

**CBSE Board
Class XII Physics
Sample Paper - 9****Time: Three Hours****Maximum Marks: 70****General Instructions**

- (a) All questions are compulsory.
- (b) There are 29 questions in total. Questions 1 to 8 carry one mark each, questions 9 to 16 carry two marks each, questions 17 to 25 carry three marks each and questions 27 to 29 carry five marks each.
- (c) Question 26 is a value based question carrying four marks.
- (d) 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 three questions of five marks each. You have to attempt only one of the given choices in such questions.
- (e) Use of calculator is not permitted.
- (f) You may use the following physical constants wherever necessary.

$$e = 1.6 \times 10^{-19} \text{ C}$$

$$c = 3 \times 10^8 \text{ m s}^{-1}$$

$$h = 6.6 \times 10^{-34} \text{ J s}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ T ma}^{-1}$$

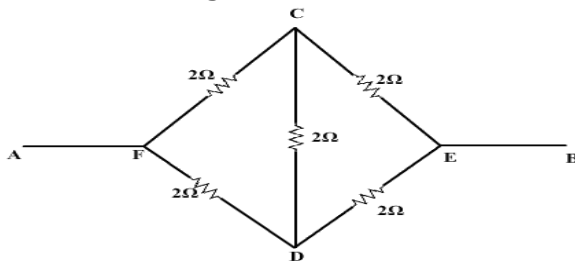
$$K_B = 1.38 \times 10^{-23} \text{ J K}^{-1}$$

$$N_A = 6.023 \times 10^{23} \text{ /mole}$$

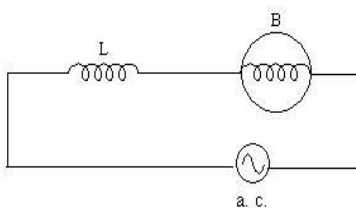
$$m_n = 1.6 \times 10^{-27} \text{ kg}$$

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1. A $500 \mu \text{ C}$ charge is at the centre of a square of side 10 cm. Find the work done in moving a charge of 10 C between two diagonally opposite points on the square. (1)
 2. What effect will be on current sensitivity of a moving coil galvanometer by increasing the number of turns in galvanometer coil? (1)
 3. Which two main considerations are kept in mind while designing the objective of an astronomical telescope? (1)
 4. How are eddy current in the transformer minimized? (1)

5. A double convex lens, made from a material of refractive index n_1 , is immersed in a liquid of refractive index n_2 where $n_2 > n_1$. What change, if any, would occur in the nature of the lens? (1)
6. Which among x-rays, sound waves and radio waves can be polarised? (1)
7. Why is the conductivity of an n-type semiconductor greater than that of the p-type semiconductor, even when both of them have same level of doping? (1)
8. A capacitor of a capacitance C is charged to a potential V . what is the electric flux through a closed surface around the capacitor? (1)
9. Why is the mass of a nucleus always less than the sum of the mass of its neutrons and protons? (2)
10. A potential difference of 2 V is applied between the points A and B shown in the network drawn in the figure
Calculate (i) equivalent resistance of the network across the points A and B, and (ii) the magnitude of currents flowing in the arms AFCEB and AFDEB.



- (2)
11. Using the Ampere's circuital law, derive an expression for the magnetic field along the axis of a toroidal solenoid. (2)
12. An inductor 'L' of reactance X_L , is connected in series with a bulb 'B' to an a. c. source as shown in figure.



Briefly explain how the brightness of the bulb changes, when

- (i) number of turns of the inductor is reduced and
- (ii) A capacitor of reactance $X_c = X_L$ is included in series in the same circuit. (2)

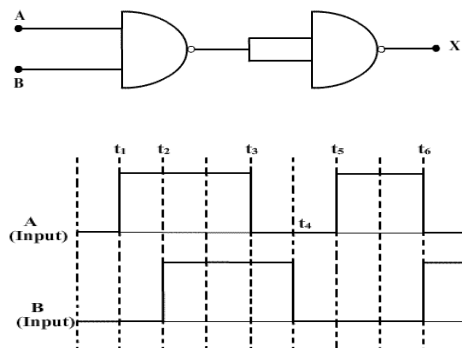
13. Define electric flux. Write its S.I unit. A spherical rubber balloon carrying a charge increases in size, how does the total electric flux coming out of the surface change? Give reason. (2)
14. Keeping the voltage of the charging source constant, what would be the percentage change in the energy stored in the parallel plate capacitor if the separation between its plates were to be decreased by 10 %? (2)
15. An armature coil consists of 20 turns of wire, each of area $A = 0.10 \text{ m}^2$ and total resistance 15.0Ω . It rotates in a magnetic field of 0.5 T at a constant frequency of $\frac{150}{\pi} \text{ Hz}$. Calculate the value of (i) maximum (ii) average induced emf produced in the coil. (2)

OR

Two circular coils one of radius a and the other of radius b are placed coaxially with their centres coinciding. For $b \gg a$, obtain an expression for the mutual inductance for the arrangement. (2)

