**Sample Paper-03** **Class 12th NEET (2024)**

## PHYSICS

### SECTION-A

**1.** The electric potential $V$ is given as a function of distance $x$(metre) by $V = (5x^2 + 10x - 9)$ volt. Value of electric field at $x = 1$ is;

(1) $-20V/m$ (2) $6V/m$

(3) $11V/m$ (4) $-23V/m$

**2.** Two identical capacitors, have the same capacitance $C$. One of them is charged to potential $V_1$ and the other to $V_2$. The negative ends of the capacitors are connected together. When the positive ends are also connected, the decrease in energy of the combined system is?

(1) $\frac{1}{4}C(V_1^2 - V_2^2)$ (2) $\frac{1}{4}C(V_1^2 + V_2^2)$

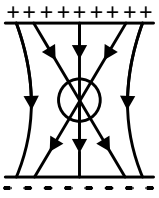
(3) $\frac{1}{4}C(V_1 - V_2)^2$ (4) $\frac{1}{4}C(V_1 + V_2)^2$

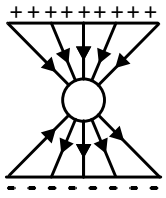
**3.** A condenser having a capacity of $6\mu F$ is charged to 100 $V$ and is then joined to an uncharged condenser of $14\mu F$ and then removed. The ratio of the charges on $6\mu F$ and $14\mu F$ and the potential of $6\mu F$ will be;

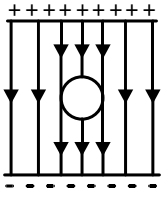
(1) $\frac{6}{14}$ and 50 volt (2) $\frac{14}{6}$ and 30 volt

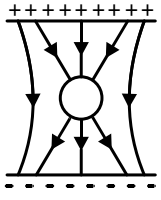
(3) $\frac{6}{14}$ and 30 volt (4) $\frac{14}{6}$ and 0 volt

**4.** An uncharged sphere of metal is placed inside a charged parallel plate capacitor. The lines of force will look like;

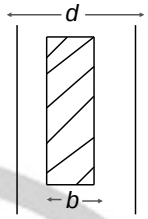
(1) 

(2) 

(3) 

(4) 

**5.** A slab of copper of thickness $b$ is inserted in between the plates of parallel plate capacitor as shown in figure. The separation between the plates is $d$ if $b = \frac{d}{2}$, then the ratio of capacities of capacitors after and before inserting the slab will be;




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

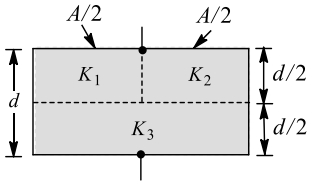
(3) $1:1$ (4) $1:\sqrt{2}$

**6.** If the electric flux entering and leaving an enclosed surface respectively is $\phi_1$ and $\phi_2$, then, charge enclosed in closed surface is;

(1) $\frac{\phi_2 - \phi_1}{\varepsilon_0}$ (2) $\frac{\phi_1 + \phi_2}{\varepsilon_0}$

(3) $\frac{\phi_1 - \phi_2}{\varepsilon_0}$ (4) $\varepsilon_0(\phi_2 - \phi_1)$

**7.** A parallel plate capacitor of area $A$, plate separation d and capacitance $C$ is filled with three different dielectric materials having dielectric constants $K_1$, $K_2$ and $K_3$ as shown. If a single dielectric material is to be used to have the same capacitance $C$ is this capacitors, then its dielectric constant $K$ is given by



