

PhysicsByAaryan

CSIR NET . GATE . JEST . BARC - Physics

Potential Formulation - CSIR NET Physics PYQs

Electromagnetism . All PYQs (2015-2025) with answer key

5 questions . Answer key included

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Q1. [Dec 2015] . 3.5 marks

Electromagnetism > Potential Formulation

CSIR NET	2015 Dec	3.5 M
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Given a uniform magnetic field $B = B_0 \hat{k}$ (where B_0 is a constant), a possible choice for the magnetic vector potential A is

1. $B_0 y \hat{i}$
2. $-B_0 y \hat{i}$
3. $B_0 (x \hat{j} + y \hat{i})$
4. $B_0 (x \hat{i} + y \hat{j})$

Q2. [June 2015] . 3.5 marks

Electromagnetism > Potential Formulation

CSIR NET	2015 June	3.5 M
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Which of the following transformations

$(V, \vec{A}) \rightarrow (V', \vec{A}')$ of the electrostatic potential V and the vector potential \vec{A} is a gauge transformation?

1. $(V' = V + ax, \vec{A}' = \vec{A} + at\hat{k})$
2. $(V' = V + ax, \vec{A}' = \vec{A} - at\hat{k})$
3. $(V' = V + ax, \vec{A}' = \vec{A} + at\hat{i})$
4. $(V' = V + ax, \vec{A}' = \vec{A} - at\hat{i})$

Q3. [Dec 2016] . 3.5 marks

Electromagnetism > Potential Formulation

CSIR NET	2016 Dec	3.5M
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Consider the operator $\vec{\pi} = \vec{p} - q\vec{A}$, where \vec{p} is the momentum operator, $\vec{A} = (A_x, A_y, A_z)$ is the vector potential and q denotes the electric charge. If

$\vec{B} = (B_x, B_y, B_z)$ denotes the magnetic field, the z -component of the vector operator $\vec{\pi} \times \vec{\pi}$ is

1. $iq\hbar B_z + q(A_x p_y - A_y p_x)$
2. $-iq\hbar B_z - q(A_x p_y - A_y p_x)$
3. $-iq\hbar B_z$
4. $iq\hbar B_z$

Q4. [June 2017] . 3.5 marks

Electromagnetism > Potential Formulation

CSIR NET	2017 June	3.5M
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The vector potential $\vec{A} = ke^{-at}r\hat{r}$ (where a and k are constants) corresponding to an electromagnetic field is changed to $\vec{A}' = -ke^{-at}r\hat{r}$. This will be a gauge transformation if the corresponding change $\phi' - \phi$ in the scalar potential is

1. akr^2e^{-at}
2. $2akr^2e^{-at}$
3. $-akr^2e^{-at}$
4. $-2akr^2e^{-at}$

Q5. [June 2018] . 3.5 marks

Electromagnetism > Potential Formulation

CSIR NET	2018 June	3.5M
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The electric field \vec{E} and the magnetic field \vec{B} corresponding to the scalar and vector potentials,

$$V(x, y, z, t) = 0 \text{ and } \vec{A}(x, y, z, t) = \frac{1}{2} \hat{k} \mu_0 A_0 (ct - x),$$

where A_0 is a constant, are

1. $\vec{E} = 0$ and $\vec{B} = \frac{1}{2} \hat{j} \mu_0 A_0$

2. $\vec{E} = -\frac{1}{2} \hat{k} \mu_0 A_0 c$ and $\vec{B} = \frac{1}{2} \hat{j} \mu_0 A_0$

3. $\vec{E} = 0$ and $\vec{B} = -\frac{1}{2} \hat{i} \mu_0 A_0$

4. $\vec{E} = \frac{1}{2} \hat{k} \mu_0 A_0 c$ and $\vec{B} = -\frac{1}{2} \hat{i} \mu_0 A_0$

Answer Key

5 questions . Subject and topic for quick revision

Q. No	Subject	Topic	Answer
Q1	Electromagnetism	Potential Formulation	2
Q2	Electromagnetism	Potential Formulation	4
Q3	Electromagnetism	Potential Formulation	4
Q4	Electromagnetism	Potential Formulation	3
Q5	Electromagnetism	Potential Formulation	2

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