# QUIZ 08: CENTRIPETAL ACCELERATION

Use the data on the right to answer the following questions.

| $L_o$ (m) | $L_f$ (m) | R (m) | Pendulum M (kg) | Hanger m (kg) | t (s) | ∂t (s) |
|---|---|---|---|---|---|---|
| 0.05 | 0.131 | 0.156 | 0.350 | 0.440 | 7.20 | 0.14 |

1. Calculate the **stretch** of the spring. Answer to **three decimal places** to match the precision of the given data. **ΔL = 0.081m**

2. Using the **static method**, calculate the **spring constant k**. Answer to **three sig figs**. **k = 53.2N/m**

When the apparatus is rotated, the elapsed time for **ten** complete revolutions is **7.20 seconds**. This is the average time for multiple timers observing multiple events.

3. The average reaction time for these timers is **∂t = 0.14s**. What is the **relative (percent) uncertainty** associated with using the stopwatches?
   A) 1.83% **B) 1.94%** C) 2.16% D) 2.25% E) 2.41%

4. If the timers had measured **fifteen** complete periods instead of ten, how would this affect the **percent uncertainty**?
   A) It wouldn't. The reaction time is what it is no matter how many periods you end up measuring.
   **B) The percent would decrease. The same absolute uncertainty (∂t) would be a smaller fraction of a larger interval.**
   C) The percent would increase. It's the same absolute uncertainty, but since there are 50% more revolutions, the percent uncertainty would be 50% greater.

5. Using the **dynamic method**, calculate the **spring constant k**. Answer to **three sig figs**. **k = 51.3N/m**

6. **True** or false: This data was probably collected for a spring that does not match the springs used in lab.

7. As the pendulum is rotated, what force causes the centripetal acceleration?
   1) The Centripetal Force. *Duh.*
   2) Gravity.
   3) Tension.
   **4) Spring force.**
   5) Normal force.
   6) Centrifugal force.

8. If the apparatus is rotated faster, with a period of **0.5 seconds**, the pendulum
   A) hangs straight down, and the same spring force still causes the centripetal acceleration.
   **B) hangs out, away from the central rotation axis. Both the spring force and the horizontal component of the tension in the supporting cord are increased and contribute to the centripetal acceleration.**
   C) hangs in, toward the rotation axis. There is less spring force, and the horizontal component of the supporting tension points away from the axis. The net horizontal force decreases, and so does the centripetal acceleration.

9. If the apparatus is rotated more slowly, with a period of **0.95 seconds**, the pendulum
   A) hangs straight down, and the same spring force still causes the centripetal acceleration.
   B) hangs out, away from the central rotation axis. Both the spring force and the horizontal component of the tension in the supporting cord are increased and contribute to the centripetal acceleration.
   **C) hangs in, toward the rotation axis. There is less spring force, and the horizontal component of the supporting tension points away from the axis. The net horizontal force decreases, and so does the centripetal acceleration.**

10. When the pendulum hangs in proper alignment, the tension in the vertical cord supporting it
   A) balances out the spring force: $T_2 = kx$.
   **B) balances out the weight of the pendulum: $T_2 = mg$.**
   C) balances out the weight of the hanging mass: $T_2 = Mg$.
   D) is zero. This is why we made such a big deal out of properly aligning the pendulum.

You now adjust the apparatus to **decrease** the radius of rotation to **r = 10 cm**. The pendulum and the spring remain unchanged.

11. **True** or false: The spring will not have to be stretched as much for the pendulum to hang vertically.

12. True or **false**: You will need to add less mass to the hanger to achieve static equilibrium, which means the spring constant will also decrease.

13. **True** or false: When the apparatus is rotated, the period will increase because the centripetal acceleration has decreased.

14. True or **false**: Rotating the apparatus clockwise (as opposed to counterclockwise) will require additional force acting centripetally to counteract the spin of the earth. The spring will have to stretch more.

15. True or **false**: If we perform this experiment on the moon (under the dome, so we don't have to be hampered by our clumsy pressure suits), we will have to increase the mass of the pendulum to get the same results as on the Earth.