CBSE Sample Paper Class 12 Physics Set 6

SUBJECT: PHYSICS **MAX. MARKS : 70**
CLASS : XII **DURATION : 3 HRS**

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 :*

$c = 3\times10^{8}\, m/s, \quad h = 6.63\times10^{-34}\, Js, \quad e = 1.6\times10^{-19}\, C, \quad \mu_0 = 4\pi\times10^{-7}\, TmA^{-1},$

$\varepsilon_0 = 8.854\times10^{-12}\, C^2N^{-1}m^{-2}, \quad m_e = 9.1\times10^{-31}\, kg, \quad \frac{1}{4\pi\varepsilon_0} = 9\times10^{9}\, Nm^2C^{-2},$

Mass of neutron $= 1.675\times10^{-27}\, kg$, Mass of proton $= 1.673\times10^{-27}\, kg$,

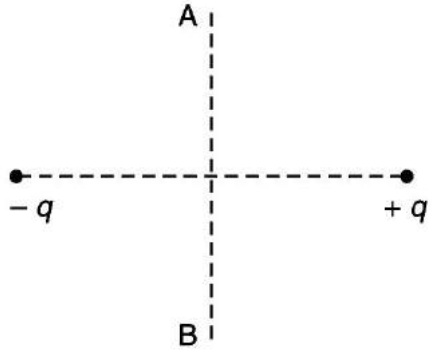
Avogadro's number $= 6.023\times10^{23}$ per gram mole, Boltzmann constant $= 1.38\times10^{-23}\, JK^{-1}$

SECTION – A

Questions 1 to 5 carry 1 mark each.

1. Draw a graph to show a variation of resistance of a metal wire as a function of its diameter keeping its length and material constant.

2. A charge 'q' is moved from a point A above a dipole of dipole moment 'p' to a point B below the dipole in equatorial plane without acceleration. Find the work done in the process.



3. Why is the use of AC voltage preferred over DC voltage? Give two reasons.

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

5. Name the essential components of a communication system.

SECTION – B

Questions 6 to 12 carry 2 marks each.

6. An α-particle and a proton are accelerated through the same potential difference. Calculate the ratio of linear momenta acquired by the two.

7. Why is base band signal not transmitted directly? Give any two reasons.

8. Two wires A and B of the same material and having same length, have their cross sectional areas in the ratio 1:6. What would be the ratio of heat produced in these wires when same voltage is applied across each?

9. In a series LCR circuit, obtain the conditions under which (i) the impedance of the circuit is minimum, and (ii) wattless current flows in the circuit.

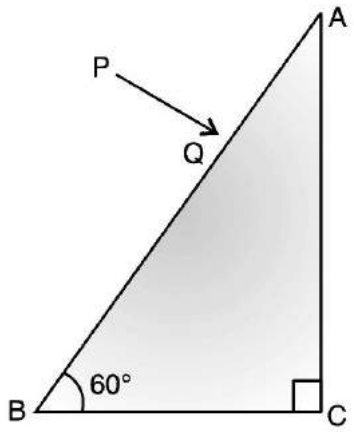
10. A conducting rod of length l is moved in a magnetic field of magnitude B with velocity v such that the arrangement is mutually perpendicular. Prove that the emf induced in the rod is $|\varepsilon| = Blv$.

11. Calculate the shortest wavelength in the Balmer series of hydrogen atom. In which region (infra red, visible, ultraviolet) of the hydrogen spectrum does this wavelength lie?

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

OR

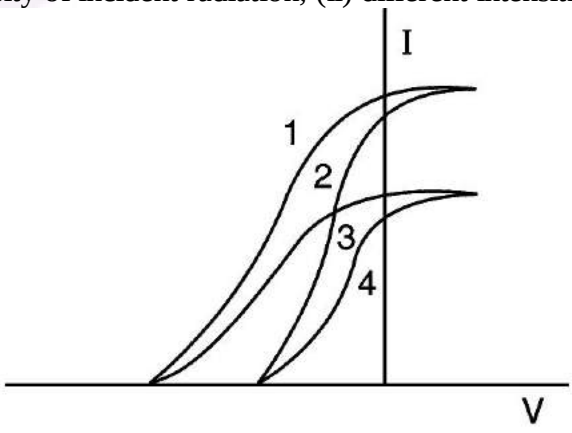
A ray PQ incident normally on the refracting face BA is reflected in the prism BAC made of material of refractive index 1.5. Complete the path of ray through the prism. From which face will the ray emerge? Justify your answer.



SECTION – C

Questions 13 to 24 carry 3 marks each.

13. The given graph shows the variation of photo-electric current (I) with the applied voltage (V) for two different materials and for two different intensities of the incident radiations. Identity and explain using Einstein's photo electric equation the pair to curves that correspond to (i) different materials but same intensity of incident radiation, (ii) different intensities but same materials.



14. Draw a schematic ray diagram of reflecting telescope showing how rays coming from a distant object are received at the eye-piece. Write its two important advantages over a refracting telescope.

