

Final Review

[Midterm Review sheet] included here

* Reconnection Rate: V_e (test) * (8)

• Dimensionless Reconnection Rate: $Me (= \frac{V_e}{V_{Ae}})$

* Sweet - Parker Mechanism

• geometry (test) †

• $V_i = \frac{\eta}{l}$ = prove it (test) † (9)

• $\frac{V_i}{V_{Ai}} = \frac{V_i}{V_0} = \frac{l}{L} = \frac{B_0}{Bi} = \frac{1}{\sqrt{R_{mi}}} = Me$ (test) † (10) (remember)

• Energy partition: Inflow EM energy

$= \frac{1}{2}(\text{outflow KE}) + \frac{1}{2}(\text{outflow heating}) + 0(\text{outflow EM energy})$

* MHD waves

• Intermediate mode — Alfvén wave mode

• Fast mode

• slow mode

$V_{ph}^2 = \frac{\omega^2}{k^2} = \frac{V_A^2 + C_s^2}{2} \pm \frac{1}{2} \sqrt{(V_A^2 - C_s^2)^2 + 4C_s^2 V_A^2 \sin^2 \theta}$

• (know how to use the dispersion relation) (test) † (11)

* shock waves

• oblique shock, slow mode, switch-off

* Petscheck's mechanism of fast reconnection

• Geometry (test) † (12)

• $\frac{M_i}{M_e} = \frac{B_0^2}{B_i^2}$ (prove it) (test) † (13)

• $Me = \frac{\pi}{8 \ln R_{me}}$ (understand it) (test) † (14)

* New Regimes of fast reconnection

* CME models & Flare models (sketch, concept) (test) † (15)

Midterm Review

* MHD Equations in space plasma* (test) ①

- * Potential magnetic field
 - unipolar field solution
 - Dipole field solution
 - PFSS model

* Force-Free Field

(what is α ? prove α is constant along \vec{B}) # (test) ②

* sheared Arcade

* Null points and separators

* X-point collapse ~ current sheet formation

* current sheet in 2-D potential field

(prove: $B_y + iB_x = f(z)$, (B_x, B_y) is potential) # (test) ③

(Draw null point, current sheet for a given $f(z)$) # (test) ④

* Magnetic Induction Equation

(derive induction equation from Ohm's Law) # (test) ⑤

(derive Reynolds number, Diffusion time) # (test) ⑥

* Frozen-flux

* Advection model - magnetic accumulation

* Diffusion model - magnetic annihilation

* stagnation-point flow model

(prove in 2-D, \vec{E} is constant) # (test) ⑦

* Sweet-Parker model