

# Mech Design - Test S2 (length 1h)

## System : Mechanical jack

NAME : Hideux  
 First name : Lélahel  
 Group : 62

### Guidelines :

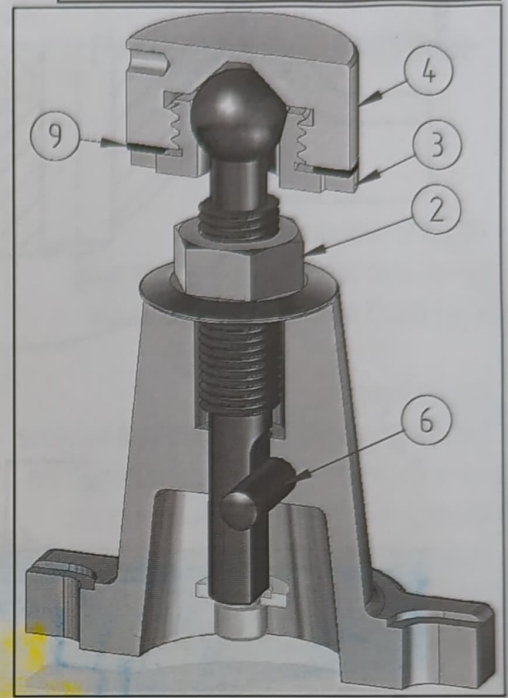
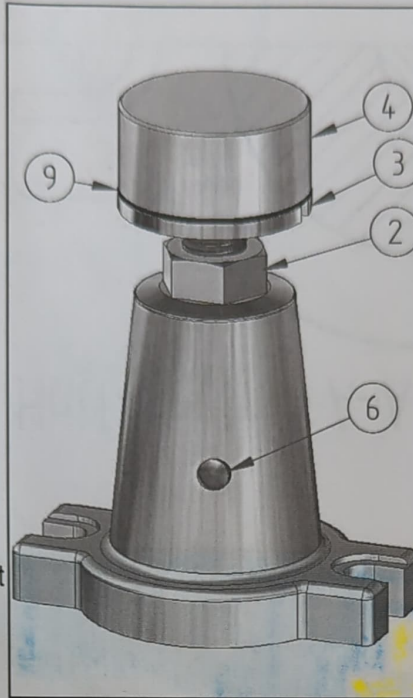
- Answer questions 1.1 to 4.3 directly on the A3 sheet
- Material:** ruler, compass, colour pencils, design booklet authorized
- Points split-up: ~3 pts/quest. 1, 3 and 4; ~11 pts/quest. 2

### System and its usage :

The system called mechanical jack is used to uplift and hold a piece of a heavy furniture.

Part 4 permits to adapt to a small tilting of the contact surface in case that it is not horizontal.

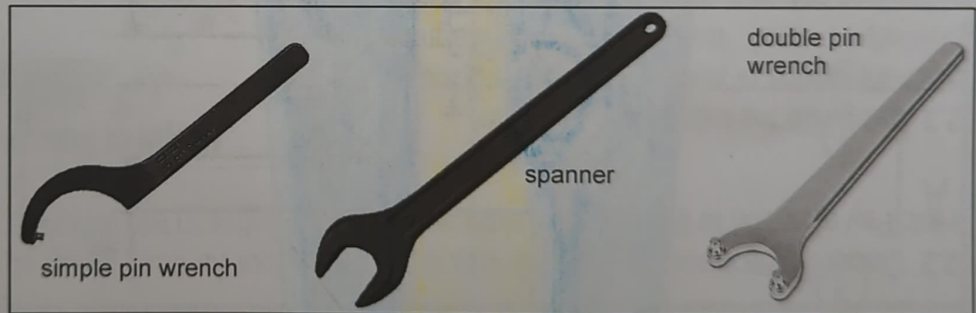
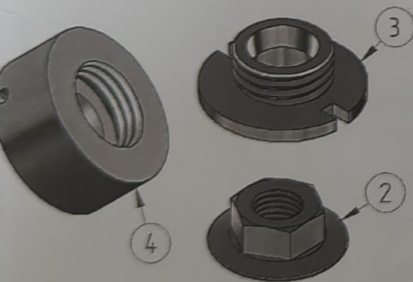
User applies a torque on the nut 2 to adjust the vertical position of the head.



17.70/20

⚠ Be careful, some answers might be incorrect

### 1 - Analysis of the system



1.1 Which type of a wrench should be used to tighten or turn with the following parts?

part 2 : spanner wrench part 3 : double pin wrench part 4 : simple pin wrench

1.2 What is the function of the adjusting washer 9 ?

It protects parts 3 and 4 from wear induced by over-screwing of the parts into each other.

