"Newtonian Nonplussers"

Use the puzzle-solving strategy to answer each question, except for questions with an asterisk (*). Show all your work. Use g = 9.80 m/s^2.

1.1) Suppose that the total force of air drag on your car is 250 N as you cruise down a highway. What force must the road provide to keep your car moving at a constant speed?*

1.2) A 2.0 kg coconut falls from a tree on Gilligan's Island. Ignoring air drag, what is the net force on the nut as it falls? What was the net force on it while it was hanging from the branch, before it fell?

1.3) In a *Muppet Show* skit, Kermit the Frog stands on the planet Coozbane doing a news interview. Suppose that his mass is, say, 10.0 kg (he is, after all, pretty big for a frog) and he finds that on Coozbane he weighs 68 N. What is **g**, the acceleration due to Coozbanian gravity? What is the net force on him as he stands there?

2.1) In the grocery store, Andy's grocery cart is full of food and has a mass of 65 kilograms. In order to accelerate his cart from rest, he applies a force of 95 N. Andy's "friend" Gomer wants to test Andy's strength and pushes back against the cart with a force of 80.0 N. What is the net force on the cart? What is the cart's acceleration?

2.2) A tension force causes a 0.75 kg box of Dunkin' Donuts to accelerate at 3.0 m/s^2 across a slightly rough tabletop such that a friction force of ~1.0 N exists on donut boxes. If that same tension force causes a box of GAD's donuts to accelerate instead at 2.5 m/s^2, what is its mass?

2.3) In an illegal drag race, Vinnie accelerates his 1000.0 kg car from rest for 6.0 seconds with a road friction force of 14,000 N. If there also exists a drag force of 2.0 x 10^3 N during the acceleration, how fast is he traveling after the 6.0s?

3.1) A 20.0 N rutabega falls from a helicopter.
- a) What is the rutabega's acceleration just after it starts falling?*
- b) After it falls for a few seconds, the air drag has built up to 16 N. What is its acceleration now?

3.2) A 1963 Buick weighs, let's say, 10,000.0 N.
- a) What is its mass?*
- b) What friction force does the road provide to accelerate it from rest to 32 m/sec in 8.0 sec, if an average air drag force of 1000.0 N is acting?

3.3) Rex the dog is experimenting to see how many lives the family's pet Kitty really has. He drops the unwilling cat from a high place with no initial speed.
- a) What is its initial acceleration?*
- b) After a short time, the cat has reached its terminal velocity {a really sick pun...} and Rex observes that the drag force on it is 80.0 N. How much does Kitty weigh? (Hint: What does "terminal velocity" really mean?)
- c) What is Kitty's mass?