

Design of Machinery

Assignment

Chapter 2

Kinematics fundamentals

Dr. Jaafar Hallal

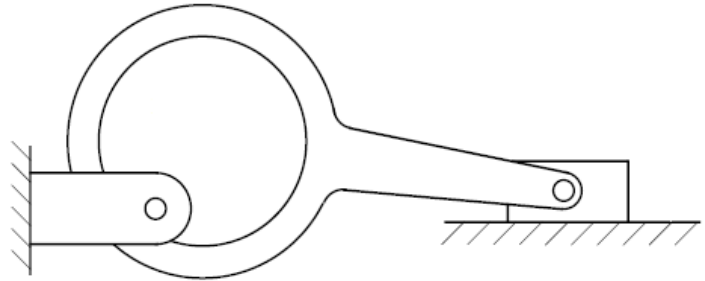
1. Mobility

Draw the kinematic diagram, determine the number of links, full joints, half joints and the Mobility (DOF). Put the number of each link on the figure.

1. Number of Links: $L =$

Number of joints: $J =$

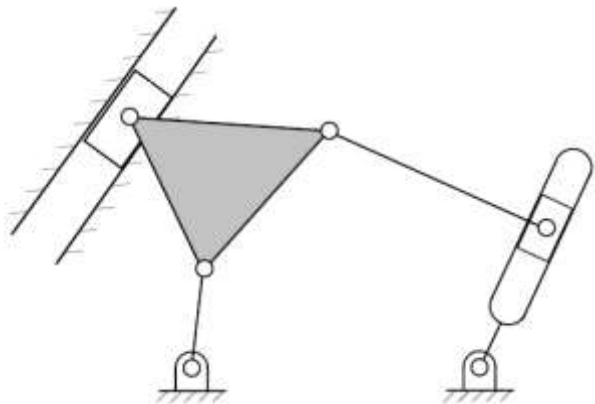
Mobility =



2. Number of Links: $L =$

Number of joints: $J =$

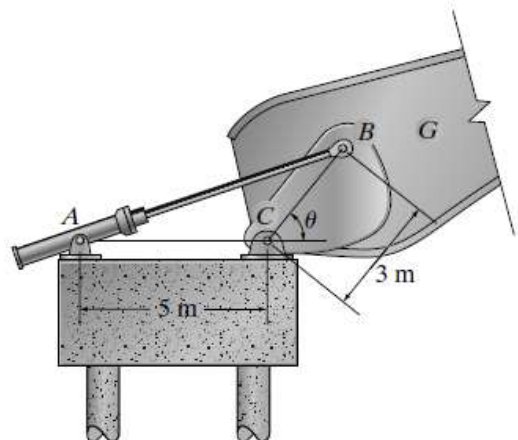
Mobility =



3. Number of Links: $L =$

Number of joints: $J =$

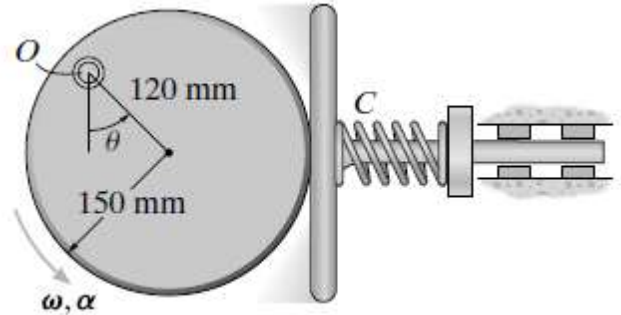
Mobility =



4. Number of Links: $L =$

