Classical Electrodynamics – Assignment #1

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0.1 Question

Let us assume that both divergence and curl of vector $\mathbf{A}$ are known, i.e. $\nabla \cdot \mathbf{A} = s$ and $\nabla \times \mathbf{A} = \mathbf{c}$, and they vanish at infinity. The vector $\mathbf{A}$ can be written as the sum of two parts; an irrotational and a solenoidal, i.e. $\mathbf{A} = -\nabla\phi + \nabla \times \mathbf{B}$. Show that $\phi(\mathbf{x})$ and $\mathbf{B}(\mathbf{x})$ for a given point of $\mathbf{x}$ are respectively given in the following forms:

$$\phi(\mathbf{x}) = \frac{1}{4\pi} \int \frac{s(\mathbf{x}')}{|\mathbf{x} - \mathbf{x}'|} d^3x', \tag{1}$$

$$\mathbf{B}(\mathbf{x}) = \frac{1}{4\pi} \int \frac{\mathbf{c}(\mathbf{x}')}{|\mathbf{x} - \mathbf{x}'|} d^3x'. \tag{2}$$

0.2 Question

Solve the following set of problems in your textbook (Classical Electrodynamics (3rd Edition), J D Jackson, pp 50–56.)

1.3

1.6

1.10

1.14

1.17

1.18

Note: *Deadline for returning back the solutions is 4th of Feb. 2016. Please try to solve them by yourself.*