1.3 The pin 6 is tightly fitted into the body 1. What is the function of this cylindrical pin?

It blocks the rotation of the shaft/screw in order to force translation when the nut is rotated.

## 2 - Graph of links and Kinematic diagram

The questions below refer to the operation of "uplifting" by the mechanical jack. User applies torque to the nut 2 in order to adjust the height of the jack's head.

2.1 Deduce the number of groups of parts and complete the table below.

**ATTENTION!** the number of lines has no significance!

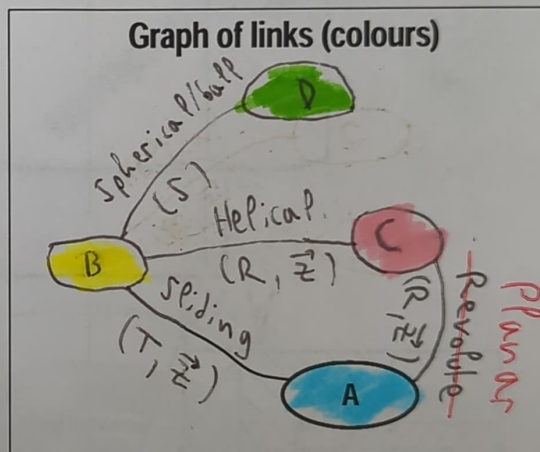
Table of groups of parts			
Group	Name	colour	N° parts
Group A	Body	Blue	7, 6
Group B	Screw	Yellow	5, 7, 8
Group C	Nut	Pink	2
(Group D)	(Head)	Green	(3, 4, 9)

in there during uplifting  
← for other operation modes

2.2 Colour-in the cross-section B-B. Use a different colour for each group of parts (in relationship with 2.1).

Hint: Pay attention to the nature of surfaces of contact between two different groups of parts.

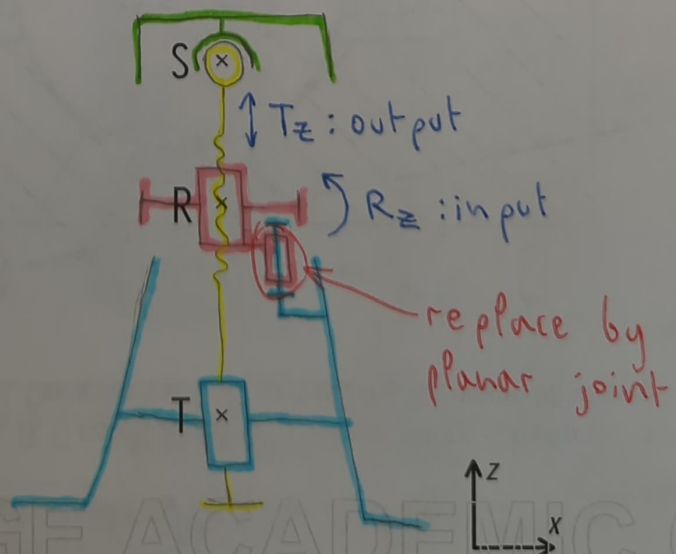
2.3 Complete the bubble diagram with different groups of parts, each with its colour and letter (name). Then complete the diagram with joints between groups of parts. For each joint precise the name, its position (if applicable) and orientation.