Number of joints: $J =$

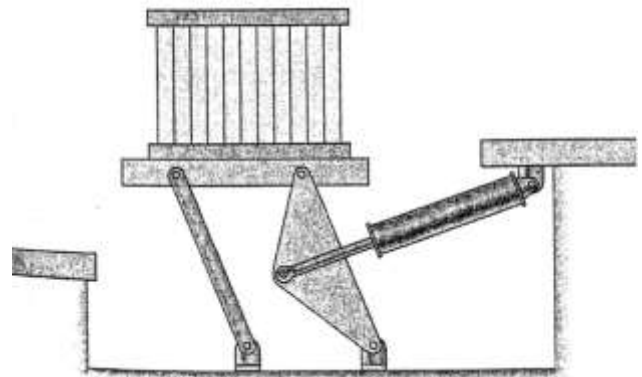
Mobility =



5. Number of Links: $L =$

Number of joints: $J =$

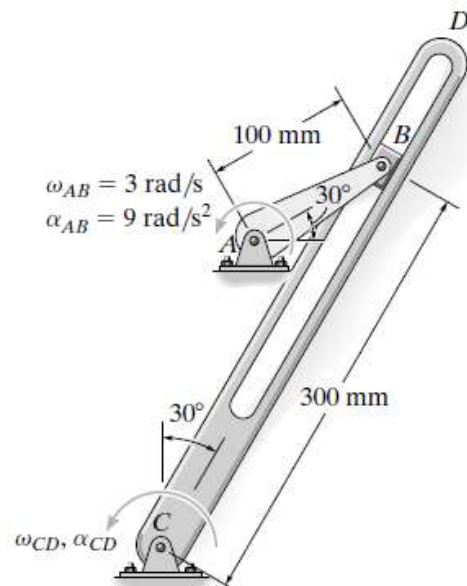
Mobility =



6. Number of Links: $L =$

Number of joints: $J =$

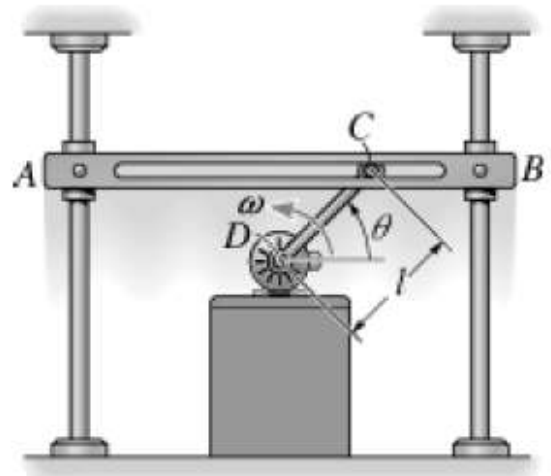
Mobility =



7. Number of Links: $L =$

Number of joints: $J =$

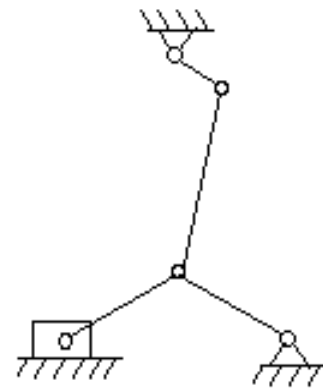
Mobility =



8. Number of Links: $L =$

Number of joints: $J =$

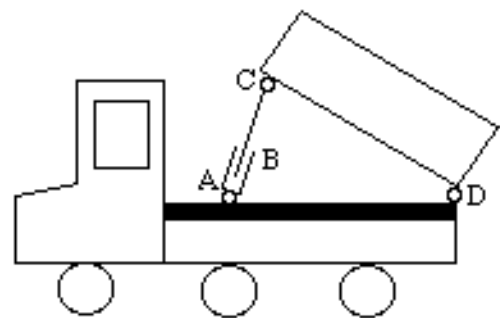
Mobility =



9. Number of Links: $L =$

Number of joints: $J =$

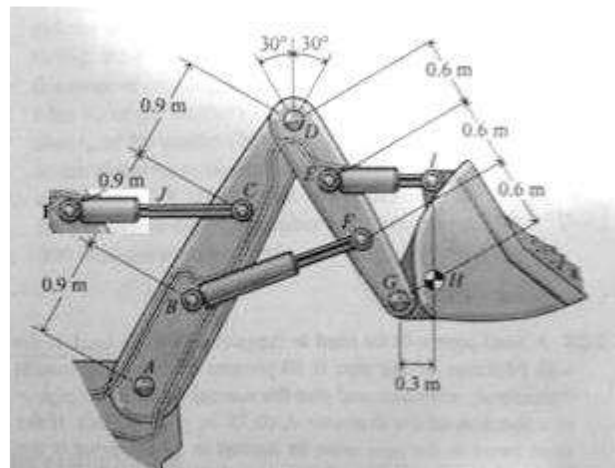
Mobility =



10. Number of Links: $L =$

