Mechanics 19 – Statics 1

Please **complete** this homework by _____. Start it early. If you can't do a question you will then have time to ask your teacher for help or go to a drop in session.

Section 1 – Review of previous topics. Please <u>complete</u> all questions.

1. A uniform beam AB of mass 40 kg and length 3 m, rests on two supports, one at A and the other at C, where BC = 1 m, as shown.


   A load of mass 10 kg is attached to the beam at B.

   (a) Draw a diagram showing the forces acting on the beam.

   (b) Calculate the magnitude of the reaction forces at A and C.

   The load at B is now increased to m kg, as a result of which the beam is on the point of tipping about C.

   (c) Calculate m.

2. A uniform beam AB of mass 20 kg and length 4 m rests on a support at A and is held in a horizontal position by a vertical string attached to the beam at B. A load of mass 8 kg is placed on the beam at C, where AC = 1 m.
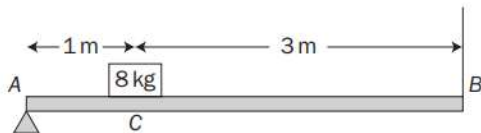
   (a) (i) Calculate the reaction at the support at A.
       (ii) Find the tension in the string.
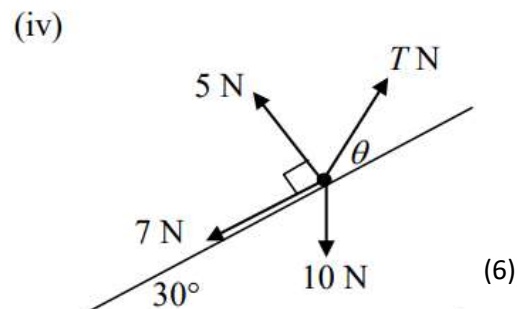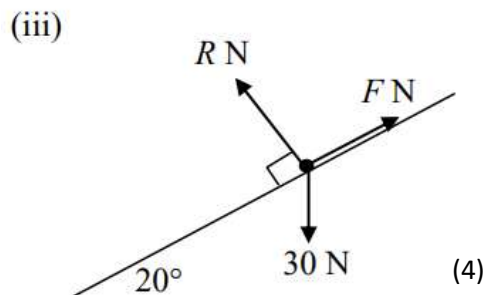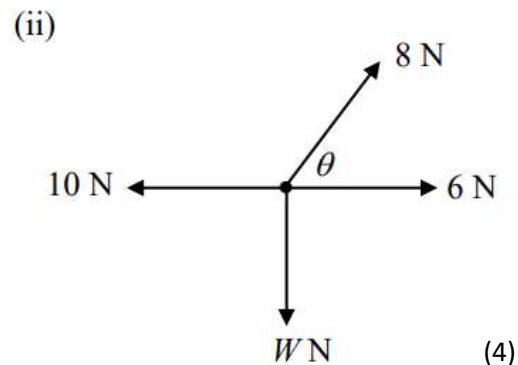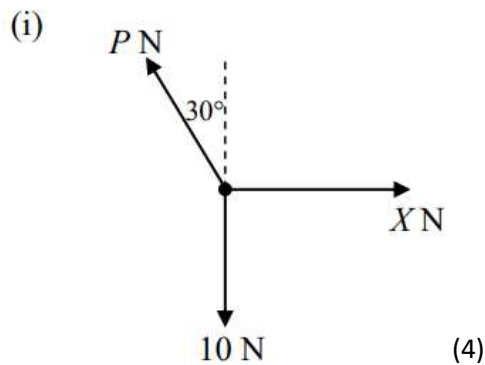
   The string has a breaking strain of 170 N.

   (b) How close to B could the 8 kg load be moved without breaking the string?

