



**centre de  
développement  
pédagogique**

*pour la formation générale  
en science et technologie*

## THE OBJECTS THAT SURROUND US...

### DECODING MECHANICAL ENGINEERING



#### **NOTES**

- *The "Mechanisms" animation, which is available on the Centre de développement pédagogique website, is suggested as a referencing resource.*
- *The majority of these questions are related to the series of numbered images annexed to this document.*
- *It is suggested that you print the annexes in colour and laminate them, in order to obtain better quality images which can be reused.*

September 2011

WORKING DOCUMENT

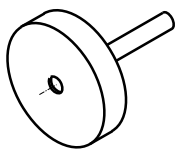
The objective targeted by this document is to observe objects containing mechanisms in order to better understand the languages used to represent or design them.

A MECHANISM IS AN  
ARRANGEMENT OF PARTS ASSEMBLED  
TO WORK AS A WHOLE.

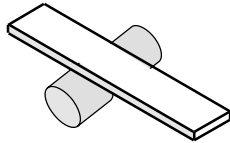
A MECHANISM TRANSMITS OR  
TRANSFORMS THE OUTSIDE FORCE  
THAT PUTS IT IN MOTION.

1- For each of the images shown below, determine whether or not it contains a mechanism. Justify your answers.

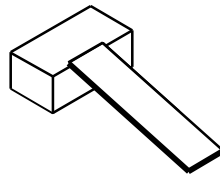
Image	Mechanism(s)	
	yes	no
<div>1</div>	<input type="checkbox"/>	<input type="checkbox"/>
<div>5</div>	<input type="checkbox"/>	<input type="checkbox"/>
<div>7</div>	<input type="checkbox"/>	<input type="checkbox"/>
<div>8</div>	<input type="checkbox"/>	<input type="checkbox"/>



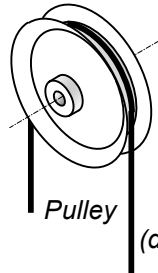
Wheel



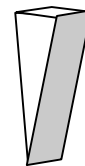
Lever



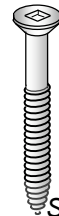
Inclined plane



Pulley



Wedge  
(double inclined plane)



Screw  
(wound wedge)

#### Simple machines

2- For each of the images of objects shown in the table, identify which simple machine(s) is/are present by ticking the appropriate box.

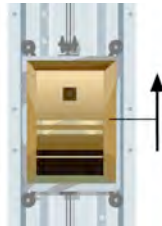
Image Simple machine	3	6	7	9	11	21
Wheel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lever	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inclined plane	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pulley	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wedge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Screw	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## MOVEMENTS

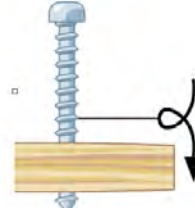
Objects that contain a mechanism have mobile parts. Their movement will directly or indirectly serve the function to which the mechanism is dedicated.



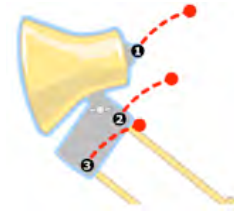
Rotation



Translation



Helical



Curvilinear translation

3- By observing the images shown below, indicate the movement each part carries out by writing its number in the appropriate box.

Images	1B	3A	4A	8C	10B	11A	12B	17B	18A	19D	21A
Rotation											
Translation											
Helical											
Curvilinear translation											

THE PARTS THAT FORM ANY  
TECHNICAL OBJECT HAVE A PRECISE  
**TECHNICAL FUNCTION.**



THE SIMPLEST FUNCTIONS, CALLED  
"BASIC MECHANICAL FUNCTIONS" ARE:  
GUIDANCE, LINK, LUBRICATION AND SEAL.

# THE FUNCTION OF A PART WHICH JOINS PIECES OF AN ASSEMBLY TOGETHER IS CALLED A LINK.

4- In a mechanism, the parts are linked to a frame, framework, chassis or surface. Depending on the characteristics or shape of the object, the link between part will either be:

- removable or fixed;
- directly or indirectly linked (using another organ like a screw);
- completely or partially linked (allowing some movement);
- rigid or elastic (distortion of a part while the object is operating).

