# NEET(UG)–2024 (EXAMINATION)

**(Held On Sunday 23rd JUNE, 2024)**

## PHYSICS

**Physics : Section-A (Q. No. 1 to 35)**

**1.** The magnetic potential energy when a magnetic bar with a magnetic moment $\vec{M}$ is placed perpendicular to the magnetic field $\vec{B}$ is:

| | | | |
|---|---|---|---|
| 1. | $\frac{-mB}{2}$ | 2. | zero |
| 3. | $-mB$ | 4. | $mB$ |

**2.** A bob is whirled in a horizontal circle by means of a string at an initial speed of $10$ rpm. If the tension in the string is quadrupled while keeping the radius constant, the new speed is:

| | | | |
|---|---|---|---|
| 1. | 20 rpm | 2. | 40 rpm |
| 3. | 5 rpm | 4. | 10 rpm |

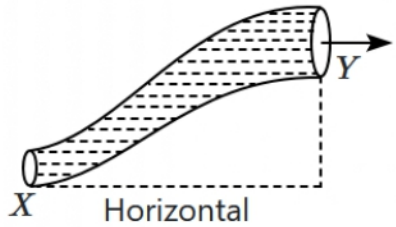
**3.** A metal cube of a side $5\ \text{cm}$, is charged with $6\ \mu\text{C}$. The surface charge density on the cube, is:

| | | | |
|---|---|---|---|
| 1. | $0.125 \times 10^{-3}\ \text{C m}^{-2}$ | 2. | $0.25 \times 10^{-3}\ \text{C m}^{-2}$ |
| 3. | $4 \times 10^{-3}\ \text{C m}^{-2}$ | 4. | $0.4 \times 10^{-3}\ \text{C m}^{-2}$ |

**4.** The incorrect relation for a diamagnetic material (all the symbols carry their usual meaning and $\varepsilon$ is a small positive number) is:

1. $\mu < \mu_0$
2. $0 \leqslant \mu_r < 1$
3. $-1 \leqslant \chi < 0$
4. $1 < \mu_r < 1 + \varepsilon$

**5.** An ideal fluid is flowing in a non-uniform cross-sectional tube $XY$ (as shown in the figure) from end $X$ to end $Y$. If $K_1$ and $K_2$ are the kinetic energies per unit volume of the fluid at $X$ and $Y$ respectively, the correct relationship between $K_1$ and $K_2$ is:




| | | | |
|---|---|---|---|
| 1. | $K_1 = K_2$ | 2. | $2K_1 = K_2$ |
| 3. | $K_1 > K_2$ | 4. | $K_1 < K_2$ |

**6.** The escape velocity for Earth is $v$. A planet having $9$ times the mass of Earth and a radius, $16$ times that of Earth, has the escape velocity of:

| | | | |
|---|---|---|---|
| 1. | $\frac{v}{3}$ | 2. | $\frac{2v}{3}$ |
| 3. | $\frac{3v}{4}$ | 4. | $\frac{9v}{4}$ |

**7.** An electron and an alpha particle are accelerated by the same potential difference. Let $\lambda_e$ and $\lambda_\alpha$ denote the de-Broglie wavelengths of the electron and the alpha particle, respectively, then:

| | | | |
|---|---|---|---|
| 1. | $\lambda_e > \lambda_\alpha$ | 2. | $\lambda_e = 4\lambda_\alpha$ |
| 3. | $\lambda_e = \lambda_\alpha$ | 4. | $\lambda_e < \lambda_\alpha$ |

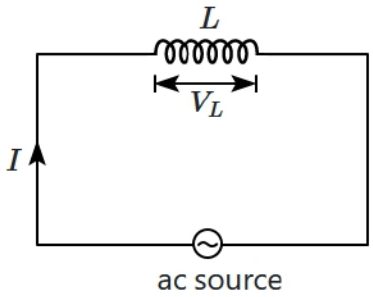
**8.** An object is moving along the horizontal $x$-direction with an initial kinetic energy of $10\ \text{J}$. It is displaced through $x = (3\hat{i})\ \text{m}$ under the influence of a force $\vec{F} = (-2\hat{i} + 3\hat{j})\ \text{N}$. The kinetic energy of the object at the end of the displacement $x$ is:

