PRE-MEDICAL : ENTHUSIAST COURSE
ALL PHASE

ALLEN CAREER INSTITUTE KOTA (RAJASTHAN) Path to Success ™

TEST PATTERN : BOARD PATTERN (GSEB)

HAVE CONTROL ⟶ HAVE PATIENCE ⟶ HAVE CONFIDENCE ⇒ 100% SUCCESS

SUBJECT : PHYSICS

Time Allowed : 2:30 Hour **Maximum Marks : 100**

Instructions :

- Please check that this question paper contains 14 printed pages.
- This question paper contains 64 questions. All the questions are compulsory.
- Figures on the right indicate full marks alloted to the question.
- Select proper option to make the statement correct.
- Read the questions carefully before you answer.
- The OMR sheet is given for answering the questions. The answer to each question is represented by (1) O, (2) O, (3) O, (4) O. Darken the circle ● of the correct answer with ball-pen.
- Rough work is to be done on the space provided for this purpose in the Test Booklet only.

1. There are 4×10^{23} atoms in conducting sphere. If one electron is released from 0.1% atoms then. Find charge on sphere. **[1]**

(1) 64 C (2) 6.4 C (3) 0.64 C (4) -6.4 C

2. Two small sphere having charge +Q are hanged with the help of insulated strings of length L. Find the value of angle between two strings and tension produced in the string. (neglect the effect of gravity.) **[1]**

(1) $180^\circ, \frac{KQ^2}{2L^2}$ (2) $90^\circ, \frac{KQ^2}{L^2}$ (3) $180^\circ, \frac{KQ^2}{L^2}$ (4) $180^\circ, \frac{KQ^2}{(2L)^2}$

3. Two equal and opposite charges placed at a finite distance. the force acting between them is F. If 25% charge is transfered to other charge then find the force acting between them is …….. **[1]**

(1) $\frac{15}{16}F$ (2) F (3) $\frac{4}{5}F$ (4) $\frac{9}{16}F$

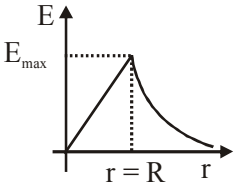
4. Three charges q,q, -2q are placed on the vertices of an equilateral triangle with length "ℓ". then what is electric dipole moment of the system ? **[1]**

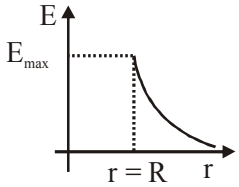
(1) $4p\ell$ (2) $2q\ell$ (3) $q\ell$ (4) $\sqrt{3}q\ell$

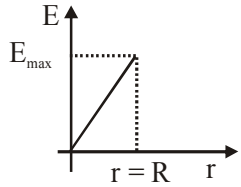
5. Linear charge density of a straight wire is given by equation $\lambda(x) = \lambda_0 x^3$. If the length of the wire is L then total charge on wire is …… **[1]**

(1) $\frac{\lambda_0 L}{2}$ (2) $\frac{\lambda_0 L^4}{4}$ (3) $\frac{\lambda_0 L^2}{2}$ (4) $\lambda_0 L$

6. Electric field due to uniformly charged non conducting sphere is ..... **[1]**

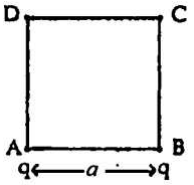
(1) 

(2) 

(3) 

(4) None

7. As shown in fig charge 'q' is placed on the vertices A and B, if charge q_1 is taken from point C to D, change in its potential energy is ……. **[1]**

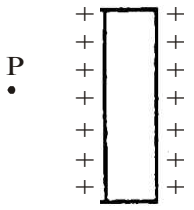


(1) Zero (2) $\frac{2kqq_1}{a}$ (3) $\frac{kqq_1}{\sqrt{2}a}$ (4) $\frac{\sqrt{2kqq_1}}{a}$

8. The distance between two plates of capacitor having capacitance '1F' is 1 mm, then area of plate is …….m^2. [$\in_0 = 8.9 \times 10^{-12}$ SI] **[1]**

(1) 1.2×10^9 (2) 1.12×10^8 (3) 2.5×10^6 (4) 2.2×10^5

9. A big metallic plate having charge density σ is shown in fig. find electric field at point P. **[1]**



(1) $\frac{\sigma}{\in_0}$ (2) $\frac{2\sigma}{\in_0}$ (3) $\frac{\sigma}{2\in_0}$ (4) $2\sigma \in_0$

