

Sample Paper – 2010
Class – XII
Subject – Physics

Time: 3 Hrs

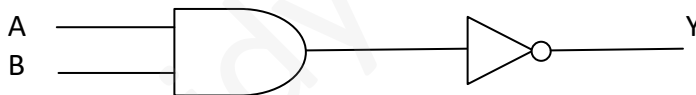
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General Instructions:

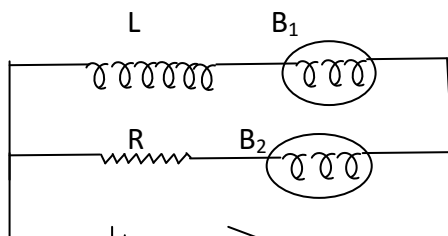
- All questions are compulsory.
- There are 30 questions in total. Questions 1 to 8 carry 1 mark each, questions 9 to 18 carry 2 marks each, questions 19 to 27 carry 3 marks each and questions 28 to 30 carry 5 marks each.
- There is no overall choice. However, an internal choice has been provided in 1 question of 2 marks, 1 question of 3 marks and all the 3 questions of 5 marks. You have to attempt only one of the given choices in such questions.
- Use of calculators is not permitted.
- You may use the following physical constants wherever necessary.

$e = 1.6 \times 10^{-19} \text{C}$, $\mu_0 = 4\pi \times 10^{-7} \text{TmA}^{-1}$, $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{Nm}^2\text{C}^{-2}$, Avagadro's Number $N_A = 6.023 \times 10^{23} / \text{mole}$

1. An electric dipole of dipole moment $20 \times 10^{-6} \text{ Cm}$ is enclosed by a closed surface. What is the net flux coming out of the surface?[1]
2. Which orientation of a magnetic dipole in a uniform magnetic field will correspond to its stable equilibrium?[1]
3. Draw a graph to show the variation of capacitive reactance with frequency of an a.c. source.[1]
4. Which part of electromagnetic spectrum has largest penetrating power?[1]
5. Draw a graph showing the variation of intensity of polarized light transmitted by the analyser.[1]
6. Name the experiment, which establishes the wave nature of a particle.[1]
7. State two properties of nuclear forces.[1]
8. Write the truth table for the combination of gates shown here.[1]

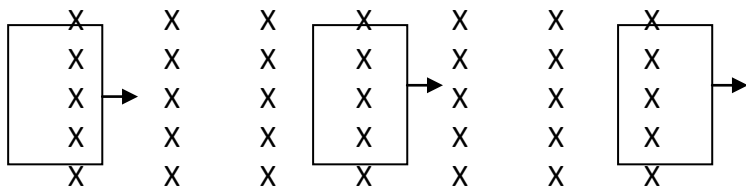


9. A charge q is placed at the center of the line joining to equal charges Q . Show that the system of three charges will be in equilibrium if $q = -Q/4$. [2]
10. Show mathematically that potential at a point on the equatorial line of an electric dipole is zero. [2]
11. A storage battery of emf 12 V and internal resistance 0.5Ω is to be charged by a 120 V d.c. supply of negligible internal resistance. What resistance is required in the circuit for the charging current to be 3 A ? What is the terminal voltage of the battery during charging? [2]
12. Using Ampere circuital law derive an expression for the magnetic field along the axis of a toroidal solenoid. [2]
13. Derive the expression for the self-inductance of a solenoid. [2]
14. In a given circuit inductor L and resistor R have identical resistance. Two similar electric lamps B_1 and B_2 are connected as shown. When switch S is closed, (i) which one of the lamps lights up earlier (ii) will the lamps be equally bright after some time? Justify your answer. [2]



OR

A uniform magnetic field exist normal to the plane of a paper over a small region of space. A rectangular loop of wire is slowly moved with a uniform velocity across the field as shown. Draw the graph showing the variation of (i) magnetic flux linked with the loop and (ii) the induced emf in the loop with time.



15. Identify the part of the electromagnetic spectrum which is [2]
 - I. Suitable for Radar system used in aircraft navigation
 - II. Adjacent to the low frequency end of the electromagnetic spectrum.
 - III. Produced in nuclear reaction.
 - IV. Produced by bombarding of metal target by high speed electrons.
16. What is the phenomenon of polarization? Derive the relation connecting the polarizing angle of a medium and its refractive index. [2]
17. A difference of 2.3 eV separates two energy levels in an atom. What is the frequency of radiation emitted when the atom make a transition from the upper level to the lower level? [2]
18. Distinguish between point to point and broadcast communication modes. Give one example of each. [2]
19. A parallel plate capacitor is charged to a potential difference V by a d.c. source. The capacitor is then disconnected from the source. If the distance between the plates is doubled, state with reason how the following will change (i) electric field between the plates, (ii) capacitance (iii) energy stored in the capacitor. [3]

