PHYSICS

BOOKS - U-LIKE PHYSICS (HINGLISH)

EXAMINATION PAPER 2020 (SOLVED)

Section A

1. If a positive charge is displaced against the electric field in which it was situated, then

A. work will be done by the electric field on the charge.

B. the intensity of the electric field decreases.

C. energy of the system will decrease.

D. energy will be provided by external source displacing the charge.

Answer: D

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2. The electric flux emerging out from 1 C charge is

A. $\frac{1}{\varepsilon_0}$

B. 4π

C. $\frac{4\pi}{\varepsilon_0}$

D. ε_0

Answer: A

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3. Two capacitors of capacitances C_1 and C_2 are connected in parallel. If a charge Q is given to the combination, the ratio of the charge on the capacitor C_1 to the charge on C_2 will be

A. $\frac{C_1}{C_2}$

B. $\sqrt{\frac{C_1}{C_2}}$

C. $\sqrt{\frac{C_2}{C_1}}$

D. $\frac{C_2}{C_1}$

Answer: A

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4. The electrical resistance of a conductor

A. varies directly proportional to its area of cross-section.

B. decreases with increase in its temperature.

C. decreases with increase in its conductivity.

D. is independent of its shape but depends only on its volume.

Answer: C

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5. $m^2V^{-1}s^{-1}$ is the SI unit of which of the following?

A. Drift velocity

B. Mobility

C. Resistivity

D. Potential gradient

Answer: B

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6. The element of a heater is rated (P, V). If it is connected across a source of voltage $\frac{V}{2}$, then the power consumed by it will be

A. P

B. 2P

C. $\frac{P}{2}$

D. $\frac{P}{4}$

Answer: D

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7. In Bohr's model of hydrogen atom, the total energy of the electron in nth discrete orbit is proportional to

A. n

B. $\frac{1}{n}$

C. n^2

D. $\frac{1}{n^2}$

Answer: D

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8. A zener diode has

A. heavily doped p-side and lightly doped n-side.

B. heavily doped n-side and lightly doped p-side.

C. heavily doped n-side as well as p-side.

D. lightly doped n-side as well as p-side.

Answer: C

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9. A region has a uniform magnetic field in it. A proton enters into the region with velocity making an angle of 45^{o} with the direction of the magnetic field. In this region the proton will move on a path having the shape of a

A. straight line.

B. circle

C. spiral.

D. helix.

Answer: D

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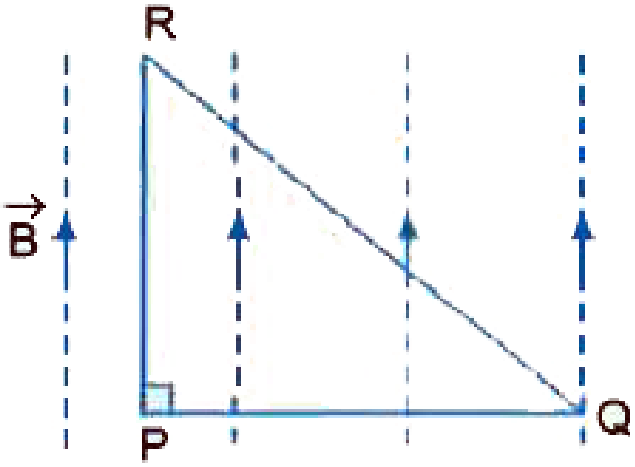
10. An isosceles right angled current carrying loop PQR is placed in a uniform magnetic field $\vec{B}$ pointing along PR. If the magnetic force acting on the arm PQ is F, then the magnetic

force which acts on the arm QR will be



A. F

B. $\frac{F}{\sqrt{2}}$

C. $\sqrt{2}F$

D. $-F$

Answer: D

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11. The shape of the wavefront originating from a line source is _____ .

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12. The refractive index of the material of a converging lens is 1.5. If air is replaced by a medium of refractive index 1.6, then the lens will now behave as a ___ lens.

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13. In Young's double-slit experiment, the separation between the two slits is halved. The new fringe width will be ___ times its initial value.

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14. The value of Brewster's angle for air-glass interface is $\frac{\pi}{3}$ hence the refractive index of glass is _____.

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15. In photoelectric effect, the number of emitted photoelectrons is proportional to _____ of incident light.

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16. Light of frequency vis incident on a photosensitive surface of threshold frequency

$v_0 (v > v_0)$. The value of kinetic energy of the emitted photoelectrons will be _____

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17. An a.c. is passed through a series LCR circuit What is the impedance of the circuit at resonance ?

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18. Two identical coils, one of copper and the other of aluminium are rotated with the same angular speed in an external magnetic field. In which of the two coils will the induced current be more ?

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19. In an a.c. circuit, the applied voltage and flowing current are $E = E_0 \sin \omega t$ and $I = I_0 \sin\left(\omega t + \frac{\pi}{2}\right)$ respectively. What is the

average power consumed in one cycle in this circuit ?

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20. What happens when a block of metal is kept in a varying magnetic field ?

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21. Mention the contribution of Indian physicist J.C. Bose in the production of

electromagnetic waves.

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22. Write one use of the electromagnetic waves of frequency range from 10^{16} Hz to 10^{20} Hz.

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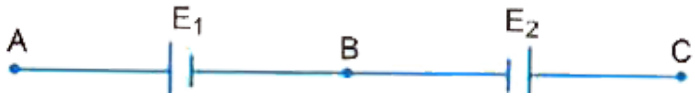
Section B

1. Two cells of emf E_1 and $E_2(E_1 > E_2)$ are connected as shown in the figure below. When a potentiometer is used to measure potential difference between the points A and B, the balancing length of the potentiometer wire is 300 cm. But the same potentiometer for the potential difference between points A and C, gives the balancing length 100 cm. Find $\frac{E_1}{E_2}$.