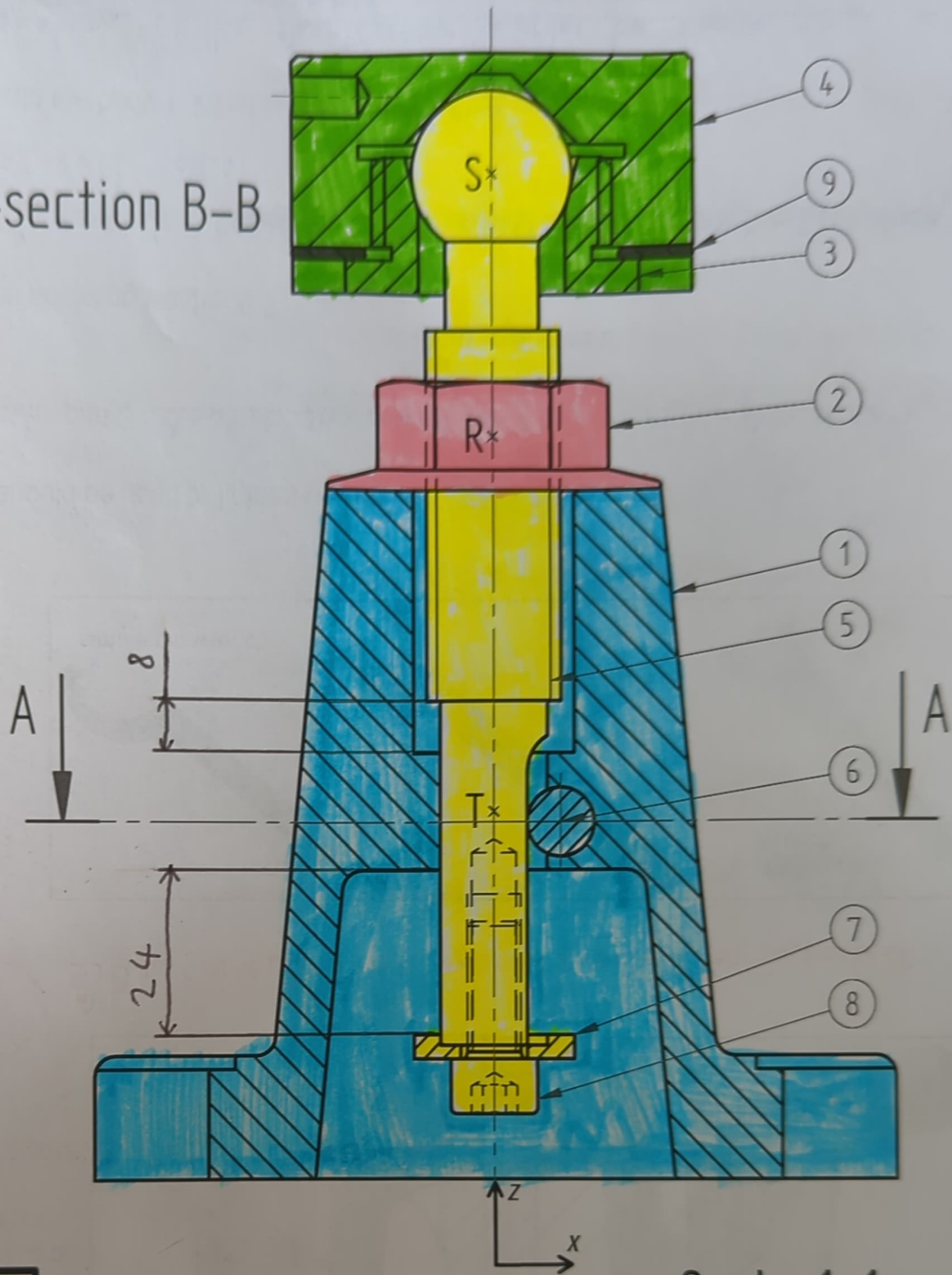
2.4 Sketch below the **kinematic diagram of the system in the (x,z) plane**. You should use the same colours as defined beforehand for your groups of parts. You should use points S, R, and T to place the centers of the joints..