3. A random sample of daily rainfall figures is taken from the data from Leeming in 1987. The values obtained are: 0.5, 0.8, 11.5, 0.5, 1.5, 0.8, 21.6, 1.2, 1.2, 1.5, 0.8, 1.5, 12.6, 16.8, 0.9.
   (a) An outlier is defined as a value which is more than 1.5 times the interquartile range above Q3 or more than 1.5 times the interquartile range below Q1. Determine which values, if any, are outliers.
   (b) Using your knowledge of the data set, would you expect a sample of the same size from the data for Perth to be more likely or less likely to contain an outlier? You must give a reason for your answer.

Section 2 – Consolidation of this week's topic. Please complete all questions.

1.

Each of the diagrams below shows a particle in equilibrium under the action of various forces. In each case find the values of the unknown forces and angles.

(i)

P N

30°

X N

10 N

(4)

(ii)

8 N

θ

10 N   6 N

W N

(4)

(iii)

R N

F N

30 N

20°

(4)

(iv)

T N

5 N

θ

7 N

10 N

30°

(6)

(18 marks)

2. A particle of mass 5kg is suspended in equilibrium by two light inextensible strings which make angles of 30º and 45º respectively with the horizontal. Find the tensions in the strings

(8 marks)

3. A particle of weight 40 N is attached to the end of a light inextensible string of length 2 m. The other end of the string is attached to a vertical wall. The particle is held at a distance of 1.2 m from the wall by a horizontal force F. Find the magnitude of F and the tension in the string.

(7 marks)

4. A small weight of 20 N is at rest on a smooth plane inclined at 30 degrees to the horizontal. It is held in position by a light rope. The angle between the rope and the plane is 20 degrees. Find the tension in the rope and the reaction at the plane.

(7 marks)

5. A particle P of weight W newtons is attached to one end of a light inextensible string. The other end of the string is attached to a fixed point O. A horizontal force of magnitude 5 N is applied to P. The particle P is in equilibrium with the string taut and with OP making an angle of 25° to the downward vertical, as shown in Figure 1.
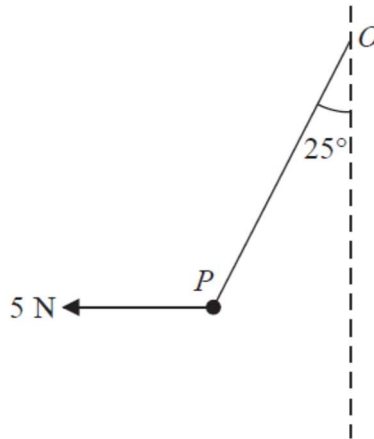
Figure 1

Find

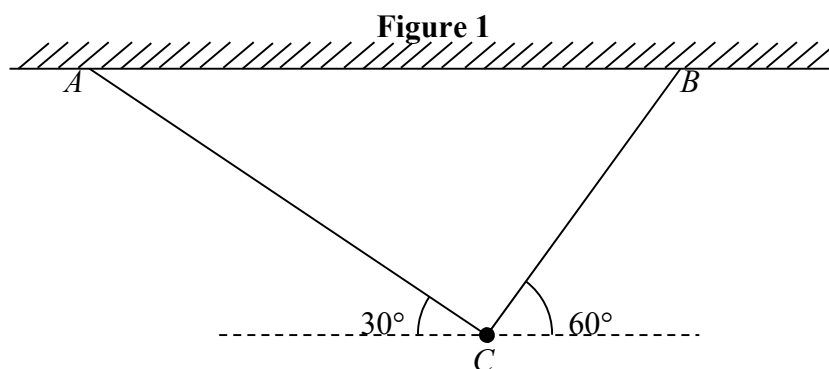(a) the tension in the string,

(3)

(b) the value of W.

(3)

(6 marks)

6.

Figure 1

A particle of weight W newtons is attached at C to the ends of two light inextensible strings AC and BC. The other ends of the strings are attached to two fixed points A and B on a horizontal ceiling. The particle hangs in equilibrium with AC and BC inclined to the horizontal at 30° and 60° respectively, as shown in Fig.1. Given the tension in AC is 50 N, calculate

(a) the tension in BC, to 3 significant figures,

(3)

(b) the value of W.

(3)

(6 marks)

TOTAL 52 marks