Problem 1 (10 points)

The frame OABC is attached to the wall at two points O (fixed directly to the wall) and C (through cable CD). The force W is acting on the frame at point B in the negative y direction and the tension force in cable CD is T = W/2. For this frame:

a) Calculate the internal resultants, i.e. forces and moments developed at the cross-section H (on the negative z face).

b) Does the internal resultant force vary along the line segment OA? What about along line segment AB?
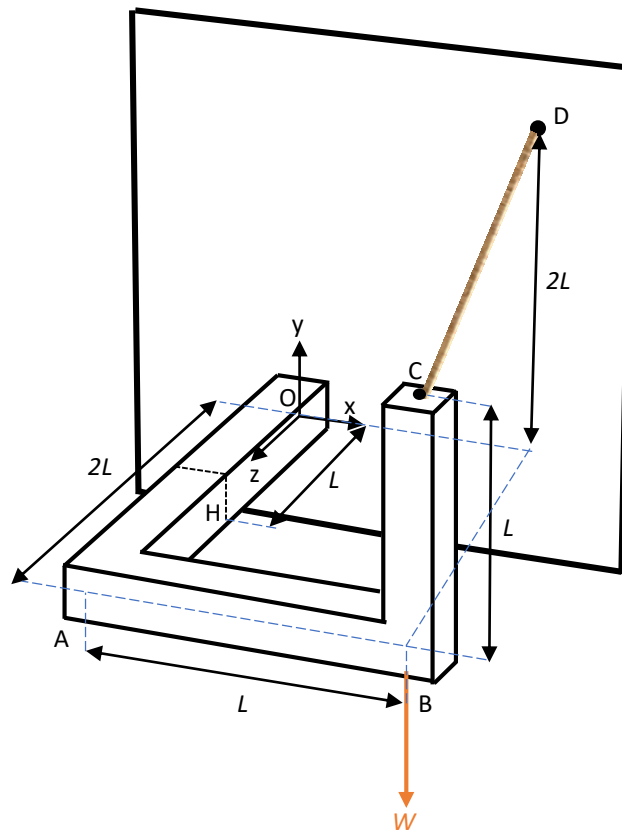

Fig 1

Problem 2 (10 points)

Frame assembly is subject to the loading as shown in Fig 2. The bars ABC and BD are rigid and the connections at A, B, and D are pin joints.

a) Determine the magnitude of the internal shear forces in the pin joints and identify the pin that carries the maximum magnitude load.

b) If the area and the shear strength of each pin is A and τ, respectively, then express the maximum value of P possible without failure in terms of τ and A. Assume that pins B and D are double-sided and the pin A is single-sided in your calculations.
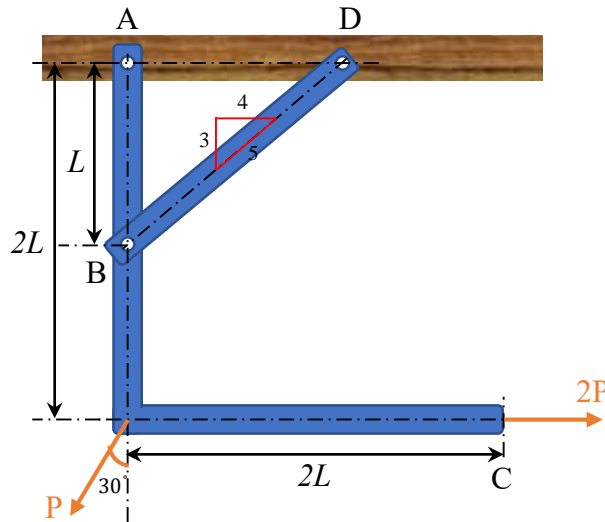

Fig 2

Problem 3 (10 points)

Two wooden blocks of identical square cross section (10 mm x 10 mm) are glued together along the plane BC as shown in Fig 3.

a) Assuming that the glue can withstand a maximum shear stress of 15,000 Pa, calculate the maximum force P that can be applied at the glued section.

b) A new glue was tested which can withstand a maximum normal stress of 8,000 Pa and a maximum shear stress of 5600 Pa. What is the maximum force that can be applied?
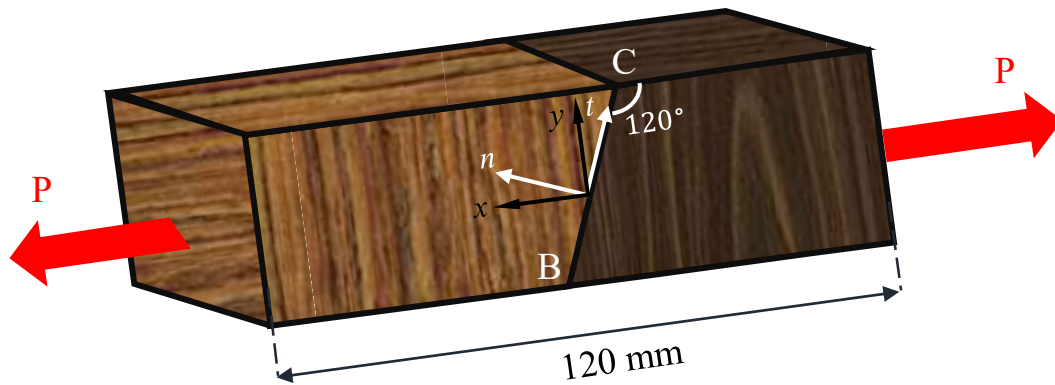

Fig 3

Problem 4 (**Conceptual**) (**5 points**)

Bar ABC is supported by a pin joint at point A and loaded by force P at point C. Bar ABC is also connected to bar BD via a pin joint at B which in turn is supported by a pin joint at D. Bar BD is oriented along the y axis.
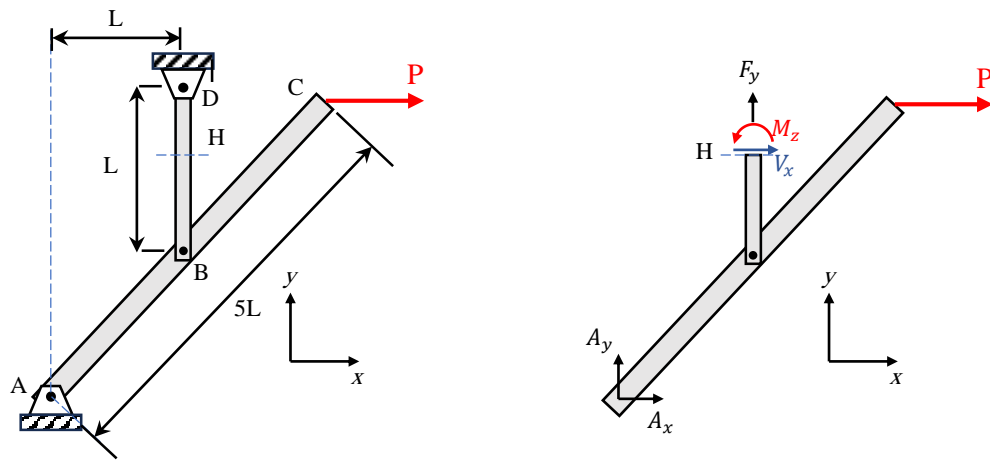

Fig 4

Select the zero internal resultant(s) at cut section H.

(a) Normal force F_y

(b) Shear force V_x

(c) Bending moment M_z

(d) All internal resultants are non-zero