OR

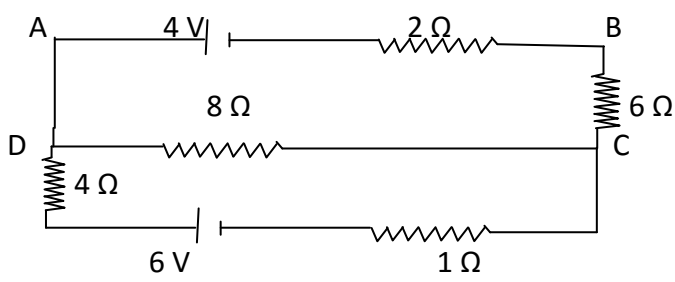
Define capacitance of a capacitor. Give its SI unit. Prove that total energy stored in the parallel plate capacitor is $\frac{1}{2} CV^2$.

20. A circular coil of 'n' turns and radius 'r' is kept normal to a magnetic field given by $B = B_0 \cos \omega t$. Deduce an expression for emf induced in this coil. State the rule which helps to detect the direction of induced current. [3]
21. Two narrow slits are illuminated by a single monochromatic source. Name the pattern obtained on the screen. One of the slit is now completely covered. What is the name of the pattern now obtained on the screen? Draw intensity pattern obtained in the two cases. Also write two differences between the patterns obtained in the above two cases.
22. Draw a labeled ray diagram to show how an image is formed by compound microscope. On what factors will (i) its resolving power and (ii) its magnifying power depend?
23. Sketch the graphs showing the variations of stopping potential with frequency of incident radiations for two photosensitive materials A and B having threshold frequencies $\nu_0 > \nu_0'$ respectively. (i) Which of two metals, A or B has higher work functions? (ii) What information do you get from the slope of the graphs? (iii) What does the value of intercepts of graph A on the potential axis represents?
24. Calculate the binding energy per nucleon (in MeV) of the nucleus ${}_{26}^{56}\text{Fe}$. [given: mass of proton = 1.00783 u, mass of neutron = 1.00867 u, mass of ${}_{26}^{56}\text{Fe} = 55.934939$ u, $1 \text{ u} = 931 \text{ MeV}/c^2$]
25. Draw the circuit diagram to show the use of transistor as an oscillator. State how the positive feedback is provided in the circuit.
26. What is an intrinsic semiconductor? How can this material be converted into (i) p-type (ii) n-type extrinsic semiconductor? Explain with the help of energy band diagrams.

27. What is amplitude modulation? Represent the process graphically. Write its two limitations.

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28. State Kirchhoff's laws of an electrical network. Using Kirchhoff's laws calculate the potential difference across the $8\ \Omega$ resistor.



Or

State the working principal of potentiometer. Explain, with the help of circuit diagram, how the emf of two primary cells are compared by using a potentiometer.

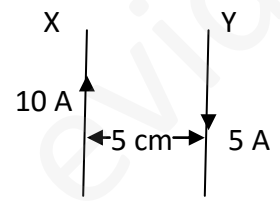
In a potentiometer arrangement, a cell of emf 1.2 V gives a balance point at 30 cm length of the wire. This cell is now replaced by another cell of unknown emf. If the ratio of the emfs of two cells is 1.5 calculate the difference in the balancing length of the potentiometer wire in two cases.

29. State Biot-Savarts law. Using Biot-Savarts law, drive an expression for magnetic field at the centre of circular coil of number of turns 'N', radius 'r' and carrying a current 'I'. a semi circular arc of radius 20 cm carries a current of 10 A. Calculate the magnetic field at the centre of arc.

Or

Depict the magnetic field lines due to two straight, long, parallel conductors carrying current I_1 and I_2 in the same direction. Hence deduce an expression for the force acting per unit length on one conductor due to the other.

Two long parallel straight wires X and Y separated by a distance of 5 cm in air carrying currents of 10 A and 5 A respectively in opposite directions. Calculate the magnitude in the direction of the force on a 20 cm length of the wire Y.



30. Drive the expression for the refractive index of the material of the prism in the terms of the angle of prism and the angle of minimum deviation. Use this formula to calculate the angle of minimum deviation for an equilateral triangular prism of refractive index $\sqrt{3}$.

Or

- a) Drive the lens equation for a biconvex lens.
- b) A beam of light converges to a point P. A lens is placed in the path of the convergent beam 12 cm from P. At what point does the beam converge if the lens is (i) a convex lens of 20 cm focal length and (ii) a concave lens of 60 cm focal length.