



Université d'Ottawa · University of Ottawa

Faculté des sciences
Physique

Faculty of Science
Physics

PHY1121A/PHY1121B

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Mid-Term Examination 1

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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.

Cellular phones, unauthorized electronic devices or course notes (unless an open-book exam) are not allowed during this exam. Phones and devices must be turned off and put away in your bag. Do not keep them in your possession, such as in your pockets. If caught with such a device or document, the following may occur: you will be asked to leave immediately the exam and academic fraud allegations will be filed which may result in you obtaining a 0 (zero) for the exam.

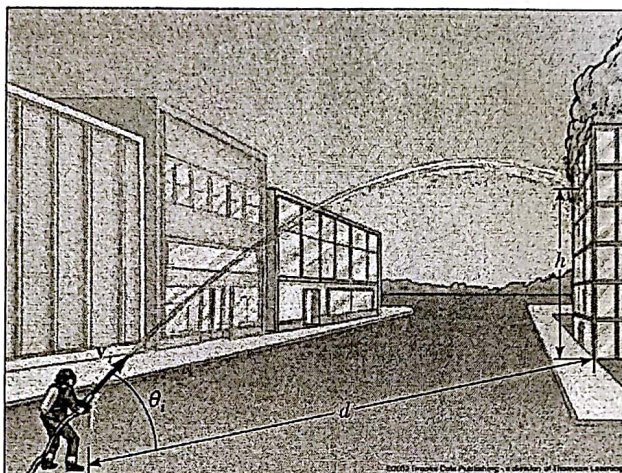
1. A train is traveling down a straight track at 20.0 m/s when the engineer applies the brakes. This results in an acceleration of -1.00 m/s^2 as long as the train is in motion. How far does the train move during a 40.0-s time interval starting at the instant the brakes are applied?
 - A) 0.00 m
 - B) 200 m
 - C) 400 m
 - D) 600 m
 - E) 800 m

2. A car and train move together along parallel paths at 25.0 m/s, with the car adjacent to the rear of the train. Then, because of a red light, the car undergoes a uniform acceleration of -2.50 m/s^2 and comes to rest. It remains at rest for 45.0 s and then accelerates back to a speed of 25.0 m/s at a rate of 2.50 m/s^2 . How far behind the rear of the train is the car when it reaches the speed of 25.0 m/s, assuming that the speed of the train has remained 25.0 m/s?
 - A) 568 m
 - B) 625 m
 - C) 794 m
 - D) 947 m
 - E) $1.38 \times 10^3 \text{ m}$

3. A ball thrown vertically upward is caught by the thrower after 20.0 s. Find the maximum height the ball reaches.

- A) 2.22×10^3 m
 B) 1.96×10^3 m
 C) 980 m
 D) 490 m
 E) 245 m

4.



A firefighter $d = 50.0$ m from a burning building directs a stream of water from a fire hose at an angle of $\theta_i = 30.0^\circ$ above the horizontal, as in the figure above. If the initial speed of the stream is $v_i = 40.0$ m/s, at what height h will the water strike the building?

- A) 20.3 m
 B) 19.5 m
 C) 18.7 m
 D) 17.1 m
 E) 16.4 m

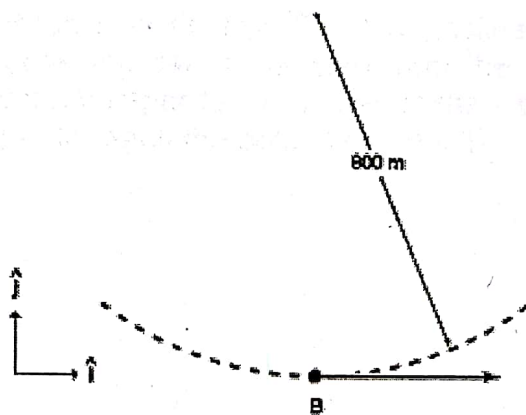
5. A car travels due east with a speed of 50.0 km/h. Rain drops are falling at a constant speed vertically with respect to the Earth. The traces of the rain on the side windows of the car make an angle of 60.0° with the vertical. The velocity of the rain with respect to the car is

- A) 28.9 km/h, downward
 B) 57.7 km/h, west of vertical
 C) 28.9 km/h, upward
 D) 57.7 km/h, east of vertical
 E) 28.9 km/h, east of vertical

6. A 0.20-km wide river has a uniform flow speed of 4.0 m/s toward the east. It takes 20 s for a boat to cross the river to a point directly north of its departure point on the south bank. In what direction must the boat be pointed in order to accomplish this?

- A) 23° west of north
 B) 20° west of north
 C) 24° west of north
 D) 22° west of north
 E) 17° west of north

7.

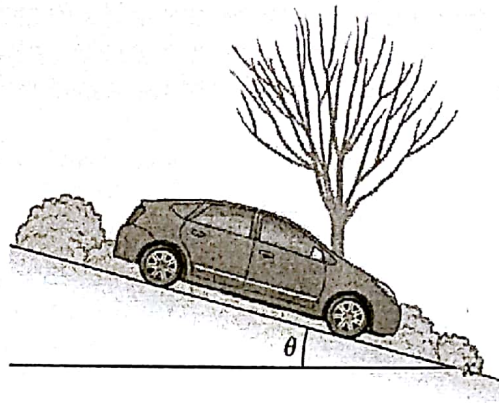


A stunt pilot performs a circular dive of radius 800 m. At the bottom of the dive (point B in the figure) the pilot has a speed of 200 m/s which at that instant is increasing at a rate of 20 m/s^2 . What acceleration does the pilot have at point B?

