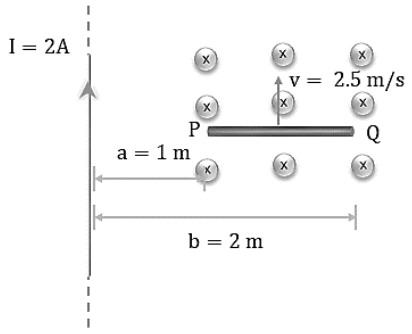
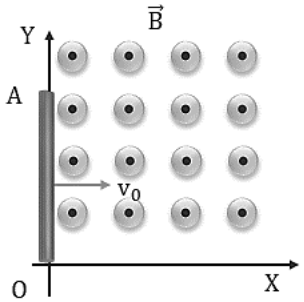
Q.1 A copper rod of length **1 m** is moving at a uniform speed of **2. 5 m/s** parallel to a long straight wire carrying a current of **2 A** as shown in the figure. Rod is perpendicular to the wire, with its ends at a distance of **1 m** and **2 m** from it. Calculate the emf induced **(in volt)** in the rod



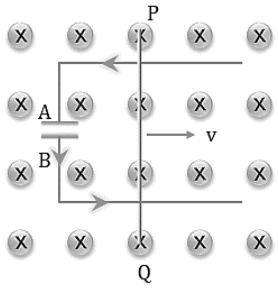
(A) $10^{-6}\ln 2$ **(B)** $10^{-6}\ln 4$ **(C)** $10^{-6}\ln 5$ **(D)** 10^{-6}

Q.2 The given figure shows a conductor **OA** of length **l** placed along **y**-axis with one end at the origin. In this region, a non-uniform magnetic field exists having magnitude $\mathbf{B = B_0\left(1 + \frac{y^2}{l^2}\right)}$ along **+z**-direction. If the conductor **OA** starts translating with velocity $\vec{\mathbf{v}} = \mathbf{v_0\hat{i}}$, then find the emf induced in the conductor



(A) $\frac{B_0 v_0 l}{2}$ **(B)** $B_0 v_0 l$ **(C)** $\frac{4}{3} B_0 v_0 l$ **(D)** Zero

Q.3 A conducting rod **PQ** of length $\mathbf{l = 1.0\ m}$ is moving with a uniform speed $\mathbf{v = 20\ m/s}$ in a uniform magnetic field $\mathbf{B = 4.0\ T}$ directed into the paper. A capacitor of capacity $\mathbf{C = 10\ \mu F}$ is connected as shown in figure. Then

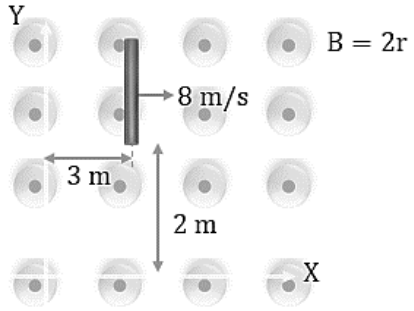


(A) $q_A = +800\ \mu C$ And $q_B = -800\ \mu C$
(B) $q_A = -800\ \mu C$ And $q_B = +800\ \mu C$
(C) $q_A = q_B = 0$
(D) The charged stored in the capacitor increases exponentially with time

Q.4 A rod of length **3 m** is kept parallel to a long wire carrying constant current **0.5 A**.It is moving away from the wire with a velocity of **10 m/s**. Find the induced emf in the rod when its distance from the long wire is **0.15 m**

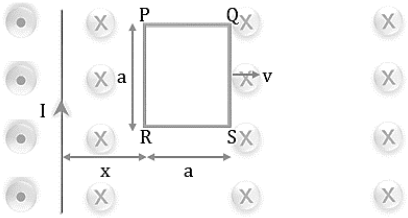
(A) 3×10^{-3} V **(B)** 2×10^{-6} V **(C)** 5×10^{-4} V **(D)** 2×10^{-5} V

Q.5 The magnetic field in a region is given by$\mathbf{B = 2r}$, where **r** is the perpendicular distance from the $\mathbf{x-axis}$. The direction of the magnetic field is along the positive$\mathbf{z-axis}$. A conducting rod of length **1 m** lies parallel to the $\mathbf{y-axis}$ as shown in the figure. If the rod moves with the velocity $\mathbf{v = 8\ m/s}$ along the positive $-\mathbf{axis}$, find the emf induced between the ends of the rod.



