Uniform Circular Motion Homework Review

AP Physics 1

December 3, 2014

1. (I) A child sitting 1.10 m from the center of a merry-go-round moves with a speed of 1.25 m/s. Calculate (*a*) the centripetal acceleration of the child, and (*b*) the net hori-

$r = 1.10\ m$

$v = 1.25\ m/s$

$a = \_\_\_\ m/s^2$

$$a = \frac{v^2}{r} = \frac{(1.25)^2}{1.10} = 1.42\ m/s^2$$

$a = 1.42\ m/s^2$

2. (I) A jet plane traveling 1890 km/h (525 m/s) pulls out of a dive by moving in an arc of radius 6.00 km. What is the plane's acceleration in g's?

$r = 6.00\ km$ * convert

$$\frac{6.00\ km \mid 1000\ m}{1\ km} = 6000\ m$$

$V = 525\ m/s$

$a = \_\_\_\ m/s^2$ (in g's, so we will have to divide by $9.8\ m/s^2$)

$$\frac{1890\ km}{h} \mid \frac{1000\ m}{1\ km} \mid \frac{1\ h}{3600\ s} =$$

$525\ m/s$

$$a = \frac{v^2}{r} = \frac{(525)^2}{6000} = 45.9\ m/s^2$$

$$\#\ of\ g's = \frac{a}{9.8} = \frac{45.9}{9.8}$$

$$= 4.68\ g's$$

3. (I) Calculate the centripetal acceleration of the Earth in its orbit around the Sun, ~~and the net force exerted on the Earth. What exerts this force on the Earth?~~ Assume that the Earth's orbit is a circle of radius 1.50×10^{11} m. ~~[Hint: see the Tables inside the front cover of this book.]~~

$r = 1.50 \times 10^{11}$ m

$T = 365$ days * convert *

$T = 31{,}536{,}000$ s

$a =$ ____ m/s^2

$V =$ ____ m/s

$\frac{365 \text{ days}}{1 \text{ day}} \left| \frac{24 \text{ h}}{1 \text{ h}} \right| \frac{60 \text{ min}}{1 \text{ h}} \left| \frac{60 \text{ s}}{1 \text{ min}} \right.$

$a = \frac{V^2}{r} = \frac{(29870.62405)^2}{1.50 \times 10^{11}} = .0059483$

$a = .00595 \text{ m/s}^2$

$a = 5.95 \times 10^{-3} \text{ m/s}^2$

$V = \frac{2\pi r}{T} = \frac{2(3.14)(1.5 \times 10^{11})}{31{,}536{,}000} =$

29870.62405 m/s

A car moving at 12.67 m/s rounds a bend in the road. The bend is semicircular and has a radius of 60.0 m. What is the centripetal acceleration of the car?

$v = 12.67\ m/s$

$r = 60.0\ m$

$a = \_\_\_\_\ m/s^2$

$$a = \frac{v^2}{r} = \frac{(12.67)^2}{60.0} = 2.67548$$

$$a = 2.68\ m/s^2$$

A town has a large clock on the hall in the town square. The clock has hands that show the hours, minutes, and seconds. A fly is sitting on the tip of the hand that shows the seconds. If the length of the hand is 1.20 m, what is the fly's centripetal acceleration?

$r = 1.20\ m$

$T = 60\ s$

$a = \_\_\_\ m/s^2$

$V = \_\_\_\ m/s$

$*a = \frac{V^2}{r} = \frac{*(.1256)^2}{1.20} = .013146$

$*V = \frac{2\pi r}{T} = \frac{*2(3.14)(1.20)}{60} = *.1256\ m/s$

$*a = .0131\ m/s^2$ or $1.31 \times 10^{-2}\ m/s^2$

A rock is tied to a string and spun in a horizontal circle. The string is 1.8 m long and the rock has an acceleration of 3.4 m/s^2. What is the tangential velocity of the rock?

$r = 1.8\ m$

$a = 3.4\ m/s^2$

$V = \_\_\_\ m/s$

$r * a = \frac{v^2}{r} * r *$

$\sqrt{ar} = \sqrt{v^2}$ *

$v = \sqrt{ar} = \sqrt{(3.4)(1.8)} = 2.4738$

$V = 2.5\ m/s$ *