College Physics 1

PHYS 1511

9/30/2016

Professor Halekas

Form A

(Put this letter on your scantron!)

Directions for completing your answer sheet

1. Use a no. 2 or softer **PENCIL**. Marks should be dark and completely fill each circle. Carefully erase any marks you want to change. Do not make any stray marks on your answer sheet.

2. Print your name in the appropriate boxes and darken the corresponding circles.

3. Record all 8 digits of your University ID number starting in box A under "**ID NUMBER**" and darken the corresponding circles. **Be sure you start in box A.**

4. Note the letter following the word **FORM** in the box at the top of this page and darken the corresponding letter in the **TEST FORM** area of your answer sheet.

5. Mark only one response for each test item.

FAILURE TO FOLLOW THE ABOVE DIRECTIONS COULD RESULT IN AN INCORRECT SCORE

Read the following and provide your signature:

I understand that sharing information with anyone during this exam by talking, looking at someone else's test, or any other form of communication, will be interpreted as evidence of cheating. I also understand that if I am caught cheating, the result will be no credit (0 points) for this test, and disciplinary action may result.

Signature: ____

Print your name: ____

(This will help identify your test paper in the event of any scoring issues)

Question 1: Charlie runs 500 m at a speed of 2 m/s to the corner store, buys a cup of coffee, and walks 500 m at a speed of 1 m/s back to his starting point. If the entire trip takes him 1000 s, what is the magnitude of Charlie's average velocity for the round trip?

A. 2 m/s
B. 1 m/s
C. 1.5 m/s
D. 0 m/s
E. 0.5 m/s

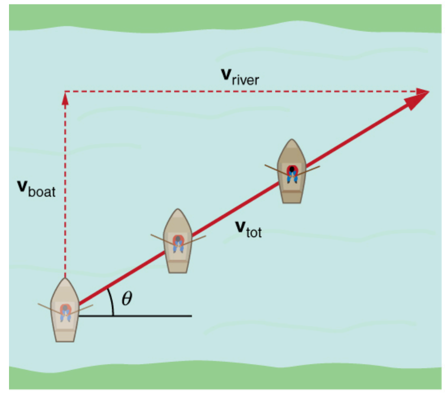
Question 2: The top of a cliff is located a distance H above the ground. At a distance $H/2$ there is a branch that juts out from the side of the cliff, and a pig is sitting on this branch. Two angry birds are launched at the pig with the same initial speed, one straight downward from the top of the cliff and one straight upward from the ground. In the absence of air resistance, which bird pops the pig first?

A. Both birds hit the pig in the same amount of time.
B. The bird launched from the ground.
C. The bird launched from the top of the cliff.
D. There is insufficient information to answer.

Question 3: A drag racer accelerates from rest with a uniform acceleration of 5 m/s^2. What distance does the car travel while accelerating to a velocity of 10 m/s?

A. 5 m
B. 10 m
C. 20 m
D. 2 m
E. 100 m

Question 4: Bob launches a boat and rows across a river at 4 m/s. As he rows, the current carries him downstream at 3 m/s. What is the magnitude of Bob's total velocity with respect to the point on the bank that he launched from?



A. 4 m/s

B. 5 m/s

C. 3.5 m/s

D. 25 m/s

E. 7 m/s

Question 5: Rover the dog is chasing a car down the street. The car is traveling at 3.5 m/s. Rover is running at 5 m/s in the same direction. Rover starts out 15 m behind the car. How far will Rover have to run to catch the car?

A. 15 m

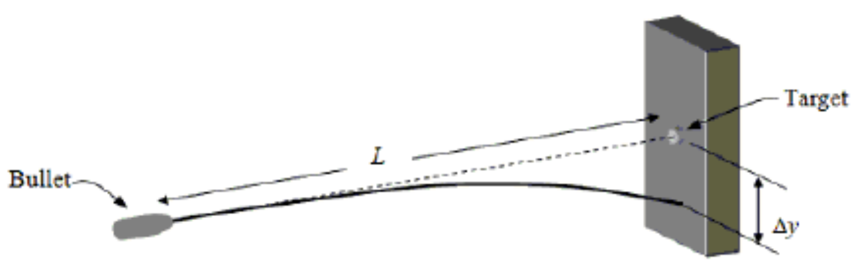
B. 35 m

C. 50 m

D. 5 m

E. 100 m

Question 6: A bullet is fired horizontally with speed v and travels a distance L before hitting a target. Thanks to gravity, it falls a distance Δy in transit. To cut the drop Δy in half for the same initial speed v, what distance should you fire from?



