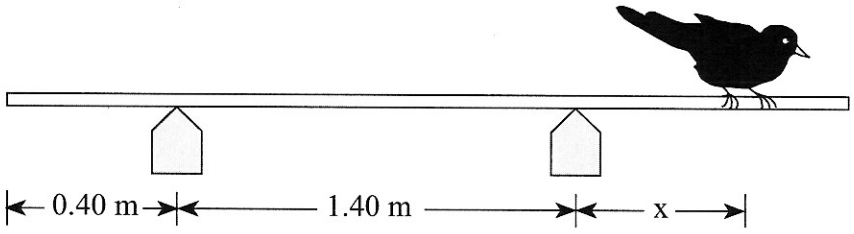
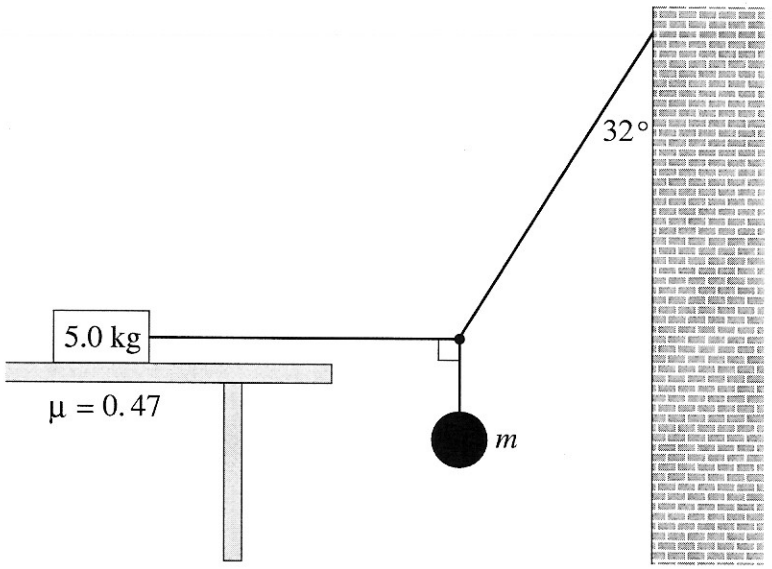
7. A 0.75 kg board of length 2.60 m initially rests on two supports as shown.



a) What maximum distance, x, from the right-hand support can a 1.20 kg bird walk before the board begins to leave the left-hand support? **(5 marks)**

b) What force does the right-hand support exert on the board at that instant? **(2 marks)**

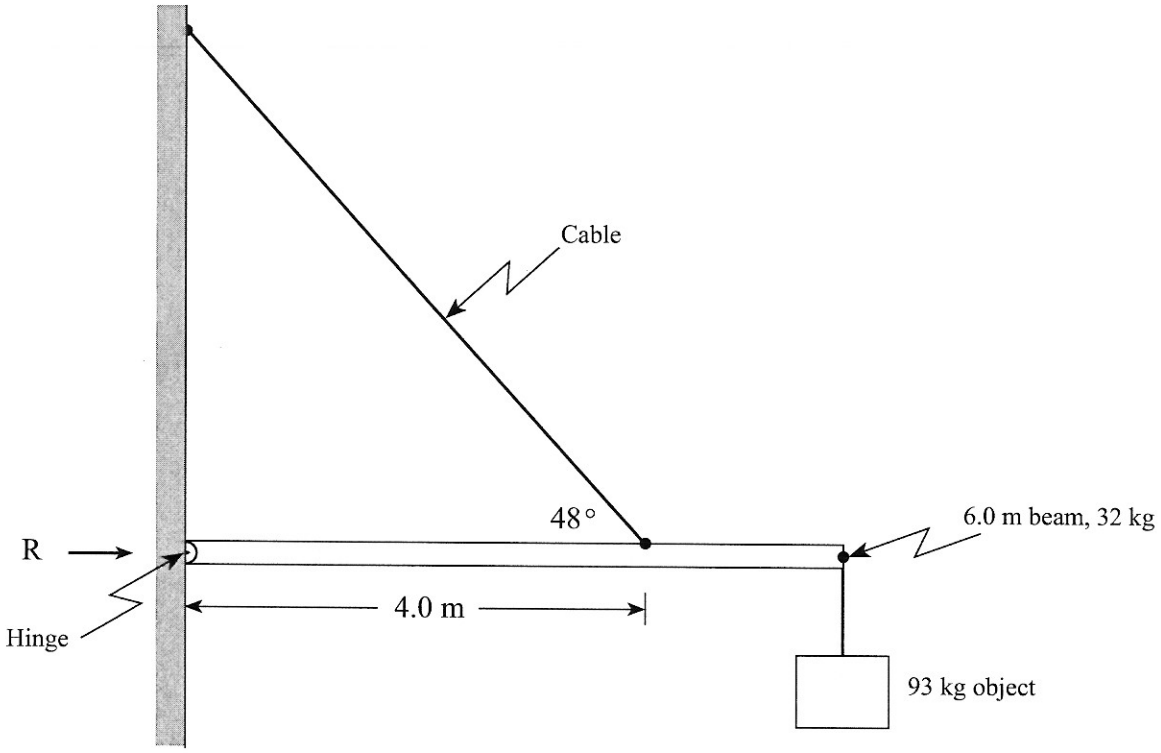
8. An object of mass, m, is suspended by two cords connected to a wall and to a 5.0 kg block resting on a table as shown.



