Exam PHYS 4A WINTER 2015 QUIZ 3 VERSION A

$g = 9.8\ m\ s^{-2}$

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1. A person is standing and rotating in a circle pulling a mass of 6 Kg around in a circle at the end of a rope 1 m long and making 40 complete revolutions per minute. The angle the rope makes with the vertical is closest to:

(A) 2.6° (B) 60.8° (C) 56.0° (D) 0.01°

2. A 940 g rock is whirled in a vertical circle at the end of a 1.3 m long string. What is the minimum speed needed at the top of the circle for the string to remain taut?

(A) 3.57 m/s (B) 109.1 m/s (C) 12.67 m/s (D) 27.2 m/s

3. A concrete block of mass 100 Kg is on the bed of a pickup truck traveling at 22 m/s. If the driver has to brake to a complete stop in 50 m, what is the minimum coefficient of static friction between the block and the bed of the truck which will prevent the block from sliding? Assume constant rate of deceleration of truck.

(A) 0.02 (B) 0.98 (C) 0.36 (D) 0.49

4. Your 12.0 Kg baby sister is hanging on to the bottom of the tablecloth with all her weight. In the middle of the table, 60 cm from each edge, is a 6.8 Kg roast turkey. From the time she starts to pull, how long do you have to intervene before the turkey goes over the edge of the table? Neglect friction between the tablecloth and the table.

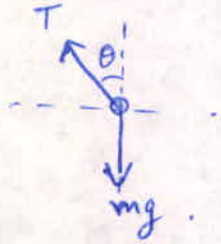
(A) 0.35 s (B) 0.44 s (C) 0.10 s (D) 0.62 s

AS PER VERSION A.

QUIZ #3 SOLUTIONS

PHYS 4A
WINTER '15

1.)

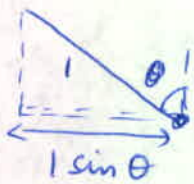


$\therefore T\cos\theta = mg \quad -(1)$

& $T\sin\theta = m\omega^2 r \quad -(2)$

$\therefore \tan\theta = \dfrac{\omega^2 r}{g} \quad \left(\dfrac{(2)}{(1)}\right)$

Here $r = l\sin\theta$



$\therefore \tan\theta = \dfrac{\omega^2 (l\sin\theta)}{g}$

$\Rightarrow \cos\theta = g/\omega^2$

& $\omega = \dfrac{40 \times 2\pi}{60}$ rad/s

$\therefore \theta = 56°$

2.)

$R = 1.3\,m$

$\therefore$ At top of the circle

$$mg + T = \frac{mV^2}{R}$$

For V minimum, $T = 0$.

$$\therefore V = \sqrt{Rg}$$

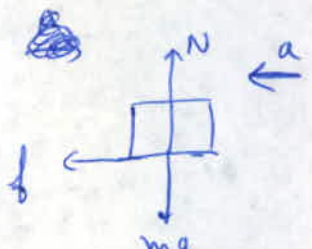
$$\Rightarrow V = 3.57\ m/s$$

3.)

If the block does not slide, then the block also moves 50 m with $V_i = 22\ m/s$ and comes to stop.

$$\therefore V_i^2 = \cancel{V_f^2}^{\,0} + 2as$$

$$\Rightarrow a = \frac{22 \times 22}{2 \times 50} = 4.84\ m/s^2$$



$$f = \mu N = \mu mg$$

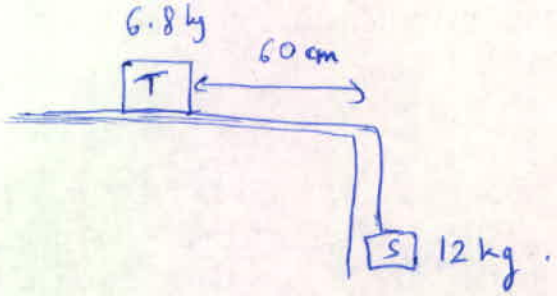
$$\Rightarrow \cancel{m}a = \mu \cancel{m} g$$

$\mu = a/g$

$\Rightarrow \mu_{min} = 0.49$

For Version D, 0.98 is also accepted as correct choice because the option was misprinted as 0.4.

4.)



Since, Turkey does not slide over tablecloth and there is NO friction between Table & Table Cloth,

Free-Body Diagrams can be drawn as

$T = m_T a$ & $m_s g - T = m_s a$

$m_s g - m_T a = m_s a$

$\Rightarrow a = \dfrac{m_s g}{m_s + m_T} = 6.26\ m/s^2$

$$\therefore \quad s = 60\ \text{cm} = \cancel{u}^{0} t + \frac{1}{2} a t^2$$

$$\Rightarrow t^2 = 2 \times \frac{60\ \text{m}}{100} \times \frac{1}{6.26\ \text{m/s}^2}$$

$$\Rightarrow \quad t = 0.44\ \text{s} \quad //$$