Truth table is:

A	B	$A \leftrightarrow B$
T	T	T
T	F	F
F	T	F
F	F	T

The statement $A \leftrightarrow B$ (A if and only if B) is true when both A and B are true, and when both A and B are false.

The statement is false when one of them A or B is false..

$$(A \to B) \leftrightarrow (\sim B \to \sim A)$$

A	B	$A \to B$	$\sim A$	$\sim B$	$\sim B \to \sim A$	$(A \to B) \leftrightarrow (\sim B \to \sim A)$
T	T	T	F	F	T	T
T	F	F	F	T	F	T
F	T	T	T	F	T	T
F	F	T	T	T	T	T

always true irrespective of truth value of A & B

so tautology.

$(A \wedge B) \Leftrightarrow \cancel{(\sim A \vee \sim B)}$ $\cancel{\sim (A \vee B)}$

$\sim(\sim A \vee \sim B)$

A	B	$A\wedge B$	$\sim A$	$\sim B$	$\sim A \vee \sim B$	$\sim(\sim A \vee \sim B)$	$(A\to B)\to \sim(\sim A \vee \sim B)$
T	T	T	F	F	F	T	T
T	F	F	F	T	T	F	T
F	T	F	T	F	T	F	T
F	F	F	T	T	T	F	T.

$(A \wedge B) \leftrightarrow \sim(\sim A \vee \sim B)$. tautology.

$(A \to B) \leftrightarrow \sim(A \wedge \sim B)$

A	B	$A\to B$	$\sim B$	$A\wedge \sim B$	$\sim(A\wedge\sim B)$	$(A\to B)\leftrightarrow \sim(A\wedge\sim B)$
T	T	T	F	F	T	T
T	F	F	T	T	F	T
F	T	T	F	F	T	T
F	F	T	T	F	T	T.

$(A\to B) \leftrightarrow \sim(A \wedge \sim B)$ is a tautology.

$\sim(A\wedge B) \leftrightarrow \sim A \vee \sim B$

A	B	$A\wedge B$	$\sim(A\wedge B)$	$\sim A$	$\sim B$	$\sim A\vee\sim B$	$\sim(A\wedge B) \leftrightarrow \sim A \vee \sim B$
T	T	T	F	F	F	F	T
T	F	F	T	F	T	T	T
F	T	F	T	T	F	T	T
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

$\sim(A \wedge B) \leftrightarrow (\sim A \vee \sim B)$

It is a tautology.

Try $\sim(A \vee B) \leftrightarrow (\sim A \wedge \sim B)$

Consider a set of statements like

~~A, B, C~~ A, B, C, D, E, F

(1) $A \to B$

(2) $\sim B \to C$

(3) $D \to E$

(4) $E \wedge G \to F$

(5) $B \to \sim E$

(6) D

$\sim A \wedge F$.

The above set of statements are connected in the given way. Based on these statement we get the implication that $\sim A \wedge F$.

We will argue in the following way:

Assume each of the ~~6~~ 6 statements ~~are~~ is true.

6 D is true and 3 is true so E is true.

~~From~~ For statement 5 to be true, B is ~~true~~, ~~so~~ false.

So for statement 1 to be true A is false..

~~So~~ Since B is false ~~so~~ ~B is true. So statement 2 is true when C is true.

C is true and E is true so F is true, since statement 4 is true

~~So we can conclude th~~
Since A is false so ~A is true.
So ~~~A and~~ $\sim A \wedge F$ is true.