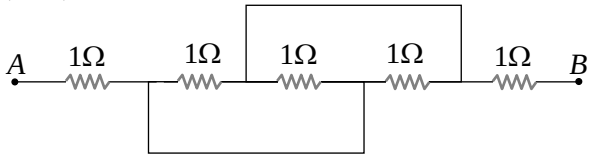

(1) $\frac{1}{K} = \frac{1}{K_1} + \frac{1}{K_2} + \frac{1}{2K_3}$

(2) $\frac{1}{K} = \frac{1}{K_1 + K_2} + \frac{1}{2K_3}$

(3) $K = \frac{K_1 K_2}{K_1 + K_2} + 2K_3$

(4) $K = K_1 + K_2 + 2K_3$

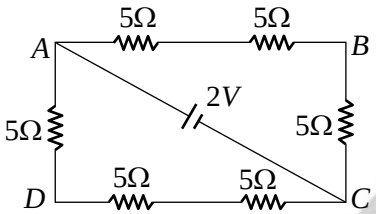
**8.** Equivalent resistance between the points $A$ and $B$ is (in Ω)




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

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

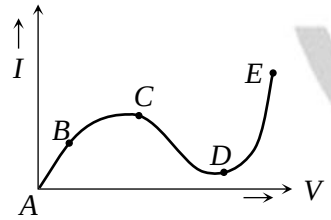
**9.** The potential difference between points $A$ and $B$ of adjoining figure is




(1) $\frac{2}{3}V$ (2) $\frac{8}{9}V$

(3) $\frac{4}{3}V$ (4) $2V$

**10.** From the graph between current $I$ and voltage $V$ shown below, identify the portion corresponding to negative resistance




(1) $AB$ (2) $BC$

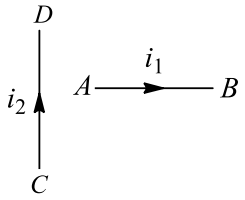
(3) $CD$ (4) $DE$

**11.** An electron ($q = 1.6 \times 10^{-19}\ C$) is moving at right angle to the uniform magnetic field $3.534 \times 10^{-5}$T. The time taken by the electron to complete a circular orbit is;

(1) 2μs (2) 4μs

(3) 3μs (4) 1μs

**12.** A current $i_1$ carrying wire $AB$ is placed near an another long wire $CD$ carrying current $i_2$ as shown in figure. If free to move, wire $AB$ will have;




(1) rotational motion only.

(2) translational motion only.

(3) rotational as well as translational motion.

(4) neither rotational nor translational motion.

**13.** The torque required to hold a small circular coil of 10 turns, $2 \times 10^{-4}m^2$ area and carrying 0.5 A current in the middle of a long solenoid of $10^3$ turns $m^{-1}$ carrying 3 A current. With its axis perpendicular to the axis of the solenoid is;

(1) $12\pi \times 10^{-7}$ Nm (2) $6\pi \times 10^{-7}$ Nm

(3) $4\pi \times 10^{-7}$ Nm (4) $2\pi \times 10^{-7}$ Nm

**14.** A paramagnetic substance of susceptibility $3 \times 10^{-4}$ is placed in a magnetic field of $4 \times 10^{-4}$ $Am^{-1}$. Then the intensity of magnetization in the units of $Am^{-1}$ is;

(1) $1.33 \times 10^{8}$ (2) $0.75 \times 10^{-8}$

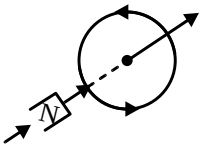
(3) $12 \times 10^{-8}$ (4) $14 \times 10^{-8}$

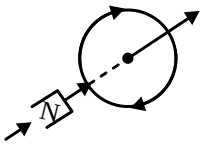
**15.** The time period of a thin bar magnet in earth's magnetic field is $T$. If the magnet is cut into equal parts perpendicular to its length, the time period of each part in the same field will be;

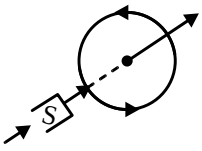
(1) $\frac{T}{2}$ (2) $\frac{T}{4}$

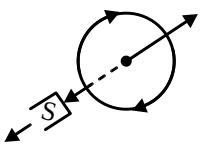
(3) $\sqrt{2}T$ (4) $2T$

**16.** Which of the following figure correctly depicts the Lenz's law. The arrows show the movement of the labelled pole of a bar magnet into a closed circular loop and the arrows on the circle show the direction of the induced current;

