Answers all questions to **3 significant figures**.

Question 1

A ladder, leaning against a wall, makes a 60° angle with the ground. When is it more likely to slip: when a person stands on the ladder near the top or near the bottom?
Explain your answer.   **(3 marks)**

Question 2

A ground retaining wall is shown below. The ground, particularly when wet, can exert a significant force F on the wall.

(i)   **(ii)**
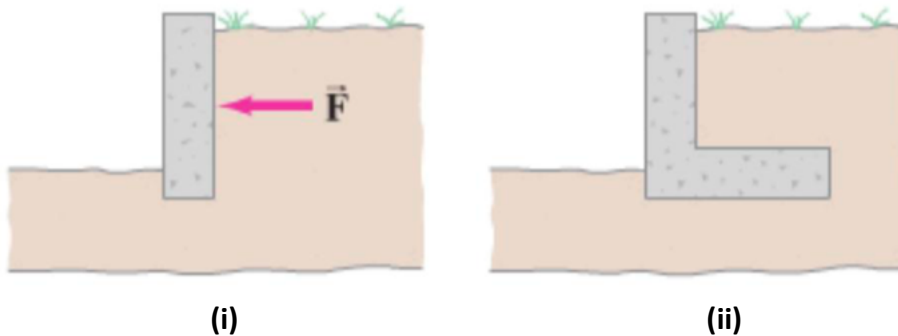
a) What force produces the torque to keep the wall upright?

(1 mark)

b) Explain why the retaining wall in (ii) would be much less likely to overturn than in (i).

(2 marks)

Question 3

Calculate the mass m needed in order to suspend the leg shown below. Assume the leg (with cast) has a mass of 15.0 kg and its centre of gravity cg is 35.0 cm from the hip joint (pivot); the sling is 80.5 cm from the hip joint (pivot).
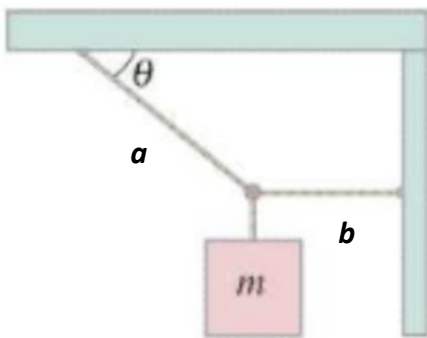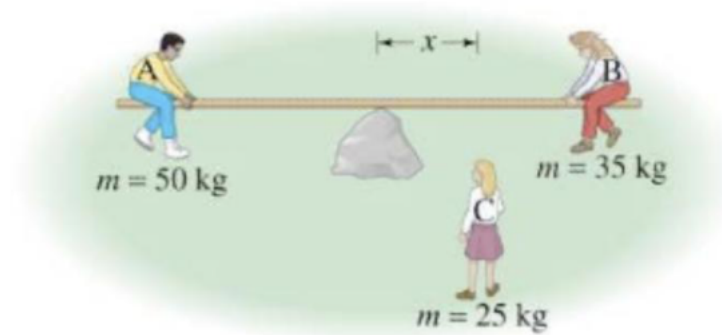

(4 marks)

Question 4

Calculate the tension in wires a and b. Neglect the mass of the wires, and assume that the angle θ Is 33° and the mass m is 170 kg.
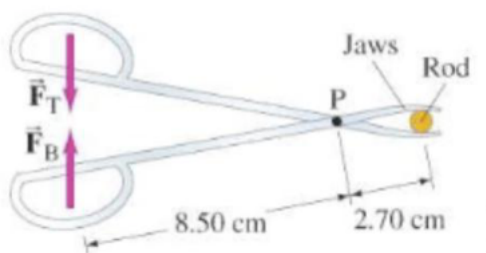
(4 marks)

Question 5

Three children are trying to balance on a seesaw, which consists of a fulcrum rock, acting as a pivot at the centre, and a very light board 3.6 m long. Two playmates are already on either end. Boy A has a mass of 50 kg, and girl B has a mass of 35 kg. Where should girl C, whose mass is 25 kg, place herself in order to balance the seesaw?
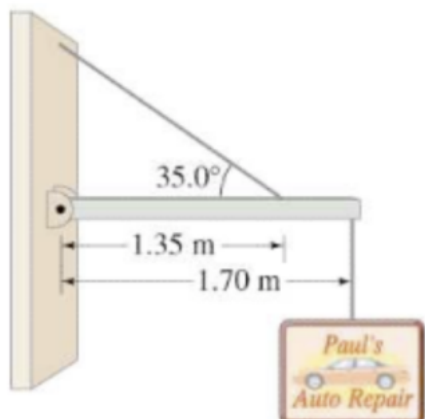

(3 marks)