Number of joints: $J =$

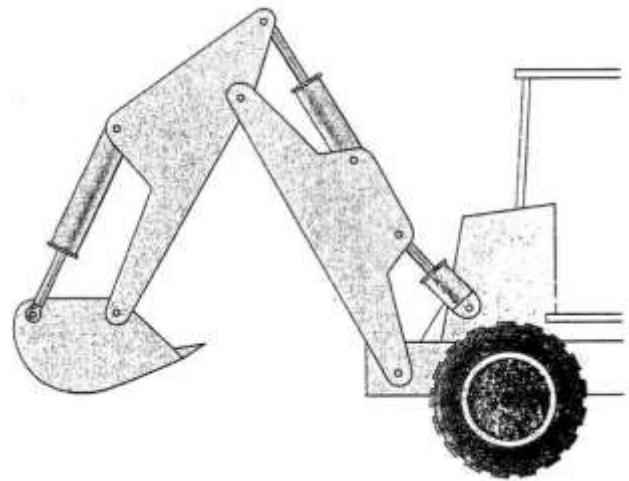
Mobility =



11. Number of Links: $L =$

Number of joints: $J =$

Mobility =

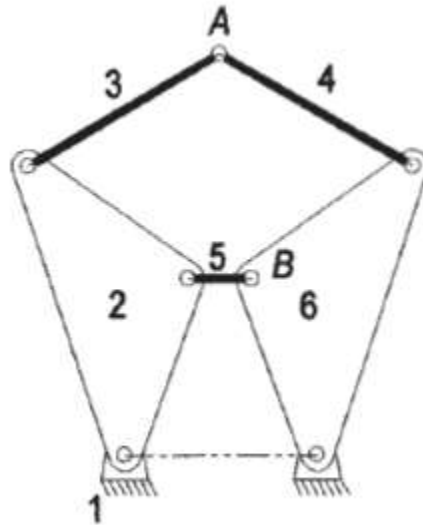


2. Number synthesis

Derive all the possible link combinations for 2-DOF, including sets up to 8 links, and link orders up to and including hexagonal links. For simplicity assume that the links will be connected with only single, full rotating joints (Pin connecting only two joints).

3. Linkage transformation (2.13)

Use linkage transformation to create a 1 D.O.F. mechanism with two sliding full joints from stephenson's sixbar linkage as shown in the figure below.