A. L

B. L/2

C. L/4

D. 2L

E. L/√2

Question 7: Sally (who has a mass of 50 kg) buckles her seatbelt and puts the gas pedal to the floor, causing her 1000 kg car to accelerate steadily at 4 m/s^2. What is the magnitude of the net force that acts on Sally during this acceleration?

A. 250 N

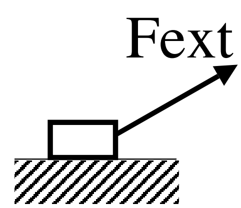
B. 1000 N

C. 200 N

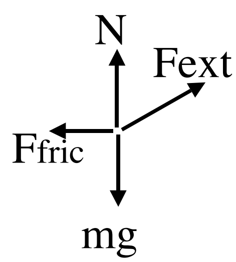
D. 4000 N

E. 0 N

Question 8: A mass m is pulled along a rough table at constant velocity by an external force F_{ext}. The magnitudes of the forces on the free-body diagram have not been drawn carefully, but the directions are correct.



Which statement below about the magnitudes of the forces *must* be true?



A: $F_{fric} > F_{ext}$, $N > mg$

B: $F_{fric} < F_{ext}$, $N < mg$

C: $F_{fric} > F_{ext}$, $N < mg$

D: $F_{fric} < F_{ext}$, $N > mg$

E: None of these

Question 9: Two hockey players get in a brawl during a somewhat odd hockey game that takes place on a frictionless ice rink. Vadim (who has a mass of 100 kg) pushes on Alexei (who has a mass of 150 kg) with a force of 300 N applied in the +X direction, in the middle of the rink. What are the resulting accelerations of the two players along the x-axis?

A. Vadim -3 m/s^2, Alexei 2 m/s^2

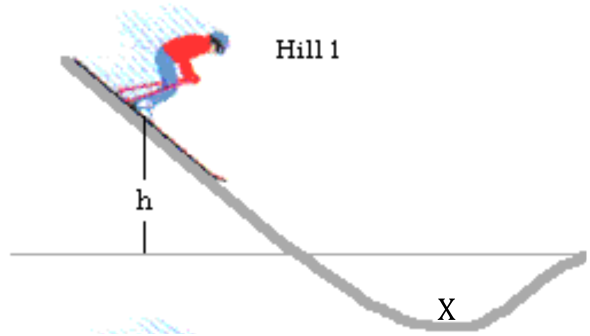
B. Vadim -2 m/s^2, Alexei 3 m/s^2

C. Vadim 0 m/s^2, Alexei 2 m/s^2

D. Vadim -2 m/s^2, Alexei 2 m/s^2

E. Vadim -3 m/s^2, Alexei 3 m/s^2

Question 10: Diana slaloms down the slope. At the point marked X she skis through a semi-circular dip. At this point, how do the magnitudes of the weight force W = mg and the normal force N acting on her compare?



A. N > mg

B. N < mg

C. N = mg

D. Depends on initial height h

E. Impossible to determine

Question 11: A 100 kg go-cart travels around a hairpin turn with a radius of 1 m at 2 m/s. What frictional force is necessary to keep the car from skidding? Assume $g = 10\ m/s^2$.

A. F = 100 N

B. F = 200 N

C. F = 300 N

D. F = 400 N

E. F = 500 N

Question 12: Which of the following free body diagrams is correct for the tetherball shown below?

