CBSE Board
Class XII Physics
Sample Paper - 2

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.

$$e = 1.6 \times 10^{-19} \text{ C}$$
$$c = 3 \times 10^8 \text{ m s}^{-1}$$
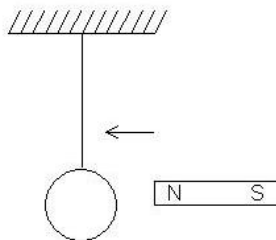$$h = 6.6 \times 10^{-34} \text{ J s}$$
$$\mu_o = 4\pi \times 10^{-7} \text{ T ma}^{-1}$$
$$K_B = 1.38 \times 10^{23} \text{ J K}^{-1}$$
$$N_A = 6.023 \times 10^{23} \text{ /mole}$$
$$m_n = 1.6 \times 10^{-27} \text{ kg}$$

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1. In spite of having magnitude as well as direction the current is a scalar quantity. Why?

(1)

2. Give the direction in which induced current flows in the wire loop when the magnet moves towards the loop as shown below:

(1)

3. How is the current represented mathematically in forward bias? (1)

4. What is the ratio of speed of infrared rays and ultraviolet rays in vacuum? (1)

5. How will the size of an object appear to change when viewed by a telescope having focal length of the objective and eyepiece as 60 cm and 5 cm respectively? (1)

6. Find the ratio of nuclear densities of the two nuclei having mass numbers in the ratio 1:4? (1)

7. A. C. power is transmitted from one station to another at highest possible voltage. Why? (1)

8. Why do semiconductor devices not work at absolute zero temperature? (1)

9. An electric dipole with dipole moment 4×10^{-9} C m is aligned at 30° with the direction of a uniform electric field of magnitude 5×10^{4} NC^{-1}. Calculate the magnitude of the torque acting on the dipole. (2)

10. What is the change in resistance of a wire when its radius is halved and the length is reduced to one fourth of its original value? (2)

11. In Young's double slit experiment the size of slits is taken of the order of the wavelength of the light used in the experiment. Give reason for it. (2)

12. Why are ferromagnetic materials used in memory devices? (2)

13. Find the wavelength of electromagnetic waves of frequency 6 x 10^{12} Hz in free space. Give the two applications of this wave. (2)

14. A convex lens of refractive index 1.5 has a focal length of 18 cm in air. Calculate the change in its focal length when it is immersed in water of refractive index of 4/3. (2)

15. The given graph shows the variation of charge q versus potential difference V for capacitors C_1 and C_2. The two capacitors have same plate separation. But the plate area of C_2 is double than that of C_1. Which of the lines in the graph correspond to C_1 and C_2 and why?
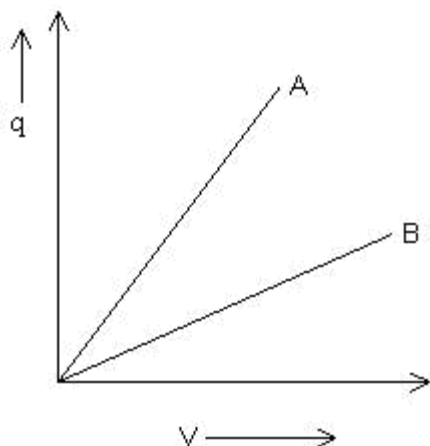
(2)

16. Explain how the maximum kinetic energy of the electrons emitted from a metal surface varies with the frequency of incident radiation.

OR

Draw a graph showing the variation of stopping potential with frequency of incident radiation in relation to photo electric effect. Deduce an expression for the slope of this graph using Einstein's photoelectric equation. (2)

17. S_1 and S_2 are two hollow concentric spheres enclosing charges Q and 2Q respectively.
    (i) What is ratio of the electric flux through S_1 and S_2?
    (ii) How will the electric flux through the sphere S_1 change, if a medium of dielectric constant 5 is introduced in the space inside S_1 in place of air? (3)

18. Two dielectric slabs of dielectric constants K_1 and K_2 and of equal width are filled in between the two plates, each of area A of the parallel plate capacitor. How does the capacitance of the capacitor get affected? (3)

19. A point charge +10 μC is at a distance 5 cm directly above the center of a square of side 10 cm as shown in figure.
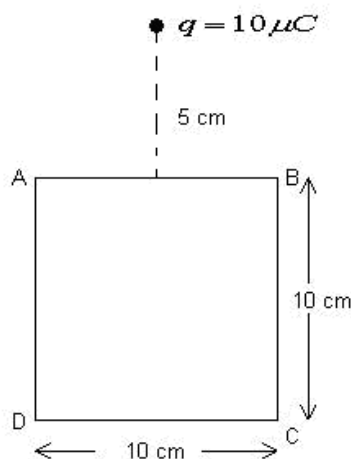
What is the magnitude of the electric flux through the square?

