- Sketch graph to show how charge Q given to a capacitor of capacity C varies with the potential difference V . Prove that the total energy stored in a parallel plate capacitor is $\frac{1}{2} CV^2$.

OR

A parallel plate capacitor is charged to potential V by a source of emf. After removing the source, the separation between the plates is doubled. How will the following change (i) electric field and (ii) capacitance of the capacitor Justify your answer

- The electric field at a point due to a point charge is 20 N/C and electric potential at that point is 10 J/C. Calculate the distance of the point from the charge and the magnitude of the charge.
- If a rate of change of current of 2 A/s induces an e.m.f. of 10 mV in a solenoid, what is the self-inductance of the solenoid?

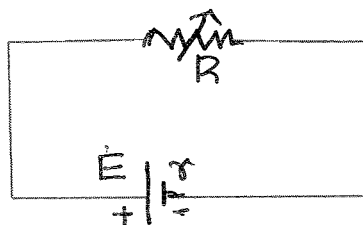
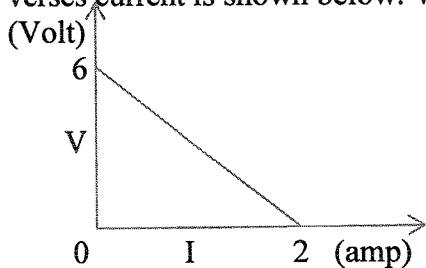
9. Suppose that the electric field amplitude of an electromagnetic wave is $E_0 = 120 \text{ N/C}$ and that its frequency = 50.0 MHz . determine B_0 , ω and λ .
10. The given figure shows an inductor L and resistor R connected in parallel to a battery B through a switch S . The resistance of R is the same as that of the coil that makes L . Two identical bulbs, P and Q are put in each arm of the circuit as shown in fig. When S is closed, which of the two bulbs will light up earlier? Justify your answer.



SECTION: C

11. Derive an expression for the force and the torque on an electric dipole kept in a uniform electric field.

12. (a) The plot of the variation of potential difference across a combination of three identical cells in series, versus current is shown below. What is the emf and internal resistance of each cell?



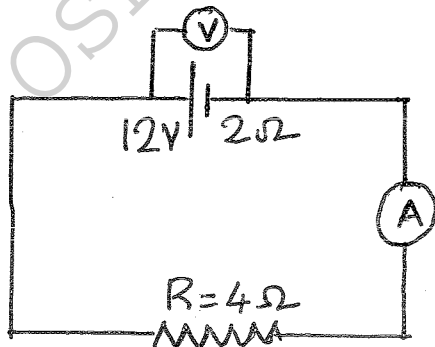
- (b) A variable resistor R is connected across a cell of emf E and internal resistance r . Plot a graph showing the variation of (i) Terminal voltage V and (ii) The current I , as a function of R .

13. Explain with the help of a labeled diagram, the underlying principle, and working of a cyclotron.

14. A ray of light passing from air through an equilateral glass prism undergoes minimum deviation when the angle of incidence is $4/3$ th of the angle of prism. Calculate the speed of light in the prism.

15. (a) The potential difference applied across a given resistor is altered so that the heat produced per second increases by a factor of 9. By what factor does the applied potential difference change?

- (b) In the figure shown, an ammeter A and a resistor of 4Ω are connected to the terminals of the source. The emf of the source is 12 V having an internal resistance of 2Ω . Calculate the voltmeter and ammeter readings.



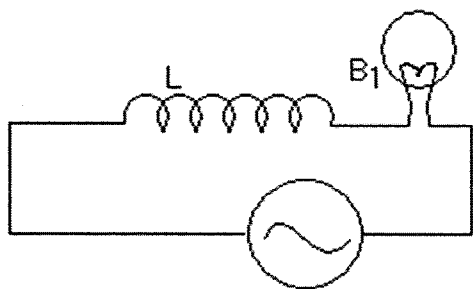
16. Monochromatic light of wavelength 589 nm is incident from air on a water surface. If refractive index for water is 1.33 , find the wavelength, frequency and speed of the refracted light.

17. (a) What is the angle of dip at a place where the horizontal and vertical components of earth's magnetic fields are equal?
- (b) The susceptibility of a magnetic material is -0.085 . Identify the magnetic type of material, give an example. A specimen of this material is kept in a uniform magnetic field. Draw the modified field pattern.
18. A galvanometer with a coil of resistance 12.0 ohms shows full scale deflection for a current of 50 mA. How will you convert the galvanometer into (a) an ammeter of range 0 to 0.5 A
(b) a voltmeter of range 0 to 10 volts?
19. Distinguish between reactance and impedance. When a series combination of a coil of inductance L and a resistor of resistance R is connected across a 12 V, 50 Hz supply, a current of 0.5 A flows through the circuit. The current differs in phase from applied voltage by $\pi/3$ radian. Calculate the value of L and R .
20. Derive an expression for the average power dissipated in a series LCR circuit.

