3-SAT = \{ \langle \phi \rangle \mid \text{there exists a satisfying assignment of 3-CNF formula } \phi \} 

\( L \in \text{NPH} \text{ if } \forall A \in \text{NP}, A \leq_p L \)
\[ L \in \text{NPC} \iff L \in \text{NP} \text{ and } L \in \text{NPH} \]

\[ \text{SAT} \in \text{NPC} \]

\[ \text{3-SAT} \in \text{NPC} \]

\[ \text{CLIQUE} = \{ (G, k) \mid \text{G is a graph that contains a clique } k \text{ vertices} \} \]
Prove

\[ \text{VERTEX-COVER} = \{ \langle G, k \rangle \mid G \text{ is a graph that contains a subset of } k \text{ vertices that cover } G^{\prime} \text{\'s edges} \} \]

is NP-Complete

Given:

\[ \text{HAMILTONIAN-CYCLE} = \{ \langle G \rangle \mid G \text{ is a graph that contains a Hamiltonian cycle} \} \in \text{NPC} \]

Prove

\[ \text{TSP} = \{ \langle G, k \rangle \mid G \text{ is a complete graph with a Hamiltonian cycle of length } k \} \]

is NP-Complete

Graph Coloring
3-COLORING = \{ \langle G \rangle \mid G \text{ is a graph that can be colored with 3 colors} \}

Prove

is NP-Complete

Reading: Sipser 7.2-7.4