2.5 Using arrows, indicate in the kinematic diagram the **input** and **output** motions.

**Kinematic diagram (colours)**

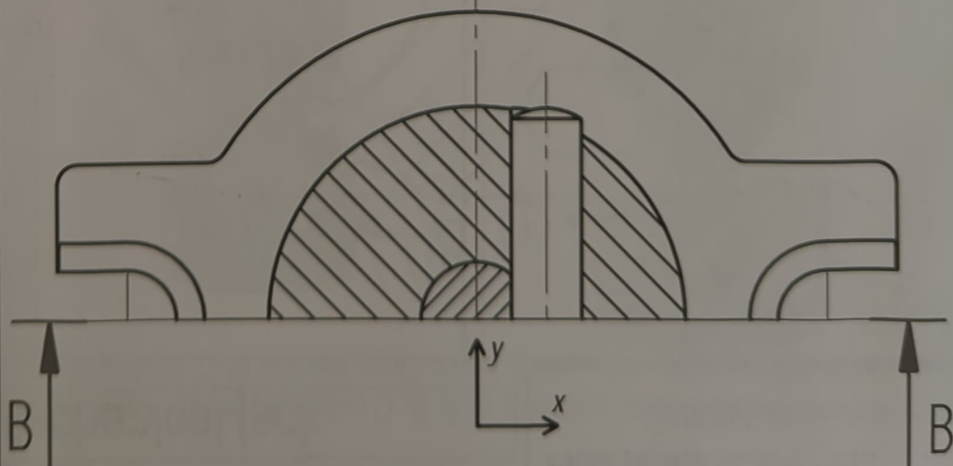


Cross-section B-B



Half-section A-A

Scale 1:1



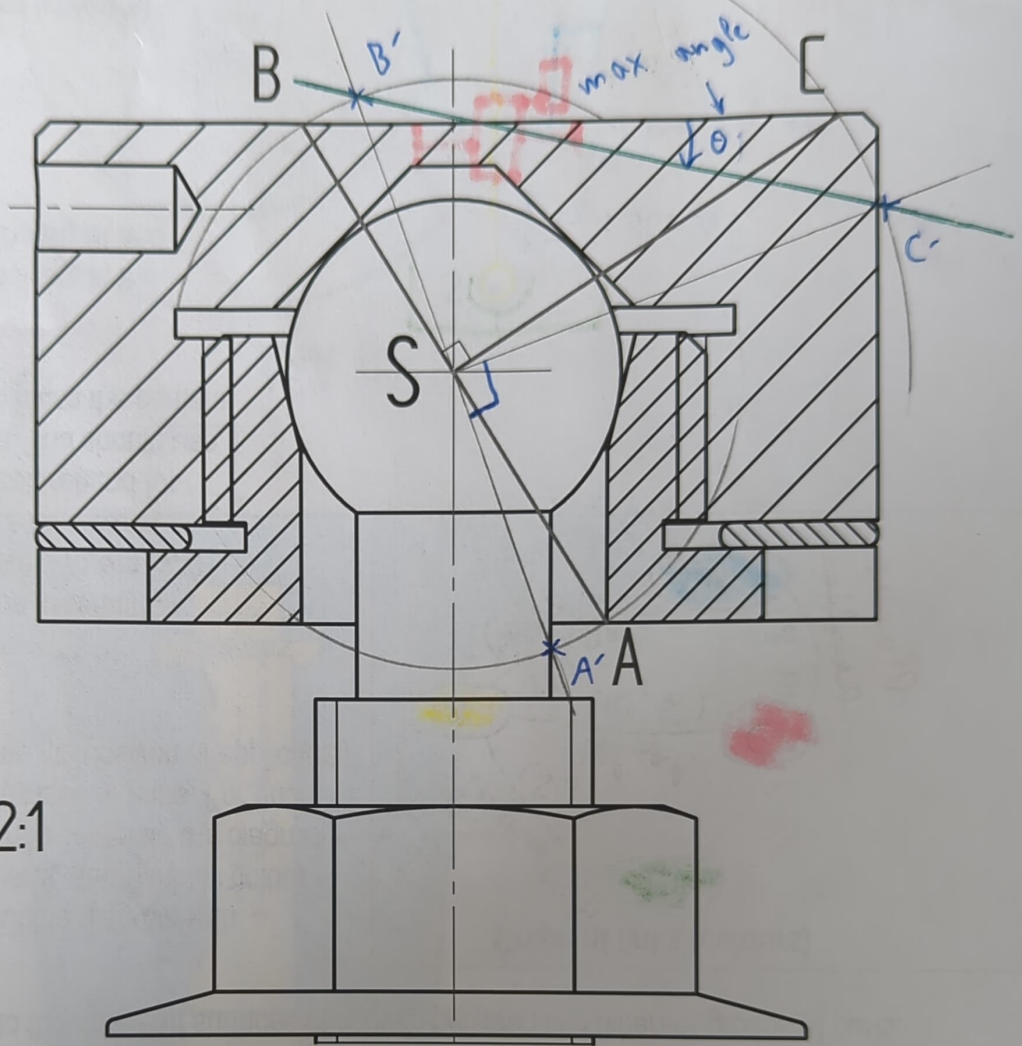
Mechanical jack

9	Adjusting washer
8	Screw CHc M8 - 20
7	Special washer
6	Cylindrical pin 10x60
5	Special screw with spherical head
4	Upper head
3	Lower head
2	Base nut
1	Body
N°	Description

### 3 - Trajectories and extreme positions

3.1 Draw trajectories of points A, B, C below considering the centre of ball S is fixed.

3.2 Find and draw extreme positions of A, B, C called A', B', C'. These positions correspond to maximal admissible rightward tilt of the jack's head. Draw the line B'-C' to show the maximum tilted angle of upper surface.



Scale 2:1

### 4 - Technology

4.1 What is the function of the washer 7 and the screw 8?

Washer 7 allows the jack to have a maximum upper position so that it doesn't disassemble itself so easily.  
Screw 8 is there to maintain washer 7 in its place.

4.2 What is the maximum translation of the screw 5? .....32.....mm

On the assembly drawing draw one or more cotes which enable you to measure this translation.

4.3 Provide a logical succession of assembling the 9 parts in order to build the full system:

Part n° 1... then n° 2... then n° 5... then n° 7... then n° 8... then n° 6... then n° 3... then n° 9... then n° 4...