| | | | |
|---|---|---|---|
| 1. | 10 J | 2. | 16 J |
| 3. | 4 J | 4. | 6 J |

**9.** An object falls from a height of $10\ \text{m}$ above the ground. After striking the ground it loses $50\%$ of its kinetic energy. The height up to which the object can re-bounce from the ground is:

| | | | |
|---|---|---|---|
| 1. | 7.5 m | 2. | 10 m |
| 3. | 2.5 m | 4. | 5 m |

**10.** In the circuit shown below, the inductance $L$ is connected to a source. The current flowing in the circuit is $I = I_0 \sin \omega t$. The voltage drop $(V_L)$ across $L$ is:




| | | | |
|---|---|---|---|
| 1. | $\omega L\ I_0 \sin \omega t$ | 2. | $\frac{I_0}{\omega L} \sin \omega t$ |
| 3. | $\frac{I_0}{\omega L} \cos \omega t$ | 4. | $\omega L\ I_0 \cos \omega t$ |

**11.** A $12\ \mathrm{pF}$ capacitor is connected to a $50\ \mathrm{V}$ battery. The electrostatic energy stored in the capacitor in $\mathrm{nJ}$ is:

| | | | |
|---|---|---|---|
| 1. | 15 | 2. | 7.5 |
| 3. | 0.3 | 4. | 150 |

**12.** A uniform wire of diameter $d$ carries a current of $100\ \mathrm{mA}$ when the mean drift velocity of electrons in the wire is $v$. For a wire of diameter $\frac{d}{2}$ of the same material to carry a current of $200\ \mathrm{mA}$, the mean drift velocity of electrons in the wire is:

| | | | |
|---|---|---|---|
| 1. | $4v$ | 2. | $8v$ |
| 3. | $v$ | 4. | $2v$ |

**13.** In an electrical circuit, the voltage is measured as $V = (200 \pm 4)$ volts and the current is measured as $I = (20 \pm 0.2)\ \mathrm{A}$. The value of the resistance is:

1. $(10 \pm 4.2)\ \Omega$
2. $(10 \pm 0.3)\ \Omega$
3. $(10 \pm 0.1)\ \Omega$
4. $(10 \pm 0.8)\ \Omega$

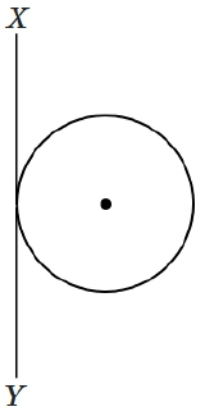
**14.** A step-up transformer is connected to an AC mains supply of $220\ \mathrm{V}$ to operate at $11000\ \mathrm{V}, 88\ \mathrm{W}$. The current in the secondary circuit, ignoring the power loss in the transformer, is:

1. $8\ \mathrm{mA}$
2. $4\ \mathrm{mA}$
3. $0.4\ \mathrm{A}$
4. $4\ \mathrm{A}$

**15.** A particle is moving along the $x$-axis with its position $(x)$ varying with time $(t)$ as $x = \alpha t^4 + \beta t^2 + \gamma t + \delta$. The ratio of its initial velocity to its initial acceleration is:

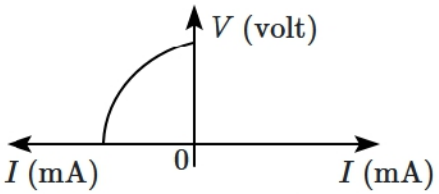
1. $2\alpha : \delta$
2. $\gamma : 2\delta$
3. $4\alpha : \beta$
4. $\gamma : 2\beta$

**16.** The radius of gyration of a solid sphere of mass $5\ \mathrm{kg}$ about $XY$-axis is $5\ \mathrm{m}$ as shown in the figure. If the radius of the sphere is $\frac{5x}{\sqrt{7}}\ \mathrm{m}$, then the value of $x$ is:



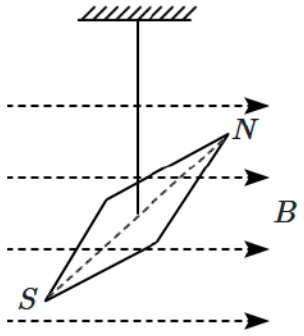

1. $5$
2. $\sqrt{2}$
3. $\sqrt{3}$
4. $\sqrt{5}$

**17.** The $I$-$V$ characteristics shown below are exhibited by a:




| | | | |
|---|---|---|---|
| 1. | Light-emitting diode | 2. | Zener diode |
| 3. | Photodiode | 4. | Solar cell |

