CBSE Sample Paper Class 12 Physics Set 3

General Instruction:

(i) **All** *questions are compulsory. There are* **27** *questions in all.*

(ii) *This question paper has* **four** *sections : Section A, Section B, Section C and Section D.*

(iii) *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.*

(iv) *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.*

(v) *You may use the following values of physical constants wherever necessary :*

$c = 3 \times 10^8 \, m/s, \qquad h = 6.63 \times 10^{-34} \, Js, \qquad e = 1.6 \times 10^{-19} \, C, \qquad \mu_0 = 4\pi \times 10^{-7} \, TmA^{-1},$

$\varepsilon_0 = 8.854 \times 10^{-12} \, C^2 N^{-1} m^{-2}, \qquad m_e = 9.1 \times 10^{-31} \, kg, \qquad \dfrac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \, Nm^2 C^{-2},$

Mass of neutron $= 1.675 \times 10^{-27} \, kg,$ Mass of proton $= 1.673 \times 10^{-27} \, kg,$

Avogadro's number $= 6.023 \times 10^{23}$ per gram mole,   Boltzmann constant $= 1.38 \times 10^{-23} \, JK^{-1}$

SECTION – A
Questions 1 to 5 carry 1 mark each.

1. Name the essential components of a communication system.

2. Define dielectric constant of a medium. What is its S.I. unit ?

3. Define the term 'relaxation time' in a conductor.

4. A planar loop of rectangular shape is moved within the region of a uniform magnetic field acting perpendicular to its plane. What is the direction and magnitude of the current induced in it ?

5. A concave lens of refractive index 1.5 is immersed in a medium of refractive index 1.65. What is nature shown by lens?

SECTION – B
Questions 6 to 12 carry 2 marks each.

6. Use Kirchhoff's rules to obtain conditions for the balance condition in a Wheatstone bridge.

7. A proton and an α-particle have the same de-Broglie wavelength. Determine the ratio of (i) their accelerating potentials (ii) their speeds.

8. Define a wavefront. Using Huygens' principle, draw the shape of a refracted wavefront, when a plane wave is incident on a convex lens.

OR

(a) When a wave is propagating from a rarer to a denser medium, which characteristic of the wave does not change and why ?

(b) What is the ratio of the velocity of the wave in the two media of refractive indices μ_1 and μ_2?

9. Differentiate between amplitude modulated (AM) and frequency modulated (FM) waves by drawing suitable diagrams. Why is FM signal preferred over AM signal ?

10. State Lenz's Law. A metallic rod held horizontally along east-west direction, is allowed to fall under gravity. Will there be an emf induced at its ends? Justify your answer.

11. Show that the current leads the voltage in phase by $\pi/2$ in an ac circuit containing an ideal capacitor.

12. Determine the distance of closest approach when an alpha particle of kinetic energy 4·5 MeV strikes a nucleus of Z = 80, stops and reverses its direction.
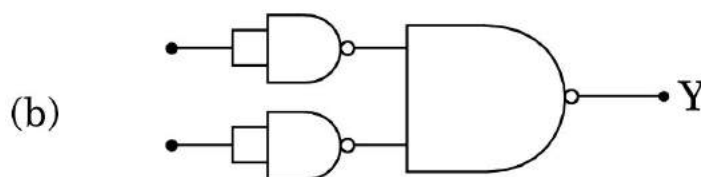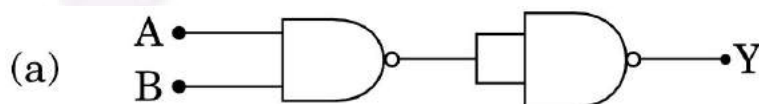
SECTION – C
**Questions 13 to 24 carry 3 marks each.**

13. Derive an expression for the magnetic moment of an electron revolving around the nucleus in terms of its angular momentum. What is the direction of the magnetic moment of the electron with respect to its angular momentum?

14. How are electromagnetic waves produced ? What is the source of the energy carried by a propagating electromagnetic wave ?
Identify the electromagnetic radiations used
(i) in remote switches of household electronic devices; and
(ii) as diagnostic tool in medicine.

15. (a) For a glass prism ($\mu = \sqrt{3}$) the angle of minimum deviation is equal to the angle of the prism. Calculate the angle of the prism.
(b) Draw a ray diagram when incident ray falls normally on one of the two equal sides of a right angled isosceles prism having refractive index $\mu = \sqrt{3}$.

16. The outputs of two NOT gates are fed to a NOR gate. Draw the logic circuit of the combination of gates. Write its truth table. Identify the gate equivalent to this circuit.

OR

You are given two circuits (a) and (b) as shown in the figures, which consist of NAND gates. Identify the logic operation carried out by the two. Write the truth tables for each. Identify the gates equivalent to the two circuits.

17. With the help of a circuit diagram, explain the working of a junction diode as a full wave rectifier. Draw its input and output waveforms. Which characteristic property makes the junction diode suitable for rectification ?

18. A potential difference V is applied across a conductor of length L and diameter D. How is the drift velocity, vd, of charge carriers in the conductor affected when (i) V is halved, (ii) L is doubled and (iii) D is halved ? Justify your answer in each case.