15. What is Global Positioning System? Explain its working principle in brief.

16. A cell of emf 'E' and internal resistance 'r' is connected across a variable load resistor R. Draw the plots of the terminal voltage V versus (i) R and (ii) the current 'I'.
It is found that when R = 4Ω, the current is 1 A when R is increased to 9Ω, then current reduces to 0.5A. Find the values of the emf E and internal resistance r.

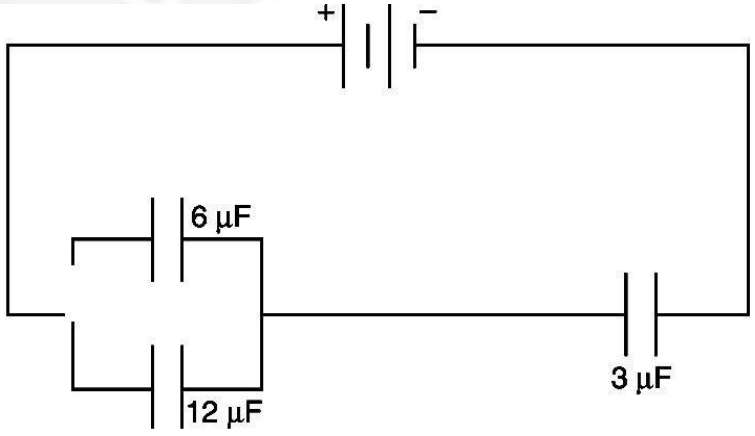
17. For a CE-transistor amplifier, the audio signal voltage across the collector resistance of $2k\Omega$ is 2V. Suppose the current amplification factor of the transistor is 100, find the input signal voltage and base current, if the base resistance is $1k\Omega$.

18. (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.

OR

Distinguish between nuclear fission and fusion. Show how in both these processes energy is released. Calculate the energy release in MeV in the deuterium-tritium fusion reaction:
${}^{2}_{1}H + {}^{3}_{1}H \rightarrow {}^{4}_{2}He + n$
Using the data :
$m\left({}^{2}_{1}H\right) = 2.014102\ u, \qquad m\left({}^{3}_{1}H\right) = 3.016049\ u$
$m\left({}^{4}_{2}He\right) = 4.002603\ u, \qquad m_n = 1.008665\ u$
$1\ u = 931.5\ MeV/c^2$

19. 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.



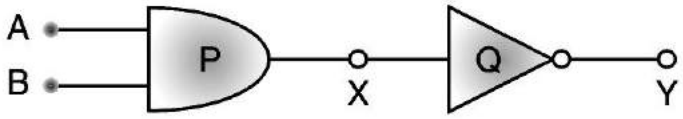
20. Write the expression for the generalized form of Ampere's Circuital law. Discuss its significance and describe briefly how the concept of displacement current is explained through charging/discharging of a capacitor in an electric circuit.

21. (i) Which segment of electromagnetic waves has highest frequency? How are these waves produced? Give one use of these waves?
(ii) Which electromagnetic waves lie near the high frequency end of visible part of em spectrum? Give its one use. In what way this component of light has harmful effects on human?

22. (a) When an AC source is connected to an ideal capacitor, then show that the average power supplied by the source over a complete cycle is zero.
(b) A lamp is connected in series with a capacitor. Predict your observations when the system is connected first across a DC and then Ac source. What happens in each case if the capacitance of the capacitor is reduced?

23. (i) Derive Snell's law on the basis of Huygen's wave theory when light is traveling from a denser medium to a rarer medium.
(ii) Draw the sketches to differentiate between plane wavefront and spherical wavefront.

24. Identify the gates P and Q shown in the figure. Write the truth table for the combination of the gates shown:



Name the equivalent gate representing this circuit and write its logic symbol.

SECTION – D

Questions 25 to 27 carry 5 marks each.

25. (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?

26. (i) Explain Biot-Savart law in the vector form.
(ii) Use is to obtain the expression for the magnetic field at an axial point, distance d from the centre of a circular coil of radius R carrying current I.
(iii) Also, find the ratio of the magnitudes of the magnetic field of the coil at the centre and at and axial point for which $x = R\sqrt{3}$.

OR

(a) A magnetic dipole is placed in a uniform magnetic field with its axis tilted with respect to its position of stable equilibrium. Deduce an expression for the time period of (small amplitude) oscillation of this magnetic dipole about an axis, passing through its centre and perpendicular to its plane.
(b) If this bar magnet is replaced by a combination of two similar bar magnets, placed over each other, how will the time period vary?

27. (i) In Young's double slit experiment, deduce the condition for (a) constructive, and (b) destructive interference at a point on the screen. Draw a graph showing variation of intensity in the interference pattern position 'x' on the screen.
(ii) Compare the interference pattern observed in Young's double slit experiment with single slit diffraction pattern, pointing out three distinguishing features.

OR

(i) Plot a graph to show variation of the angle of deviation as a function of angle of incidence light passing through a prism. Derive an expression for refractive index of the prism in terms of angle of minimum deviation and angle of prism.
(ii) What is dispersion of light? What is its cause?
(iii) A ray of light incident normally on one face of a right isosceles prism is totally reflected as shown in fig. What must be the minimum value of refractive index of glass? Give relevant calculations.