OR

An inductor L of reactance X_L is connected in series with a bulb B to an A.C. source as shown in the figure. Briefly explain how does the brightness of the bulb change when

- (a) Number of turns of the inductor is reduced and
- (b) A capacitor of reactance $X_C = X_L$ is included in series in the same circuit.



21. Define displacement current. What should be done to produce a displacement current of 5 mA in a capacitor of capacitance 10 μ F.
22. (a) Derive the mirror formula, with the help of ray diagram for an object, kept just beyond the center of curvature of a concave mirror.
- (b) Draw the graph showing the variation of (i) u versus v and
(ii) $1/u$ versus $1/v$ for the same mirror.

SECTION: D

23. Asha's uncle was advised by his doctor to have a MRI (magnetic resonance imaging) scan of his brain. Her uncle felt that it was too expensive and wanted to postpone it. When Asha learnt about this, she took the help of her family and when approached the doctor he also offered a substantial discount. She thus convinced her uncle to undergo the test to enable the doctor to know the condition of his brain. The resulting information greatly helped his doctor to treat him properly.
- Based on the above paragraph, answer the following questions:
- (a) What according to you are the values displayed by Asha, her family and the doctor?
- (b) What in your view could be the reason for MRI test to be so expensive?
- (c) Assuming that MRI test was performed using a magnetic field of 0.01 T, find the maximum and minimum values of the force that the magnetic field could exert on a proton that was moving with a speed of 10^4 m/s.

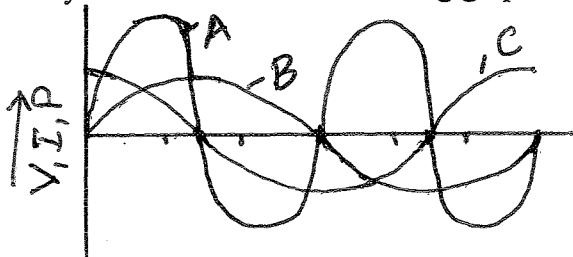


SECTION : E

24. (a) Derive an expression for the electric field E due to a dipole of length '2a' at a point distant r from the centre of the dipole on the axial line.
 (b) Draw a graph of E versus r for $r \gg a$.
 (c) If this dipole were kept in a uniform external electric field E_0 , diagrammatically represent the position of the dipole in stable and unstable equilibrium and write the expressions for the torque acting on the dipole in both the cases.

OR

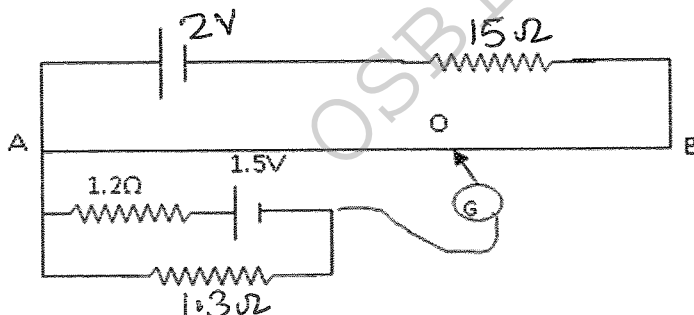
- (a) Use Gauss's theorem to find the electric field due to a uniformly charged infinitely large plane thin sheet with surface charge density σ .
 (b) An infinitely large thin plane sheet has a uniform surface charge density $+\sigma$. Obtain the expression for the amount of work done in bringing a point charge q from infinity to a point, distant r , in front of the charged plane sheet.
25. A device 'X' is connected to an ac source $V = V_0 \sin \omega t$. The variation of voltage, current and power in one cycle is shown in the following graph :



- (a) Identify the device 'X'.
 (b) Which of the curves A, B and C represent the voltage, current and the power consumed in the circuit ? Justify your answer.
 (c) How does its impedance vary with frequency of the ac source ? Show graphically.
 (d) Obtain an expression for the current in the circuit and its phase relation with ac voltage.

OR

- (a) Draw a labelled diagram of an ac generator. Obtain the expression for the emf induced in the rotating coil of N turns each of cross-sectional area A , in the presence of a magnetic field B .
 (b) A horizontal conducting rod 10 m long extending from east to west is falling with a speed 5.0 ms^{-1} at right angles to the horizontal component of the Earth's magnetic field, $0.3 \times 10^{-4} \text{ Wb m}^{-2}$. Find the instantaneous value of the emf induced in the rod.
26. (a) State the working principal of a potentiometer.
 (b) Write two possible causes for one sided deflection in the potentiometer experiment.
 (c) AB is 1m long uniform wire of 10Ω resistance. The other data are shown in the circuit diagram. Calculate (i) Potential gradient along AB, and (ii) length AO of the wire, when the galvanometer shows no deflection.



OR

- (a) Define the term drift velocity of charges in a conductor.
 (b) Derive a relation between current and drift velocity.
 (c) Using the above expression deduce Ohm's law.