19. A cyclotron's oscillator frequency is 10 MHz. What should be the operating magnetic field for accelerating protons ? If the radius of its 'dees' is 60 cm, calculate the kinetic energy (in MeV) of the proton beam produced by the accelerator.

20. In Young's double slit experiment, the two slits are separated by a distance of 1·5 mm and the screen is placed 1 m away from the plane of the slits. A beam of light consisting of two wavelengths 650 nm and 520 nm is used to obtain interference fringes. Find
(a) the distance of the third bright fringe for $\lambda = 520$ nm on the screen from the central maximum.
(b) the least distance from the central maximum where the bright fringes due to both the wavelengths coincide.

21. In the following arrangement of capacitors, the energy stored in the $6\,\mu$F capacitor is E. find the value of the following:
(i) Energy stored in $12\,\mu$F capacitor.
(ii) Charge on $12\,\mu$F, $6\,\mu$F, $3\,\mu$F capacitor energy stored in $3\,\mu$F capacitor.
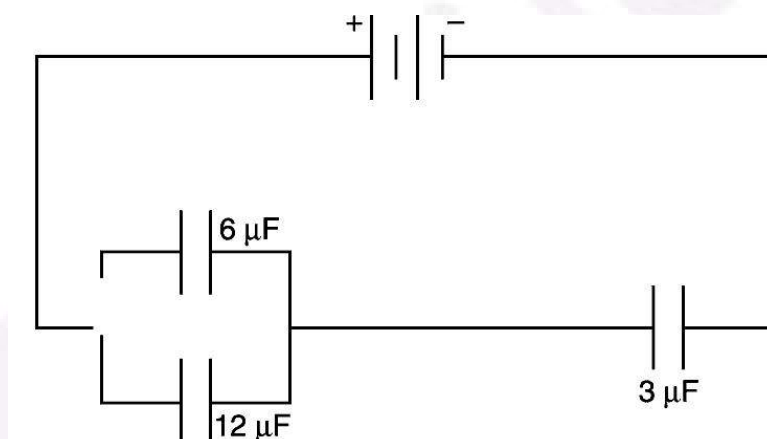
22. (a) Write the basic nuclear process involved in the emission of β^+ in a symbolic form, by a radioactive nucleus.
(b) In the reactions given below:
$(i)\,^{11}_{6}C \rightarrow {}^{z}_{y}B + x + v$

$(ii)\,^{12}_{6}C + {}^{12}_{6}B \rightarrow {}^{20}_{a}Ne + {}^{c}_{b}He$
Find the values of x, y and x & a, b and c.

23. Name the three different modes of propagation in a communication system.
State briefly why do the electromagnetic waves with frequency range from a few MHz upto 30 MHz can reflect back to the earth. What happens when the frequency range exceeds this limit ?

24. Define the terms 'stopping potential' and 'threshold frequency' in relation to photoelectric effect. How does one determine these physical quantities using Einstein's equation ?

SECTION – D

Questions 25 to 27 carry 5 marks each.

25. What are coherent sources? Why are coherent sources required to produce interference of light? Give an example of interference of light in everyday life.

In Young's double slit experiment, the two ,slits are 0.03 cm apart and the screen is placed at a distance of 1.5m away from the slits, the distance between the central bright fringe and central bright fringe is 1 cm. Calculate the wavelength of light used.

OR

(a) Draw a labelled ray diagram showing the formation of image by a compound microscope in normal adjustment. Derive the expression for its magnifying power.

(b) How does the resolving power of a microscope change when

(i) the diameter of the objective lens is decreased,

(ii) the wavelength of the incident light is increased ?

Justify your answer in each case.

26. (a) State Faraday's law of electromagnetic induction.

(b) Explain, with the help of a suitable example, how we can show that Lenz's law is a consequence of the principle of conservation of energy.

(c) Use the expression for Lorentz force acting on the charge carriers of a conductor to obtain the expression for the induced emf across the conductor of length l moving with velocity v through a magnetic field B acting perpendicular to its length.

OR

(a) Using phasor diagram, derive the expression for the current flowing in an ideal inductor connected to an a.c. source of voltage, $v = v_o \sin \omega t$. Hence plot graphs showing variation of (i) applied voltage and (ii) the current as a function of ωt.

(b) Derive an expression for the average power dissipated in a series LCR circuit.

27. (i) Use Gauss's law to find the electric field due to a uniformly charged infinite plane sheet. What is the direction of field for positive and negative charge densities?

(ii) Find the ratio of the potential differences that must be applied across the parallel and series combination of two capacitors C_1 and C_2 with their capacitances in the ratio 1 : 2 so that the energy stored in the two cases become the same.

OR

(i) If two similar large plates, each of area A having surface charge densities $+\sigma$ and $-\sigma$ are separated by a distance d in air, find the expressions for

(a) field at points between the two plates and on outer side of the plates. Specify the direction of the field in each case.

(b) the potential difference between the plates.

(c) the capacitance of the capacitor so formed.

(ii) Two metallic spheres of radii R and 2R charged so that both of these have same surface charge density σ. If they are connected to each other with a conducting wire, in which direction will the charge flow and why?

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