**18.** The magnetic moment and moment of inertia of a magnetic needle as shown are, respectively, $1.0 \times 10^{-2}\ \mathrm{A\,m^2}$ and $\frac{10^{-6}}{\pi^2}\ \mathrm{kg\,m^2}$. If it completes $10$ oscillations in $10\ \mathrm{s}$, the magnitude of the magnetic field is:




1. $0.4\ \mathrm{T}$
2. $4\ \mathrm{T}$
3. $0.4\ \mathrm{mT}$
4. $4\ \mathrm{mT}$

**19.** The capacitance of a capacitor with charge $q$ and a potential difference $V$ depends on:

| | |
|---|---|
| 1. | both $q$ and $V$ |
| 2. | the geometry of the capacitor |
| 3. | $q$ only |
| 4. | $V$ only |

**20.** Given below are two statements:

| | |
|---|---|
| **Statement I:** | Image formation needs regular reflection and/or refraction. |
| **Statement II:** | The variety in colour of objects we see around us is due to the constituent colours of the light incident on them. |

| | |
|---|---|
| 1. | **Statement I** is correct but **Statement II** is incorrect. |
| 2. | **Statement I** is incorrect but **Statement II** is correct. |
| 3. | Both **Statement I** and **Statement II** are correct. |
| 4. | Both **Statement I** and **Statement II** are incorrect. |

**21.** A uniform metal wire of length $l$ has $10\ \Omega$ resistance. Now this wire is stretched to a length $2l$ and then bent to form a perfect circle. The equivalent resistance across any arbitrary diameter of that circle is:

| | | | |
|---|---|---|---|
| 1. | $10\ \Omega$ | 2. | $5\ \Omega$ |
| 3. | $40\ \Omega$ | 4. | $20\ \Omega$ |

**22.** The spectral series which corresponds to the electronic transition from the levels $n_2 = 5, 6, \ldots$ to the level $n_1 = 4$ is:

| | |
|---|---|
| 1. | Pfund series |
| 2. | Brackett series |
| 3. | Lyman series |
| 4. | Balmer series |

**23.** Given below are two statements: One is labeled as **Assertion (A)** and the other is labeled as **Reason (R)**.

| | |
|---|---|
| **Assertion (A):** | Houses made of concrete roofs overlaid with foam keep the room hotter during summer. |
| **Reason (R):** | The layer of foam insulation prohibits heat transfer, as it contains air pockets. |

In the light of the above statements, choose the correct answer from the options given below:

| | |
|---|---|
| 1. | **(A)** is True but **(R)** is False. |
| 2. | **(A)** is False but **(R)** is True. |
| 3. | Both **(A)** and **(R)** are True but **(R)** is not the correct explanation of **(A)**. |
| 4. | Both **(A)** and **(R)** are True and **(R)** is the correct explanation of **(R)**. |

**24.** A particle executing simple harmonic motion with amplitude $A$ has the same potential and kinetic energies at the displacement:

| | | | |
|---|---|---|---|
| 1. | $2\sqrt{A}$ | 2. | $\frac{A}{2}$ |
| 3. | $\frac{\mathrm{A}}{\sqrt{2}}$ | 4. | $A\sqrt{2}$ |

**25.** Two slits in Young's double slit experiment are $1.5\ \text{mm}$ apart and the screen is placed at a distance of $1\ \text{m}$ from the slits. If the wavelength of light used is $600 \times 10^{-9}\ \text{m}$ then the fringe separation is:

1. $4 \times 10^{-5}\ \text{m}$
2. $9 \times 10^{-8}\ \text{m}$
3. $4 \times 10^{-7}\ \text{m}$
4. $4 \times 10^{-4}\ \text{m}$

**26.** Water is used as a coolant in a nuclear reactor because of its:

1. high thermal expansion coefficient
2. high specific heat capacity
3. low density
4. low boiling point

**27.** The pitch of an error-free screw gauge is $1\ \text{mm}$, and there are $100$ divisions on the circular scale. While measuring the diameter of a thick wire, the pitch scale reads $1\ \text{mm}$, and $63^{\text{rd}}$ division on the circular scale coincides with the reference line. The diameter of the wire is:

| | | | |
|---|---|---|---|
| 1. | $1.63\ \text{cm}$ | 2. | $0.163\ \text{cm}$ |
| 3. | $0.163\ \text{m}$ | 4. | $1.63\ \text{m}$ |

