Consider the above circular capacitor, and the Amperian loop (radius $r$) in the plane midway between the plates. When the capacitor is charging, the line integral of the magnetic field around the Amperian loop is

1. Zero: No current crosses the surface spanning the Amperian loop
2. Zero: The magnetic field is perpendicular to the Amperian Loop
3. Non-zero: An electric current flows between the capacitor plates
4. Non-zero: There is time changing electric flux on the surface spanning the Amperian Loop
Answer: 4. When the capacitor is charging up, the line integral of the magnetic field around the Amperian loop is non-zero because there is a time changing electric flux on the flat disc that spans the Amperian Loop
The plot above shows a side and a top view of a capacitor with charge $Q$ with electric and magnetic fields $E$ and $B$ at time $t$. The charge $Q$ is:

1. Increasing in time
2. Constant in time.
3. Decreasing in time.
4. Don’t have a clue.
Answer: 1. The charge $Q$ is increasing in time.
The B field is counterclockwise, which means that the current (real & displacement) must be flowing out of the page = up. So there is more charge being carried to the bottom plate.
The graph shows a plot of the function $y = \cos( k \cdot x )$. The value of $k$ is

1. $\frac{1}{2}$
2. $\frac{1}{4}$
3. $\pi$
4. $\frac{\pi}{2}$
5. Don’t have a clue
Answer: 4. \( k = \frac{\pi}{2} \)

\( \lambda = 4 \rightarrow k = \frac{2\pi}{\lambda} = \frac{\pi}{2} \)

\( y = \cos \left( \frac{\pi x}{2} \right) \) is 1 at –4, 0, 4, etc.
The graph shows the E (yellow) and B (blue) fields of a plane wave. This wave is propagating in the

1. +x direction
2. –x direction
3. +z direction
4. –z direction
5. Don’t have a clue
Answer: 4. \(-z\) direction.

We can see this because this is the direction of \(E \times B\) (Yellow x Blue)
The plot above shows a side and a top view of a capacitor with charge $Q$ with electric and magnetic fields $E$ and $B$ at time $t$. The charge $Q$ is:

5. Increasing in time
6. Constant in time.
7. Decreasing in time.
8. Don’t have a clue.
Answer: 1. The charge $Q$ is increasing

The direction of the Poynting Flux $S (=E \times B)$ inside the capacitor is inward. Therefore electromagnetic energy is flowing inward, and the energy in the electric field inside is increasing. Thus $Q$ must be increasing, since $E$ is proportional to $Q$. 
The plot above shows a side and a top view of a solenoid carrying current $I$ with electric and magnetic fields $E$ and $B$ at time $t$. In the solenoid, the current $I$ is:

1. Increasing in time
2. Constant in time.
3. Decreasing in time.
4. Don’t have a clue.
Answer: 3. The current I is decreasing

The Poynting Flux $S = E \times B$ inside the solenoid is outward from the center of the solenoid. Therefore electromagnetic energy is flowing outward, and the energy in the magnetic field inside is decreasing. Thus I must be decreasing, since B is proportional to I.