

$$ave. = 6.2$$

$$\sigma = 3.0$$

Name Answer Key

Lab: 8:00 am 11:10 am 2:30 pm

**Quiz #8: Interactions and Potential Energy**

**Problem 1 (1.5 points)**

A cart on an air track is moving at 1.0 m/s when the air is suddenly turned off. After the air is turned off, friction does work on the cart and it comes to rest after traveling 0.5 m. The experiment is repeated, but now the cart is moving at 2.0 m/s when the air is turned off. How far does the cart travel before coming to rest?

C

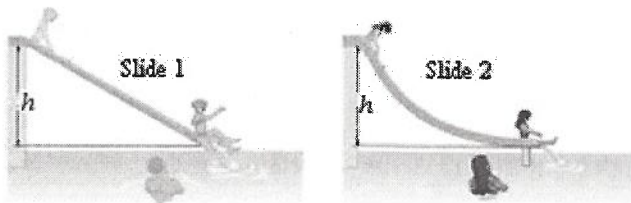
- a) 0.5 m
- b) 1.0 m
- c) 2.0 m
- d) 4.0 m
- e) not enough information

if speed doubles, KE increases by a factor of four so it takes four times as much work to bring it to rest

**Problem 2 (1.5 points)**

Swimmers at a water park have a choice of two frictionless water slides as shown in the figure below. Although both slides drop over the same height,  $h$ , slide 1 is straight while slide 2 is curved, dropping quickly at first and then leveling out. How does the speed  $v_1$  of a swimmer reaching the end of slide 1 compares with  $v_2$ , the speed of a swimmer reaching the end of slide 2?

From conservation of energy

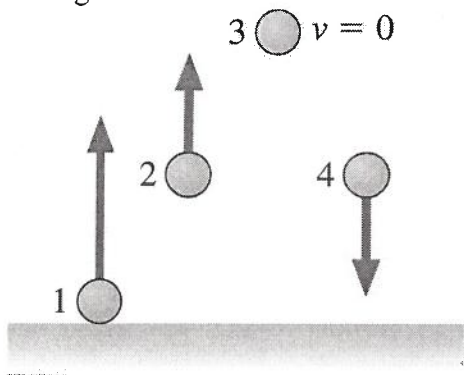


C

- a)  $v_1 > v_2$
- b)  $v_1 < v_2$
- c)  $v_1 = v_2$
- d) No simple relationship exists between  $v_1$  and  $v_2$  because we do not know the curvature of slide 2.

**Problem 3 (2 points)**

Rank in order, from largest to smallest, the gravitational potential energies of the identical balls 1 through 4.

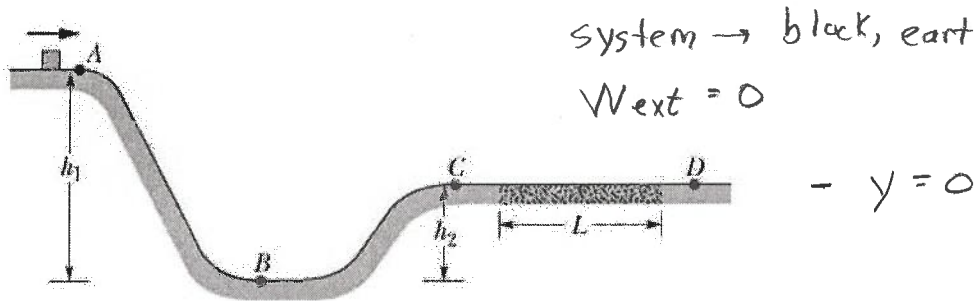


$$3 > 2 = 4, > 1$$

$U_g = mgy$  only depends upon height.

**Problem 4 (5 points)**

In the figure below, a small block is sent through point A with speed 7.0 m/s. Its path is frictionless except for the section of length  $L = 6.50$  m, where the coefficient of kinetic friction is 0.55. The indicated heights are  $h_1 = 6.0$  m and  $h_2 = 2.0$  m. (a) What is the speed of the block at point C? (b) What is the speed of the block at point D?



$$(a) \quad \frac{1}{2} m v_f^2 + m g y_f \stackrel{=0}{=} \frac{1}{2} m v_i^2 + m g y_i$$

$$v_f = \sqrt{v_i^2 + 2 g y_i}$$

$$v_f = \sqrt{(7.00 \text{ m/s})^2 + 2(9.80 \text{ m/s}^2)(4.00 \text{ m})}$$

$$v_f = 11.3 \text{ m/s} \quad (11 \text{ m/s})$$

$$f_k \Delta x = \mu_k m g L$$

$$(b) \quad \frac{1}{2} m v_f^2 + m g y_f + \Delta E_{th} \stackrel{=0}{=} \frac{1}{2} m v_i^2 + m g y_i$$

$$\frac{1}{2} m v_f^2 = \frac{1}{2} m v_i^2 + m g y_i - (\mu_k m g) L$$

$$v_f^2 = v_i^2 + 2 g y_i - 2 \mu_k g L$$

$$v_f = \sqrt{v_i^2 + 2 g y_i - 2 \mu_k g L}$$

$$v_f = \sqrt{(7.00 \text{ m/s})^2 + 2(9.80 \text{ m/s}^2)(4.00 \text{ m}) - 2(0.55)(9.80 \text{ m/s}^2)(6.50 \text{ m})}$$

$$v_f = 7.57 \text{ m/s} \quad (7.6 \text{ m/s})$$