INSA LYON	
LAST NAME : **First name :**	Duration: 30min No documents authorized

FITS AND TOLERANCES EXAM

Description:

We study a revolute joint represented on following page in a cross-section. This revolute joint uses self-lubricated bush to eas… …ould be **embedded** into the base.

bore (hole) diam 15H7
max 15.018
min 15.000

shaft diam 15p6
max 15.029
min 15.018

clearance = diam(bore)-diam(shaft)
max=15.018-15.018=0
min=15.000-15.029=-0.029
clearance is negative = > tight

PART 1: FITS

Problem 1:

In the table below we…
Give the missing fit b… …possible responses).

		Maximum and minimum diameter clearance
shaft 2 and base 1 ϕ15H7p6		?
shaft 2 and bush 3 ϕ20H8f7		?
bush 3 and wheel 4 ?	Type of fit : tight fit Reason : ?	?

Explain briefly why you would choose these fits, write down their standard form using symbols in the appropriate boxes on the drawing 1, and calculate the maximum and minimum clearances using the tables given below. The nominal diameters are given on the drawing.

PART 2: FUNCTIONAL CLEARANCES & CHAIN OF COTES

Problem 2: clearance c

stack assemblies

Identify and draw the chain of cotes for the functional clearance c. Write down the equations corresponding to the functional clearance c:

?

A design engineer wants this clearance c to be between 0.25 and 0.5mm. Using the known dimension of the base 1, determine the tolerance cote to be used on the shaft. Place this cote on the drawing 2.

?

Problem 3: missing clearance "a"

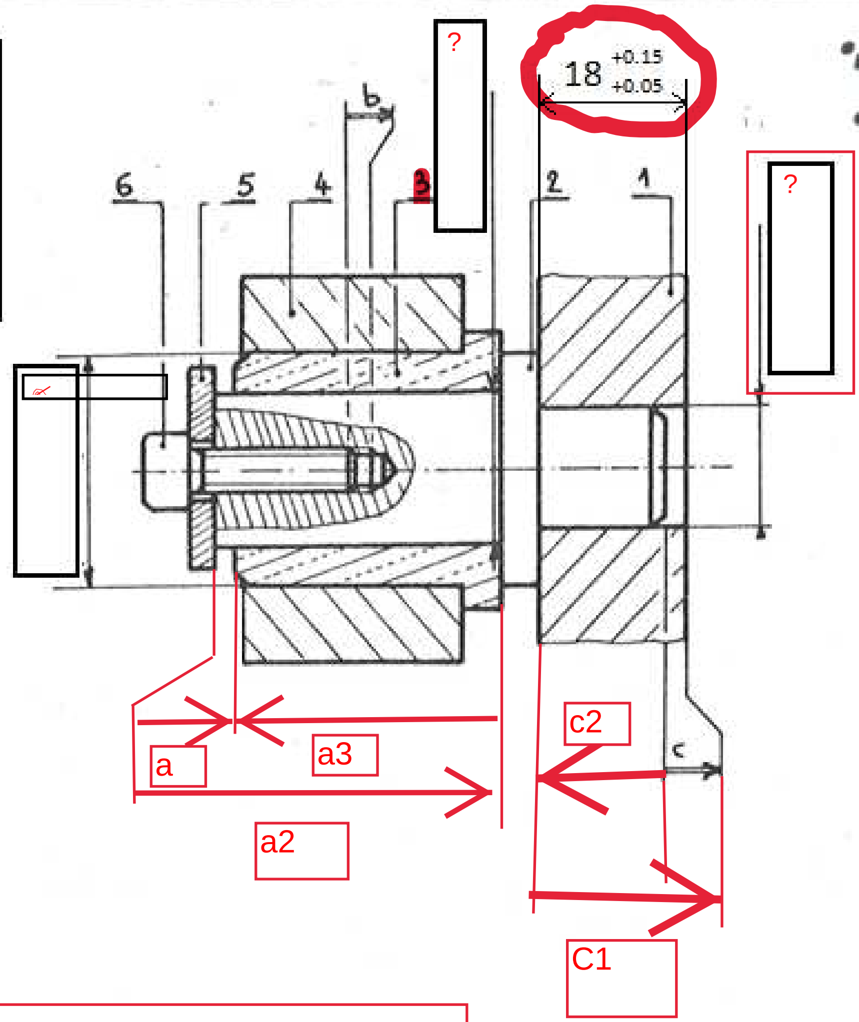
Identify the functional clearance "a" necessary for the functioning of the revolute joint. Place the clearance vector on the drawing 1 and draw a corresponding chain of cotes associated with this clearance.

BONUS QUESTION :

Problem 4: What is the reason for the clearance "b"?

?

