INDIAN SCHOOL SOHAR
TERM- II EXAMINATION 2018-19
PHYSICS (THEORY)

No. of printed pages: 6

CLASS: XII **Max Marks: 70**
DATE: 22/11/2018 **Duration: 3 Hours**

General Instructions:

1. All questions are compulsory. There are 27 questions in all.
2. This question paper has four sections: Section A, Section B, Section C and Section D.
3. Section A contains five questions of one mark each, Section B contains seven questions of two marks each, Section C contains twelve questions of three marks each, and Section D contains three questions of five marks each.
4. There is no overall choice. However, internal choices have been provided in two questions of one mark, two questions of two marks, four questions of three marks and three questions of five marks weightage. You have to attempt only one of the choices in such questions.
5. 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

$\mu_o = 4\pi \times 10^{-7}$ T m A^{-1}

$\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2 N^{-1} m^{-2}$

$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^{9}$ N m^2 C^{-2}

$m_e = 9.1 \times 10^{-31}$ kg

mass of neutron = 1.675×10^{-27} kg

mass of proton = 1.673×10^{-27} kg

Avogadro's number = 6.023×10^{23} per gram mole

Boltzmann constant = 1.38×10^{-23} JK^{-1}

Section A

1. Name the electromagnetic radiations used for (a) water purification, and (b) eye surgery.

OR

Which part of the electromagnetic spectrum has the largest penetrating power?

2. Why should electrostatic field be zero inside a charged conductor?

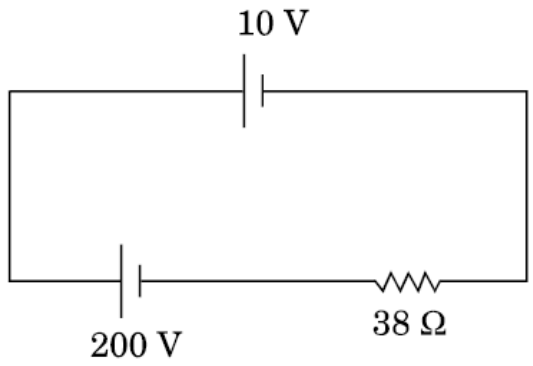
OR

Define electric flux. Write its SI unit.

3. Two charges of magnitudes -3Q and +2Q are located at points (a, 0) and (4a, 0) respectively. What is the electric flux due to these charges through a sphere of radius '5a' with its centre at the origin?
4. Depict the behavior of magnetic field lines in the presence of a diamagnetic material.
5. Name the physical quantity which is the ratio of magnetic flux and induced current? Write its SI unit.

Section A

6. A 10 V cell of negligible internal resistance is connected in parallel across a battery of emf 200 V and internal resistance 38 Ω as shown in the figure. Find the value of current in the circuit.



OR

In a potentiometer arrangement for determining the emf of a cell, the balance point of the cell in open circuit is 350 cm. When a resistance of 9 Ω is used in the external circuit of the cell, the balance point shifts to 300 cm. Determine the internal resistance of the cell.

7. Draw the intensity pattern for single slit diffraction and double slit interference. Hence, state two differences between interference and diffraction patterns.

OR

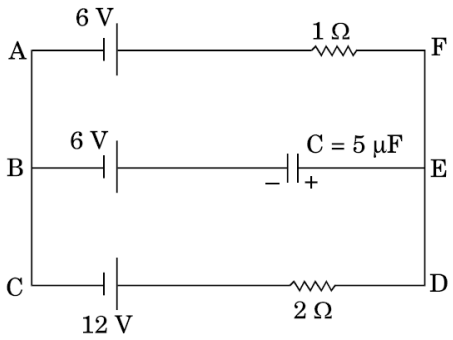
Unpolarised light is passed through a polaroid P_1. When this polarised beam passes through another polaroid P2 and if the pass axis of P_2 makes angle θ with the pass axis of P_1, then write the expression for the polarised beam passing through P_2. Draw a plot showing the variation of intensity when θ varies from 0 to 2π.

8. 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.
9. Write two properties of a material suitable for making (a) a permanent magnet, and (b) an electromagnet.
10. Obtain the expression for the energy stored in an inductor L connected across a source of emf.
11. Write two points of difference between intrinsic and extrinsic Semiconductors.

