

QUIZ 10: TORQUE

Answer the questions using your clicker. If there are no multiple choices, the question is true/false. Use the T and F keys to respond. Please do not mark on this quiz paper. Each question is worth 4 points.

When the meter stick is balanced with no additional masses, the **90g** stick is in equilibrium when the pivot is located at the **49.6cm** mark.

1. For the first class lever shown on the right, a load $m_1 = 70\text{g}$ is positioned at the **10cm** mark. Locate the equilibrium position (as marked on the meter stick) of the effort, $m_2 = 60\text{g}$.
- $$m_1gr_1 - m_2gr_2 = 0$$

$$(70\text{g})(49.6 - 10)\text{cm} = (60\text{g})(x_2 - 49.6\text{cm})$$

$$x_2 = 95.8\text{cm}$$

A) 10 cm

B) 39.6 cm

C) 46.2 cm

D) 49.6 cm

E) **95.8cm**

2. When the unchanged load is repositioned to the **20cm** mark, what effort m_2 is required to maintain equilibrium, if the effort *has not been moved* from its previous position.

$$m_1gr_1 - m_2gr_2 = 0$$

$$(70\text{g})(49.6 - 20)\text{cm} = m_2(95.8 - 49.6)\text{cm}$$

$$m_2 = 45\text{g}$$

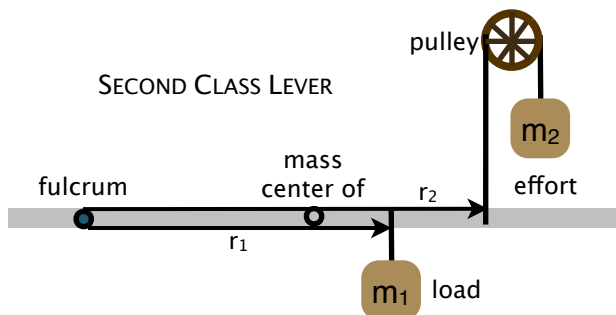
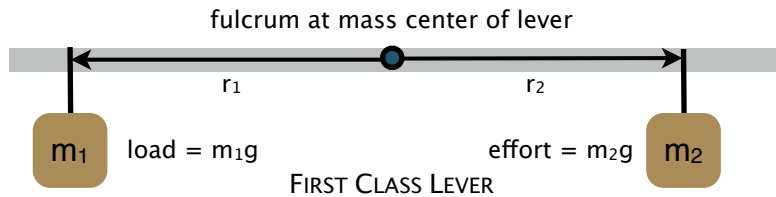
A) 22 g

B) 35 g

C) **45 g**

D) 52 g

E) 207 g



The second class lever shown has its pivot fixed at the **15 cm** mark. A load $m_1 = 100\text{g}$ is positioned as shown, at the **60 cm** mark.

3. If the effort is attached at the **80 cm** mark, how much mass m_2 must be attached for equilibrium? Assume that the string attaches directly to the stick (*there is no clamp here to consider*).

$$m_2gr_2 - mgr - m_1gr_1 = 0$$

$$m_2r_2 = mr + m_1r_1$$

$$m_2(80 - 15)\text{cm} = (90\text{g})(49.6 - 15)\text{cm} + (100\text{g})(60 - 15)\text{cm}$$

$$m_2 = 117\text{g}$$

A) 69 g

B) 75 g

C) 92 g

D) **117 g**

E) 131 g

4. True or **false**: Sliding the load to the left, toward the fulcrum, will require the placement of additional mass at the effort to maintain the equilibrium of the system.

A third class lever is shown on the right. The pivot is fixed at the **12 cm** mark on the meter stick, and the load m_1 is fixed at the **90 cm** mark.

5. True or **false**: The effort m_2 will be smaller than the load m_1 .

6. **True** or false: Your forearm is this type of lever.

7. When the effort is attached at the **27 cm** mark, a **300g** effort is required. What is the load m_1 ?

A) 3 g

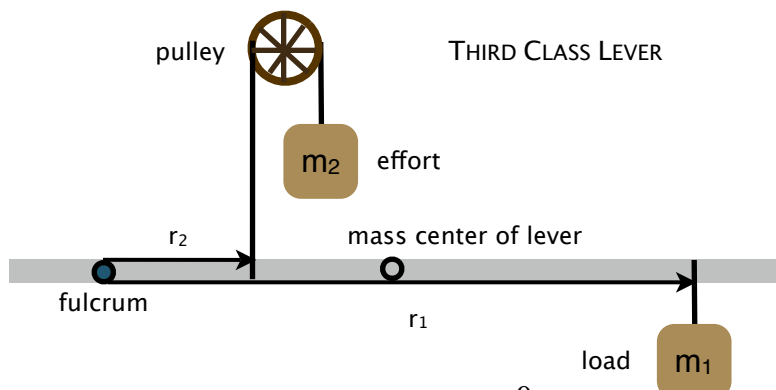
B) **13 g (well, 14.3g, but this is obviously the closest value to correct; sorry for the typo)**

C) 52 g

D) 78 g

E) 99 g

8. **True** or false: If you increase the load m_1 , you will need to slide the effort m_2 (no change in mass here) to the right, away from the fulcrum, to maintain the equilibrium of the system.



$$m_2gr_2 - mgr - m_1gr_1 = 0$$

$$m_1r_1 = m_2r_2 - mr$$

$$m_1(90 - 12)\text{cm} = (300\text{g})(27 - 12)\text{cm} - (90\text{g})(49.6 - 12)\text{cm}$$

$$m_1 = 14.3\text{g}$$