Proposition 6.2.6: For all sets A, B, C,
if $A \subseteq B$ and $B \subseteq C^c$ Then $A \cap C = \emptyset$.

Proof: Let A, B, C be any sets.

Suppose $A \subseteq B$ and $B \subseteq C^c$.
[NTS: $A \cap C = \emptyset$]

Suppose, by way of contradiction, that $A \cap C \neq \emptyset$.

$\therefore$ There exists an element $x \in U$ such that $x \in (A \cap C)$.

$\therefore$ $x \in A$ AND $x \in C$ by definition of "Intersection".

$\therefore$ $x \in C$ by specialization.

$\therefore$ $x \in A$ by specialization.

$\therefore$ Since $A \subseteq B$, $x \in B$ by UNIVERSAL Modus Ponens.

$\therefore$ Since $B \subseteq C^c$, $x \in C^c$ by UNIVERSAL Modus Ponens.

$\therefore$ $x \notin C$ by definition of "Complement"

$\therefore$ $x \in C$ and $x \notin C$ by Conjunction, and this is a contradiction.

$\therefore$ $A \cap C = \emptyset$ by proof-by-contradiction.

QED, By Direct Proof.

[The "QED, by Direct Proof" is an abbreviation of the following:
$\therefore$ For all sets A, B, C, if $A \subseteq B$ and $B \subseteq C^c$, Then $A \cap C = \emptyset$, by Direct Proof.
QED]