PHYS1022 Summary Sheet 6

Sources of the Magnetic Field
Chapter 26 (continued)

26.5 The origin of the Magnetic Field

The magnetic field of a moving point charge

$$\underline{B} = \frac{\mu_0}{4\pi}\frac{q\underline{v}\times\hat{\underline{r}}}{r^2}$$

Dependence on $1/r^2$
Analogy with Coulomb's law
Direction of B

The magnetic field of currents: the Biot-Savart law

$$d\underline{B} = \frac{\mu_0}{4\pi}\frac{Id\underline{l}\times\hat{\underline{r}}}{r^2}$$

Magnetic field of a straight current-carrying conductor

Magnetic force between parallel conductors

26.6 Magnetic field lines and magnetic flux

$\Phi_m = \int_S \underline{B}\cdot d\underline{A}$ Gauss' law for magnetism

Magnetic flux (compare with Gauss for electric fields)
No magnetic monopoles

Force and torque on a current loop
Magnetic field of a circular current loop (exercise)

26.8 Ampère's law

$\oint_C \underline{B}\cdot\underline{dl} = \mu_0 I_C$ Use of symmetry (compare Gauss's law for electric field)

Applications of Ampère's law:

B inside and outside a wire
B inside a solenoid
B inside a toroid