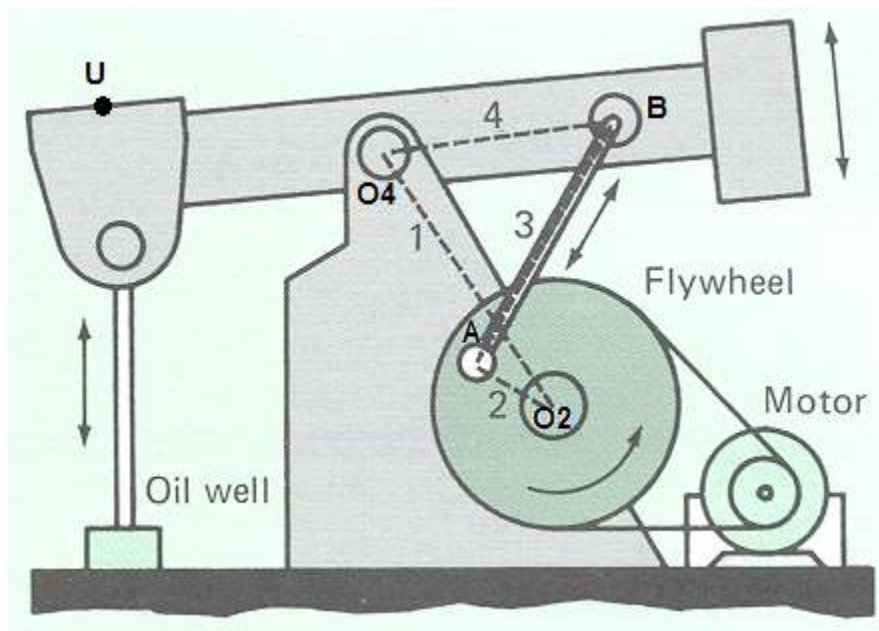


4. Grashof condition and Barker classification

The device in the figure below is an oil well pump. Link number is shown on the figure.

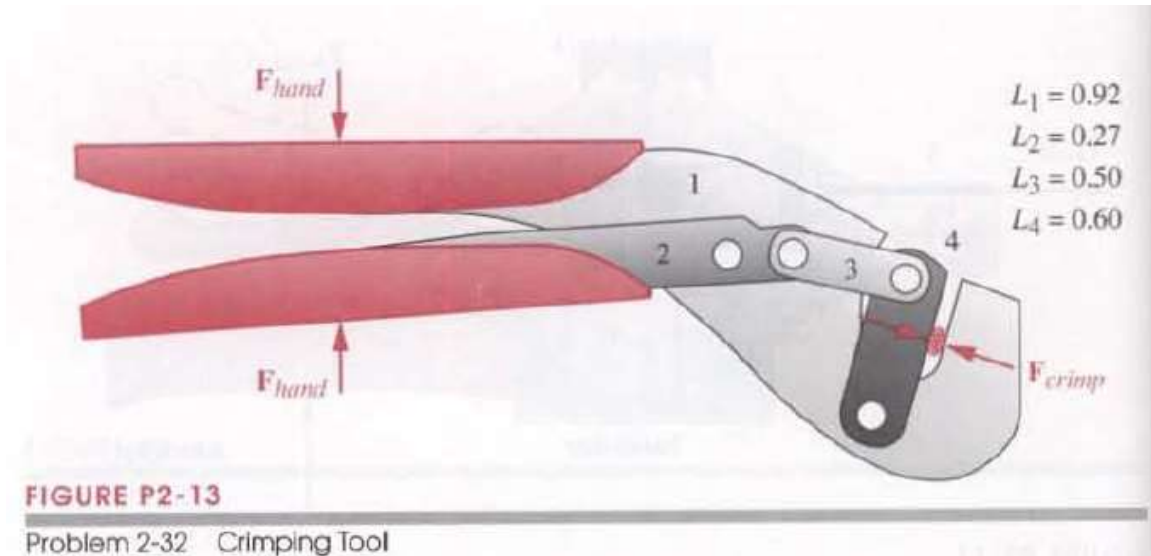
$L_1=4\text{m}$; $L_2=1\text{m}$; $L_3=3.5\text{m}$ and $L_4=3\text{m}$

Draw the kinematic diagram, and determine the Grashof condition and the Barker classification



