X2.d 107

Physics 107 (Kaldon-23825) **Name** _____

WMU - Spring 2000 **Book Title** _____

Exam 2 - 100,000 points

Rev. 5/25/00 Th.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

"Fact or Fiction" (30,000 points) *Multiple-Guess-Pick-The-Best-Answer-Fill-In-The-Bubbles*

1.) (a) The coefficient of kinetic friction is always _____ than the coefficient of static friction.
A = Larger B = Smaller C = The Same D = None of these
Ⓐ Ⓑ Ⓒ Ⓓ

(b) In a head-on totally inelastic collision between two cars, the resulting wreck will travel in the direction of the car which has the _____ momentum.
A = Larger B = Smaller C = The Same D = None of these
Ⓐ Ⓑ Ⓒ Ⓓ

(c) Car A crashes into Car B and the resulting wreck is left at a standstill ($V = 0$). If the mass of A is larger than the mass of B, then before the wreck the speed of A must have been _____ than the speed of B.
A = Larger B = Smaller C = The Same D = None of these
Ⓐ Ⓑ Ⓒ Ⓓ

(d) An arrow is shot into the air. At the top of its ballistic arc, the K.E. of the arrow is _____ than at launch.
A = Larger B = Smaller C = The Same D = None of these
Ⓐ Ⓑ Ⓒ Ⓓ

In parts (e)-(h), select which of Newton's 3 laws or the 2 Conservation laws that <u>*best describes*</u> the situation.

(e) The speed with which an arrow shot into the air at 67 m/s strikes the ground. *Launch θ is not known.*
A = Newton's 1st B = Newton's 2nd C = Newton's 3rd
D = Momentum E =Energy F = None of these
Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ

(f) The normal force of a book sitting on a table and the weight of the book.
A = Newton's 1st B = Newton's 2nd C = Newton's 3rd
D = Momentum E =Energy F = None of these
Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ

(g) The gravitational attraction between a book and the Earth.
A = Newton's 1st B = Newton's 2nd C = Newton's 3rd
D = Momentum E =Energy F = None of these
Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ

(h) Throwing snowballs while on ice skates.
A = Newton's 1st B = Newton's 2nd C = Newton's 3rd
D = Momentum E =Energy F = None of these
Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ

In parts (i)-(j), select the answer closest to representing a vector with $v_x = 8.0$ *m/s* and $v_y = 4.0$ *m/s*.

(i) The magnitude of the vector v is closest to:
A = 0 B = 4.0 m/s C = 8.0 m/s
D = 9.0 m/s E = 12.0 m/s F = None of these
Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ

(j) The standard angle for the vector v is closest to:
A = 27° B = 30° C = 45° D = 60°
E = 63° F = None of these
Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ

"Drive," He Said. (35,000 points)

2.) (a) A car (m = 1890 kg) accelerates from rest to 65 m.p.h. (29.1 m/s) with $a = 2.40$ *m/s²*. Find the force required to accelerate the car.

(b) The road curves ahead with a radius of 95.0 m. Find the centripetal acceleration, a_c, and the centripetal force, F_c, of the car as it makes its turn.

(c) For the car to make its turn safely, what is the minimum value of the coefficient of static friction? *(It would probably be more, but that wouldn't change the applied centripetal force.)*

(d) A moose (!!) wanders into the middle of the road and stops, looking at the approaching car with disdain. In a panic, the driver slams on the brakes, locking up the wheels. If the coefficient of kinetic friction is $\mu_k = 0.800$, how far does the car skid before it comes to a stop?

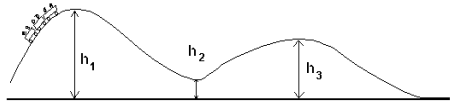
(e) The car does not stop in time and runs into the moose ($m = 1010$ *kg*), while still traveling at 8.35 m/s. With the moose jammed into the windshield, what is the speed of the car/moose combination immediately after the wreck?

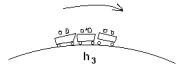
Moose / Microsoft Bookshelf '95

Neither Rain Nor Sleet Nor Snow Nor Gloom of Night… (35,000 points)

3.) An amusement park has a new roller coaster, the Refrocroptator, where the track has $h_1 = 12.00$ *m*, $h_2 = 3.00$ *m*, $h_3 = 6.00$ *m* above the ground. The mass of the loaded train is 4130 kg. Assume no friction.

(a) The roller coaster is pulled up to the top of the first hill, h_1. It is essentially not moving (K.E. ≈ 0). What is its potential energy (P.E.) relative to the ground?





(b) As the train tops out at the circular curve at h_3, do the passengers feel *lighter* or *heavier* than they would at rest? *Briefly* explain, but use physics, please. *You may find that a Free Body Diagram is helpful*.

(c) Find the speed of the train at the top of second hill, h_3.

(d) Find the force of gravity that the Moon overhead exerts on the train. *The distance between the Moon and the Earth is $R = 3.82 \times 10^8$ m, the Moon's mass is 7.36×10^{22} kg, and the radius of the Earth is $R_E = 6.40 \times 10^6$ m.*

(e) We usually start with the Free Body Diagram and then write the equations. Here we reverse the process :The following two equations describe the forces acting on a small child in line being pulled by his mother. Draw the Free Body Diagram. *Show F_1 as a single vector, not its x- and y- components.*

$$\sum F_y = F_N + F_1 \sin 144^\circ - mg = 0$$

$$\sum F_x = F_1 \cos 144^\circ + F_{f,s} = 0$$