(1) 


(2) 

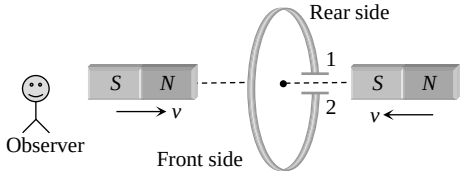

(3) 


(4) 

**17.** An average induced e.m.f. of 1V appears in a coil when the current in it is changed from 10A in opposite direction in 0.5 sec. Self-inductance of the coil is;

(1) 25 mH (2) 50 mH
(3) 75 mH (4) 100 mH

**18.** The north and south poles of two identical magnets approach a coil, containing a condenser, with equal speeds from opposite sides. Then;




(1) plate 1 will be negative and plate 2 positive.
(2) plate 1 will be positive and plate 2 negative.
(3) both the plates will be positive.
(4) both the plates will be negative.

**19.** The time taken by an alternating current of 50 Hz in reaching from zero to its maximum value will be;

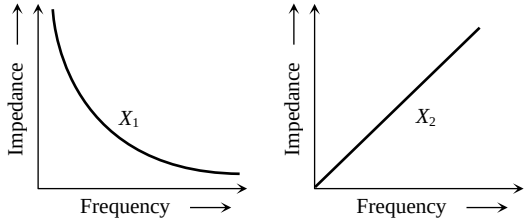
(1) 0.5 s (2) 0.005 s
(3) 0.05 s (4) 5 s

**20.** In an *AC* circuit the voltage applied is $E = E_0 \sin \omega t$. The resulting current in the circuit is $I = I_0 \sin\left(\omega t - \frac{\pi}{2}\right)$. The power consumption in the circuit is given by;

(1) $P = \frac{E_0 I_0}{\sqrt{2}}$ (2) $P$ = zero

(3) $P = \frac{E_0 I_0}{2}$ (4) $P = \sqrt{2} E_0 I_0$

**21.** The graphs given below depict the dependence of two reactive impedances $X_1$ and $X_2$ on the frequency of the alternating e.m.f. applied individually to them. We can then say that;

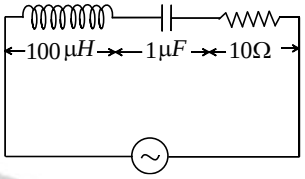



(1) $X_1$ is an inductor and $X_2$is a capacitor.
(2) $X_1$ is a resistor and $X_2$ is a capacitor.
(3) $X_1$ is a capacitor and $X_2$ is an inductor.
(4) $X_1$ is an inductor and $X_2$ is a resistor.

**22.** An *LCR* circuit contains $R = 50\ \Omega$, $L = 1$ mH and $C = 0.1\mu F$. The impedance of the circuit will be minimum for a frequency of;

(1) $\frac{10^5}{2\pi} S^{-1}$ (2) $\frac{10^6}{2\pi} S^{-1}$
(3) $2\pi \times 10^5\ s^{-1}$ (4) $2\pi \times 10^6 s^{-1}$

**23.** The following series $L - C - R$ circuit, when driven by an e.m.f. source of angular frequency 70 kilo-radians per second, the circuit effectively behaves like;

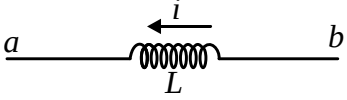



(1) purely resistive circuit.
(2) series $R - L$ circuit.
(3) series $R - C$ circuit.
(4) series $L - C$ circuit with $R = 0$.

