UNIVERSITY OF TORONTO

Faculty of Applied Science and Engineering

CIV100S – MECHANICS

Final Examination

18th April 2017

Examiner: Prof. Michael Seica

Time allowed: 2-½ hours

FAMILY NAME:_____ **GIVEN NAME(S):**_____

(Please print clearly)

STUDENT NUMBER: _____

CIRCLE THE MODEL NUMBER OF YOUR CALCULATOR:

CASIO FX991 **SHARP EL520**

NOTES:

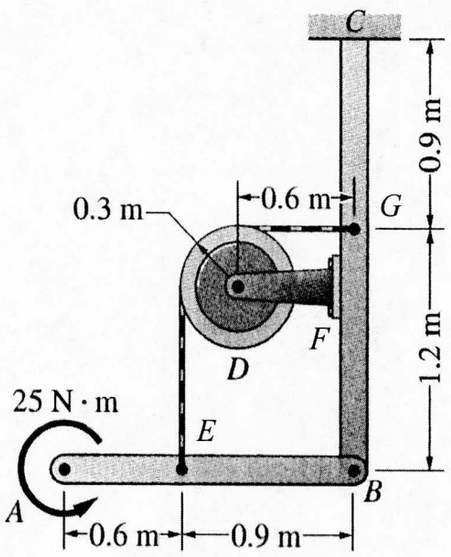
1. **Ensure that you have all 7 sheets of the examination paper. Page 7 is blank.**
2. **Answer <u>all</u> five questions. The value of the questions is indicated below.**
3. **If you need more space for a question, please use the back of the preceding question. In all cases, please indicate clearly where your calculations are continued.**
4. **The only calculators permissible are listed above. Please circle your model.**
5. **This is a closed-book examination. No other paper will be allowed on the desk.**
6. **Do <u>not</u> remove the staple.**

DO NOT WRITE IN THIS SPACE.

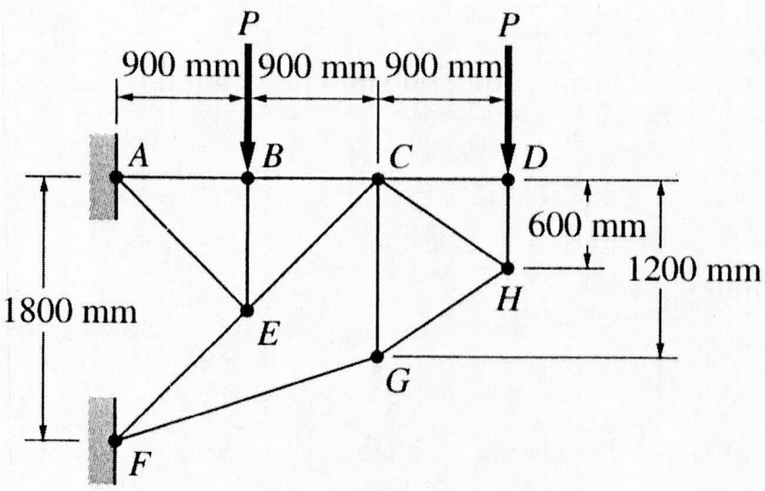
1	/12
2	/12
3	/12
4	/12
5	/12
TOTAL	**/60**

NAME: _____

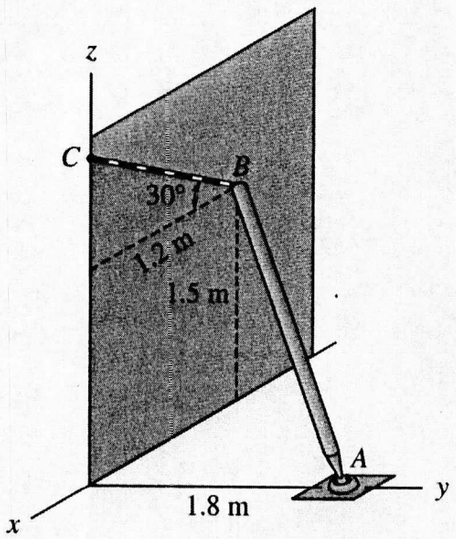
1. Determine all forces exerted on member *BFGC* of the frame illustrated and show a summary of your final answers on a separate diagram of this member.



