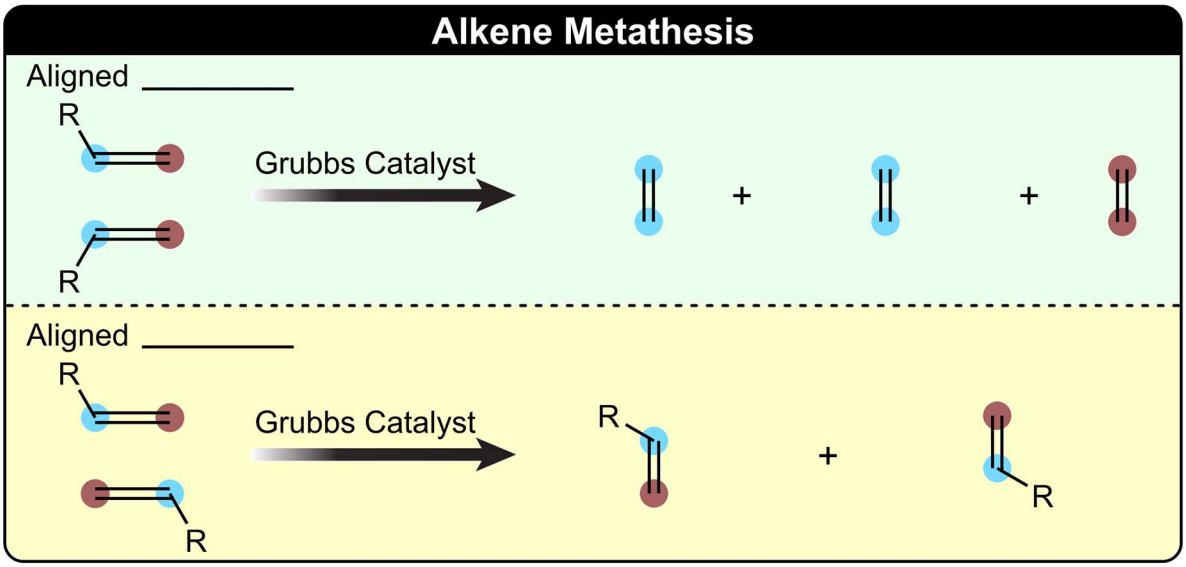
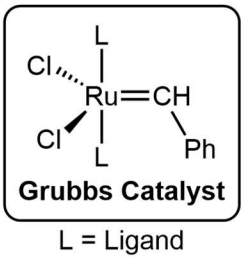
CONCEPT: ALKENE METATHESIS

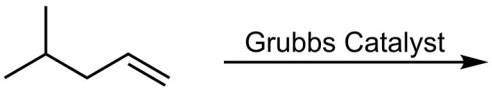
- In alkene (olefin) metathesis, two alkenes interchange their ___ atoms from the _____ bond.
  - □ Product is a mixture of *E* and *Z* isomers.





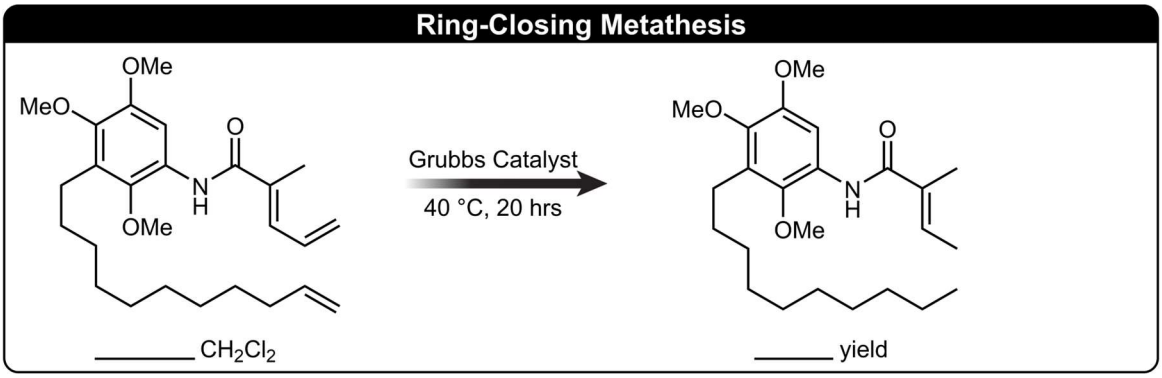
- Alkene metathesis is an equilibrium process, gives best yields when _____ alkenes are used.
  - □ Ethene gas is highly volatile, bubbles out of solution, drives reaction to the _____.

EXAMPLE: Draw the products of the following olefin metathesis reaction.