12. Use the mirror equation to show that an object placed between f and 2f of a concave mirror forms an image beyond 2f.

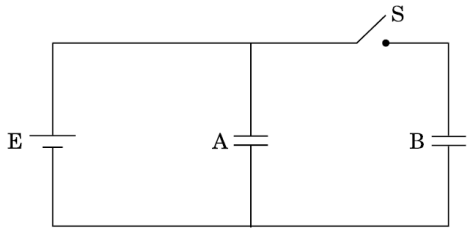
Section A

13. A charge Q is distributed uniformly over a metallic sphere of radius R. Obtain the expressions for the electric field (E) and electric potential (V) at a point $0 < x < R$. Show on a plot the variation of E and V with x for $0 < x < 2R$.
14. In the given circuit, with steady current, calculate the potential difference across the capacitor and the charge stored in it.



OR

Two identical parallel plate capacitors A and B are connected to a battery of V volts with the switch S closed. The switch is now opened and the free space between the plates of the capacitors is filled with a dielectric of dielectric constant K. Find the ratio of the total electrostatic energy stored in both capacitors before and after the introduction of the dielectric

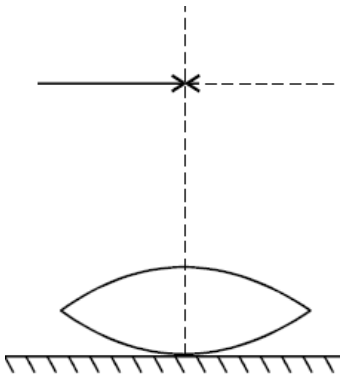


15. (a) Define the term 'conductivity' of a metallic wire. Write its SI unit.
    (b) Using the concept of free electrons in a conductor, derive the expression for the conductivity of a wire in terms of number density and relaxation time. Hence obtain the relation between current density and the applied electric field E.
16. (a) Define SI unit of current in terms of the force between two parallel current carrying conductors.
    (b) Two long straight parallel conductors carrying steady currents $\mathbf{I_a}$ and $\mathbf{I_b}$ along the same direction are separated by a distance d. How does one explain the force of attraction between them? If a third conductor carrying a current $\mathbf{I_c}$ in the opposite direction is placed just in the middle of these conductors, find the resultant force acting on the third conductor.

OR

(a) State Biot – Savart law and express this law in the vector form.
(b) Two identical circular coils, P and Q each of radius R, carrying currents 1 A and √3 A respectively, are placed concentrically and perpendicular to each other lying in the XY and YZ planes. Find the magnitude and direction of the net magnetic field at the centre of the coils.

17. (a) State the principle of working of a transformer.
    (b) Define efficiency of a transformer.
    (c) State any two factors that reduce the efficiency of a transformer
18. A source of ac voltage $v = v_0 \sin\omega t$, is connected across a pure inductor of inductance L. Derive the expressions for the instantaneous current in the circuit. Show that average power dissipated in the circuit is zero.
19. (a) How are electromagnetic waves produced? Explain.
    (b) A plane electromagnetic wave is travelling through a medium along the +ve z-direction. Depict the electromagnetic wave showing the directions of the oscillating electric and magnetic fields.
20. (a) If one of two identical slits producing interference in Young's experiment is covered with glass, so that the light intensity passing through it is reduced to 50%, find the ratio of the maximum and minimum intensity of the fringe in the interference pattern.
    (b) What kind of fringes do you expect to observe if white light is used instead of monochromatic light?
21. A symmetric biconvex lens of radius of curvature R and made of glass of refractive index 1·5, is placed on a layer of liquid placed on top of a plane mirror as shown in the figure. An optical needle with its tip on the principal axis of the lens is moved along the axis until its real, inverted image coincides with the needle itself. The distance of the needle from the lens is measured to be x. On removing the liquid layer and repeating the experiment, the distance is found to be y. Obtain the expression for the refractive index of the liquid in terms of x and y.