A coefficient of friction of 0.47 exists between the 5.0 kg block and the table. What is the maximum mass, m, that can be hung from the cords before the 5.0 kg block begins to move?

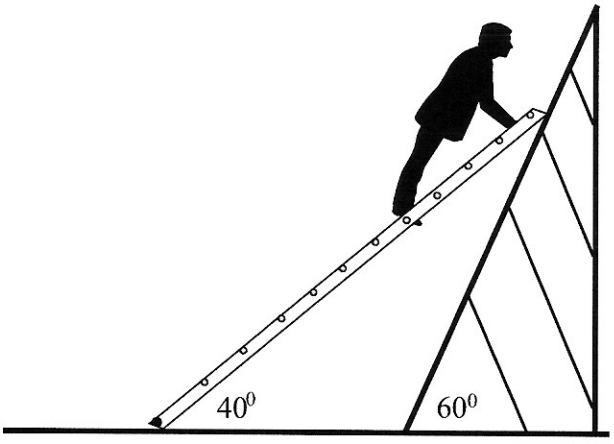
(7 marks)

9. A 6.0 m uniform beam of mass 32 kg is suspended horizontally by a hinged end and a cable. A 93 kg object is connected to one end of the beam.

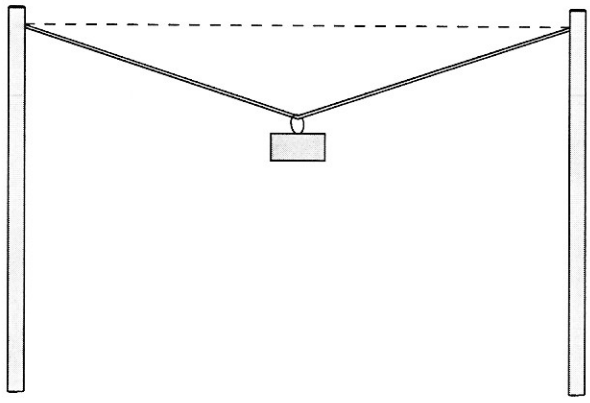


What is the magnitude and direction of the reaction force R that the hinge exerts on the beam? **(10 marks)**

10. A 65 kg person is $\frac{3}{4}$ of the way up a 25 kg uniform ladder as shown in the diagram below. The ladder is leaning against a frictionless surface inclined at 60^0 to the horizontal. What is the minimum coefficient of friction between the ladder and the floor necessary to maintain equilibrium? **(10 marks)**



11. A wire is stretched between two posts. A mass is suspended near the centre as shown below.



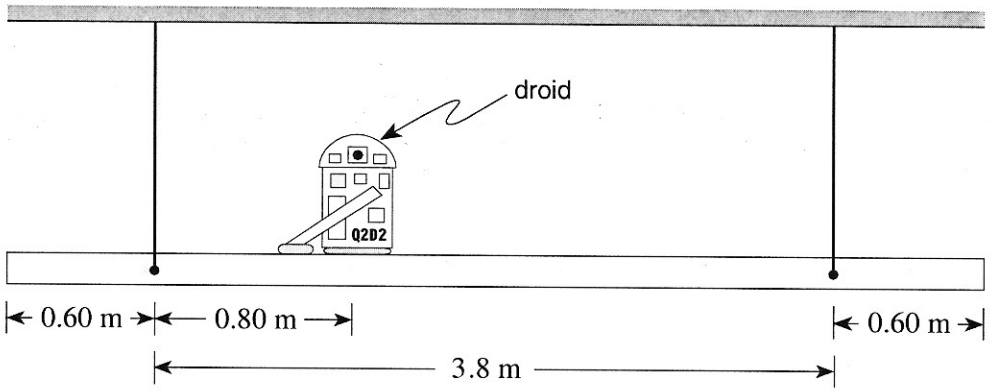
If the tension in the wire were increased, is it possible to make the wire perfectly horizontal? Explain your answer in terms of forces. **(4 marks)**