Ring-Closing Metathesis

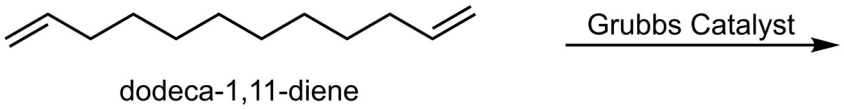
- Intramolecular alkene metathesis is an important synthetic method to prepare _____.
  - □ Used to make _____ rings which are otherwise difficult to synthesize.



- Carried out in very dilute solutions to avoid _____molecular metathesis.

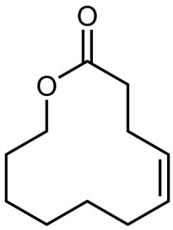
CONCEPT: ALKENE METATHESIS

EXAMPLE: Draw one of the products of the following ring-closing metathesis reaction.



dodeca-1,11-diene

PRACTICE: Identify the alkene that undergoes metathesis to yield the following product.



PRACTICE: 1,4-Divinylcyclohexane has two isomers. One isomer undergoes ring-closing metathesis to form a bicyclic compound. Draw the structure of that compound.

CONCEPT: ALKENE METATHESIS

Alkene Metathesis Mechanism

- Alkene metathesis takes place in ____ phases.

  Phase (1): Grubbs catalyst reacts with the alkene to form ____ intermediates.

  Phase (2): Intermediates react with the alkene to yield products.

Phase (1) Mechanism

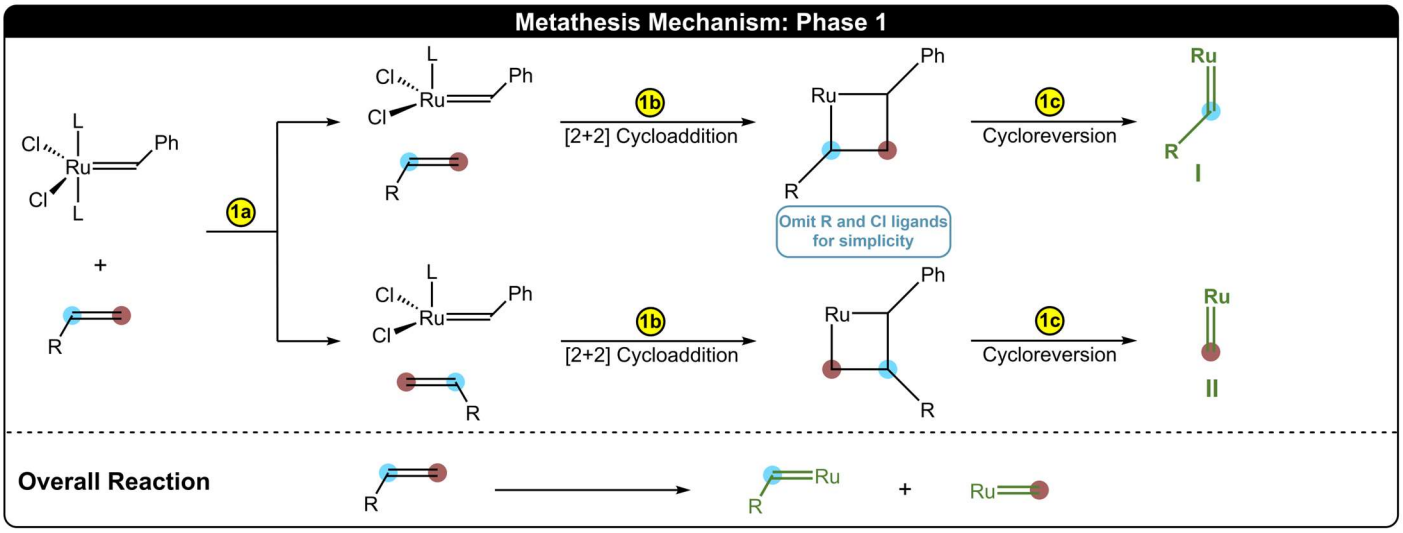
There are ___ steps in phase 1.

> **Cycloreversion**
> The reverse of cycloaddition.

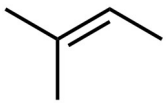
(1a) The alkene replaces one of the ligands (L) in the Grubbs catalyst.

(1b) The catalyst undergoes a _____ cycloaddition with the alkene to form a _____cyclobutane.

(1c) The metallacyclobutane undergoes ***cycloreversion*** to form two intermediates.



