The potential difference V and the current i flowing through an instrument in an ac circuit of frequency f are given by $V = 5 \cos \omega t$ volts and $I = 2 \sin \omega t$ amperes (where $\omega = 2\pi f$). The power dissipated in the instrument is (1)Zero (2)10 W (3)5 W (4)2.5 W

Solution

The potential difference V can be expressed as

$$V = 5\cos\omega t = 5\sin\left(\omega t + \frac{\pi}{2}\right),$$

because $\cos a = \sin \left(a + \frac{\pi}{2}\right)$ for any a.

The power dissipated in the instrument is

$$P = V_{rms} I_{rms} \cos \varphi,$$

where rms means the root mean square, $\cos \varphi$ - the power factor, where φ is the phase angle between the voltage and current.

Since

$$\varphi = \frac{\pi}{2}$$

therefore

$$\cos\varphi=\cos\frac{\pi}{2}=0.$$

The power dissipated in the instrument is

$$P = V_{rms}I_{rms} \cdot 0 = 0.$$

Answer: (1) Zero.