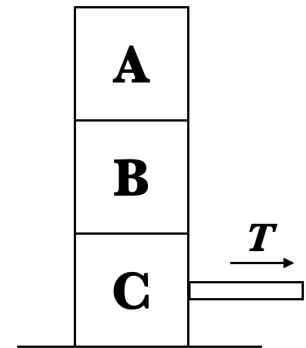


PHYS 2130 Exam 1B Solutions  
February 16, 2026

1. Three boxes are stacked as shown, with a rope attached to block C being pulled to the right. The stack is **not moving**. (Draw force diagrams for partial credit for this question.)

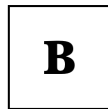
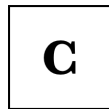


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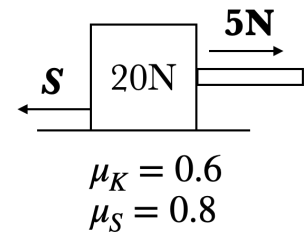
(a) D How many forces are acting on box C?  
A) 2 B) 3 C) 4 D) 5 E) 6 F) more than 6

4

(b) C How many **normal** forces are acting on box B?  
A) 0 B) 1 C) 2 D) 3 E) 4 F) more than 4



2. A block with weight 20 N is being pulled on by a  $T = 5\text{ N}$  tension force to the right, and feels a static friction force from the table to the left. The block is **not moving**. The coefficients of friction between block and table are  $\mu_K = 0.6$  and  $\mu_S = 0.8$ .



4

(a) A The force of static friction on the block is  
A) 5 N B) 12 N C) 16 N D) 20 N

4

(b) D Which of the following is a force twin (in the sense of Newton's Third Law) to the static frictional force on the block?  
A) The weight of the block  
B) The normal force on the block from the table  
C) The tension in the rope on the block  
D) The static frictional force of the block on the table

3. A 20 N block is being dragged to the right with a 5 N tension force. The coefficients of friction are the same as in the previous problem.

4

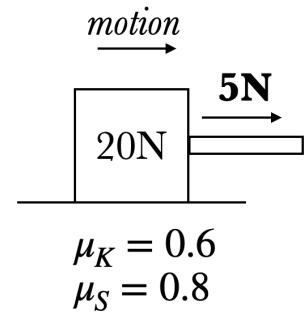
(a) **A** What is the mass of the block?

A) 2.0 kg B) 20 kg C) 200 kg

4

(b) **B** What is the acceleration of the block?

A)  $-0.35 \text{ m/s}^2$  B)  $-3.5 \text{ m/s}^2$  C)  $-5.5 \text{ m/s}^2$  D)  $-9.8 \text{ m/s}^2$

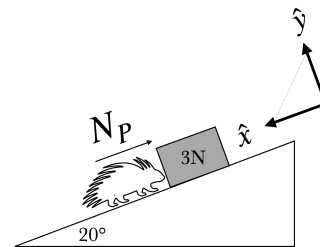


## Change: extra credit problem worth 2 points

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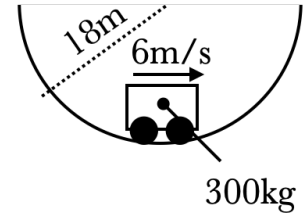
4. **D** A porcupine tries to push a 3 N block up a  $20^\circ$  incline with friction coefficients  $\mu_S = 0.6$  and  $\mu_K = 0.4$ . What is the minimum force  $N_P$  the porcupine must provide to make the block start moving?

A) 0.67 N B) 1.8 N C) 2.2 N D) 2.7 N E) 3.4 N



	x	y
<i>weight</i>		
<i>normal, ramp</i>		
<i>s.friction, ramp</i>		
<i>normal, porcupine</i>		

5. A 300 kg rollercoaster car is moving at a constant 6 m/s along a circular curve with a radius of 18 m. At this moment, the car is at the bottom of the curve.



4

(a) **C** What is the weight of the car?  
 A) 30.1 N B) 300 N C) 2940 N

4

(b) **A** What is the acceleration of the car?  
 A)  $2 \text{ m/s}^2 \uparrow$  B)  $0.3 \text{ m/s}^2 \uparrow$  C)  $0 \text{ m/s}^2$   
 D)  $0.3 \text{ m/s}^2 \downarrow$  E)  $2 \text{ m/s}^2 \downarrow$  F)  $9.8 \text{ m/s}^2 \downarrow$

4

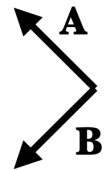
(c) **E** What is the normal force of the road on the car?  
 A) 2340 N B) 2840 N C) 2940 N D) 3040 N E) 3540 N

4

6. **D** A 2 m long wire has a cross-sectional area of  $0.01 \text{ m}^2$  and a Young's modulus of  $Y = 3 \times 10^{11} \text{ N/m}$ . If a 2000 N weight is hung from the wire, by how much does the wire stretch?  
 A) 0.03 nm B) 13 nm C)  $0.67 \mu\text{m}$  D)  $1.3 \mu\text{m}$

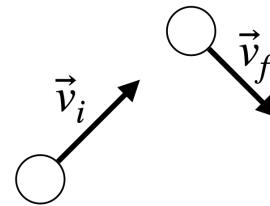
4

7. **B** The figure shows vectors  $\vec{A}$  and  $\vec{B}$ . What is  $\vec{A} + \vec{B}$ ?  
 A)  $\downarrow$  B)  $\leftarrow$  C)  $\uparrow$  D)  $\rightarrow$