10. What is electric potential on the surface of nucleus (Z = 50) having radius 9×10^{-15} m ? **[1]**

(1) 80 (2) 9 (3) 8×10^6 (4) 9×10^5

11. Two concentric spheres of radii r_1 and r_2 carry charges q_1 and q_2, respectively. if the surface charge density (σ) is the same for both the spheres, the electric potential at the common centre will be **[1]**

(1) $\frac{\sigma}{\varepsilon_0} \times \frac{r_1}{r_2}$ (2) $\frac{\sigma}{\varepsilon_0} \times \frac{r_2}{r_1}$ (3) $\frac{\sigma}{\varepsilon_0}(r_1 - r_2)$ (4) $\frac{\sigma}{\varepsilon_0}(r_1 + r_2)$

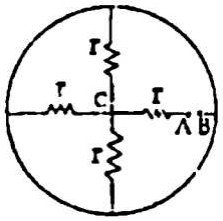
12. n capacitors are connected in parellel with source of 'V' volt then energy stored is …….. **[1]**

(1) $\frac{1}{2n}CV^2$ (2) CV^2 (3) CV (4) $\frac{1}{2}nCV^2$

13. Electron is accelerated from stationary position with electric potential 'V', then it's final velocity is……..(Charge & mass of electron are 'e' and 'm' repectively) **[1]**

(1) $\sqrt{\frac{2eV}{m}}$ (2) $\sqrt{\frac{eV}{m}}$ (3) $\frac{eV}{m}$ (4) $\frac{eV}{2m}$

14. Find the equivalent resistance between point A and B as shown in fig. **[1]**



(1) 4r (2) $\frac{5r}{2}$ (3) $\frac{4r}{3}$ (4) $\frac{r}{4}$

15. Current 'I' is passing through the conductor of radius 'r' having drift velocity 'V_d'. if it is passing through conductor of radius '2r', what will be new drift velocity. **[1]**

(1) $\frac{V_d}{4}$ (2) V_d (3) $2V_d$ (4) $4V_d$

16. Photoelectrons are emitted when light incident on metal surface in time which is approximately equal to **[1]**

(1) 10^{-9} sec (2) 10^{-2} sec (3) 10^{-3} sec (4) 10^{-7} sec

17. Three capacitors connected in series have an effective capacitance of 2μF. If one of the capacitors is removed, the equivalent capacitance becomes 3μF. the capacitance of the capacitor that is removed is

(1) 6μF (2) 1 μF (3) $\frac{3}{2}$ μF (4) $\frac{2}{3}$ μF **[1]**

18. One black paper is kept at the mid of convex lens as shown in figure then….. **[1]**

(1) Image is not formed with remaining part of lens

(2) Brightness of image is reduced

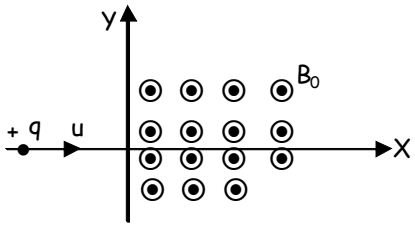
(3) Mid part of image is not formed

(4) Two image are formed with open part

19. Convex lens made from three different glass as shown in fig. how many images will be formed ? **[1]**

(1) 3 (2) 4 (3) 1 (4) 2

20. A proton moving with speed u along the positive x-axis enters at y = 0 in a region of uniform magnetic field $\vec{B} = B_0\hat{K}$, extends to the right of Y-axis as shown in the figure. the proton leaves the region after some time with speed v at coordinate y, then **[1]**



(1) v > u, y < 0 (2) v = u, y = 0 (3) v = u, y > 0 (4) v = u, y < 0

21. A small object with length 'ℓ' (length of object is along axis) is kept at distance u on the axis of concave mirror. If focal length is f then length of image is.... (ℓ << u) **[1]**

(1) $l\left(\frac{u-f}{f}\right)^2$ (2) $l\left(\frac{f}{u-f}\right)$ (3) $\left(\frac{u-f}{f}\right)$ (4) $l\left(\frac{f}{u-f}\right)^2$

