

**St. John's High School Chandigarh****CLASS - XII****PHYSICS (042) Pre Board Jan (2019-20)****Time allowed: 3 hours****Max. Marks: 70**

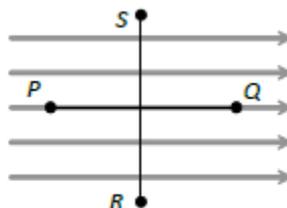
General Instructions:

1. All questions are compulsory. There are **37** questions in all.
2. This question paper has four sections: Section A, Section B, Section C and Section D.
3. Section A contains **twenty questions** of one mark each, Section B contains **seven questions** of two marks each, Section C contains **seven 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 each, two questions of two marks, one question of three marks and three questions of five marks weightage. You have to attempt only one of the choices in such questions.

**Section – A****Directions (Q1-Q10) select the most appropriate option from those given below each question (1×10)**

1. An electron and a proton are in a uniform electric field, the ratio of their accelerations will be 1  
(1) Zero  
(2) Unity  
(3) The ratio of the masses of proton and electron  
(4) The ratio of the masses of electron and proton
2. A cylinder of radius R and length L is placed in a uniform electric field E parallel to the cylinder axis. The total flux for the surface of the cylinder is given by 1  
(1)  $2\pi R^2 E$                       (2)  $\pi R^2 / E$                       (3)  $(\pi R^2 - \pi R) / E$                       (4) Zero
3. A hollow metallic sphere of radius R is given a charge Q. Then the potential at the centre is \_\_\_\_\_ 1
4. A series combination of three capacitors of capacities  $1\mu F$ ,  $2\mu F$  and  $8\mu F$  is connected to a battery of e.m.f. 13 volt. The potential difference across the plates of  $2\mu F$  capacitor will be: 1  
(1) 1V                      (2) 8V                      (3) 4V                      (4) V
5. If 2 bulbs rated 2.5W– 110 V and 100W– 110 V are connected in series to a 220 V supply then 1  
(1) 2.5Wbulb will fuse                      (2) 100Wbulb will fuse  
(3) both will fuse                      (4) both will not fuse

6. A proton is moving along Z-axis in a magnetic field. The magnetic field is along X-axis. The proton will experience a force along 1  
 (1) X-axis (2) Y-axis (3) Z-axis (4) Negative Z-axis
7. An electron enters a region where magnetic (B) and electric (E) fields are mutually perpendicular to one another, then 1  
 (1) It will always move in the direction of B (2) It will always move in the direction of E  
 (3) It always possess circular motion (4) It can go undeflected also
8. In electromagnetic induction, the induced charge in a coil is independent of 1  
 (1) Change in the flux (2) Time  
 (3) Resistance in the circuit (4) None of the above
9. A light wave travels from glass to water. The refractive index for glass and water are  $\frac{2}{3}$  and  $\frac{3}{4}$  respectively. The value of the critical angle will be: 1  
 (1)  $\sin^{-1}(\frac{1}{2})$  (2)  $\sin^{-1}(\frac{9}{8})$  (3)  $\sin^{-1}(\frac{8}{9})$  (4)  $\sin^{-1}(\frac{5}{7})$
10. The refractive index of the material of prism of  $60^\circ$  angle is  $\sqrt{2}$ . At what angle the ray of light be incident on it so that minimum deviation takes place? 1  
 (1)  $45^\circ$  (2)  $60^\circ$  (3)  $30^\circ$  (4)  $75^\circ$
11. The number of photo-electrons emitted per second from a metal surface increases when 1  
 (1) The energy of incident photons increases  
 (2) The frequency of incident light increases  
 (3) The wavelength of the incident light increases  
 (4) The intensity of the incident light increase
12. If the de-Broglie wavelengths for a proton and for a  $\alpha$  – particle are equal, then the ratio of their velocities will be 1  
 (1) 4 : 1 (2) 2 : 1 (3) 1 : 2 (4) 1 : 4
13. The points resembling equal potentials are \_\_\_\_\_ and \_\_\_\_\_ 1