Question 6

A pair of forceps are used to hold a thin plastic rod firmly. If each finger squeezes with a force:
$F_T = F_B = 11.0\ N$, what force do the forceps jaws exert on the plastic rod?
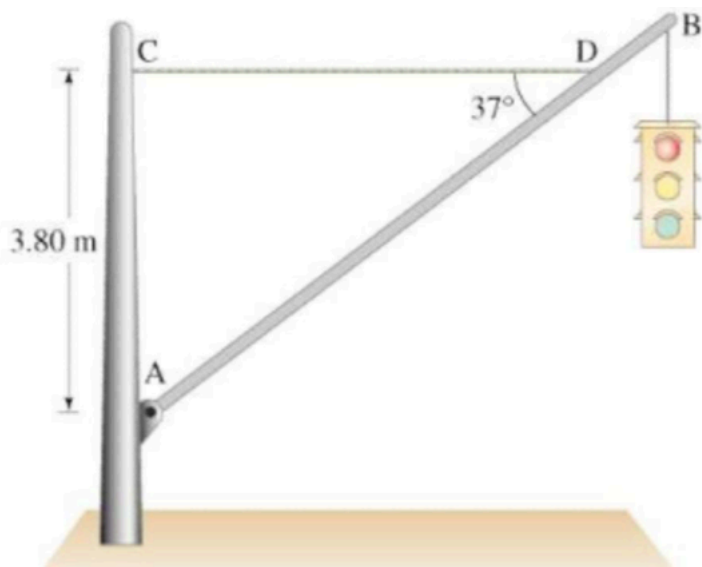

(3 marks)

Question 7

A shop sign weighing 245 N is supported by a uniform 155 N beam as shown below. Find the tension in the wire. **(4 marks)**

Question 8

A traffic light hangs from a pole as shown below. The uniform aluminium pole AB is 7.50 m long and has a mass of 12.0 kg.
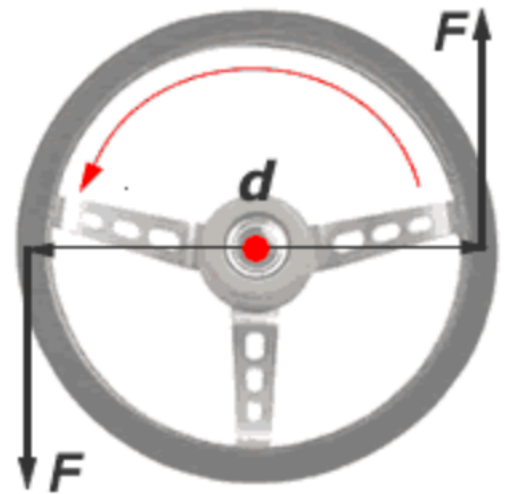
Determine the tension in the horizontal, massless cable CD. **(5 marks)**

Question 9

The diagram below shows two forces acting on a steering wheel.

a) Explain how a couple is an example of two equal forces
   acting in opposite directions on the same object can create
   a change in motion.   **(3 marks)**

b) Calculate the total torque acting on the wheel if the diameter of the wheel *d* is equal to 25 cm and
   the force *F* is equal to 2.5 N.   **(3 marks)**

Question 10

An awning is cantilevered from a building as shown below. The awning has uniformly distributed mass of **15 kg**, spread over its total length of **5 m**. Calculate the mass of the sign *S* hanging from the awning, given that the tension in the cable *C* is equal to **320 N**.
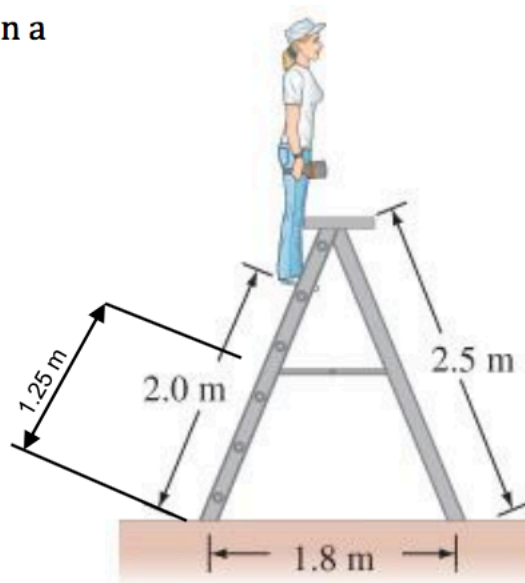
(5 marks)
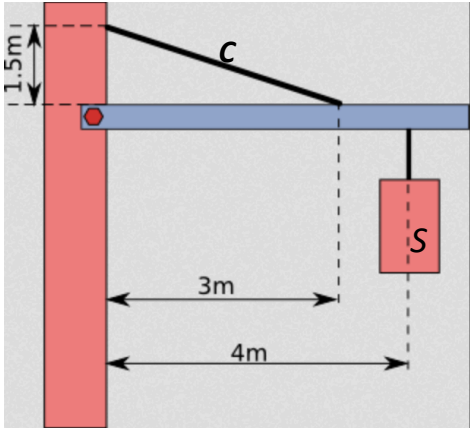
Question 11

Jenny has a mass of 60 kg and she is standing on a 15 kg ladder as shown. There is no friction between the ladder's feet and the floor.

a) Find the reaction force from the ground on each   on a
     side of the ladder.   **(5 marks)**   n

1.25 m

2.0 m

2.5 m

1.8 m

b) Find the tension in the chain between the two sides of the ladder. Assume the chain is halfway up the ladder. Hint: you will need to consider one side of the ladder as a free body.

(5 marks)

END OF TEST. PLEASE CHECK YOUR WORK CAREFULLY