**24.** A point source of electromagnetic radiation has an average power output of 800 W. The maximum value of electric filed at a distance 4.0 m from the source is;

(1) 64.7 $Vm^{-1}$
(2) 57.8 $Vm^{-1}$
(3) 56.72 $Vm^{-1}$
(4) 54.77 $Vm^{-1}$

**25.** The inductor shown in the figure has inductance 0.44 H and carries a current in the direction shown that is decreasing at a uniform rate $\frac{di}{dt} = -0.02$ A/s. The value of $V_a - V_b$ is;




(1) 4.4 mV (2) – 4.4 mV
(3) 8.8 mV (4) –8.8 mV

**26.** If an electromagnetic wave is propagate in a medium with permittivity ε and permeability μ, then $\sqrt{\frac{\mu}{\varepsilon}}$ is the;

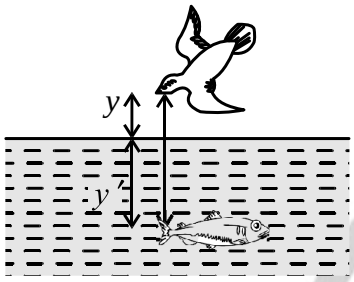
(1) intrinsic impedance of the medium.
(2) square of the refractive index of the medium.
(3) refractive index of the medium.
(4) energy density of the medium.

**27.** Fringe width in a YDSE is measured to be $\beta$. What will be the fringe width if the wavelength of incident light is tripled, the separation between the slits is halved and the separation between the screen and the slits doubled?

(1) $6\beta$ (2) $12\beta$

(3) $\frac{\beta}{6}$ (4) $\frac{\beta}{12}$

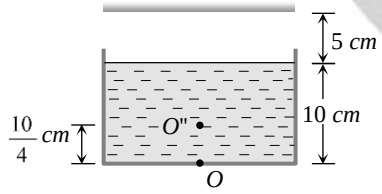
**28.** A fish rising vertically up towards the surface of water with speed $3ms^{-1}$ observes a bird diving vertically down towards it with speed $9ms^{-1}$. The actual velocity of bird is;




(1) 4.5 $ms^{-1}$ (2) 5 $ms^{-1}$

(3) 3.0 $ms^{-1}$ (4) 3.4 $ms^{-1}$

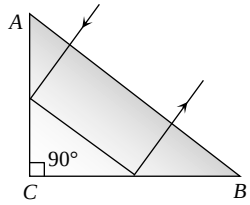
**29.** Consider the situation shown in figure. Water $\left(\mu_w = \frac{4}{3}\right)$ is filled in a beaker upto a height of 10 cm. A plane mirror fixed at a height of 5 cm from the surface of water. Distance of image from the mirror after reflection from it of an object *O* at the bottom of the beaker is;




(1) 15 cm (2) 12.5 cm

(3) 7.5 cm (4) 10 cm

**30.** A ray of light incident normally on an isosceles right angled prism travels as shown in the figure. The least value of the refractive index of the prism must be;




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

(3) 1.5 (4) 2.0

**31.** Which of the following statements are **correct**?

**Statement I:** In photoelectric effect, if the energy absorbed by the electrons exceeds the work function of the metal, then most loosely bound electrons emerge with maximum kinetic energy.

**Statement II:** In photoelectric effect, kinetic energy of the emitted electrons is independent of the intensity of the radiation.

(1) I only

(2) II only

(3) I and II

(4) Neither I nor II

**32.** Two capacitors of capacitances $C_1$ = 3 $\mu F$ and $C_2$ = 9$\mu F$ are connected in series and the resulting combination is connected across 300V. Match quantities in **List-I** with their values in **List-II**.

| List-I | | List-II | |
|---|---|---|---|
| (A) | Potential across $C_1$ (in V) | (I) | 75 |
| (B) | Potential across $C_2$ (in V) | (II) | 225 |
| (C) | Energy stored in $C_1$ (in J) | (III) | $2.5 \times 10^{-2}$ |
| (D) | Energy stored in $C_2$ (in J) | (IV) | $7.6 \times 10^{-2}$ |

(1) A – II; B – I; C – IV; D – III

(2) A – IV; B – I; C – II; D – III

(3) A – II; B – I; C – III; D – IV

(4) A – IV; B – II; C – III; D – I

**33.** **Assertion (A):** Interference pattern is made by using blue light instead of red light, the fringes becomes narrower.

