

X2.15a

PHYS-107(15) (Kaldon-)
WMU - Fall 2003
Exam 2A - 100,000 points

107

Name S O L U T I O N

Book Title _____

Rev. 10/21/03 M.A.2

State Any Assumptions You Need To Make – Show All Work – Circle Any Final Answers
Use Your Time Wisely – Work on What You Can – Be Sure to Write Down Equations
Short Answers Should Be Short! – Feel Free to Ask Any Questions

EXAM 2 [FORM - A] 8AM

PHYS-107 (KALDON-15)

FALL 2003

WMU

“Conservation Laws aren’t just for Physicists,
They’re for everybody.”

What World Series?

“Fact or Friction” (50,000 points) Multiple-Guess-Pick-The-Best-Answer-Fill-In-The-Bubbles

- 1.) (a) The Work Energy Theorem says that the Work done on an object changes its _____ Energy.
A = Static B = Kinetic C = Potential D = Radial Inward
E = Tangent F = Radial Outward A B C D E F
- (b) The _____ coefficient of friction is always the smaller.
A = Static B = Kinetic C = Potential D = Radial Inward
E = Tangent F = Radial Outward A B C D E F
- (c) Rodney the Reindeer goes around and around on his string because there is a _____ Force.
A = Static B = Kinetic C = Potential D = Radial Inward
E = Tangent F = Radial Outward *This is U.C.M.* A B C D E F
- (d) There is no centrifugal force. If Rodney’s string breaks, his initial motion is _____ to the circle.
A = Static B = Kinetic C = Potential D = Radial Inward
E = Tangent F = Radial Outward A B C D E F
- (e) An object tossed straight up, will have only _____ Energy at its turning point.
A = Static B = Kinetic C = Potential D = Radial Inward
E = Tangent F = Radial Outward *At rest at turning point.* A B C D E F
- (f) A woman throws a ball horizontally. The work she does on the ball results in the ball gaining _____ Energy.
A = Static B = Kinetic C = Potential D = Radial Inward
E = Tangent F = Radial Outward *Same as in (1a).* A B C D E F
- In parts (g)-(i), select which of Newton’s 3 laws or the 2 Conservation laws that *best describes* the situation.
- (g) A car speeding up to merge into the expressway traffic.
A = Newton’s 1st B = Newton’s 2nd C = Newton’s 3rd
D = Momentum E = Energy F = None of these A B C D E F
- (h) The force of the Earth on the Moon and the force of the Sun on the Moon.
A = Newton’s 1st B = Newton’s 2nd C = Newton’s 3rd
D = Momentum E = Energy F = None of these A B C D E F
- (i) The difference between a totally elastic collision and a totally inelastic collision.
A = Newton’s 1st B = Newton’s 2nd C = Newton’s 3rd
D = Momentum E = Energy F = None of these A B C D E F
- (j) A golf ball sitting on a tee, just before it is struck.
A = Newton’s 1st B = Newton’s 2nd C = Newton’s 3rd
D = Momentum E = Energy F = None of these A B C D E F

"Drivin' Along in My Automobile..." (50,000 points)

2.) A car (mass = 2110 kg) is driving along at a constant speed of 67 mph (29.9 m/s). (a) Find the weight of the car.

$$w = mg = (2110\text{kg})(9.81\text{m/s}^2) = 20,700\text{N}$$

(b) The engine has to supply a force of 3450 N just to overcome air resistance. If there *wasn't* air resistance, find the acceleration a that a force of 3450 N would have on this car.

$$F = ma$$

$$a = \frac{F}{m} = \frac{3450\text{N}}{2110\text{kg}} = 1.635\text{m/s}^2$$

(c) The coefficients of friction are 1.00 and 0.820 respectively. What is the maximum braking force that the car can supply while under complete control?

The Maximum Braking Force would be Maximum Static Friction.

$$F_N = w = mg = 20,700\text{N}$$

$$F_{f,s,\max} = \mu_s F_N = (1.00)(20,700\text{N})$$

$$= 20,700\text{N}$$

(d) A dog runs across the road and the driver stomps on the brake pedal, skidding to a stop in a distance d . Find d .

Skidding tells us this would be Kinetic Friction.

$$F_N = w = mg = 20,700\text{N}$$

$$F_{f,k} = \mu_k F_N = (0.820)(20,700\text{N})$$

$$= 16,970\text{N}$$

$$\sum F_x = -F_{f,k} = ma_x$$

$$a_x = \frac{-F_{f,k}}{m} = \frac{-16,970\text{N}}{2110\text{kg}} = -8.043\text{m/s}^2$$

$$\sum F_x = -F_{f,k} = ma_x$$

$$a_x = \frac{-F_{f,k}}{m} = \frac{-16,970\text{N}}{2110\text{kg}} = -8.043\text{m/s}^2$$

$$v_x^2 = v_{0x}^2 + 2a_x(x - x_0)$$

$$0 = v_{0x}^2 + 2a_x(x - 0)$$

$$2a_x x = -v_{0x}^2$$

$$x = \frac{-v_{0x}^2}{2a_x} = \frac{-(29.9\text{m/s})^2}{2(-8.043\text{m/s}^2)}$$

$$= 55.58\text{m}$$

$$W = \Delta KE$$

$$Fd = \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2$$

$$Fd = -\frac{1}{2}mv_0^2$$

OR

$$d = \frac{-mv_0^2}{2F} = \frac{-(2110\text{kg})(29.9\text{m/s})^2}{2(-16,970\text{N})}$$

$$= 55.58\text{m}$$

(e) While traveling at a speed of 67 mph (29.9 m/s), the driver falls asleep at the wheel and drifts over to the right, running into a parked SUV (mass = 2890 kg). Find the speed of the wreck, V .

$$p_{\text{before}} = p_{\text{after}} \quad ; \quad p = mv$$

$$m_1 v_1 + m_2 v_2 = (m_1 + m_2) V$$

$$V = \frac{m_1 v_1 + 0}{(m_1 + m_2)}$$

$$= \frac{(2110\text{kg})(29.9\text{m/s})}{(2110\text{kg} + 2890\text{kg})}$$

$$= 12.62\text{m/s}$$