XF.14A 107

PHYS-107(14) (Kaldon-14959) **Name**_____

WMU - Summer I 2003
Final Exam - 200,000 points **CHECK-OUT:** ☐ T1 ☐ T2 ☐ Q21 ☐ Q23 ☐ _____

Rev. 06/23/02 M.7

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
"Last Chance" (50,000 points) ***Multiple-Guess-Pick-The-Best-Answer-Fill-In-The-Bubbles***

1.) In parts (a)-(d), select which Newton's Law or Conservation Law best applies.

(a) You hit me, but I hit you just as hard…
A = Newton's 1st B = Newton's 2nd C = Newton's 3rd
D = Momentum E = Energy F = None of these
Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ

(b) The First Law of Thermodynamics is a statement about…
A = Newton's 1st B = Newton's 2nd C = Newton's 3rd
D = Momentum E = Energy F = None of these
Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ

(c) This is the only one that does not involve vectors.
A = Newton's 1st B = Newton's 2nd C = Newton's 3rd
D = Momentum E = Energy F = None of these
Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ

(d) An object at rest tends to stay at rest…
A = Newton's 1st B = Newton's 2nd C = Newton's 3rd
D = Momentum E = Energy F = None of these
Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ

In parts (e)-(h), select which speed best represents the situation described.

(e) *"So, there we were, just walking to class."*
A = 2.0 m/s B = 8.0 m/s C = 30. m/s D = 270 m/s E = 610 m/s
F = 22,000 m/s
Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ

(b) *"So after this stupid physics class, I'm flying down to Disney World!"*
A = 2.0 m/s B = 8.0 m/s C = 30. m/s D = 270 m/s E = 610 m/s
F = 22,000 m/s
Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ

(c) *"So, man, we were like, just listening to some tunes and zoomin' to Detroit on I-94."*
A = 2.0 m/s B = 8.0 m/s C = 30. m/s D = 270 m/s E = 610 m/s
F = 22,000 m/s
Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ

(d) *"He catches the football! He's running down the field! He's at the 30… the 20… the 10… Touchdown!"*
A = 2.0 m/s B = 8.0 m/s C = 30. m/s D = 270 m/s E = 610 m/s
F = 22,000 m/s
Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ

In parts (i)-(j), select the answer that best fills in the blank.

(i) A tuning fork chimes $f = 480$ *Hz*. A second fork, with a lower pitch, has a frequency _____ the first fork.
A = more than B = less than C = the same as
D = None of these
Ⓐ Ⓑ Ⓒ Ⓓ

(j) An electron in hydrogen is moved to a larger diameter orbit. The strength of the Coulomb electric force between the electron and the proton is now _____ it was. *Ignore the minus sign due to attraction.*
A = more than B = less than C = the same as
D = None of these
Ⓐ Ⓑ Ⓒ Ⓓ

Happy Holidays! (50,000 points)

2.) For Thanksgiving, we cooked a 17.74 pound ($m = 8.06$ *kg*) turkey. When it went into the oven it was still cold, 40°F (4.44°C). To be properly cooked, one source suggests that the interior should be heated to 170°F (76.7°C). (a) Assuming that the turkey is mostly water, and therefore has a specific heat of $c_{water} = 4180$ *J/kg·°C*, how much energy did it take to heat the turkey?

(b) The bird was in the oven for 4.00 hours. Find the power in Watts that was used to heat the bird. *If you didn't get an answer to (a), use Q = 1,000,000 J.*

(c) If the oven runs at 1250 W, what is the efficiency of cooking the turkey? In other words, what percentage of the total power actually went into cooking the turkey? *If you didn't get an answer to (b), use P = 511 W.*

If this was an electric oven, plugged into a 220 volt outlet, find (d) the current *I* and…

(e) … the resistance *R* of the oven? *Note: This does not depend on (d).*

Freedom From Want – Norman Rockwell

And Now From the Land of Hockey And SARS, eh? (50,000 points)

3.) Mrs. Dr. Phil just got back last night from a conference in Toronto, Ontario, Canada. Earlier in the day she visited the Sky Pod – the "World's Highest Observation Deck at the CN Tower, Canada's Wonder of the World" – which is 1465 feet (447 m) above the ground. (a) If the express elevator has a total mass of 5550 kg, find the change in the Potential Energy, ΔP.E., as the elevator goes from ground to Sky Pod.

(b) If water to the bathroom on the Sky Pod level is pumped up from the ground, what gauge pressure in the column of water is necessary to get the water 1465 feet (447 m) above the ground?

(c) Calculate the speed that any object – water, the elevator, a tourist's camera – will free fall to the ground from the Sky Pod level. *Assume no air resistance, as usual.*

(d) One of Toronto Blue Jay baseball players is invited up to the Sky Pod level and throws a Major League fastball straight out – with $v_{0x} = 45.0$ *m/s (101 mph).* How far does it travel horizontally before it first hits the ground? *Again, ignore air resistance.*

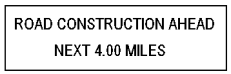
CN TOWER
CANADA'S WONDER OF THE WORLD

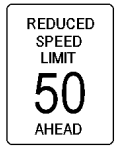
(e) A week from today, July 1st, is Canada Day – the Canadians' equivalent of the American 4th of July. During the festive celebrations, fireworks are shot off in the CN Railways yard that surrounds the CN Tower. One of the shells is shot straight up and comes to a stop (and exploding into a lovely red and yellow starburst) at the same height as the Sky Pod. Find the vector velocity of the shell at time $t = 0$.

Ah, Summertime in Michigan – And the Roads Are All Set to be Torn Up! (50,000 points)

4.) June Bugs bring summer heat… and Michigan highway construction projects. Michigan drivers, of course, hate to slow down for *anything*. How long (time) does it take for a car driving at 70 mph (31.3 m/s) to travel four miles (6440 m)?

(b) Assuming that traffic does *not* come to a stop, find the time it takes to travel the four miles (6440 m) at the reduced speed of 50 mph (22.4 m/s), and the number of seconds *longer* it takes than at 70 mph.





(c) Car A (m = 2135 kg) is heading north and has properly slowed to 50 mph (22.4 m/s). Car B (m = 2324 kg) is still traveling northward at 70 mph (31.3 m/s) and failing to slow down for the construction zone, rear ends Car A. With what speed will the car wreck (Car A+B) be traveling right after impact?

(d) Car C (m = 2547 kg) is also heading north at 70 mph (31.3 m/s) and sees the collision 103 m in front. Find the acceleration, a_x, that Car C needs in order to come to a stop in 103 meters.

(e) Assuming that Car C has anti-lock brakes and maintains control the entire time it is braking, find the coefficient of friction that just manages to brings the car to a stop. Identify whether it is static or kinetic friction (μ_s or μ_k). *If you didn't get an answer to (d), use ½ g as the deceleration.*