**Reason (R):** In Young's double slit experiment, fringe width is given by relation $B = \frac{\lambda D}{d}$.

(1) Both **Assertion (A)** and **Reason (R)** are the true, and Reason (R) is a correct explanation of **Assertion (A)**.

(2) Both **Assertion (A)** and **Reason (R)** are the true, but **Reason (R)** is not a correct explanation of **Assertion (A).**

(3) **Assertion (A)** is true, and **Reason (R)** is false.

(4) **Assertion (A)** is false, and **Reason (R)** is true.

**34.** When an independent positive charge moves from higher potential to lower potential, then match the entries of **List-I** with the entries of **List-II**.

| List-I | | List-II | |
|---|---|---|---|
| (A) | Its kinetic energy | (I) | will remain constant |
| (B) | Its potential energy | (II) | will decrease |
| (C) | Its mechanical energy | (III) | will increase |

(1) (A) – (III); (B) – (II); (C) – (I)

(2) (A) – (II); (B) – (III); (C) – (I)

(3) (A) – (III); (B) – (I); (C) – (II)

(4) (A) – (I); (B) – (II); (C) – (III)

**35.** The energy stored in a parallel plate capacitor is given by $V_E = \frac{Q^2}{2C}$. Now which of the following statements is **not** true?

**I.** The work done in charging a capacitor is stored in the form of electrostatic potential energy given by expression $V_E = \frac{Q^2}{2C}$.

**II.** The net charge on the capacitor is *Q*.

**III.** The magnitude of the net charge on one plate of a capacitor is Q.

(1) I only (2) II only

(3) I and II (4) I, II and III

## SECTION-B

**36.** **Assertion (A):** Electromagnets are made of soft iron.

**Reason (R):** Coercivity of soft iron is small.

(1) Both **Assertion (A)** and **Reason (R)** are the true, and **Reason (R)** is a correct explanation of **Assertion (A)**.

(2) Both **Assertion (A)** and **Reason (R)** are the true, but **Reason (R)** is not a correct explanation of **Assertion (A)**.

(3) **Assertion (A)** is true, and **Reason (R)** is false.

(4) **Assertion (A)** is false, and **Reason (R)** is true.

**37.** **Statement I:** In Young's experiment, the fringe width for dark fringes is different from that for bright fringes.

**Statement II:** In Young's double slit experiment the fringes are performed with a source of white light; then only black and white fringes are observed.

(1) Statement I and Statement II both are correct.

(2) Statement I is correct, but Statement II is incorrect.

(3) Statement I is incorrect, but Statement II is correct.

(4) Statement I and Statement II both are incorrect.

**38.** Wavelength of first line in Lyman series is λ. The wavelength of first line in Balmer series is;

(1) $\frac{5}{27}\lambda$ (2) $\frac{36}{5}\lambda$

(3) $\frac{27}{5}\lambda$ (4) $\frac{5}{36}\lambda$

**39.** In the Bohr model of a hydrogen atom, the centripetal force is furnished by the coulomb attraction between the proton and the electron. If $a_0$ is the radius of the ground state orbit, *m* is the mass and *e* is charge on the electron and $\varepsilon_0$ is the vacuum permittivity, the speed of the electron is;

(1) 0 (2) $\frac{e}{\sqrt{\varepsilon_0 a_0 m}}$

(3) $\frac{e}{\sqrt{4\pi\varepsilon_0 a_0 m}}$ (4) $\sqrt{\frac{4\pi\varepsilon_0 a_0 m}{e}}$

**40.** Four lowest energy levels of *H*-atom are shown in the figure. The number of possible emission lines would be;


(1) 3 (2) 4

(3) 5 (4) 6

**41.** A radioactive sample at any instant has its disintegration rate 5000 disintegrations per minute. After 5 min, the rate becomes 1250 disintegration per minute. Then, its decay constant (per minute) is;