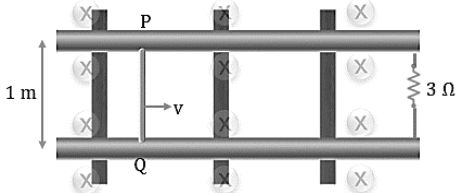
(A) 48 V **(B)** 40 V **(C)** 35 V **(D)** 24 V

Q.6 An infinite wire having current **I** is kept on the plane of paper. Find the **EMF** induced in the square metal loop at the instant when it moves with speed **v** in the same plane of the wire, in the direction as shown in the figure.



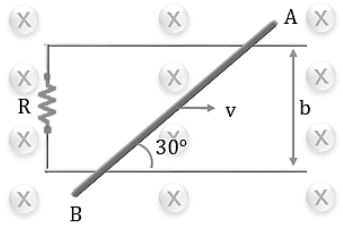
(A) $\frac{3\mu_0 I a^2 v}{2\pi x(x-a)}$ **(B)** $\frac{\mu_0 I a^2 v}{2\pi x(x-a)}$ **(C)** $\frac{3\mu_0 I a^2 v}{2\pi x(x+a)}$ **(D)** $\frac{\mu_0 I a^2 v}{2\pi x(x+a)}$

Q.7 The wire **PQ** has mass **0.5 kg** and resistance **2 Ω** can slide on the smooth, very long horizontal parallel rails separated by a distance of **1 m**. The resistance of the rails is negligible. A uniform magnetic field of magnitude **0.6 T** exists in the rectangular region, and a resistance **3 Ω** connects the rails outside the field region. At $\mathbf{t = 0}$, the wire **PQ** is pushed towards the right with a speed $\mathbf{v = 5\ m/s}$. Find the current in the loop at an instant when the speed of the wire **PQ**is **5 m/s**.



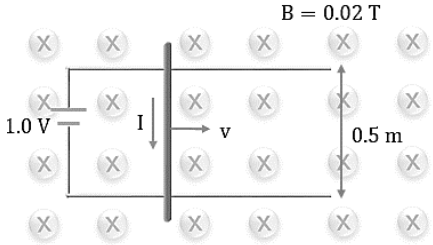
(A) 0.6 A **(B)** 1.2 A **(C)** 3 A **(D)** 2.4 A

Q.8 A wire is sliding as shown in the figure. The angle between the acceleration and the velocity of the wire is:



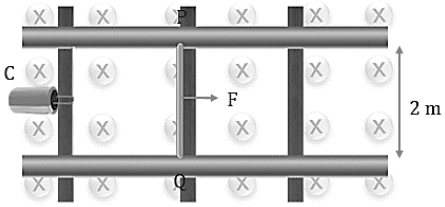
(A)30° **(B)**40° **(C)**120° **(D)**90°

Q.9 Two long parallel wires, having zero resistance, are connected to each other by a battery of $\mathbf{1.0\ V}$. The separation between the wires is $\mathbf{0.5\ m}$. A metallic bar of resistance$\mathbf{10\ \Omega}$, placed perpendicular to the wires, moves on these wires. A uniform magnetic field of $\mathbf{0.02\ T}$ is acting perpendicular to the plane containing the bar and the wires. Find the steady-state velocity of the bar.



(A)10 m/s **(B)**50 m/s **(C)**100 m/s **(D)**150 m/s

Q.10 A conducting wire **PQ** of mass $\mathbf{1.8\ kg}$ and length $\mathbf{2\ m}$ can freely slide on a pair of parallel, smooth rails placed in a magnetic field of magnitude$\mathbf{1\ T}$. The rails are connected by a capacitor of capacitance$\mathbf{0.5\ F}$. The electric resistance of the rails and wire is zero. A constant force **F** acts on the wire as shown. Find the value of **F** if the acceleration of the wire is $\mathbf{5\ m/s^2}$.



(A)7 N **(B)**14.5 N **(C)**19 N **(D)**23 N

ANSWER KEY

Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(A)	(C)	(A)	(D)	(B)	(D)	(A)	(C)	(C)	(C)