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2. Two identical bars, one of paramagnetic material and other of diamagnetic material are kept in a uniform external magnetic field parallel to it. Draw diagrammatically the modifications in the magnetic field pattern in each case.

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3. Two coplanar and concentric coils 1 and 2 have respectively the number of turns N_1 and N_2 and radii r_1 and $r_2(r_2 > > r_1)$. Deduce

the expression for mutual inductance of this system.

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4. How does an oscillating charge radiate an electromagnetic wave ? Give the relation between the frequency of radiated wave and the frequency of oscillating charge.

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5. (a) Explain briefly the fact that electromagnetic waves carry energy.

(b) Why do we not feel the pressure due to sunshine?

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6. A converging lens of focal length f_1 is placed coaxially in contact with a diverging lens of focal length $f_2((f_1 > f_2)$. Determine

the power and nature of the combination in terms of f_1 and f_2.

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7. How is the resolving power of a compound microscope affected if (a) wavelength of light used is decreased, and (b) the diameter of its objective lens is increased? Justify your answers.

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8. Define the terms (a) threshold frequency, and (b) stopping potential. How were these tenns incorporated in Einstein's photoelectric equation?

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9. A hydrogen atom is in its third excited state. (a) How many spectral lines can be emitted by it before coming to the ground state ? Show these transitions in the energy level diagram. (b) In which of the above transitions will the

spectral line of shortest wavelength be emitted ?

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Section C

1. A hydrogen atom is in its third excited state.

(a) How many spectral lines can be emitted by it before coming to the ground state ? Show these transitions in the energy level diagram.

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spectral line of shortest wavelength be emitted ?

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2. A series LCR a.c. circuit has L = 2.0 H, C = 32 μF and R = 10 Ω.

(a) At what angular frequency of a.c. will it resonate ?

(b) Calculate the Q value of the circuit.

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3. An ideal inductor of $\frac{5}{\pi}$ H inductance is connected to a 200 V, 50 Hz a.c. supply.

(a) Calculate the rms and peak value of current in the inductor.

(b) What is the phase difference between current through the inductor and the applied voltage ? How will it change if a small resistance is connected in series with this inductor in the circuit ?

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4. (a) Using the necessary ray diagram, derive the mirror formula for a concave mirror.

(b) In the magnified image of a measuring scale (with equidistant markings) lying along the principal axis of a concave mirror, the markings are not equidistant. Explain.

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5. (a) The density of the nuclear matter is tremendously larger than the physical density

of the material. Explain.

(b) The nuclear forces are not coulomb forces between nucleons. Explain.

(c) Draw a plot of the potential energy between a pair of nucleons as a function of distance between them inside a nucleus.

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6. What do you mean by wave nature of an electron? How was quantisation of angular momentum of the orbiting electron in Bohr's

model of hydrogen atom explained by de-Broglie hypothesis ?

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7. Name the diode which can act as a voltage regulator. Explain its working with the help of its labelled circuit diagram. Draw its V-1 characteristic.

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8. (a) Why is an intrinsic semiconductor deliberately converted into an extrinsic semiconductor by adding impurity atoms ?

(b) Explain briefly the two processes that occur in p-n junction region to create a potential barrier.

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Section D

1. (a) An electric dipole of dipole moment $\overrightarrow{p}$ is placed in a uniform electric field $\overrightarrow{E}$ at an angle θ with it. Derive the expression for torque $\left(\overrightarrow{\tau}\right)$ acting on it. Find the orientation of the dipole relative to the electric field for which torque on it is (i) maximum, and (ii) half of maximum.

(b) Two point charges $q_1 = +1\mu C$ and $q_2 = +4\mu C$ are placed 2 m apart in air. At what distance from q_1 along the line joining the two charges, will the net electric field be zero ?

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2. (a) Derive an expression for the energy stored in a parallel plate capacitor of capacitance C when charged up to voltage V. How is this energy stored in the capacitor ?

(b) A capacitor of capacitance 1 μF is charged by connecting a battery of negligible internal resistance and emf 10 V across it. Calculate the amount of charge supplied by the battery in charging the capacitor fully.

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3. (a) Derive the expression for the force acting per unit length between two long straight parallel current carrying conductors. Hence, define one ampere.

(b) Two long parallel straight conductors are placed 12 cm apart in air. They carry equal currents of 3 A each. Find the magnitude and direction of the magnetic field at a point midway between them (drawing a figure) when the currents in them flow in opposite directions.

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4. (a) Draw the schematic sketch of a cyclotron. Explain the shape of the path on which charged particle moves when the particle is accelerated by it.

(b) To convert a given galvanometer into a voltmeter of ranges 2 V, V and $\frac{V}{2}$ volt, resistances R_1, R_2 and R_3 ohm respectively, are required to be connected in series with the galvanometer. Obtain the relationship between R_1, R_2 and R_3.

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5. (a) What is meant by plane polarised light? An unpolarised light is incident at an angle θ on the surface of glass of refractive index n. If the reflected and refracted rays are perpendicular to each other, then obtain the relationship between n and θ.

(b) Two polaroids P1 and P2 are placed in a crossed position. Unpolarised light of intensity I_0 is incident on P_1. If P_2 is rotated through an angle θ about the direction of propagation

of light, keeping P_1 fixed, plot the graph of intensity of light for $0^\circ < \theta < 360^\circ$ which is (i) transmitted by P_1 and (ii) transmitted by P_2

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6. (a) Briefly describe the Young's double-slit experiment of interference of light. Derive the expression for fringe width in the pattern.

(b) Monochromatic light of wavelength 588 nm is incident from air to water interface. Find

the wavelength and speed of the refracted light. The refractive index of water is $\frac{4}{3}$.

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