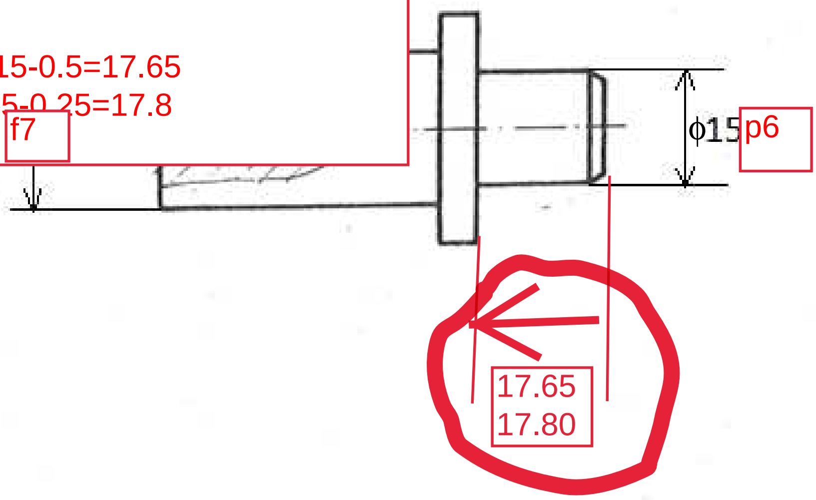
1 : Base
2 : Shaft
3 : Self-lubricated bush
4 : Wheel
5 : Washer
6 : Screw CHc M6



Drawing 1
Scale 1:1

c=c1-c2
max(c)=max(c1)-min(c2)
min(c)=min(c1)-max(c2)

min(c2)=max(c1)-max(c)=18.15-0.5=17.65
max(c2)=min(c1)-min(c)=18.05-0.25=17.8



Drawing 3 (bush)
Scale 1:1

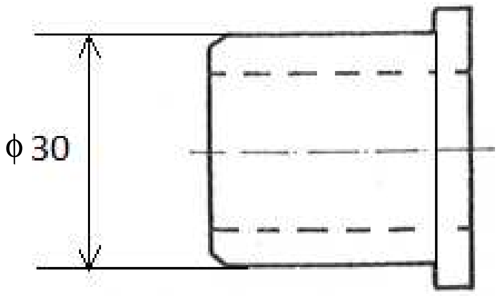


Table of the fundamental tolerances ISO

diam 15 p6 =

min 15.018
max 15.029

diam 15H7=
max=15.018
min=15.000

	DIMENSIONS (in mm)									
from	0	3	6	10	18	30	50	80	120	180
to (included)	3	6	10	18	30	50	80	120	180	250
quality	FUNDAMENTAL TOLERANCES TI (in µm)									
5	4	5	6	8	9	11	13	15	18	20
6	6	8	9	11	13	16	19	22	25	29
7	10	12	15	18	21	25	30	35	40	46
8	14	18	22	27	33	39	46	54	63	72
9	25	30	36	43	52	62	74	87	100	115
10	40	48	58	70	84	100	120	140	160	185
11	60	75	90	110	130	160	190	220	250	290
12	100	120	150	180	210	250	300	350	400	460
13	140	180	220	270	330	390	460	540	630	720
14	250	300	360	430	520	620	740	870	1000	1150
15	400	480	580	700	840	1000	1200	1400	1600	1850
16	600	750	900	1100	1300	1600	1900	2200	2500	2900

Fundamental deviations for shafts

Remark :

<u>For bores</u>, deviation are symetrical around the nominal dimension.

Ex : Shaft : $10f7 = 10^{-13}_{-28}$

Bore : $10F7 = 10^{+28}_{+13}$

Shafts	from 0 to 3 included	from 3 to 6 included	from 6 to 10 included	from 10 to 18 included	from 18 to 30 included	from 30 to 50 included	from 50 to 80 included	from 80 to 120 included	from 120 to 180 included	from 180 to 250 included	from 250 to 315 included	from 315 to 400 included	from 400 to 500 included
d	- 20 -	- 30 -	- 40 -	- 50 -	- 65 -	- 80 -	- 100 -	- 120 -	- 145 -	- 170 -	- 190 -	- 210 -	- 230 -
e	- 14 -	- 20 -	- 25 -	- 32 -	- 40 -	- 50 -	- 60 -	- 72 -	- 85 -	- 100 -	- 110 -	- 125 -	- 135 -
f	- 6 -	- 10 -	- 13 -	- 16 -	- 20 -	- 25 -	- 30 -	- 36 -	- 43 -	- 50 -	- 56 -	- 62 -	- 68 -
g	- 2 -	- 4 -	- 5 -	- 6 -	- 7 -	- 9 -	- 10 -	- 12 -	- 14 -	- 15 -	- 17 -	- 18 -	- 20 -
h	- 0 -	- 0 -	- 0 -	- 0 -	- 0 -	- 0 -	- 0 -	- 0 -	- 0 -	- 0 -	- 0 -	- 0 -	- 0 -
js	± IT/2	± IT/2	± IT/2	± IT/2	± IT/2	± IT/2	± IT/2	± IT/2	± IT/2	± IT/2	± IT/2	± IT/2	± IT/2
k	+ + 0	+ + 1	+ + 1	+ + 1	+ + 2	+ + 2	+ + 2	+ + 3	+ + 3	+ + 4	+ + 4	+ + 4	+ + 5
m	+ + 2	+ + 4	+ + 6	+ + 7	+ + 8	+ + 9	+ + 11	+ + 13	+ + 15	+ + 17	+ + 20	+ + 21	+ + 23
n	+ + 4	+ + 8	+ + 10	+ + 12	+ + 15	+ + 17	+ + 20	+ + 23	+ + 27	+ + 31	+ + 34	+ + 37	+ + 40
p	+ + 6	+ + 12	+ + 15	+ + 18	+ + 22	+ + 26	+ + 32	+ + 37	+ + 43	+ + 50	+ + 56	+ + 62	+ + 68