**28.** Let us consider two solenoids $A$ and $B$, made from the same magnetic material of relative permeability $\mu_r$ and of equal area of cross-section. Length of $A$ is twice that of $B$ and the number of turns per unit length in $A$ is half that of $B$. The ratio of self-inductances of the two solenoids, $L_A : L_B$ is:

1. $1 : 2$
2. $2 : 1$
3. $8 : 1$
4. $1 : 8$

**29.** When the output of an OR gate is applied as input to a NOT gate, then the combination acts as a:

1. NAND gate
2. NOR gate
3. AND gate
4. OR gate

**30.** An interference pattern can be observed due to the superposition of more than one of the following waves:

**(A)** $y = a\sin(\omega t)$
**(B)** $y = a\sin(2\omega t)$
**(C)** $y = a\sin(\omega t - \phi)$
**(D)** $y = a\sin(3\omega t)$

Identify the waves from the options given below:

| | | | |
|---|---|---|---|
| 1. | **(B)** and **(C)** only | 2. | **(B)** and **(D)** only |
| 3. | **(A)** and **(C)** only | 4. | **(A)** and **(B)** only |

**31.** If $\phi$ is the work function of photosensitive material in electron-volts and light of a wavelength of numerical value $\lambda = \dfrac{hc}{e}$ metres is incident on it with energy above its threshold value at an instant, then the maximum kinetic energy of the photo-electron ejected by it at that instant is (in SI units): (take $h$ as Plank's constant and $c$ as the velocity of light in free space)

1. $e + 2\phi$
2. $2e - \phi$
3. $e - \phi$
4. $e + \phi$

**32.** Among the various types of electromagnetic radiation, the one with the smallest wavelength is:

| | | | |
|---|---|---|---|
| 1. | X-rays | 2. | Gamma rays |
| 3. | Ultraviolet rays | 4. | Microwaves |

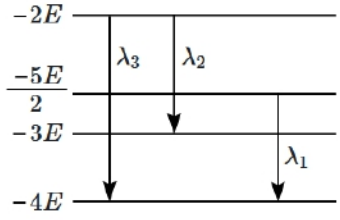
**33.** The equilibrium state of a thermodynamic system is described by:

$A$. Pressure
$B$. Total heat
$C$. Temperature
$D$. Volume
$E$. Work done

Choose the most appropriate answer from the options given below:

| | |
|---|---|
| 1. | $A, B$ and $E$ only |
| 2. | $B, C$ and $D$ only |
| 3. | $A, B$ and $C$ only |
| 4. | $A, C$ and $D$ only |

**34.** Some energy levels of a molecule are shown in the figure with their wavelengths of transitions.




Then:

| | | | |
|---|---|---|---|
| 1. | $\lambda_3 > \lambda_2, \lambda_1 = 2\lambda_2$ | 2. | $\lambda_3 > \lambda_2, \lambda_1 = 4\lambda_2$ |
| 3. | $\lambda_1 > \lambda_2, \lambda_2 = 2\lambda_3$ | 4. | $\lambda_2 > \lambda_1, \lambda_2 = 2\lambda_3$ |

**35.** A box of mass $5\ \text{kg}$ is pulled by a cord, up along a frictionless plane inclined at $30^\circ$ with the horizontal. The tension in the cord is $30\ \text{N}$. The acceleration of the box is: (take $g = 10\ \text{ms}^{-2}$)

1. $2\ \text{ms}^{-2}$
2. zero
3. $0.1\ \text{ms}^{-2}$
4. $1\ \text{ms}^{-2}$

**Physics : Section-B (Q. No. 36 to 50)**

**36.** If the ratio of relative permeability and relative permittivity of a uniform medium is $1 : 4$. The ratio of the magnitudes of electric field intensity $(E)$ to the magnetic field intensity $(H)$ of an EM wave propagating in that medium is:

$\left(\text{Given that} \sqrt{\frac{\mu_0}{\varepsilon_0}} = 120\pi\right)$

1. $30\pi : 1$
2. $1 : 120\pi$
3. $60\pi : 1$
4. $120\pi : 1$

**37.** The value of the electric potential at a distance of $9\ \text{cm}$ from the point charge $4 \times 10^{-7}\ \text{C}$ is:

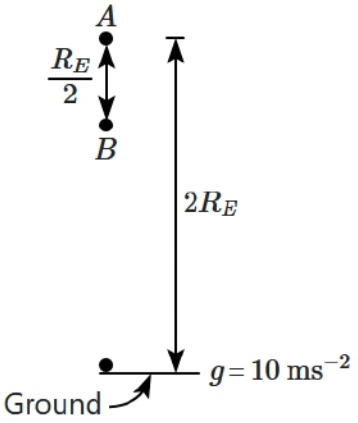
$\left[\text{Given} \frac{1}{4\pi\varepsilon_0} = 9 \times 10^9\ \text{N m}^2\ \text{C}^{-2}\right]$

| | | | |
|---|---|---|---|
| 1. | $4 \times 10^2\ \text{V}$ | 2. | $44.4\ \text{V}$ |
| 3. | $4.4 \times 10^5\ \text{V}$ | 4. | $4 \times 10^4\ \text{V}$ |

**38.** The displacement of a traveling wave is given by $y = C \sin \frac{2\pi}{\lambda}(at - x)$ where $t$ is time, $x$ is distance and $\lambda$ is the wavelength, all in SI units. The frequency of the wave is:

| | | | |
|---|---|---|---|
| 1. | $\frac{2\pi\lambda}{a}$ | 2. | $\frac{2\pi a}{\lambda}$ |
| 3. | $\frac{\lambda}{a}$ | 4. | $\frac{a}{\lambda}$ |

**39.** An object of mass $100\ \text{kg}$ falls from point $A$ to $B$ as shown in the figure. The change in its weight, corrected to the nearest integer ($R_E$ is the radius of the Earth), is:




1. $49\ \text{N}$
2. $89\ \text{N}$
3. $5\ \text{N}$
4. $10\ \text{N}$

**40.** The potential energy of a particle moving along the $x$-direction varies as $V = \frac{Ax^2}{\sqrt{x} + B}$. The dimensions of $\frac{A^2}{B}$ are:

1. $[M^{3/2}L^{1/2}T^{-3}]$
2. $[M^{1/2}LT^{-3}]$
3. $[M^2L^{1/2}T^{-4}]$
4. $[ML^2T^{-4}]$

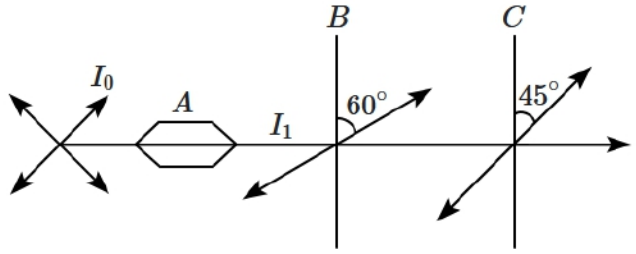
**41.** The two-dimensional motion of a particle, described by $\vec{r} = (\hat{i} + 2\hat{j})A\cos(\omega t)$ is a/an:

| | |
|---|---|
| **(A)** | parabolic path |
| **(B)** | elliptical path |
| **(C)** | periodic motion |
| **(D)** | simple harmonic motion |

Choose the correct answer from the options given below:

| | |
|---|---|
| 1. | **(B), (C),** and **(D)** only |
| 2. | **(A), (B),** and **(C)** only |
| 3. | **(A), (C),** and **(D)** only |
| 4. | **(C)** and **(D)** only |

**42.** A beam of unpolarised light of intensity $I_0$ is passed through a polaroid $A$, through another polaroid $B$, oriented at $60^\circ$ and finally through another polaroid $C$, oriented at $45^\circ$ relative to $B$ as shown in the figure. The intensity of the emergent light is:




| | | | |
|---|---|---|---|
| 1. | $\frac{I_0}{16}$ | 2. | $\frac{I_0}{4}$ |
| 3. | $\frac{I_0}{2}$ | 4. | $\frac{I_0}{32}$ |

**43.** Select the correct statements among the following:

| | |
|---|---|
| A. | slow neutrons can cause fission in $\mathrm{U}_{92}^{235}$ than fast neutrons. |
| B. | $\alpha$-rays are helium nuclei. |
| C. | $\beta$-rays are fast-moving electrons or positrons. |
| D. | $\gamma$-rays are electromagnetic radiations of wavelengths larger than $X$-rays. |