Among the illustrations of selected objects, indicate the characteristics of the linkage between the designated parts. Indicate your answers by ticking in the table below.

<b>The link between</b>  <b>Characteristics</b> 	3A and 3B	14A and 14B	15A and 15B	18A and 18B	21A and 21C
Removable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fixed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Direct	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Indirect	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Complete (total)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Partial	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rigid	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Elastic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

THE FUNCTION OF A PART THAT  
DIRECTS ANOTHER PART ALONG  
A SPECIFIC TRAJECTORY IS  
**GUIDANCE.**

LINK AND GUIDANCE BETWEEN PARTS  
ALLOW THE SUPPRESSION OF MOTION  
THAT WOULD IMPEDE THE PROPER  
FUNCTIONING OF THE MECHANISM.

5- In order to correctly fulfill their function, the parts in movement in an object must retain their expected trajectory.

Among the images of selected objects, find the objects whose parts are guided.  
Identify the type of guidance and specify which part of the object is in movement  
(mobile organ) and which part guides the movement by indicating the coordinates of  
the parts in the table below.

Images ➡


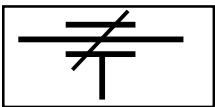



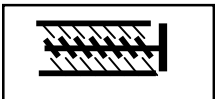


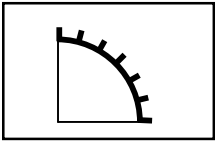

2	3	4	5	9	10	11	14	17	19
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<b>Translation guidance</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Mobile organ
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Guides the movement of the organ

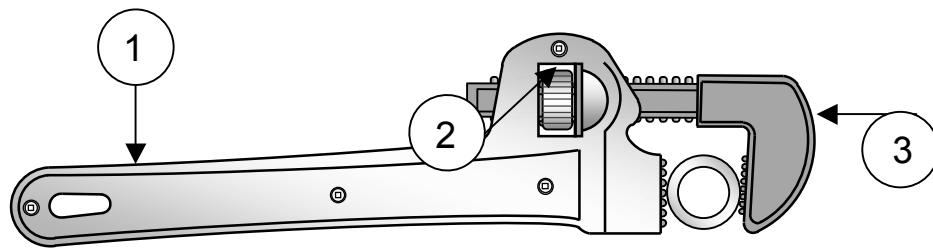
<b>Rotation guidance</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Mobile organ
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Guides the movement of the organ

<b>Helical guidance</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Mobile organ
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Guides the movement of the organ

6- Among the selected objects, indicate those in which you find an element that justifies the use of one or several of the symbols below. Detail your choice by writing the image number in the appropriate box.

Images →	1	2	3	9	10	11	13	14	16	19	21
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7- Observe the drawing of the **pipe wrench** below.



a. Give the global function of this object.

\_\_\_\_\_

b. Name the parts of the object.

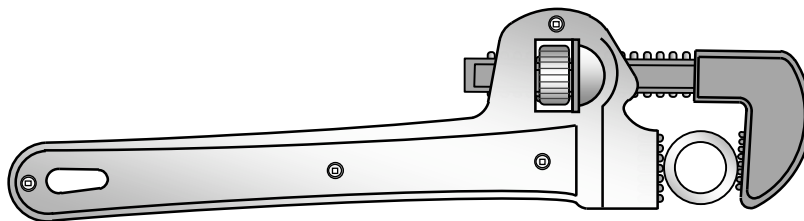
1. \_\_\_\_\_ 2. \_\_\_\_\_ 3. \_\_\_\_\_

c. Which part is the input organ of this object?