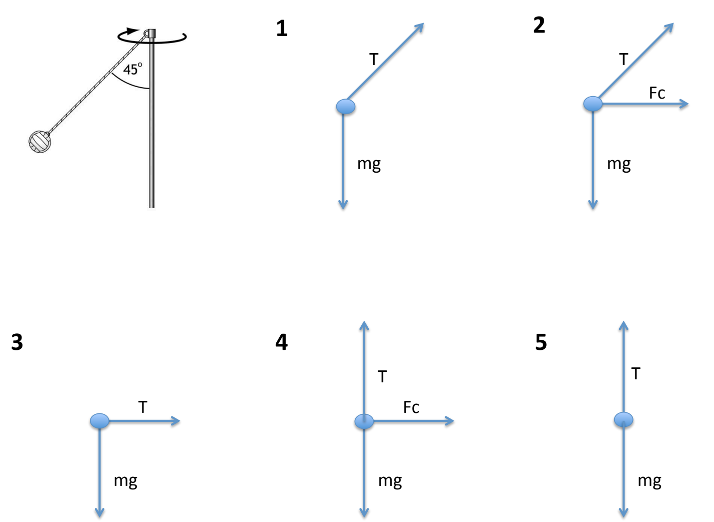
A. 1

B. 2

C. 3

D. 4

E. 5



Question 13: Lindsey pushes a big bottle of Mountain Dew across a frictionless floor (somehow she does this without slipping and falling!), accelerating the 1 kg soda bottle from rest to a final velocity of 2 m/s. How much work does she do on the bottle in the process?

A. 1 J

B. 0.5 J

C. 2 J

D. 4 J

E. 10 J

Question 14: Saul the donkey pulls a mining cart up an inclined plane at a constant speed. Which of the following is true?

A. The gravitational force does positive work on the cart.

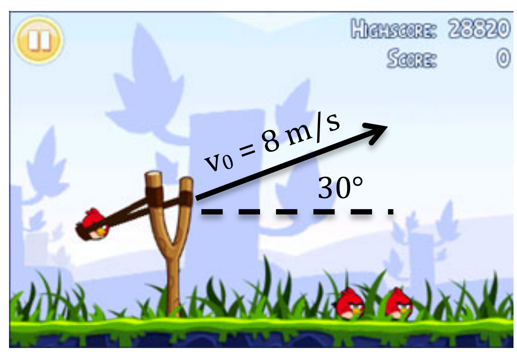
B. The net work done by all the forces on the cart is positive.

C. The kinetic energy of the cart changes.

D. The total mechanical energy of the cart is conserved.

E. The cart does negative work on Saul.

Question 15: An angry bird with a mass of 1 kg is launched with an initial velocity of 8 m/s, at an angle of 30° above horizontal. How high above its starting point does the bird reach at the highest point of its trajectory? Assume $g = 10\ m/s^2$.



A. 1 m

B. 3.2 m

C. 8 m

D. 0.8 m

E. 4 m

Trigonometry (*For right triangle with sides Adjacent, Opposite, and Hypoteneuse):*

Sin(θ) = O/H *Cos(θ) = A/H* *Tan(θ) = O/A* $H^2 = O^2 + A^2$ $A_{circle} = \pi r^2$

Sin(30°) = Cos(60°) = ½ *Sin(60°) = Cos(30°) =*$\sqrt{3}/2$ *~=0.866* *Sin(45°) = Cos(45°) =* $\sqrt{2}/2$ *~0.707*

Sin(0°) = Cos(90°) = 0 *Sin(90°) = Cos(0°) = 1*

Kinematics:

$\langle \vec{v} \rangle = \frac{\Delta \vec{r}}{\Delta t}$ $\langle \vec{a} \rangle = \frac{\Delta \vec{v}}{\Delta t}$ $\vec{r}(t) = \overrightarrow{r_0} + \overrightarrow{v_o} t + \frac{1}{2} \vec{a} t^2$ $v(t)^2 = {v_o}^2 + 2\vec{a} \cdot \Delta \vec{r}(t)$

Newton's Laws:

$\sum \vec{F} = m\vec{a}$ $\overrightarrow{F_{AB}} = -\overrightarrow{F_{BA}}$

Forces:

$F_G = mg$ (@ surface) ${f_s}^{MAX} = \mu_s F_N$ $f_k = \mu_k F_N$

$F_C = ma_c = \frac{mv^2}{r}$ $F_{spring} = -kx$

Work & Energy:

$KE_{trans} = \frac{1}{2} m v^2$ $\Delta KE = W_{net}$ $PE_G = mgh$ $PE_{spring} = \frac{1}{2} k x^2$

E = KE + PE $\Delta E = W_{nc}$ $W = \vec{F} \cdot \Delta \vec{r} = |\vec{F}||\Delta \vec{r}| \cos \theta_{Fdr}$

Rotational Motion:

$\theta = s/r$ $a_c = \frac{v^2}{r}$