22. A person cannot see properly beyond 2m. To remove this error of vision the required lens power is ..... D **[1]**

(1) +2.0 (2) -1.0 (3) +1.0 (4) -0.5

23. Two equally charged, identical metal spheres *A* and *B* repel each other with a force '*F*'. The spheres are kept fixed with a distance '*r*' between them. A third identical, but uncharged sphere *C* is brought in contact with *A* and then placed at the mid-point of the line joining *A* and *B*. The magnitude of the net electric force on *C* is **[1]**

(1) *F* (2) 3*F*/4 (3) *F*/2 (4) *F*/4

24. Davisson-Germer experiment explained **[1]**

(1) Particle nature of light (2) Particle nature of electrons

(3) Wave nature of light (4) Wave nature of electrons

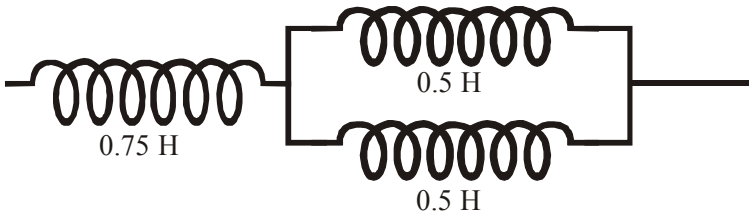
25. One particle stationary at x = x_0. Then find its De-Broglie wave length. **[1]**

(1) ∞ (2) 0 (3) 1 (4) Nothing can be said

26. The rate of change of current through one coil of a system of two coils is 1.6 As^{-1}. If an induced emf of 2.56×10^{-2} V is produced in the other coil, the mutual inductance of the system of coils is ..... mH. **[1]**

(1) 16 (2) 1.6 (3) 160 (4) 2.56

27. Equivalent inductance of the circuit shown in the figure is **[1]**



(1) 1.0 H (2) 1.75 H (3) 0.75 H (4) 0.25 H

28. Length of one metal rod is 1 meter. 2 tesla is the intensity of the magnetic field. When this rod is rotating with the frequency of 10 Hz perpendicular to the field line by keeping its one end fixed as axis of rotation, induced emf is ..... . **[1]**

(1) 10π V (2) 20π V (3) 30π V (4) 40π V

29. Two inductors A and B have same value of L. No. of turns in them are 100 and 300 respectively. Find ratio of their radius. Both have same length. **[1]**

(1) 1 : 3 (2) 3 : 1 (3) 1 : 9 (4) 9 : 1

30. For a L, C, R, connected in series with an a.c. source L = 1H, c = 20 μF and R = 6Ω. Calculate the Q factor. **[1]**

(1) 3.72 (2) 0.372 (3) 37.2 (4) 2.37

31. An A.C. L-R circuit comprieses of an inductor, whose reactance $X_L = 3R$, where R is the resistance of the circuit. If a capacitor, whose reactance $X_C = R$ is connected in series then what will be the ratio of the new and the old power factor ? **[1]**

(1) $\sqrt{2}$ (2) $\frac{1}{\sqrt{2}}$ (3) 2 (4) 1

32. In frequency of A.C. supply is 60 Hz then how much time A.C. voltage becomes zero in one second ? **[1]**

(1) 30 (2) 60 (3) 120 (4) 240

33. Ratio of rms value and maximum value of A.C. current or voltage is ..... **[1]**

(1) 1 : $\sqrt{2}$ (2) $\sqrt{2}$: 1 (3) 1 : 2 (4) 2 : 1

34. Resonance frequency is change if ..... is change in L-C-R series A.C. circuit. **[1]**

(1) only R (2) only L (3) only C (4) Any of L and C

35. Relation between $\vec{E}$ and $\vec{B}$ is ..... (C-velocity of light) **[1]**

(1) $\frac{B}{E} = c$ (2) $\frac{E}{B} = c$ (3) $c = \vec{E} \cdot \vec{B}$ (4) $c = \vec{B} \times \vec{E}$

36. Wave number of first line of Balmer series of H in terms of Rydberg's constant is ..... . **[1]**

(1) R (2) 3R/4 (3) 5R/36 (4) 8R/9

37. Ratio of first three Bohr's orbit in H is ..... . **[1]**

(1) $1 : \frac{1}{2} : \frac{1}{3}$ (2) 1 : 8 : 27 (3) 1 : 4 : 9 (4) 1 : 2 : 3

38. The ratio of energies in first excited state and second excited state of electron in hydrogen atom is ..... . **[1]**

