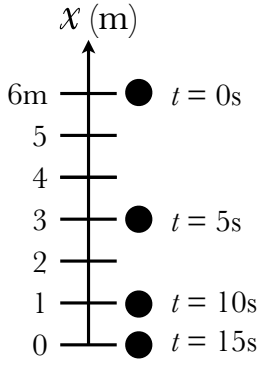
Physics 101 Name:_____

October 12, 2016 Exam 1 15 questions, 81 points

1. The figure shows the motion diagram of a ball. We'll say that "up" is the $+x$ direction.



[3] (a) _____ Which of the following describes this motion?

A) Moving up, and getting faster
B) Moving up, and getting slower
C) Moving down, and getting faster
D) Moving down, and getting slower

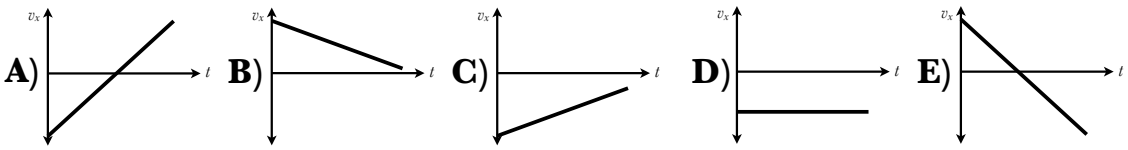
[2] (b) _____ What direction does the ball's acceleration point?

A) ↑ **B)** ↓

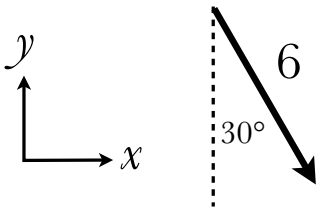
[3] (c) What is the displacement Δx between $t = 5\,\text{s}$ and $t = 10\,\text{s}$?

[3] (d) What is the velocity v between $t = 5\,\text{s}$ and $t = 10\,\text{s}$?

[3] (e) _____ Which of the following is the graph of the velocity v_x of this object, as a function of time?

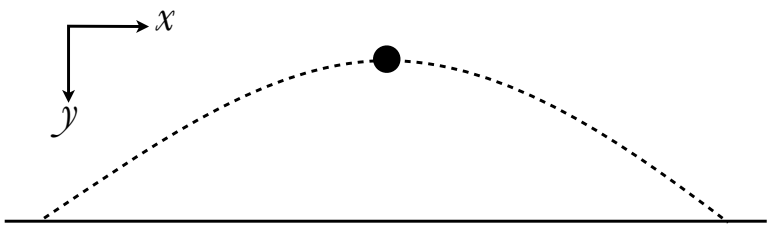


3 2. _____ Which of these describes the vector shown?



A) $6\sin 30°\hat{x} + 6\cos 30°\hat{y}$ **B)** $6\cos 30°\hat{x} + 6\sin 30°\hat{y}$
C) $6\sin 30°\hat{x} - 6\cos 30°\hat{y}$ **D)** $6\cos 30°\hat{x} - 6\sin 30°\hat{y}$

3. A ball is thrown through the air as shown. *Note the axes!*



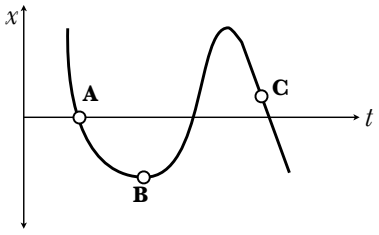
3 (a) _____ What is true about the velocity of the ball at the top of its flight?

A) $v_x = 0$ **B)** $v_y = 0$ **C)** Both of these **D)** Neither of these

3 (b) _____ What is the acceleration $\vec{a}$ of the ball at the top of its flight?

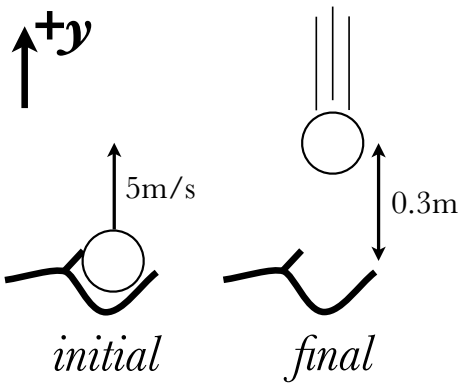
A) $0\,\mathrm{m/s^2}$ **B)** $9.8\hat{y}\,\mathrm{m/s^2}$ **C)** $-9.8\hat{y}\,\mathrm{m/s^2}$ **D)** None of these.

