

First Name: _____

Last Name: _____

L11 - FQ - Circular Motion (Horizontal Systems)

Use the following information to answer Q1-Q3:

A toy car is on a horizontal circular track of radius 3.80 meters, travelling at a constant 1.75 m/s. If the car speeds up even a little, it flies off of the track.

Q1: The coefficient of friction between the toy car's tires and the track is $a.bc \times 10^{-d}$, where a , b , c , and d are ____, ____, ____, and ____.

(Record your **four digit** answer in the Numerical Response boxes below)

8	2	2	2
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$$m = ?$$

$$r = 3.8 \text{ m}$$

$$v = 1.75 \text{ m/s}$$

$$F_c = F_f$$

$$\frac{mv^2}{r} = \mu_s F_n$$

$$\frac{mv^2}{r} = \mu_s mg$$

$$\frac{v^2}{r} = \mu_s g$$

$$\frac{(1.75)^2}{(3.8)} = \mu_s (9.81)$$

$$\mu_s = 8.22 \times 10^{-2}$$

Q2: The acceleration of the toy car is

- a. 0.00 m/s^2
- b. 0.46 m/s^2
- ☒ c. 0.81 m/s^2
- d. 2.17 m/s^2

linear acceleration = 0 m/s^2 (Constant speed).

But it is changing direction (i.e. circular motion).

$$a_c = \frac{v^2}{r} = \frac{(1.75)^2}{(3.8)} = 0.81 \text{ m/s}^2$$

Q3: The frequency of rotation of the car is $a.bc \times 10^{-d} \text{ Hz}$, where a , b , c , and d are ____, ____, ____, and ____.

(Record your **four digit** answer in the Numerical Response boxes below)

7	3	3	2
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$$v = \frac{2\pi r}{T}$$

So

$$T = \frac{2\pi r}{v} = \frac{2\pi (3.8)}{(1.75)}$$

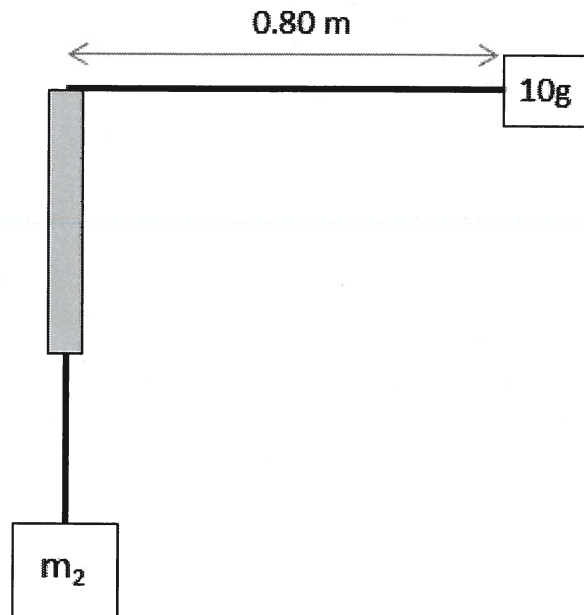
$$T = 13.64 \text{ s}$$

$$f = \frac{1}{T} = \frac{1}{13.64} = 7.33 \times 10^{-2} \text{ Hz}$$

KEY

Use the following information to answer Q4-Q5:

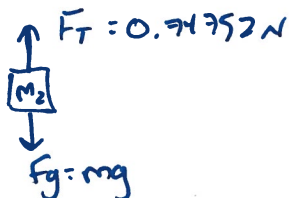
A rubber stopper is spun around a pen tube in a horizontal circle, as depicted below. The period of rotation is 0.65 seconds.



Q4: What is the mass of the hanging object, in grams? (2 marks)

$$F_c = \frac{mv^2}{r} = \frac{(10 \times 10^{-3})v^2}{(0.8)} \quad \text{where } v = \frac{2\pi r}{T} = \frac{2\pi(0.8)}{0.65} = 7.733 \text{ m/s}$$

$$F_c = \frac{(10 \times 10^{-3})(7.733)^2}{(0.8)} = 0.74752 \text{ N} \Rightarrow F_T = 0.74752 \text{ N}$$



$$F_T = F_g$$

$$0.74752 = m_2(9.81)$$

$$m_2 = 7.61998 \times 10^{-2} \text{ kg}$$

$$m_2 \approx 76.2 \text{ g}$$

MARKING:

Beginning:	0.0 – 2.0
Progressing	2.5 – 3.0
Competent	3.5 – 4.5
Exemplary	5.0