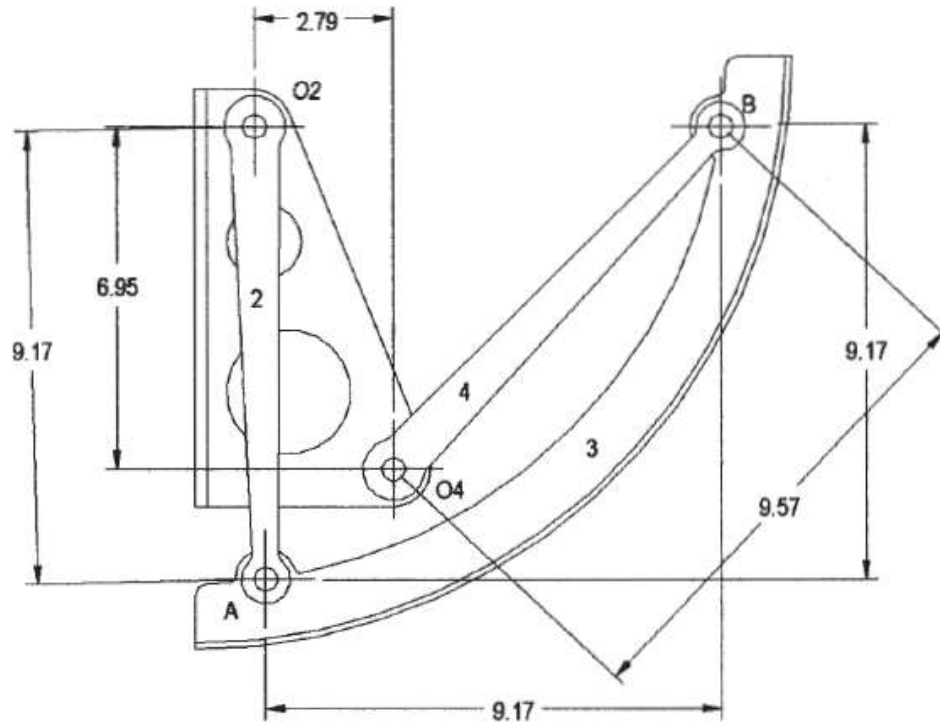
5. Grashof condition and Barker classification (2.32)

Find the mobility, the Grashof condition, and the Barker classifications of the mechanism in the figure below.



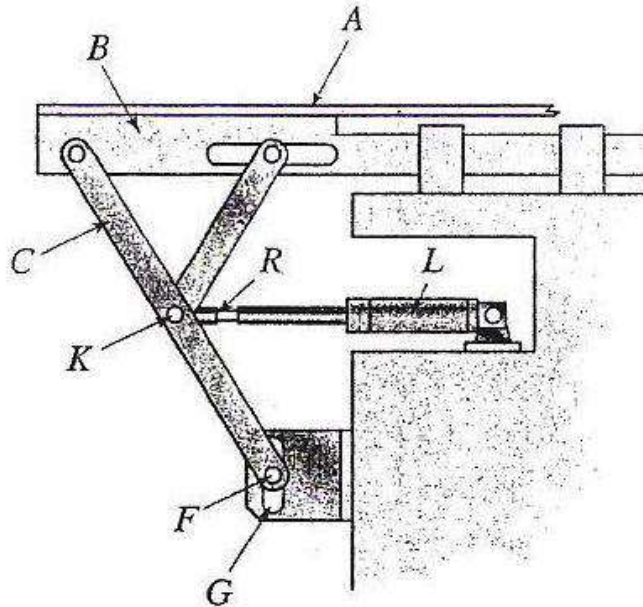
6. Grashof condition and Barker classification

Find the mobility, the Grashof condition, and the Barker classifications of the mechanism in the figure below.



7. Question

The figure below depicts a production transfer machine that moves clutch housings from one station to another.



a) Compute the mobility of this mechanism. Put the links' numbers on the figure

b) Draw the kinematic sketch of this mechanism

c) Carefully examine the configuration of the components in the mechanism, then answer by **True or False** the examinations in the following table;

- Bar B and table A are restricted to horizontal translation
- As the air cylinder L is shortened the bar B moves toward the right
- As the air cylinder L is shortened the point K moves to the left and upward
- As the air cylinder L is shortened the point F moves upward

- As the air cylinder L is shortened the link C moves to the left and rotates anticlockwise
- The purpose of the mechanism is to move table A from left to right and the bottom linkage assists to support load placed on table A