Electrodynamics, Minimum Questions

1. Coulomb's law (1) $\vec{F} = k\frac{Q_1 Q_2}{r^2}\vec{e}_r$
2. Definition of the electric field intensity (1) $\vec{E} = \frac{\vec{F}}{q}$
3. Potential difference between two points(1) $U_{1,2} = \int_1^2 \vec{E}d\vec{s}$
4. The first law of electrostatics, integrated and differential form (2) $\oint_c \vec{E}d\vec{s} = 0, \quad \nabla \times \vec{E} = 0$
5. Electric field and potential due to a point charge (2) $\vec{E} = k\frac{Q}{r^2}\vec{e}_r, \quad U = k\frac{Q}{r}$
6. Definition of the electric polarization vector (1) $\vec{P} = \lim_{\Delta V \to 0} \frac{\Delta \vec{p}}{\Delta V}$
7. Definition of the electric induction vector (1) $\vec{D} = \varepsilon_0 \vec{E} + \vec{P}$
8. Gauss's law of electrostatics, integrated and differential form (2) $\oint_A \vec{D}d\vec{A} = Q, \quad \nabla \vec{D} = \rho$
9. Definition of the capacitance (1) $C = \frac{Q}{U}$
10. The potential energy of a charged capacitor (1) $W = \frac{1}{2}QU$
11. The current density vector (convection and conduction) (1) $\vec{J} = \rho\vec{v} + \vec{j}$
12. Conduction current density in a metallic conductor at rest (1) $\vec{j} = -en_e\vec{v}_e$
13. Charge conservation law, integrated and differential form (2) $\frac{d}{dt}\int_V \rho dV = -\oint_A \vec{J}d\vec{A}, \quad \frac{\partial \rho}{\partial t} + \nabla \vec{J} = 0$
14. Definition of electromotive force, emf (1) $\mathcal{E}_{-,+} = \int_{-,+} \vec{E}^* d\vec{s}$
15. Differential form of Ohm's law (1) $\vec{j} = \gamma\left(\vec{E} + \vec{E}^*\right)$
16. Ohm's law for a complete circuit (1) $\mathcal{E} = I\left(R + r\right)$
17. Kirchoff's rules (2) $\sum_{i=1}^{n} I_i = 0, \quad \sum_{i=1}^{n} U_i = 0$
18. Joule1s law integrated form (1) $P_{1,2} = U_{1,2}I$
19. The unknown resistance by the Wheatstone bridge (1) $R_x = R_2\frac{R_4}{R_3}$
20. The Ampère's force (1) $d\vec{F} = Id\vec{r} \times \vec{B}$
21. The Lorentz's force (1) $\vec{F} = q\vec{v} \times \vec{B}$
22. Torque acting on a plane current loop (1) $\vec{M} = I\vec{A} \times \vec{B}$
23. Gauss's law for magnetism, integrated and differential form (2) $\oint_A \vec{B}d\vec{A} = 0, \quad \nabla \vec{B} = 0$
24. Definition of the magnetization vector (1) $\vec{M} = \lim_{\Delta V \to 0} \frac{\Delta \vec{m}}{\Delta V}$
25. Definition of the magnetic field strength(1) $\vec{H} = \frac{\vec{B}}{\mu_0} - \vec{M}$

26. Ampère's law for magnetism, integrated and differential form (2) $\oint_c \vec{H} d\vec{s} = \sum_{i=1}^{n} I_i, \quad \nabla \times \vec{H} = \vec{J}$
27. Biot-Savart law for a current element (1) $d\vec{B} = \frac{\mu_0 I}{4\pi} \frac{d\vec{s} \times \vec{r}}{r^3}$
28. Magnetic field due to a long solenoid (1) $H = \frac{N I}{l}$
29. The Neumann's law for moving induction (1) $\varepsilon_{A,B} = \int_{A,B} (\vec{v} \times \vec{B}) d\vec{s}$
30. The induced emf due to a simple AC generator (1) $\varepsilon = \varepsilon_0 \sin \omega t$
31. Faraday's law of induction, integrated and differential form (2) $\oint_c \vec{E} d\vec{s} = -\frac{d}{dt} \int_A \vec{B} d\vec{A}, \quad \nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$
32. Self inductance of a long solenoid (1) $L = \frac{\mu N^2 A}{l}$
33. The magnetic energy of a coil (1) $W = \frac{1}{2} L I^2$
34. Magnetic energy density (1) $w_m = \frac{1}{2} \vec{B} \vec{H}$
35. The generalization of the loop theorem (1) $L \dot{I} + R I + \frac{Q}{C} = \varepsilon$
36. Electromotive force and current in a serial RLC circuit (1) $\varepsilon(t) = \varepsilon_0 \cos \omega t, \; I(t) = I_0 \cos(\omega t - \varphi)$
37. Phase difference between electromotive force and current in a serial RLC circuit (1) $\cos \varphi = \frac{R}{Z}$
38. Complex and real impedance of a serial RLC circuit (2) $\hat{Z} = R + i\left(L\omega - \frac{1}{\omega C} \right), \quad Z = \sqrt{R^2 + \left(L\omega - \frac{1}{\omega C} \right)^2}$
39. Average power in an RLC circuit (1) $P = U_{rms} I_{rms} \cos \varphi$
40. Definition of the root-mean-square value of an alternating current (1) $I_{rms} = \sqrt{\frac{1}{T} \int_0^T I^2(t) \; dt}$
41. The root-mean-square value of a sinusoidal alternating current or emf (1) $I_{rms} = \frac{I_0}{\sqrt{2}}, \quad U_{rms} = \frac{U_0}{\sqrt{2}}$
42. Ampère-Maxwell law, integrated and differential form (2) $\oint_c \vec{H} d\vec{s} = \sum_{i=1}^{n} I_i + \frac{d}{dt} \int_A \vec{D} d\vec{A}, \quad \nabla \times \vec{H} = \vec{J} + \frac{\partial \vec{D}}{\partial t}$
43. Wave equation for the electric field (1) $\nabla^2 \vec{E} = \varepsilon \mu_0 \frac{\partial^2 \vec{E}}{\partial t^2}$
44. Phase velocity in vacuum (1) $c = \frac{1}{\sqrt{\varepsilon_0 \mu_0}}$
45. Monochromatic plane wave solution $E_x = E_{x0} \cos \omega \left(t - \frac{\vec{n} \vec{r}}{u} \right)$
46. Connection between amplitude vectors and velocity of propagation $\vec{E}_0 = -\vec{u} \times \vec{B}_0$
47. Definition of the Poynting vector (1) $\vec{S} = \vec{E} \times \vec{H}$
48. The Snell's law (1) $\frac{\sin \alpha}{\sin \beta} = n_{2,1}$

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