(1) $\frac{1}{4}$ (2) $\frac{4}{9}$ (3) $\frac{9}{4}$ (4) 4

39. Diameter of innermost orbit of hydrogen atom is 1.06 Å then diameter of 10th orbit is ..... . **[1]**

(1) 5.3 Å (2) 10.6 Å (3) 53 Å (4) 106 Å

40. Co-ordinates of point where graph of ln N $\rightarrow$ t intercept on t axis during nuclear decay will be ..... . **[1]**

(1) (0, ln N_0) (2) (ln N_0, 0) (3) $\left(\frac{\ln N_0}{\lambda}, 0\right)$ (4) (0, $-\lambda$)

41. At t = 0 activity of radioactivie element is 9750 disintegration/min and at t = 5 min activity is 975 disintegration/min then decay constant will be ..... (Min^{-1}) **[1]**

(1) 0.230 (2) 0.461 (3) 0.691 (4) 0.922

42. In t = $\frac{1}{\lambda}$ time how much part of initial nuclei will remain undecayed ? **[1]**

(1) 63.2 % (2) 50% (3) 36.8% (4) 20%

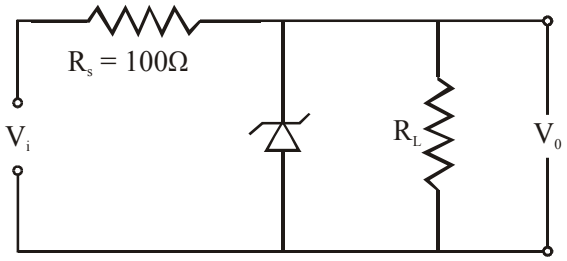
43. Complete reaction ${}^{11}_{6}C \rightarrow {}^{11}_{5}B + \beta^{+} + ...$ **[1]**

(1) ${}_{-1}e^{0}$ (2) ${}_{1}H^{1}$ (3) $\bar{\nu}$ (4) ν

44. A potential barrier of 0.50 V exists across a P-N junction. If the depletion region is 50×10^{-7}m wide, the intensity of the electric field in the region is ..... . **[1]**

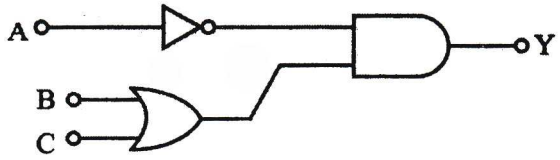
(1) $1.0 \times 10^{6} \frac{V}{m}$ (2) $1.0 \times 10^{5} \frac{V}{m}$ (3) $2.0 \times 10^{5} \frac{V}{m}$ (4) $2.0 \times 10^{6} \frac{V}{m}$

45. The current flowing through the resister R_S = 100 Ω at any instant in below circuit is 10 mA. On changing the value of V_i current through R_S becomes 15 mA. Find the change in p.d. across R_L. (Assuming the potential across diode is always above its barrrier potential) **[1]**



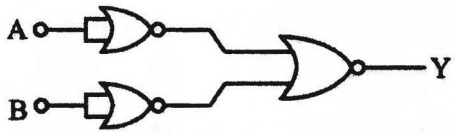
(1) 500 V (2) 10 V (3) 0 V (4) None of the above

46. The boolean equation for the circuit given in figure is ..... . **[1]**



(1) $Y = (\bar{A} \cdot B) + C$ (2) $Y = \bar{A}\ (\bar{B}+\bar{C})$ (3) $Y = \bar{A} \cdot (A+B)$ (4) $Y = \bar{A} \cdot (B+C)$

47. Identify the operation performed by the circuit given below. **[1]**



(1) NOT (2) AND (3) OR (4) NAND

48. Soap bubble looks coloured due to ..... . **[1]**

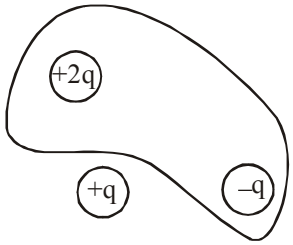
(1) dispersion (2) interference

(3) reflection (4) polarisation

49. The magnitude of electric field intensity E is such that, an electron placed in it would experience an electrical force equal to twice of weight is given by ..... . **[1]**