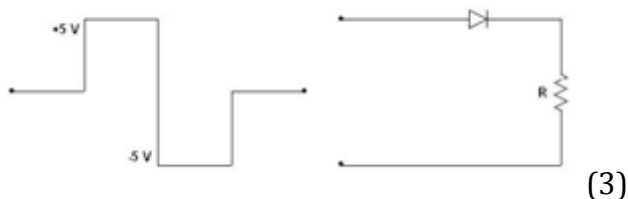
16. A transmitting antenna at the top of a tower has a height of 36 m and the height of receiving antenna is 49 m. What is the maximum distance between them, for satisfactory communication in the LOS mode? (Radius of earth = 6400 Km). (2)
17. A convex lens made up of glass of refractive index 1.5 is dipped, in turn in:
 (i) Medium A of refractive index 1.65
 (ii) Medium B of refractive index 1.33
 Explain, giving reasons, whether it will behave as a converging lens or a diverging lens in each of these two media. (3)
18.
 (a) Using gauss's law, derive an expression for the electric field intensity at any point outside a uniformly charged thin spherical shell of radius R and charge density σ C/m^2 .
 (b) A uniformly charged conducting sphere of 2.5 m in diameter has surface charge density of $100 \mu\text{C/m}^2$. Calculate the
 (i) Charge on the sphere
 (ii) Total electric flux passing through the sphere. (3)

19. Draw the output waveform at X, using the given inputs A, B for the logic circuit shown below. Also identify the gate. (3)



OR

Draw and explain the output waveform across the load resistor R, if the input waveform is as shown in the given figure.



20. Define the term 'resolving power' of an astronomical telescope. How does it get affected by

- (i) Increasing the aperture of the objective lens?
- (ii) Increasing the wavelength of the light used?

Justify your answer in each case.

(3)

21. A potential difference of V volts is applied to a conductor of length L and diameter D. How are the electric field and resistance of the conductor affected when in turn

- (i) V is doubled
- (ii) L is halved
- (iii) D is halved

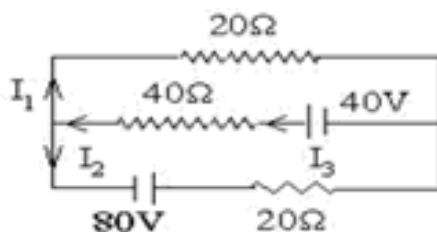
(3)

22. Define the term (i) work function (ii) threshold frequency (iii) stopping potential with reference to photoelectric effect.

Calculate the maximum kinetic energy of electron emitted from a photosensitive surface of work function 3.2 eV, for the incident radiation of wavelength 300 nm. (3)

23. Draw a plot of the variation of amplitude versus ω for an amplitude modulated wave. Define modulation index. State its importance for effective amplitude modulation. (3)

24. Distinguish between an intrinsic semiconductor and p-type semiconductor. Give reason, why a p-type semiconductor crystal is electrically neutral, although $n_h \gg n_e$?
 Where n_e = number of free electron
 n_h = number of free holes
 n_i = Intrinsic carrier concentration (3)
25. State the principle of working of p - n diode as a rectifier. Explain with the help of a circuit diagram the use of p - n diode as a full wave rectifier. Draw a sketch of the input output waveforms. (3)
26. A person looking at a person wearing a shirt with a pattern comprising vertical and horizontal lines is able to see vertical lines more distinctly than the horizontal ones. He shares his problem with his friend who suggests him to go to a doctor immediately.
 (i) Name the value displayed by his friend.
 (ii) What is this defect due to?
 (iii) How is such a defect of eye corrected? (4)
27. State Kirchhoff's rules of current distribution in an electrical network.
 Using these rules determine the value of the current I_1 in the electric circuit given below. (5)



OR

Define the term potential gradient of potentiometer.

In a potentiometer arrangement, a cell of 1.20 Volt 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 emf's of the two cells is 1.5, calculate the difference in the balancing length of the potentiometer wire in the two cases. (5)

28. A bar magnet M is falling under gravity through an air cored coil C. Plot a graph showing variation of induced emf (E) with time t. What does the area enclosed by the E-t curve depict?

An armature coil consists of 20 turns of wire, each of area $A = 0.10 \text{ m}^2$ and total resistance 15.0Ω . It rotates in a magnetic field of 0.5 T at a constant frequency of $\frac{150}{\pi} \text{ Hz}$. Calculate the value of (i) maximum (ii) average induced emf produced in the coil. (5)

OR

Write the relation for the force $\vec{F}$ acting on a charge carrier q moving with a velocity $\vec{v}$ through a magnetic field $\vec{B}$ in vector notation. Using this relation, deduce the conditions under which this force will be (i) maximum (ii) minimum

An electron travelling west to east enters a chamber having a uniform electrostatic field in a north to south direction. Specify the direction in which a uniform magnetic field should be set up to prevent the electron from deflecting from its straight line path. (5)

29. Prove that $\frac{-\mu_1}{u} + \frac{\mu_2}{v} = \frac{\mu_2 - \mu_1}{R}$ when refraction occurs from rarer to denser media at a convex refracting spherical surface.

OR

Draw a labelled diagram of a compound microscope when the image is formed at infinity. Deduce the expression for its magnifying power. How can the magnifying power be increased? (5)