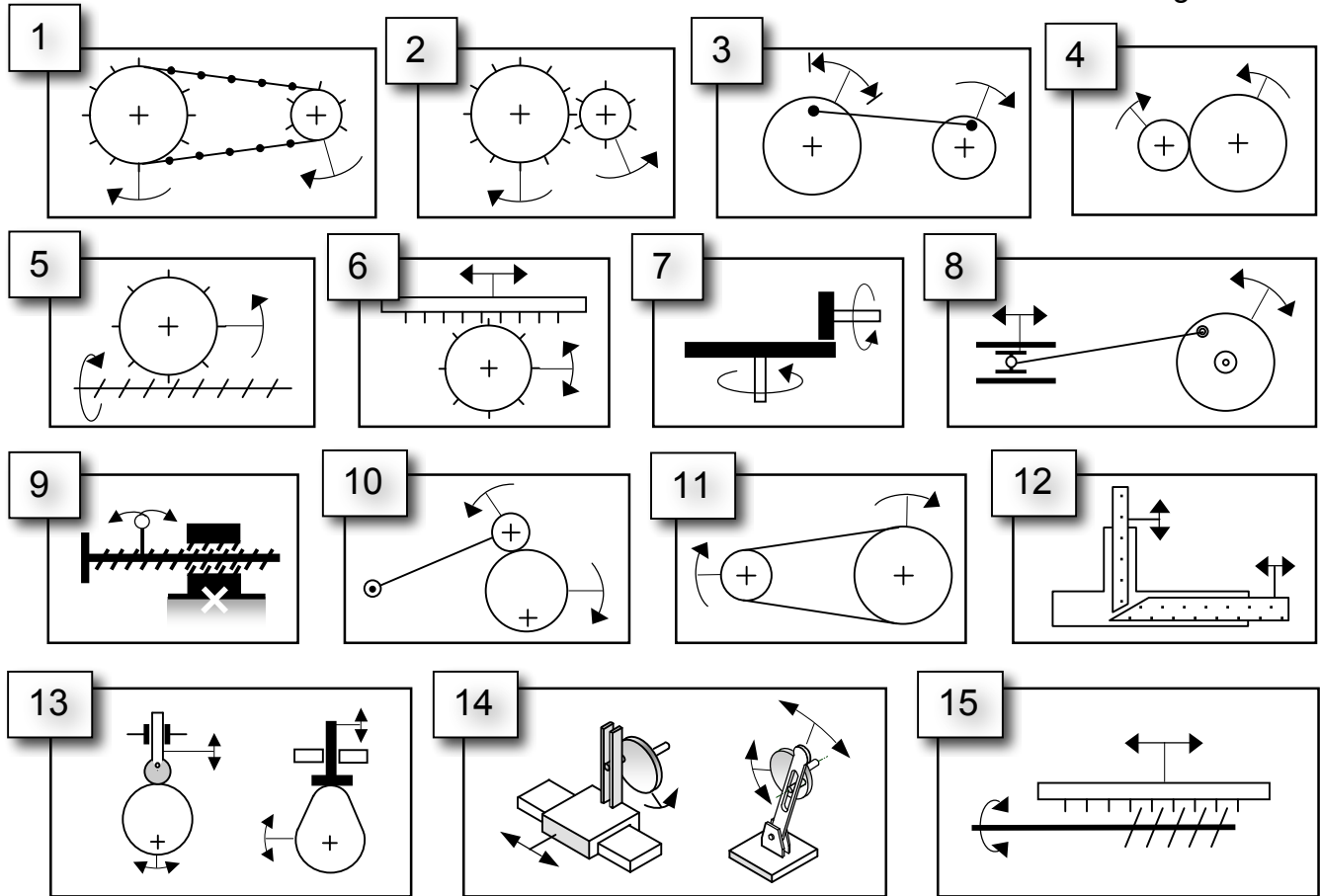
\_\_\_\_\_

d. On the drawing above, indicate the appropriate movement symbol for each of the mobile parts.

e. On the drawing below, indicate and name the simple machines present.



8- Associate the name to the mechanisms represented by the diagrams below. Indicate whether the mechanism transforms or translates the movement of the motor organ.



Crank and slide  
Friction wheel  
Gear  
Rod and crank  
Wedge system

Rack and pinion  
Cam and roller  
Rack and screw  
Pulley and belt

Nut and bolt  
Gear and worm drive  
Chain and gear  
Crank - rod - crank

1. _____ Transmission or transformation	2. _____ Transmission or transformation	3. _____ Transmission or transformation
4. _____ Transmission or transformation	5. _____ Transmission or transformation	6. _____ Transmission or transformation
7. _____ Transmission or transformation	8. _____ Transmission or transformation	9. _____ Transmission or transformation
10. _____ Transmission or transformation	11. _____ Transmission or transformation	12. _____ Transmission or transformation
13. _____ Transmission or transformation	14. _____ Transmission or transformation	15. _____ Transmission or transformation



9- Diagrams o  
arrangements

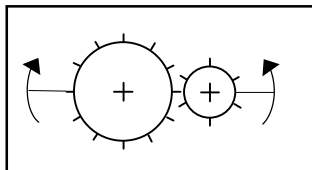
Among the im  
below. Indicat

A MECHANISM IS AN  
ARRANGEMENT OF PARTS ASSEMBLED  
TO WORK AS A WHOLE.