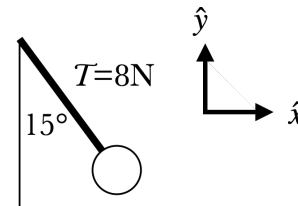
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8. **A** A hockey puck is moving to the northeast at first. After a little while, it is moving southeast. What is the direction of  $\Delta\vec{v}$ ?  
 A)  $\downarrow$  B)  $\leftarrow$  C)  $\uparrow$  D)  $\rightarrow$



4

9. **C** A ball is attached to a rope, which makes a  $15^\circ$  angle from the vertical, as shown. The magnitude of the tension in the rope is  $T = 8\text{ N}$ . How would you write  $\vec{T}$  in component form?  
 A)  $+8 \sin 15^\circ \hat{x} + 8 \cos 15^\circ \hat{y}$  B)  $+8 \cos 15^\circ \hat{x} + 8 \sin 15^\circ \hat{y}$   
 C)  $-8 \sin 15^\circ \hat{x} + 8 \cos 15^\circ \hat{y}$  D)  $-8 \cos 15^\circ \hat{x} + 8 \sin 15^\circ \hat{y}$   
 E)  $+8 \sin 15^\circ \hat{x} - 8 \cos 15^\circ \hat{y}$  F)  $+8 \cos 15^\circ \hat{x} - 8 \sin 15^\circ \hat{y}$   
 G)  $-8 \sin 15^\circ \hat{x} - 8 \cos 15^\circ \hat{y}$  H)  $-8 \cos 15^\circ \hat{x} - 8 \sin 15^\circ \hat{y}$



10. The figure shows the graph of the velocity of a ball versus time. Suppose that  $+\hat{y}$  points upward.

2

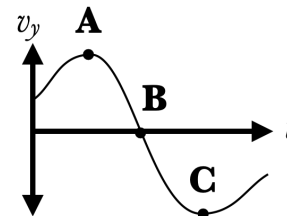
- (a) **B** At which point does the ball reach its highest point?

2

- (b) **B** At point C, the ball is moving  
 A) upward B) downward

2

- (c) **C** The acceleration of the ball at point B is  
 A) upward B) zero C) downward



4

11. **C** A car is driving at 20 m/s when the driver sees a wall 100 m ahead. The driver hits the brakes and comes to a stop right at the wall. How long does it take for the car to come to a stop?  
 A) 2 s   B) 5 s   C) 10 s   D) 20 s



2

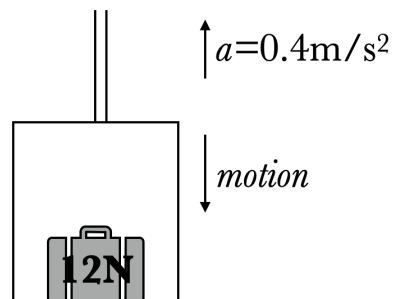
12. A 12 N suitcase is being lowered in an elevator, with an acceleration of  $0.4 \text{ m/s}^2$  upward.

- (a) **B** The elevator is  
 A) speeding up   B) slowing down

4

- (b) Circle the **forces** that are acting on the suitcase.  
 acceleration   normal   tension   weight

Please record with the first initial of every circled answer. e.g. ATW or NW.

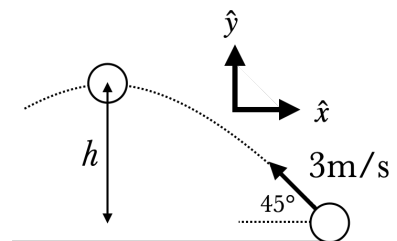


13. A ball is shot at a  $45^\circ$  angle at  $3\text{ m/s}$ . We want to know how high the ball goes in the air.

5

(a) Fill in the table with what is *given* in this problem.

	<b>x</b>	<b>y</b>
$\Delta x$		
$v_i$	<b><math>-3 \cos 45^\circ</math> or <math>-2.12</math></b>	<b><math>+3 \sin 45^\circ</math> or <math>+2.12</math></b>
$v_f$		<b>0</b>
$a$	<b>0</b>	<b><math>-9.8</math></b>
$\Delta t$		



Please record as the number of correctly filled in blocks, a '-', and then the number of blocks that are filled in that shouldn't be.

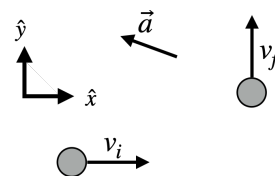
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(b) **D** How high  $h$  did the ball go in the air?

- A) 0.03 m   B) 0.11 m   C) 0.21 m  
 D) 0.23 m   E) 0.46 m

4

14. **B** An asteroid is initially moving at 48 m/s to the right, and has a constant acceleration of  $\vec{a} = (-3\hat{x} + 2\hat{y}) \text{ m/s}^2$ . How long until the asteroid is moving in the  $+\hat{y}$  direction? (The table is provided for partial credit but does not have to be used.)  
 A) 13 s   B) 16 s   C) 24 s   D) 48 s



	<b>x</b>	<b>y</b>
$\Delta x$		
$v_i$		
$v_f$		
$a$		
$\Delta t$		

4

15. **C** A child is dragging a stuffed animal across the floor. Which force is larger?  
 A) The force of the child on the stuffed animal  
 B) The force of the stuffed animal on the child  
 C) Both forces are the same