14. Half-lives of two radioactive elements A and B are 20 minutes and 40 minutes, respectively. Initially, the samples have equal number of nuclei. After 80 minutes, the ratio of decayed numbers of A and B nuclei will be: \_\_\_\_\_ 1
15. In the  $n$ th orbit, the energy of an electron eV  $E_n = -\frac{13.6}{n^2}$  for hydrogen atom. The energy required to take the electron from first orbit to second orbit will be \_\_\_\_\_ 1
16. A biconvex lens with equal radii of curvature has refractive index 1.6 and focal length 10 cm. Its radius of curvature will be \_\_\_\_\_ 1
17. A convex lens of power 4D and a concave lens of power 3D are placed in contact, the equivalent power of combination \_\_\_\_\_ 1
18. How is the mean life of a radioactive sample related to its half-life? 1
19. What happens to the width of depletion layer of p-n junction when it is 1  
 (i) forward biased  
 (ii) reverse biased?
20. In half-wave rectification, what is the output frequency if the input frequency is 50 Hz? 1  
 What is the output frequency of a full wave rectifier for the same input frequency?

### Section – B

21. A potentiometer wire of length 100 cm has a resistance of 10 ohm. It is connected in series with a resistance and an accumulator of emf 2V and of negligible internal resistance. A source of emf of 10mV is balanced against a length of 40 cm of the potentiometer wire. What is the value of external resistance? 2
22. A small coil of  $N$  turns has an effective area  $A$  and carries a current  $I$ . It is suspended in a horizontal magnetic field  $B$  such that its plane is perpendicular to  $B$ . Find the work done in rotating it by  $180^\circ$  about the vertical axis. 2
23. Two similar coils of radius  $R$  are lying concentrically with their planes at right angles to each other. The currents flowing in them are  $I$  and  $2I$ , respectively. Find the resultant magnetic field induction at the centre. 2
24. A step-down transformer is connected to main supply 200V to operate a 6V, 30W bulb. Find the current in primary. 2
25. The slits in a Young's double slit experiment have equal widths and the source is placed symmetrically relative to the slits. The intensity at the central fringes is  $I_0$ . If one of the slits is closed, find the intensity at this point. 2

26. A screen is placed 90 cm from an object. The image of the object on the screen is formed by a convex lens at two different locations separated by 20 cm. Determine the focal length of the lens. 2
27. How does a Light Emitting Diode (LED) work? Give two advantages of LED's over the conventional incandescent lamps. 2

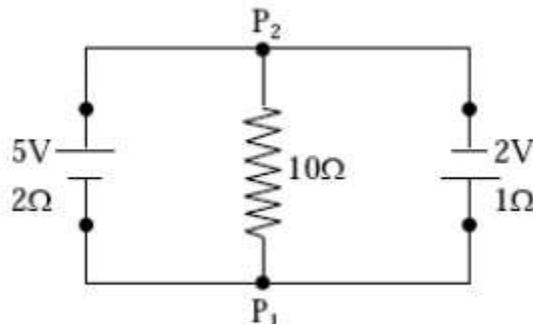
**Section – C**

28. In an ac circuit an alternating voltage  $e = 200\sqrt{2} \sin 100t$  volts is connected to a capacitor of capacity  $1 \mu\text{F}$ . Find the r.m.s value of the current in the circuit. 3

**OR**

The instantaneous values of alternating current and voltages in a circuit are given as  $i = \frac{1}{\sqrt{2}} \sin (100 \pi t)$  ampere and  $e = \frac{1}{\sqrt{2}} (100\pi t + \frac{\pi}{3})$  Volt . Find the average power in watts consumed in the circuit. 3