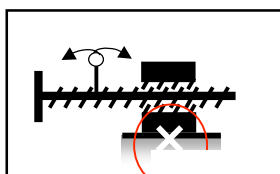
arts

am

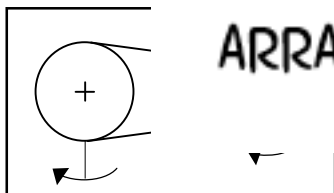
3	4	6	7	9	10	12	14	19	22
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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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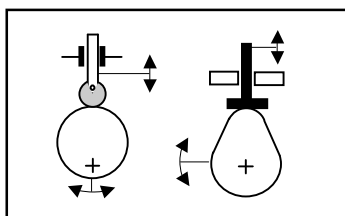


<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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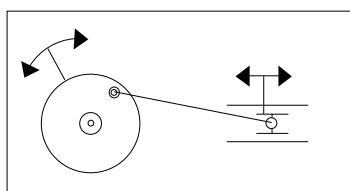


A MECHANISM IS AN  
ARRANGEMENT OF PARTS ASSEMBLED  
TO WORK AS A WHOLE.

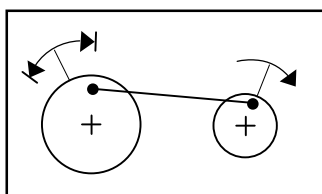
<input type="checkbox"/>
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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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No mechanism shown

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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# A MECHANISM IS AN ARRANGEMENT OF PARTS ASSEMBLED TO WORK AS A WHOLE.

This statement implies that in an arrangement, certain organs (parts) may move and act as a whole. The objective of this action is to change the nature of the movement, to modify the speed or to change the direction of the movement of the parts.

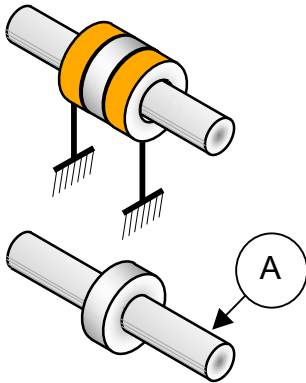
10 - Among the selected images, identify whether the mechanism changes the nature of the movement or modifies it.

	Changes the nature of the movement	Modifies the speed and/or the direction of the movement of the parts
6	<input type="checkbox"/>	<input type="checkbox"/>
7	<input type="checkbox"/>	<input type="checkbox"/>
9	<input type="checkbox"/>	<input type="checkbox"/>
10	<input type="checkbox"/>	<input type="checkbox"/>
11	<input type="checkbox"/>	<input type="checkbox"/>
12	<input type="checkbox"/>	<input type="checkbox"/>
17	<input type="checkbox"/>	<input type="checkbox"/>
18	<input type="checkbox"/>	<input type="checkbox"/>
19	<input type="checkbox"/>	<input type="checkbox"/>

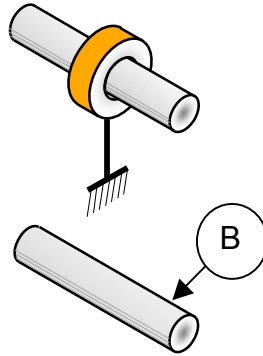
IN ORDER TO CONTROL THE MOTION  
BETWEEN TWO PARTS,  
WE HAVE RECOURSE TO DIFFERENT  
**TYPES OF LINKS** CHOSEN IN  
ACCORDANCE WITH THE FUNCTION  
EACH PART MUST PERFORM.

Certain types of links are obtained by the shape of the parts. It is the shape that determines the degree of liberty of the movement.