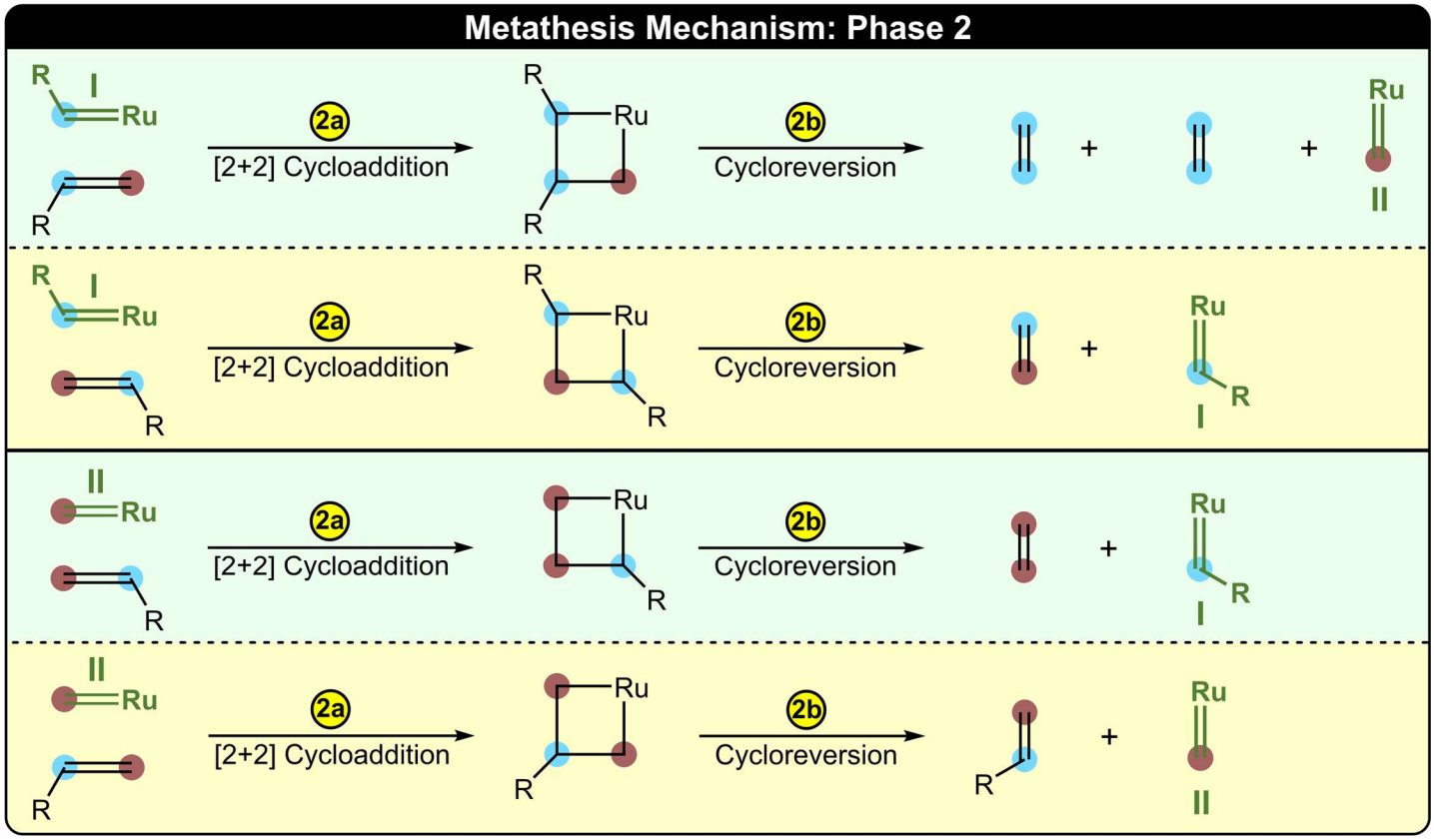
EXAMPLE: Draw the organometallic intermediates formed when the following alkene reacts with Grubbs catalyst.



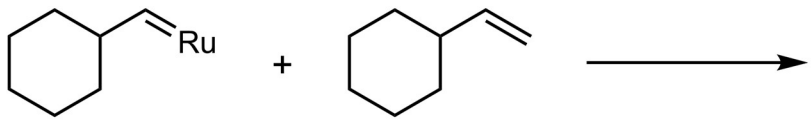
CONCEPT: ALKENE METATHESIS

Phase (2) Mechanism

- Each of the intermediates undergoes a cycloaddition (2a) and cycloreversion (2b) reaction cycle with the alkene.
  - □ One _____ product and other intermediate is produced in each reaction.



EXAMPLE: Draw the metallacyclobutane intermediate that leads to the formation of the metathesis product.



PRACTICE: Predict the products of the following metathesis reaction. Assume there is no self-metathesis and the product is unreactive under reaction conditions.