STATIC EQUILIBRIUM
PROVINCIAL EXAMINATION ASSIGNMENT
ANSWER KEY / SCORING GUIDE

PART A: Multiple Choice (each question worth ONE mark)

Q	K
1.	A
2.	A
3.	B
4.	D
5.	B
6.	C
7.	C
8.	C
9.	D
10.	D
11.	C
12.	B
13.	A
14.	C
15.	A
16.	C
17.	A
18.	C
19.	D
20.	A
21.	D
22.	B
23.	D
24.	C
25.	C
26.	A
27.	C
28.	D
29.	C
30.	C
31.	B
32.	B
33.	A

1. A 25 kg droid rests on a 5.0 m long shelf supported by two cables as shown. The mass of the shelf is 12 kg.



Find the tension in **each** cable. **(7 marks)**

Using left-hand support as fulcrum:

$$\left.\begin{aligned} \Sigma \tau_c &= \Sigma \tau_{cc} \\ \tau_D + \tau_s &= \tau_c \\ F_D d_D + F_s d_s &= F_{c_R} d_c \end{aligned}\right\} \leftarrow \textbf{1 mark}$$

$$25\text{ kg} \cdot 9.8\text{ m/s}^2 \cdot 0.80\text{ m} + 12\text{ kg} \cdot 9.8\text{ m/s}^2 \cdot 1.9\text{ m} = F_{c_R} \cdot 3.8\text{ m} \quad \leftarrow \textbf{3}\tfrac{1}{2}\textbf{ marks}$$

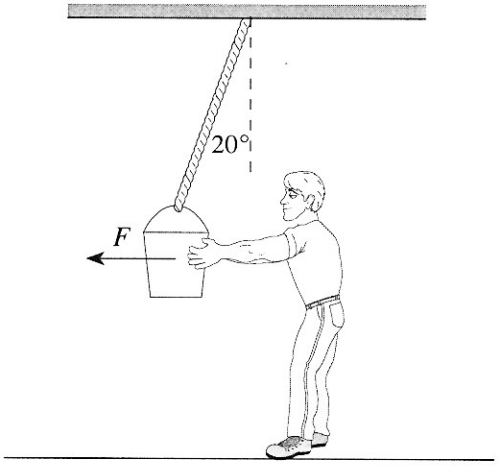
$$F_{c_R} = 110\text{ N} \quad \leftarrow \tfrac{1}{2}\textbf{ mark}$$

$$F_{c_L} + F_{c_R} = F_g \quad \leftarrow \textbf{1 mark}$$

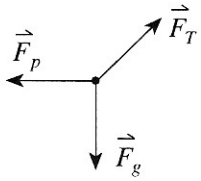
$$F_{c_L} + 110\text{ N} = 363\text{ N} \quad \leftarrow \tfrac{1}{2}\textbf{ mark}$$

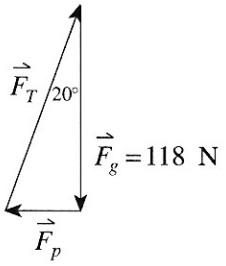
$$F_{c_L} = 253\text{ N} \quad \leftarrow \tfrac{1}{2}\textbf{ mark}$$

2. Peter exerts a horizontal force F on a 12 kg bucket of concrete so that the supporting rope makes an angle of $20°$ with the vertical.



a) Find the tension force in the supporting rope. **(3 marks)**





← **1 marks**

$$F_T = \frac{118}{\cos 20°} \qquad \leftarrow 1 \textbf{ marks}$$

$$= 125 \text{ N} \qquad \leftarrow \textbf{1 mark}$$

$$F_T = 1.3 \times 10^2 \text{ N}$$

b) Peter now exerts a new force which causes the rope to make a greater angle with the vertical. How will the tension force in the supporting rope change?

- ☑ The tension force will increase.
- ☐ The tension force will decrease.
- ☐ The tension force will remain the same.

(Check one response.) **(1 mark)**

c) Using principles of physics, explain your answer to b). **(3 marks)**

The vertical component of the tension is equal to the weight and is unchanged. Peter's horizontal force increases with a larger angle. The horizontal component of the tension is equal to Peter's and therefore is also increased. Thus, the resultant tension is increased.