- A) $(50\hat{i} + 20\hat{j}) \text{ m/s}^2$
 B) $(20\hat{i} - 50\hat{j}) \text{ m/s}^2$
 C) $(20\hat{i} + 50\hat{j}) \text{ m/s}^2$
 D) $(-20\hat{i} + 50\hat{j}) \text{ m/s}^2$
 E) $(-50\hat{i} + 20\hat{j}) \text{ m/s}^2$

8.

4



A car of mass m is on a frictionless driveway inclined at an angle θ as in the figure above. Suppose the car is released from the top of the incline and the distance from the car's bumper to the bottom of the incline is d . How long does it take the front bumper to reach the bottom of the hill?

A) $3\sqrt{\frac{d}{g \sin \theta}}$

B) $\sqrt{\frac{5d}{g \sin \theta}}$

C) $\sqrt{\frac{3d}{g \sin \theta}}$

D) $2\sqrt{\frac{d}{g \sin \theta}}$

E) $\sqrt{\frac{2d}{g \sin \theta}}$

9. A hockey puck on a frozen pond is given an initial speed of 22.0 m/s. If the puck always remains on the ice and slides 115 m before coming to rest, determine the coefficient of kinetic friction between the puck and ice.

A) 0.177

B) 0.215

C) 0.241

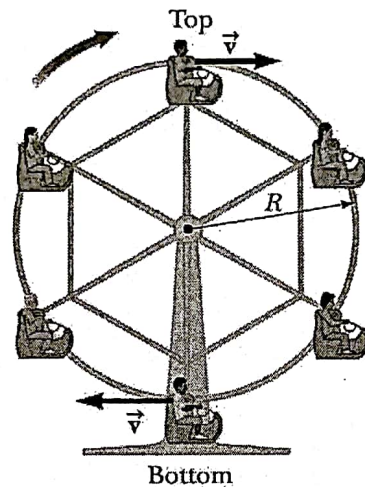
D) 0.257

E) 0.269

10. A 20.0-kg block is initially at rest on a horizontal surface. A horizontal force of 75.0 N is required to set the block in motion, after which a horizontal force of 60.0 N is required to keep the block moving with constant speed. The coefficients of static and kinetic friction between the block and the surface are

- (A) 0.383 and 0.306, respectively.
 B) 0.306 and 0.245, respectively.
 C) 0.289 and 0.226, respectively.
 D) 0.271 and 0.215, respectively.
 E) 0.258 and 0.206, respectively.

11.

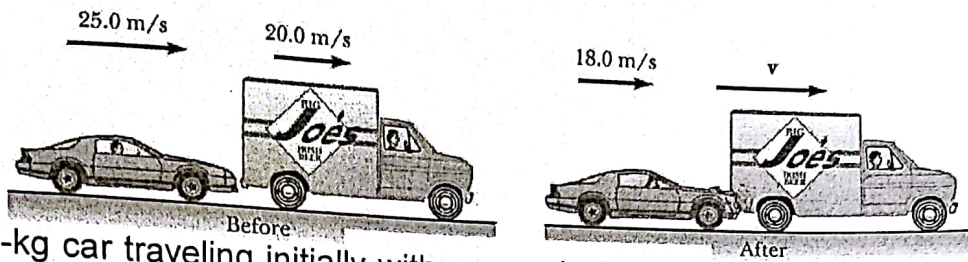


11. A child of mass m rides on a Ferris wheel as shown in the figure above. The child moves in a vertical circle of radius $R = 9.00$ m at a constant speed of $v = 3.00$ m/s. Determine the force exerted by the seat on the child at the top of the ride. Express your answer in terms of the weight of the child, mg .

- A) $0.924mg$
 B) $0.917mg$
 C) $0.908mg$
 D) $0.898mg$
 E) $0.881mg$

12.

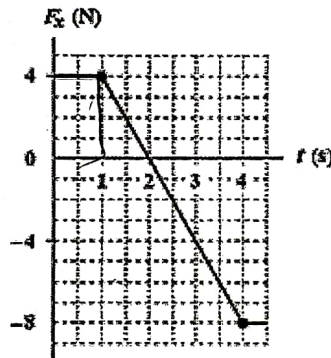
6



A 1200-kg car traveling initially with a speed of 25.0 m/s in an easterly direction crashes into the rear end of a 9000-kg truck moving in the same direction at 20.0 m/s (see figure above). The velocity of the car right after the collision is 18.0 m/s to the east. How much mechanical energy is lost in the collision?

- A) 9.64 kJ
- B) 8.92 kJ
- C) 8.68 kJ
- D) 8.33 kJ
- E) 8.12 kJ

13.



The only force acting on a 2.0-kg object moving along the x axis is shown. If the velocity v_x is -2.0 m/s at $t = 0$, what is the velocity at $t = 4.0$ s?

- A) -2.0 m/s
- B) -4.0 m/s
- C) -3.0 m/s
- D) 1.0 m/s
- E) 5.0 m/s

14. A 2.0-kg block sliding on a rough horizontal surface is attached to one end of a horizontal spring ($k = 250$ N/m) which has its other end fixed. The block passes through the equilibrium position with a speed of 2.6 m/s and first comes to rest at a displacement of 0.20 m from equilibrium. What is the coefficient of kinetic friction between the block and the horizontal surface?

- A) 0.32
- B) 0.45
- C) 0.58
- D) 0.19
- E) 0.26