OR

A parallel plate capacitor with air as dielectric is charged by a d. c. source to a potential V. Without disconnecting the capacitor from the source, air is replaced by another dielectric medium of dielectric constant 10. How does electric field between the plates and energy stored in the capacitor change? (3)

20. State the condition under which the phenomenon of resonance occurs in a series LCR circuit. Plot a graph showing variation of current with frequency of a.c. source in a series LCR circuit. (3)

21. Two coherent sources whose intensity ratio is 81:1 produce interference fringes. Find the ratio of intensity of maxima and minima in fringe system. (3)

22. A long solenoid with 15 turns per cm has a small loop of area 2.0 cm^2 placed inside normal to the axis of the solenoid. If the current carried by the solenoid changes steadily from 2A to 4A in 0.1 sec, what is the induced emf in the loop while the current is changing? (3)

23. How does the size of a nucleus depend on its mass number? Explain why the density of nuclear matter is independent of the size of nucleus. (3)

24. Give the frequency ranges of the following:
     (i)   High frequency band (HF)
     (ii) Ultra – high frequency band (UHF)
     (iii) Super – high frequency band (SHF) (3)

25.
     (a) State two advantages of pulse code modulation over amplitude modulation.
     (b) What is the range of FM signals? Why is an FM signal less susceptible to noise than AM signal? (3 marks)

26. Shobha and Naina are two friends who are married. Shobha is very poor and a childless widow whereas Naina is having a good economic status. Once Naina noticed that Shobha's eyesight has become weak and she was not even able to read letters written on signboards from a distance. Naina asked Shobha that why she did not take care of this, Shobha that she did not have enough money for its remedy so she did not see the doctor. Listening to this, Naina took Shobha to an eye specialist and asked the whole expenditure for its remedy. Doctor said that it is the case of Myopia and can be resolved without any major expenditure. After the treatment, Shobha's eyesight was better than before.

(a) What are the benefits of true friendships?

(b) The far point of Shobha's eye is at a distance of 0.1 m. What power lens is required to see distant objects? (4)

27. Using Ampere's circuital law, derive an expression for the magnetic field along the axis of a toroidal solenoid.

OR

Derive an expression for the torque on a rectangular coil of area A carrying current I placed in a magnetic field B at an angle θ to the direction of the field. (5)
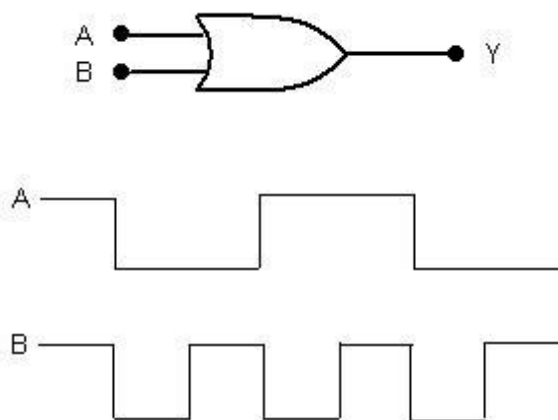
28. Derive lens maker's formula for a double convex lens.

OR

Draw a ray diagram of a compound microscope showing the final image formation at least distance of distinct vision D. State its working principle. Show that its magnifying power is

given as $M = -\dfrac{v_o D}{u_o}\left[\dfrac{1}{F_e} + \dfrac{1}{v_e}\right]$ (5)

29. The circuit symbol of a logic gate and two input waveforms A and B are shown in the figure given below.

i) name the logic gate

ii) write its truth table

iii) Tabulate the details of output waveform & represent its output waveform graphically.

OR

With the help of a labeled circuit diagram, describe working principle of a common emitter amplifier using a $p–n–p$ transistor. Define the terms current gain and voltage gain and write their expressions. (5)