PHYS1120 Exam I review

Things to remember for PHYS1110:

- algebra, trig (sin, cos, ..)
- vector math, especially vector addition
- $\mathbf{F}_{net} = m\mathbf{a}$ problems, free-body diagrams

Ch.21 Charges and Fields

- Coulomb's Law: $F = k\frac{|q_1 q_2|}{r^2}$
- Definition of electric field: $\vec{E} = \frac{\vec{F}_{on\,q}}{q}$, $\vec{F}_{on\,q} = q\vec{E}$
- E-field due to a point charge: $\vec{E} = k\frac{Q}{r^2}\hat{r}$ (derived from Coulomb + definition of **E**)
- E-field due to many charges: $\vec{E}_{tot} = \sum_i \vec{E}_i = \vec{E}_1 + \vec{E}_2 + \vec{E}_3 + ...$

  (fields add like vectors, not numbers)
- Know how to set up an integral: $\vec{E}_{tot} = \int d\vec{E}$, $E_{tot,x} = \int dE_x$, $dE = k\frac{dQ}{r^2}$,

  $dQ = \lambda\,dx$ or $\sigma\,dA$ or $\rho\,dV$ depending on geometry
- Field line diagrams

Ch.22 Gauss's Law

- Electric flux: $\Phi = \vec{E}\cdot\vec{A}$ (if **E** constant, surface flat), $\Phi = \int \vec{E}\cdot d\vec{a}$
- Gauss's Law: $\oint_S \vec{E}\cdot d\vec{a} = \frac{Q_{enclosed}}{\varepsilon_0}$
- Main results for spherical, cylindrical, and planar symmetry

  E inside charged spherical shell = 0

  E outside charged spherical charge = same as point charge

  E outside cylindrical charge distribution $\propto 1/r$

  infinite plane: $E = \frac{\sigma}{2\varepsilon_0}$

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- Metals in equilibrium:

  E = 0 inside metal , $q_{net,inside} = 0$, q_{net} on surface only, **E** $\perp$ surface, $E_{outside} = \frac{\sigma}{\varepsilon_0}$

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