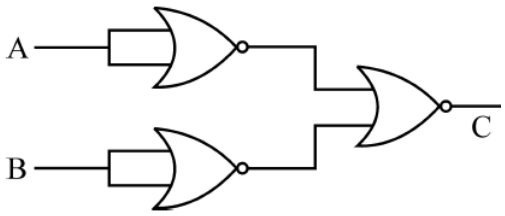
OR

(a) Monochromatic light of wavelength 589 nm is incident from air on a water surface. If μ (refractive index) for water is 1·33, find the wavelength, frequency and speed of the refracted light.
(b) A double convex lens is made of a glass of refractive index 1·55, with both faces of the same radius of curvature. Find the radius of curvature required, if the focal length is 20 cm.

22. (a) A student wants to use two p-n junction diodes to convert alternating current into direct current. Draw the labelled circuit diagram she would use and explain how it works.
    (b) Give the truth table and circuit symbol for NAND gate.

OR

(a) Write the truth table for the combination of the gates shown in the figure.



(b) Explain briefly how a photo diode operates

23. (a) Give three reasons why modulation of a message signal is necessary for long distance transmission.
(b) Show graphically an audio signal, a carrier wave and an amplitude modulated wave.

24. (a) How is amplitude modulation achieved?
(b) The frequencies of two side bands in an AM wave are 640 kHz and 660 kHz respectively. Find the frequencies of carrier and modulating signal. What is the bandwidth required for amplitude modulation?

Section D

25. (a)Draw a ray diagram to show image formation when the concave mirror produces a real, inverted and magnified image of the object.
(b)Obtain the mirror formula and write the expression for the linear magnification.
(c)Explain two advantages of a reflecting telescope over a refracting telescope.

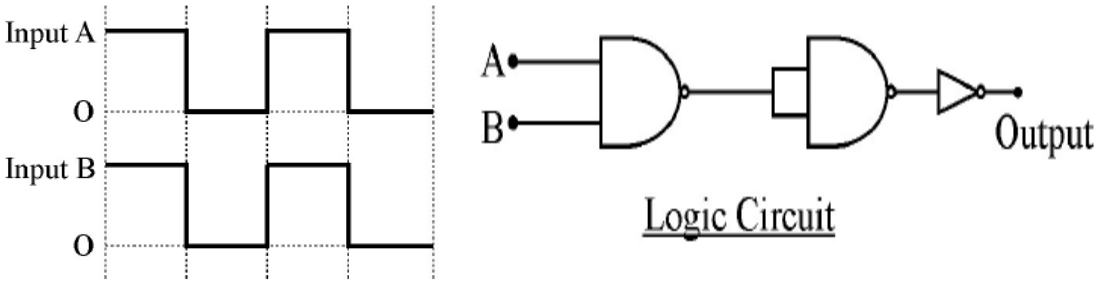
OR

(a) Draw a ray diagram to show the image formation by a combination of two thin convex lenses in contact. Obtain the expression for the power of this combination in terms of the focal lengths of the lenses.
(b) A ray of light passing from air through an equilateral glass prism undergoes minimum deviation when the angle of incidence is 3/4 th of the angle of prism. Calculate the speed of light in the prism.

26. (a) Explain with the help of suitable diagram, the two processes which occur during the formations of a p-n junction diode. Hence define the terms (i) depletion region and (ii) potential barrier.
(b) Draw a circuit diagram of a p-n junction diode under forward bias and explain its working.

OR

(a) Discuss the input and output characteristics of npn transistor in CE configuration.
(b) Using the wave forms of the input A and B, draw the output waveform of the given logic circuit. Identify the logic gate obtained. Write also the truth table.



27. (a) Define a wavefront. Using Huygens Principle, verify the laws of reflection at a plane surface.
(b) In a single slit diffraction experiment, the width of the slit is made double the original width. How does this affect the size and intensity of the central diffraction band? Explain.
(c) When a tiny circular obstacle is placed in the path of light from a distant source, a bright spot is seen at the centre of the obstacle. Explain why.

OR

(a) In Young's double slit experiment, a monochromatic source of light S is kept equidistant from the slits S_1 and S_2. Explain the formation of dark and bright fringes on the screen.
(b) (i) A beam of light consisting of two wavelengths, 650 nm and 520 nm, is used to obtain interference fringes in a Young's double-slit experiment. Find the distance of the third bright fringe on the screen from the central maximum for wavelength 650 nm. (ii) What is the least distance from the central maximum where the bright fringes due to both the wavelengths coincide? Given: the separation between the slits is 4 mm and the distance between the screen and plane of the slits is 1.2 m.