29. A 5 V battery with internal resistance  $2 \Omega$  and a 2V battery with internal resistance  $1 \Omega$  are connected to a  $10 \Omega$  resistor as shown in the figure. Find the current in the  $10 \Omega$  resistor. 3



30. What is the shape of the wavefront in each of the following cases? 3
- (i) Light diverging from point source.
  - (ii) Light emerging out of a convex lens when a point source is placed at its focus.
  - (iii) The portion of the wavefront of light from a distant star intercepted by earth.
31. In a potentiometer experiment, it is found that no current passes through the galvanometer when the terminals of the cell are connected across 52 cm of the potentiometer wire. If the cell is shunted by a resistance of  $5 \Omega$  , a balance is found when the cell is connected across 40 cm of the wire. Find the internal resistance of the cell. 3
32. (i) What is meant by half-life of a radioactive element? 3
- (ii) The half-life of a radioactive substance is 30 s. Calculate
    - (a) the decay constant and

(b) time taken for the sample to decay by  $\frac{3}{4}$ th of the initial value. 3

33. Two circular coils, one of radius  $r$  and the other of radius  $R$  are placed coaxially with their centres coinciding. For  $R \gg r$  obtain an expression for the mutual inductance of the arrangement? 3

34. Draw a labelled diagram of a full wave rectifier circuit. State its working principle. Show the input-output waveforms. 3

### Section – D

35.(i) Define electric flux. Write its SI unit 5

(ii) Using Gauss' law, prove that the electric field at a point due to a uniformly charged infinite plane sheet is independent of the distance from it

(iii) How is the field directed if (a) the sheet is positively charged, (b) negatively charged?

**OR**

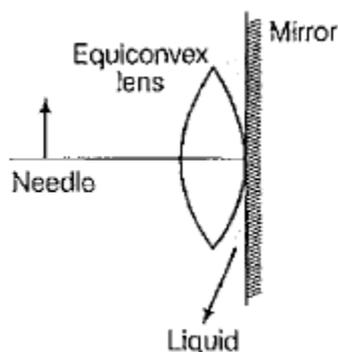
(i) How is the electric field due to a charged parallel plate capacitor affected when a dielectric slab is inserted between the plates fully occupying the intervening region?

(ii) A slab of material of dielectric constant  $K$  has the same area as the plates of a parallel plate capacitor but has thickness  $\frac{1}{2}d$ , where  $d$  is the separation between the plates. Find the expression for the capacitance when the slab is inserted between the plates.

36. How is the working of telescope different from that of a microscope? The focal lengths of the objective and eyepiece of a microscope are 1.25 cm and 5 cm respectively. Find the position of the object relative to the objective in order to obtain an angular magnification of 30 in normal adjustment. 5

**OR**

Figure shows an equiconvex lens (of refractive index 1.50) in contact with a liquid layer on top of a plane mirror. A small needle with its tip on the principal axis is moved along the axis until its inverted image is found at the position of the needle. The distance of the needle from the lens is measured to be 45.0 cm. The liquid is removed and the experiment is repeated. The new distance is measured to be 30.0 cm. What is the refractive index of the liquid? 5



- 37.(a) Draw a graph showing the variation of binding energy per nucleon with mass number for different nuclei. Explain, with the help of this graph, the release of energy by the process of nuclear fusion.
- (b) Draw the energy level diagram showing the emission of  $\alpha$ -particles followed by  $\gamma$ -rays by a  ${}^{60}_{27}\text{Co}$  nucleus.
- (c) Plot the distribution of kinetic energy of  $\beta$ -particles and state why the energy spectrum is continuous.

5

**OR**

- (a) Using Bohr's second postulate of quantization of orbital angular momentum show that the circumference of the electron in the  $n^{\text{th}}$  orbital state in hydrogen atom is  $n$  times the de Broglie wavelength associated with it.
- (b) The electron in hydrogen atom is initially in the third excited state. What is the maximum number of spectral lines which can be emitted when it finally moves to the ground state?

5