



Université d'Ottawa · University of Ottawa

Faculté des sciences
Physique

Faculty of Science
Physics

PHY 1121

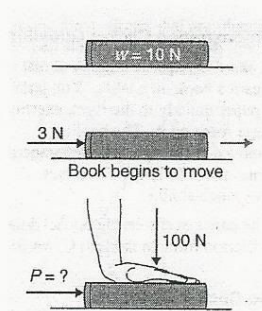
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Mid-Term Examination

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The answers should be entered carefully on a computer readable sheet using an HB pencil. When the exam time is over, you hand over only the computer sheet and keep this questionnaire for yourself.

1. A student throws a ball at an angle of 30.0° above the horizontal at a wall 20.0 m away. The ball's initial speed is 15.0 m/s, and it leaves student's hand at a height of 1.50 m above the ground. How long does the ball take to get to the wall?
- A) 2.67 s
 - B) 1.54 s
 - C) 1.42 s
 - D) 1.13 s
 - E) None of the above is correct.

2.



This book weighs 10 N and to move it along the surface of the table, a minimum horizontal force of 3 N must be applied. If I push down on the top of the book with my hand with a force of 100 N, the minimum horizontal force P required to move the book is

- A) 3 N.
- B) 10 N.
- C) 30 N.
- D) 100 N.
- E) 33 N.

3. Consider an ideal massless rubber-band which has an unstretched length l_0 . A roll of 50 pennies of total mass m_p is attached to a rubber band. The new stretched length of the rubber band with the pennies hanging down from the end of the rubber-band is l . Assume that the rubber band satisfies Hooke's law when it is stretched. What is the spring constant of the rubber band?

- A) $\frac{m_p g}{l-l_0}$
 B) $\frac{2m_p g}{l-l_0}$
 C) $\frac{l-l_0}{m_p g}$
 D) $\frac{l-l_0}{2m_p g}$
 E) $\sqrt{\frac{m_p g}{l-l_0}}$

4. An experienced bartender knows just the right initial speed of a glass of beer to get it to come to a stop in front any customer sitting along the bar. Say the initial speed needed to move a glass all the way to the end of the bar is v_{end} . In terms of v_{end} , with what speed should an identical glass of beer be released if it is to stop at a customer sitting three-quarters of the way down the bar? (The kinetic energy converted to thermal energy because of friction is proportional to the distance the glass skids).

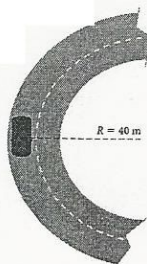
- A) $\frac{3}{4} v_{\text{end}}$
 B) $\frac{1}{2} v_{\text{end}}$
 C) $\frac{\sqrt{3}}{2} v_{\text{end}}$
 D) $\frac{1}{\sqrt{2}} v_{\text{end}}$
 E) $\frac{2}{3} v_{\text{end}}$

5. Two carts, one of mass $m_1 = 0.25$ kg and the other of mass $m_2 = 0.40$ kg, travel along a straight horizontal track with velocities $v_{1i} = 0.20$ m/s and $v_{2i} = -0.050$ m/s. What are the carts' velocities after they collide elastically?

- A) $v_{1f} = -0.14$ m/s, $v_{2f} = 0.19$ m/s
 B) $v_{1f} = 0.14$ m/s, $v_{2f} = -0.11$ m/s
 C) $v_{1f} = 0.19$ m/s, $v_{2f} = -0.14$ m/s
 D) $v_{1f} = -0.11$ m/s, $v_{2f} = 0.14$ m/s
 E) $v_{1f} = -0.16$ m/s, $v_{2f} = 0.21$ m/s