(1) 0.8 $\log_e 2$ (2) 0.4 $\log_e 2$

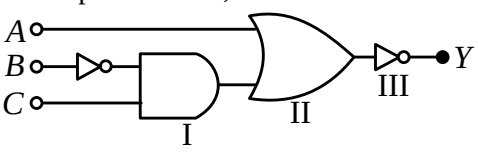
(3) 0.2 $\log_e 2$ (4) 0.1 $\log_e 2$

**42.** What is the current in the circuit shown below?


(1) 0 A (2) $10^{-2}$ A

(3) 1 A (4) 0.10 A

**43.** The output *Y* of the logic circuit shown in figure is best represented as;




(1) $\overline{A} + \overline{B \cdot C}$ (2) $A + \overline{B} \cdot C$

(3) $\overline{A + B \cdot C}$ (4) $\overline{A + \overline{B} \cdot C}$

**44.** If two waves represented by $y_1 = 4 \sin \omega t$ and $y_2 = 3 \sin\left(\omega t + \frac{\pi}{3}\right)$ interfere at a point, the amplitude of the resulting wave will be about;

(1) 7 (2) 6
(3) 5 (4) 3.5

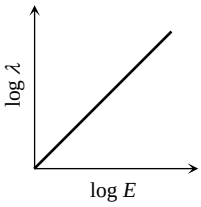
**45.** In Young's double slit experiment, an interference pattern is obtained on a screen by a light of wavelength 6000Å coming from the coherent sources $S_1$ and $S_2$. At certain point $P$ on the screen third dark fringe is formed. Then the path difference $S_1P - S_2P$ in microns is;

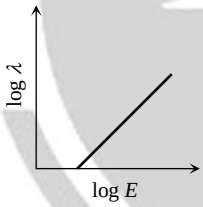
(1) 0.75 (2) 1.5
(3) 3.0 (4) 4.5

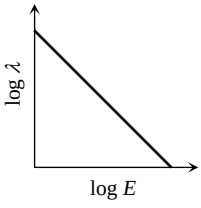
**46.** In Young's double slit experiment with sodium vapour lamp of wavelength 589 nm and the slits 0.589 mm apart, the half angular width of the central maximum is;

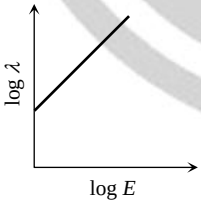
(1) $\sin^{-1}(0.01)$ (2) $\sin^{-1}(0.0001)$
(3) $\sin^{-1}(0.001)$ (4) $\sin^{-1}(0.1)$

**47.** The log-log graph between the energy $E$ of an electron and its de-Broglie wavelength $\lambda$ will be;

(1) 


(2) 


(3) 


(4) 

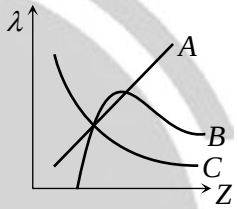

**48.** If $\frac{e}{m}$ of electron is $1.76 \times 10^{11}$ C kg$^{-1}$ and stopping potential is 0.71 V, then the maximum velocity of the photoelectron is;

(1) 150 km/s (2) 200 km/s
(3) 500 km/s (4) 250 km/s

**49.** What is the de-Broglie wavelength of the α-particle accelerated through a potential difference $V$?

(1) $\frac{0.287}{\sqrt{V}}$ Å (2) $\frac{12.27}{\sqrt{V}}$ Å
(3) $\frac{0.101}{\sqrt{V}}$ Å (4) $\frac{0.202}{\sqrt{V}}$ Å

**50.** The variation of wavelength $\lambda$ of the $K_\alpha$ line with atomic number $Z$ of the target is shown by the following curve of;




(1) $A$
(2) $B$
(3) $C$
(4) None of these