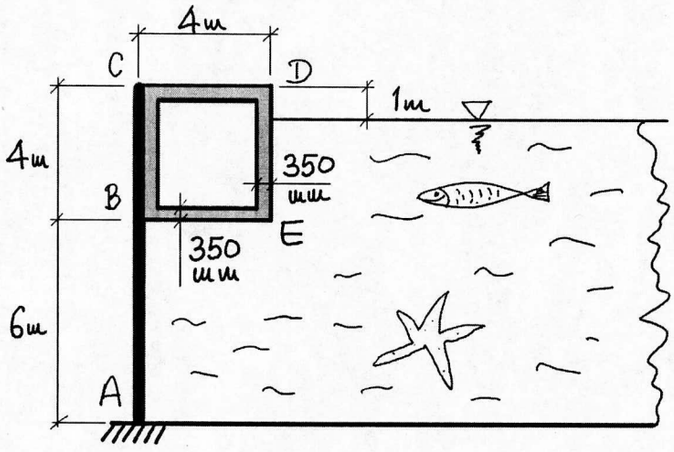
2. Two concentrated forces, each having a magnitude of P, are acting on a walkway supported by a truss, as illustrated. The truss is pinned at *A* and *F*.
(a) Find the forces in members *AB*, *CH*, *CG* and *GH* of the truss, in terms of P;
(b) Members *AB, CG* and *CH* are to be constructed from Grade 6061-T4 aluminium with a yield stress of 110 MPa and must all have the same solid square cross-section. Assuming that P = 18 kN, determine the dimension of the cross-section, *a*, given that the material is available in 5 mm increments and the load factor for axial tension is 1.6;
(c) Knowing that the modulus of elasticity for aluminium is 70,000 MPa, determine the elongation of member *CH*, as designed.



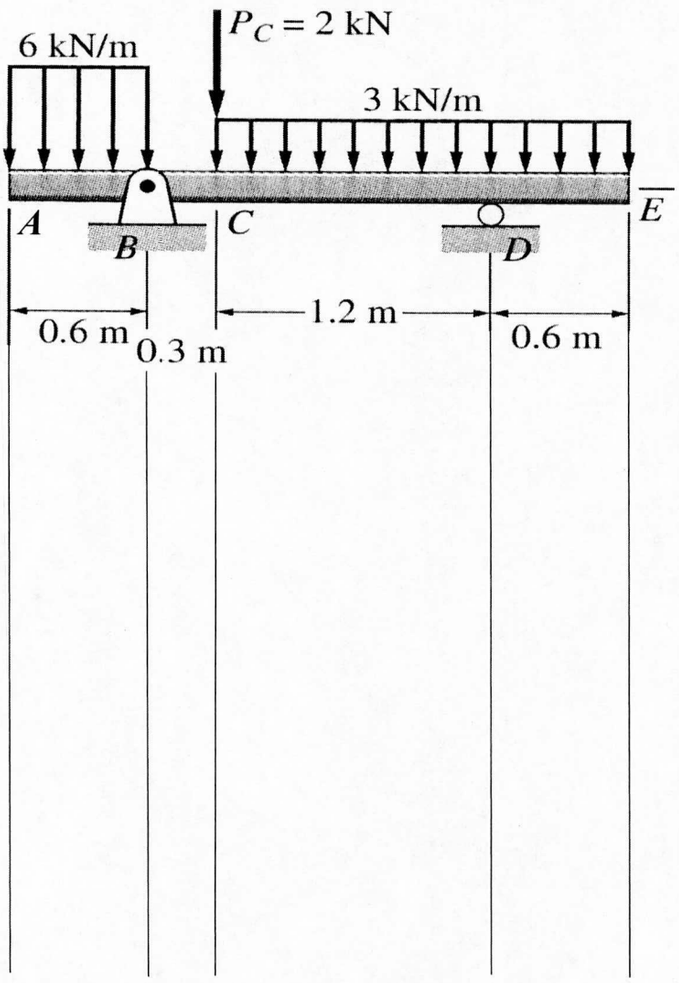
3. The upper end of the homogenous, constant cross-section, straight bar *AB* leans against the frictionless vertical wall, at *B*. If the bar has a mass of 35 kg, determine the tension in cable BC and the magnitude of the total force exerted by the ball-and-socket joint at *A*.

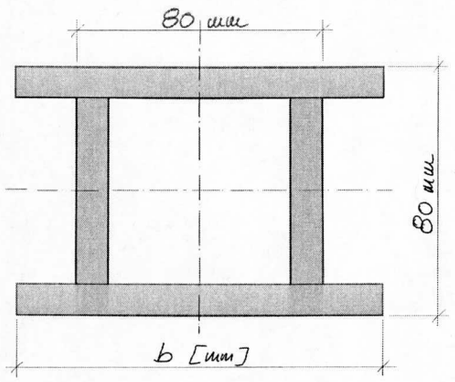


4. The structure *ABCDE* is used to prevent fresh water from flowing out of the long channel on the right. The weight of the vertical panel *ABC* may be neglected and *BCDE* is made of a steel hollow box having the same wall thickness all around. The density of steel is 7,850 kg/m^3. Determine the reaction force components at the fixed base *A*.



5. The simply supported beam illustrated below is made of 10 mm thick plywood sheets, attached (e.g. glued) together to form a 'Box'-shaped cross-section. Both flanges have the same width, b.
(a) Draw the shear force and bending moment diagrams for the beam in the space reserved below, indicating the values at A, B, C, D and E, as well as any potential local maxima and minima;
(b) Determine the width of the beam, b, such that it can safely carry the loads applied. The plywood has a failure stress of 40 MPa in both tension and compression and the required load factor for wood in flexure is 3.0. The fabrication shop can cut the plywood sheets in multiples of 10 mm.





Cross-Section of Beam