6. A car requires 300 kJ of energy to overcome air resistance and maintain a constant speed of 20 m/s over a distance of 1.0 km. What is the force of air resistance exerted on the car?
- A) 300 N
B) 200 N
C) 100 N
D) 50 N
E) 10 N
7. While designing a conveyor belt system for an airport, you determine that, on an incline of 22° , the magnitude of the maximum acceleration a rubber belt can give a typical suitcase before the suitcase begins slipping is 4.0 m/s^2 . What is a coefficient of static friction for a typical suitcase on rubber?
- A) 0.80
B) 0.87
C) 0.90
D) 0.93
E) 0.95
8. Moving at its maximum safe speed, an amusement park carousel takes 12 s to complete a revolution. At the end of the ride, it slows down smoothly, taking 2.5 rev to come to a stop. What is the magnitude of the angular acceleration of the carousel while it is slowing down?
- A) $1.7 \times 10^{-2} \text{ rad/s}^2$
B) $1.1 \times 10^{-2} \text{ rad/s}^2$
C) $9.6 \times 10^{-3} \text{ rad/s}^2$
D) $8.7 \times 10^{-3} \text{ rad/s}^2$
E) $7.7 \times 10^{-3} \text{ rad/s}^2$

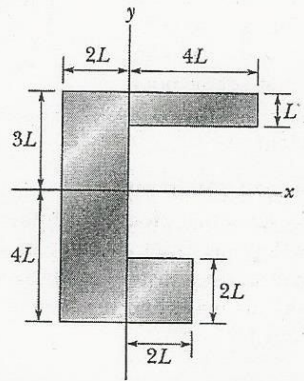
9.



A highway has a flat section with a tight level curve of radius 40 m. If the coefficient of static friction between tires and pavement is 0.45, what is the maximum speed at which a car can negotiate the curve safely?

- A) 13 km/h
B) 26 km/h
C) 48 km/h
D) 64 km/h
E) 76 km/h

10.



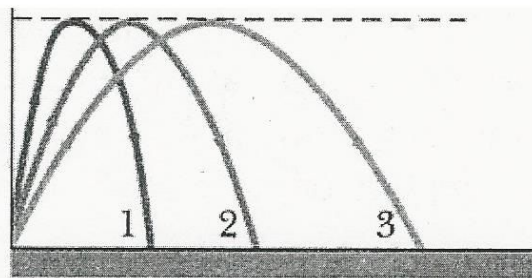
What is the y coordinate of the center of mass for the uniform plate shown above if $L = 5.0$ cm?

- A) 0.5 cm
- B) 0.0 cm
- C) -1.0 cm
- D) -1.5 cm
- E) -2.0 cm

11. Snow is falling vertically at a constant speed of 8.0 m/s. At what angle from the vertical do the snowflakes appear to be falling as viewed by the driver of a car traveling on a straight, level road with a speed of 50 km/h?

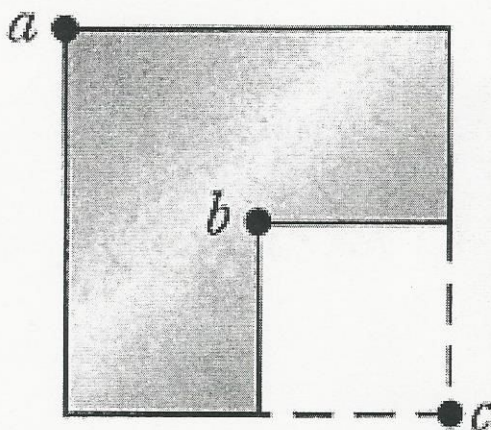
- A) 60°
- B) 55°
- C) 50°
- D) 45°
- E) 40°

12.



The figure above shows three paths for a football kicked from ground level. Ignoring the effects of air, rank the paths according to time of flight, greatest first.

- A) 1, 2, 3
- B) 1, 3, 2
- C) 3, 1, 2
- D) 3, 2, 1
- E) All tie



The figure above shows a uniform metal plate that had been square before 25% of it was snipped off. Three letter points are indicated. Rank them according to the moment of inertia of the plate around a perpendicular axis through them, greatest first.

- A) c, b, a
- B) c, a, b
- C) a, b, c
- D) b, a, c
- E) b, c, a

14. Between 1911 and 1990, the top of the leaning bell tower at Pisa, Italy, moved toward the south at an average rate of 1.2 mm/y. The tower is 55 m tall. What is the average angular speed of the tower's top about its base?

- A) 1.4×10^{-13} rad/s
- B) 3.2×10^{-13} rad/s
- C) 5.8×10^{-13} rad/s
- D) 6.9×10^{-13} rad/s
- E) 8.4×10^{-13} rad/s