TEST 1 (Modern Physics)

22.03.2017

1. Differential form of Faraday's law is given by:

A. $\operatorname{div}\vec{\mathbf{B}} = 0$

B. $\operatorname{rot}\vec{\mathbf{B}} = \mu_o(\vec{\mathbf{j}} + \varepsilon_o \frac{\partial \vec{\mathbf{E}}}{\partial t})$

C. $\oint_C \vec{\mathbf{E}} \circ d\vec{\mathbf{l}} = -\frac{d\Phi_B}{dt}$

D. $\operatorname{rot}\vec{\mathbf{E}} = -\frac{\partial \vec{\mathbf{B}}}{\partial t}$

E. $\operatorname{rot}\vec{\mathbf{E}} = \mu_o \varepsilon_o \frac{\partial \vec{\mathbf{B}}}{\partial t}$

Explain the meaning of symbols

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2. Divergence operator of any vector field, $\operatorname{div}\vec{\mathbf{E}}$ is **defined** as:

A. $\operatorname{div}\vec{\mathbf{E}} = \nabla \circ \vec{\mathbf{E}} = \frac{\partial E_x}{\partial x} + \frac{\partial E_y}{\partial y} + \frac{\partial E_z}{\partial z}$

B. $\operatorname{div}\vec{\mathbf{E}} = \lim_{V \to 0} \frac{\oint \vec{\mathbf{E}} \circ d\vec{\mathbf{A}}}{V}$

C. $\operatorname{div}\vec{\mathbf{E}} = \frac{\rho}{\varepsilon_o}$

D. $\operatorname{div}\vec{\mathbf{E}} = \nabla \times \vec{\mathbf{E}} = \frac{\partial E_x}{\partial x}\hat{\mathbf{i}} + \frac{\partial E_y}{\partial y}\hat{\mathbf{j}} + \frac{\partial E_z}{\partial z}\hat{\mathbf{k}}$

E. $(\operatorname{div}\vec{\mathbf{E}}) \circ \hat{\mathbf{n}} = \lim_{a_i \to 0} \frac{\oint_{C_i} \vec{\mathbf{E}} \circ d\vec{\mathbf{l}}}{a_i}$

Explain the meaning of symbols

3. For a field vector in 3D space, expressed as:

$$\vec{\mathbf{w}} = y\hat{\mathbf{i}} + x\hat{\mathbf{j}}$$

A. $\text{div}\,\vec{\mathbf{w}} = 0$, $\text{curl}\,\vec{\mathbf{w}} = 0$

B. $\text{div}\,\vec{\mathbf{w}} \neq 0$, $\text{curl}\,\vec{\mathbf{w}} = 0$

C. $\text{div}\,\vec{\mathbf{w}} \neq 0$, $\text{curl}\,\vec{\mathbf{w}} \neq 0$

D. $\text{div}\,\vec{\mathbf{w}} = 0$, $\text{curl}\,\vec{\mathbf{w}} \neq 0$

E. $grad\ \vec{\mathbf{w}} = 0$, $\text{curl}\,\vec{\mathbf{w}} = 0$

4. General form of a differential wave equation is:

A. $\nabla^2\Psi(\vec{\mathbf{r}},t) = \frac{1}{\mathrm{v}^2}\frac{\partial\Psi}{\partial t}$

B. $\frac{d^2x}{dt^2} + \omega_0{}^2 x = 0$

C. $\nabla^2\Psi(\vec{\mathbf{r}},t) = \mathrm{v}^2\frac{\partial^2\Psi}{\partial t^2}$

D. $\nabla\Psi(\vec{\mathbf{r}},t) = \frac{1}{\mathrm{v}^2}\frac{\partial^2\Psi}{\partial t^2}$

E. $\nabla^2\Psi(\vec{\mathbf{r}},\mathrm{t}) = \frac{1}{\mathrm{v}^2}\frac{\partial^2\Psi}{\partial \mathrm{t}^2}$

Explain the meaning of symbols

5. Maxwell's equations predict that the speed of light in free space is

A. an increasing function of frequency
B. a decreasing function of frequency
C. independent of frequency
D. a function of the distance from the source
E. a function of the size of the source