3 4. _____ The figure shows the position of an object with respect to time. At which point is the acceleration zero?



5. A ball is thrown directly into the air with an initial speed of 5 m/s. It reaches a maximum height, and then begins to fall back down. We want to calculate the ball's velocity when it is 0.3 m above the hand (and moving downward).

Δy	
v_{iy}	
v_{fy}	
a	
Δt	



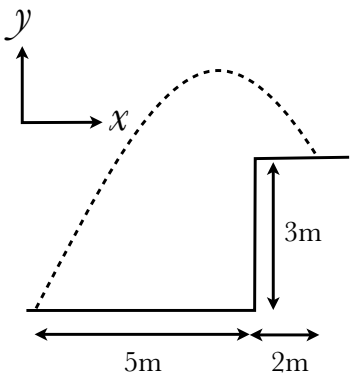
3 (a) Fill in the table with the information that's given. Write "NEED" next to the variable you want to solve for.

3 (b) Find the velocity requested.

6. A cannonball is fired from ground level and lands on top of a building that is 3 m high, and 5 m away; the ball lands 2 m away from the edge of the building. When the ball lands, the horizontal component of its velocity is $v_{fx} = 2\,\text{m/s}$.

Δx		Δy	
v_{ix}		v_{iy}	
v_{fx}	**2 m/s**	v_{fy}	
a_x		a_y	

Δt	

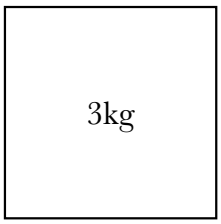


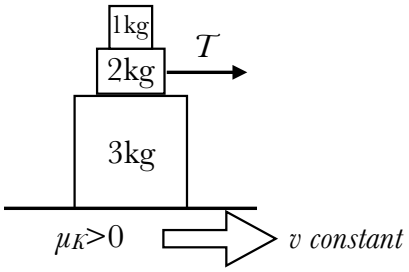
4 (a) Fill in the above table with what you're given by the problem.

3 (b) Find the time it takes for the ball to land.

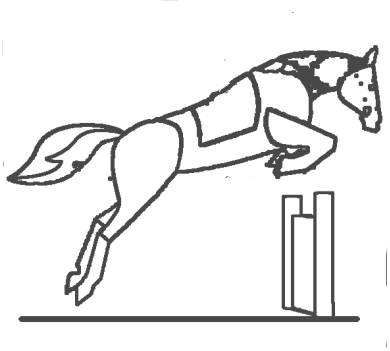
3 (c) What is the speed $|v|$ of the ball at the very top of its flight? (You don't need to answer part (b) to answer this.)

[3] 7. The right figure shows a stack of three blocks that are being dragged along a table by a rope that's attached to the middle block. There is friction between all surfaces, but disregard air resistance. Draw all the forces that are acting on the separate 3 kg block below. Label these with letters such as W, N, etc, and if there are multiple forces of the same type, indicate what object is exerting the force as a subscript. (e.g. "$N_{1\,\mathrm{kg}}$" for a normal force from the 1 kg block).

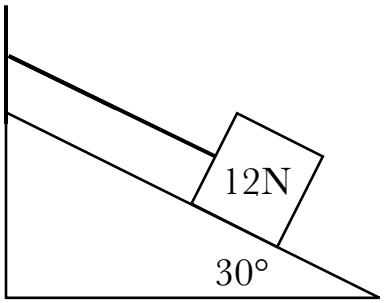




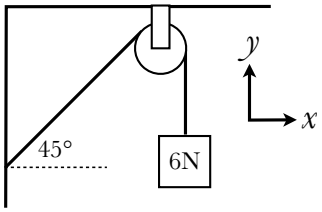
[3] 8. A horse is jumping over a hurdle, having just left the ground. Label the forces acting on the horse. Ignore air resistance.