Choose the most appropriate answer from the options given below:

| | | | |
|---|---|---|---|
| 1. | A, B, and C only | 2. | A, B, and D only |
| 3. | A and B only | 4. | C and D only |

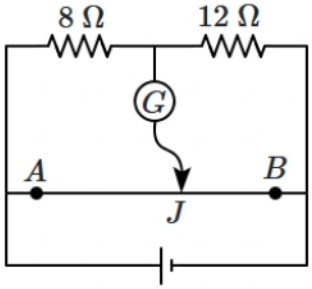
**44.** Let $\omega_1, \omega_2$ and $\omega_3$ be the angular speeds of the second hand, minute hand, and hour hand of a smoothly running analog clock, respectively. If $x_1, x_2$ and $x_3$ are their respective angular distance in $1\ \text{minute}$ then the factor that remains constant $(k)$ is:

1. $\frac{\omega_1}{x_1} = \frac{\omega_2}{x_2} = \frac{\omega_3}{x_3} = k$
2. $\omega_1 x_1 = \omega_2 x_2 = \omega_3 x_3 = k$
3. $\omega_1 x_1^2 = \omega_2 x_2^2 = \omega_3 x_3^2 = k$
4. $\omega_1^2 x_1 = \omega_2^2 x_2 = \omega_3^2 x_3 = k$

**45.** The magnetic moment of an iron bar is $M$. It is now bent in such a way that it forms an arc section of a circle subtending an angle of $60^\circ$ at the centre. The magnetic moment of this arc section is:

| | | | |
|---|---|---|---|
| 1. | $\frac{3M}{\pi}$ | 2. | $\frac{4M}{\pi}$ |
| 3. | $\frac{M}{\pi}$ | 4. | $\frac{2M}{\pi}$ |

**46.** The given circuit shows a uniform straight wire $AB$ of $40\ \text{cm}$ length fixed at both ends. In order to get zero reading in the galvanometer $G$, the free end of $J$ is to be placed from the end $B$ at:

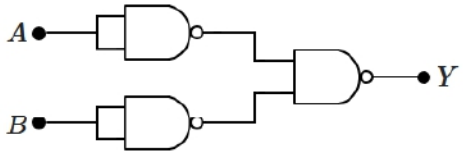



| | | | |
|---|---|---|---|
| 1. | $32\ \text{cm}$ | 2. | $8\ \text{cm}$ |
| 3. | $16\ \text{cm}$ | 4. | $24\ \text{cm}$ |

**47.** According to the law of equipartition of energy, the number of vibrational modes of a polyatomic gas of constant $\gamma = \frac{C_\text{p}}{C_\text{v}}$ is (where $C_p$ and $C_v$ are the specific heat capacities of the gas at constant pressure and constant volume, respectively):

| | | | |
|---|---|---|---|
| 1. | $\frac{4+3\gamma}{\gamma-1}$ | 2. | $\frac{3+4\gamma}{\gamma-1}$ |
| 3. | $\frac{4-3\gamma}{\gamma-1}$ | 4. | $\frac{3-4\gamma}{\gamma-1}$ |

**48.** The output $Y$ for the inputs $A$ and $B$ of the given logic circuit is:

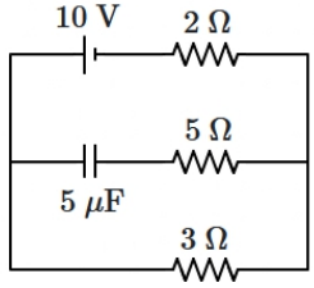



| | | | |
|---|---|---|---|
| 1. | $A \cdot B$ | 2. | $\overline{A} \cdot \overline{B}$ |
| 3. | $A + B$ | 4. | $\overline{A} + \overline{B}$ |

**49.** The amplitude of the charge oscillating in a circuit decreases exponentially as $\mathrm{Q} = \mathrm{Q}_0 \mathrm{e}^{-Rt/2L}$ where $Q_0$ is the charge at $t = 0$ s.The time at which charge amplitude decreases to $0.50\, Q_0$ is nearly:
$(\text{Given that } R = 1.5\,\Omega,\ L = 12\,\text{mH},\ \ln(2) = 0.693$

1. $19.01$ ms
2. $11.09$ ms
3. $19.01$ s
4. $11.09$ s

**50.** The steady-state current in the circuit shown below is:




1. $0.67$ A
2. $1.5$ A
3. $2$ A
4. $1$ A