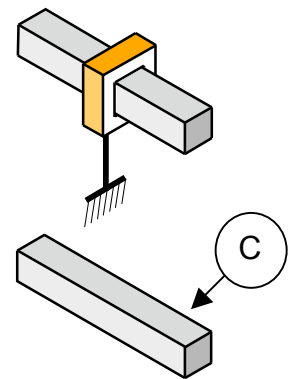
Pivot link



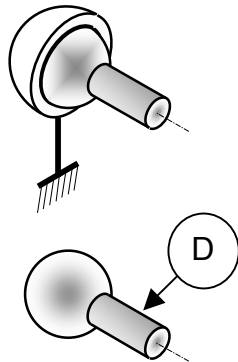
Sliding pivot



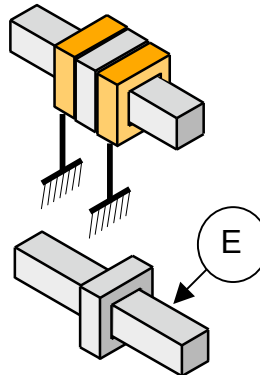
Sliding link



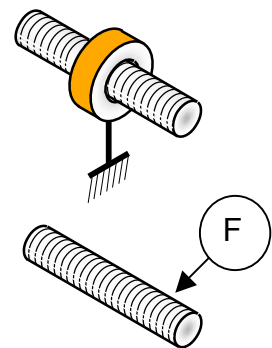
Ball joint



Embedding link

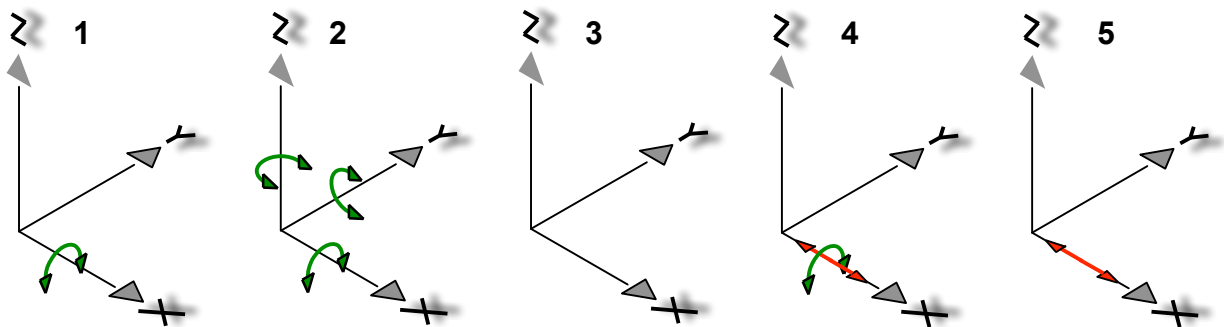


Helical link



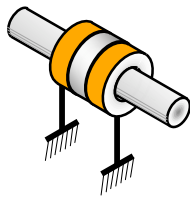
Each type of link above limits the liberty of movement.

11 - Associate the organs A, B, C, D, E, and F with the orthogonal axes 1, 2, 3, 4 and 5, which represents the permitted movement for each organ.

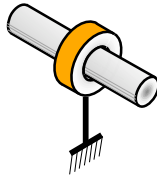


A		B		C		D		E		F	
---	--	---	--	---	--	---	--	---	--	---	--

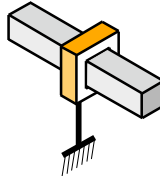
# LINK AND GUIDANCE BETWEEN PARTS ALLOW THE SUPPRESSION OF MOTION THAT WOULD IMPEDE THE PROPER FUNCTIONING OF THE MECHANISM.



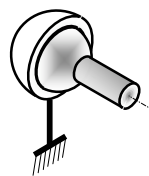
Pivot link



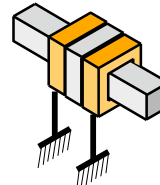
Sliding  
pivot



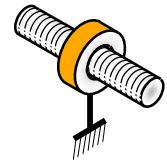
Sliding link



Ball joint



Embedding  
link



Helical link

12 - By observing the movement possible between the organs identified on the images, associate their liberty of movement to the types of links illustrated.

The link between



1A and 1B	3A and 3B	4A and 4C	11B and 11C	16A and 16B	19C and 19D	20A and 20C	21D and 21B
<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>

## Types of links



Pivot link	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sliding pivot link	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sliding link	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ball joint link	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Embedding link	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Helical link	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