(1) $\frac{2mg}{e}$ (2) mge (3) $\frac{e}{mg}$ (4) $\frac{e^2}{m^2g}$

50. Arrangement of charges are shown in figure, flux linked with closed surface is ..... . **[1]**



(1) $\frac{q}{\varepsilon_0}$ (2) Zero (3) $\frac{2q}{\varepsilon_0}$ (4) $\frac{3q}{\varepsilon_0}$

PART-B

Time Allowed : 2 Hour **Maximum Marks : 50**

Instructions :

- Write in a clear legible handwriting.
- There are three sections in Part-B of the question paper and total 1 to 18 question are there.
- All the questions are compulsory. Internal options are given.
- Start new section on new page.
- The numbers at right side represent the marks of the question.
- Maintain sequence.

SECTION-A

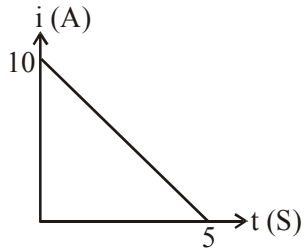
❖ **Answer the following (1 to 8) questions as directed in the question.**

1. Self inductance of solenoid depends on which factors ? **[2]**

2. A plane mirror makes an angle of 30° with horizontal. If a vertical ray strikes the mirror, find the angle between mirror and reflected ray ? **[2]**

3. Value of resistance for a carbon resistor having colour code red, orange, yellow, gold. **[2]**

4.



Find value of average current. **[2]**

5. Write the characteristic of electric field lines. **[2]**

6. Explain coloumb's law in scalar form. **[2]**

7. Derive $E = \frac{\sigma}{2\varepsilon_0}\hat{n}$ **[2]**

8. Derive equation for combination of thin lenses in contact. **[2]**

SECTION-B

❖ **Answer the following (9 to 14) questions with necessary calculations as directed in the question.**

9. There are 1.5×10^4 turns in the winding of a toroidal ring. The radius of circular axis of the ring is 10 cm. The radius of cross-section of ring is 2.0 cm. Find inductance of the ring. **[3]**

10. L = 8.1 mH, C = 12.5 μF and R = 100Ω are connected in series with A.C. source of 230 V and frequency 500 Hz. Calculate voltage across the two ends of resistance and current flowing in the circuit. **[3]**

11. In Young's experiment, the distance between two slits is 1 mm and the distance between two consecutive bright fringes is 0.03 cm. Now, on displacing the screen away from the slits by 50 cm, the distance between two consecutive dark fringes is doubled. Find the wavelength of light used. **[3]**

12. By the fusion of 1 kg deuterium ($_1H^2$) according to the reaction ($_1H^2 + {}_1H^2 \rightarrow {}_2^3He + {}_0n^1 + 3.27$ MeV). How long can a bulb of 100 W give light ?

($N_A = 6.02 \times 10^{23}$, 1 yr = 3.16×10^7 s) **[3]**

13. An electron falls through a distance of 1.5 cm in a uniform electric field of magnitude 2×10^4 N/C. The direction of the field is reversed keeping its magnitude unchanged and a proton falls through the same distance. Compute the time of fall in each case. **[3]**

14. Two point charges $q_A = 3\mu C$ and $q_B = -3\ \mu C$ are located 20 cm apart in vacuum. **[3]**

(a) What is electric field at the mid point O of the line AB joining the two charges?

(b) If a negative test charge of magnitude 1.5×10^{-9} C is placed at this point. What is the force experienced by the test charge?

(M) Derive $E = \frac{\lambda}{2\pi\varepsilon_0}\hat{r}$

SECTION-C

❖ **Answer the following (15 to 18) questions with necessary calculations as directed in question.**

15. A region is specified by the potential function : **[4]**

Q : $4x^2 + 3y^3 - 9z^2$

Calculate the electric field at a point (3, 4, 5) in this region.

16. Derive the equation of intensity distribution in an interference pattern due to superposition of two waves. **[4]**

17. By using Bohr's hypothesis derive the equation of radius of electron revolving in hydrogen atom. **[4]**

18. Derive equation $E = \frac{2kp}{r^3}\hat{p}$ (on the axis) and $E = \frac{-kp}{r^3}\hat{p}$ (on the equatorial plane) for electric dipole.**[4]**

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