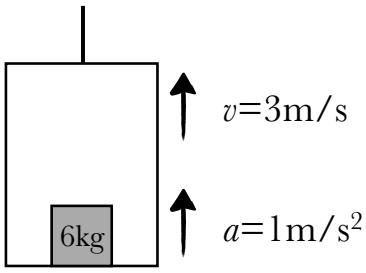
3 9. _____ A box of weight $W = 12\,\text{N}$ is suspended on a frictionless ramp by a rope. The ramp makes a 30° angle with the horizontal. Find the tension in the rope.
A) 4 N **B)** 6 N **C)** 10 N **D)** 12 N



3 10. _____ A $W = 6\,\text{N}$ block is suspended from a rope, as shown, and is stationary. The rope runs over a pulley and attaches to a wall at a 45° angle. What is the tension in the rope?
A) 3 N **B)** 2.1 N **C)** 4.2 N **D)** 6 N **E)** 12 N

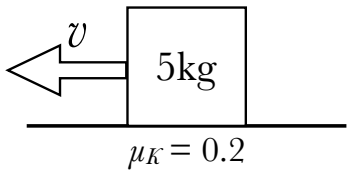


3 11. _____ An elevator moves upward at 3 m/s and is accelerating upward at $1\,\text{m/s}^2$. A 6 kg block (with a weight of 59 N) sits on the floor of the elevator. What is the normal force on the block due to the floor of the elevator?
A) 53 N **B)** 59 N **C)** 65 N



12. A 5 kg block slides across a table to the left, and slows down due to friction.

[3] (a) What is the weight of the block?

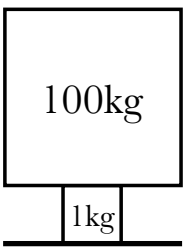


[3] (b) What is the force of kinetic friction on the block?

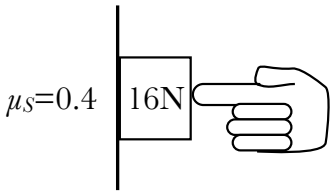
[3] (c) What is the block's acceleration $\vec{a}$? Give magnitude and direction.

[3] 13. _____ A 100 kg block is balanced atop a 1 kg block. Which is the larger force?

A) The force of the 100 kg block on the 1 kg block
B) The force of the 1 kg block on the 100 kg block
C) Both forces have the same magnitude



14. A $W = 16\,\text{N}$ block is pressed against a wall by a finger as shown, and is stationary. The coefficient of static friction between wall and block is $\mu_S = 0.4$.



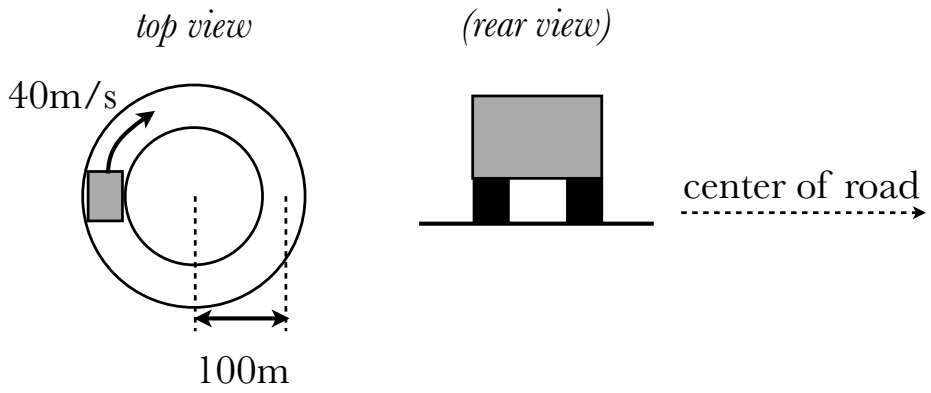
3 (a) _____ What is the static frictional force S on the block from the wall?

A) 0.4 N **B)** 6.4 N **C)** 16 N **D)** 40 N

3 (b) _____ What force must the finger exert on the block, so that it doesn't slip?

A) at least 16 N
B) at least 25 N
C) at least 40 N
D) it doesn't matter; any force will do

15. The figure shows a car driving around a circular track with radius 100 m, at a constant speed of 40 m/s.



3 (a) Draw the forces acting on the car in the figure marked "rear view". Ignore any forces that point into or out of the page.

3 (b) _____ What is the car's acceleration in the "rear view" figure?

A) $0\,\mathrm{m/s^2}$
B) $9.8\,\mathrm{m/s^2} \leftarrow$ **C)** $9.8\,\mathrm{m/s^2} \rightarrow$ **D)** $9.8\,\mathrm{m/s^2} \downarrow$
E) $16\,\mathrm{m/s^2} \leftarrow$ **F)** $16\,\mathrm{m/s^2} \rightarrow$