Kinematics: Linear and Circular Motion

PHYS 2425

Phil Alcorn

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1. Conceptual Questions

A. A car moves at constant velocity on a straight road. What must the net force on the car be? Explain why.

No force, because there's no acceleration.

B. If you double the net force on an object but keep its mass constant, what happens to its acceleration?

It doubles.

C. A skydiver reaches terminal velocity during free fall. Why does the skydiver stop accelerating even though gravity is still acting?

The force of air resistance (a type of friction) acting against his fall

E. Explain why astronauts "feel weightless" in orbit, even though gravity is still acting on them.

They feel weightless because they are falling at g.

2. Newton's Laws

A. A car of mass 45kg accelerates from rest to a speed of 25 m/s over a period of 13 seconds. What must be the average force on the car?

The average accelearion is about 1.923 $\frac{m}{s}$. This means the average force must be m * a = 86.5N.

B. A car of mass 45kg is moving at a rate of 25 m/s before applying the brakes and coming to a stop in 50m. What is the force of the brakes on the car?

$V_f^2 - v_o^2 = 2a\Delta x$ so $a = -6.25m/s^2$. So the Force is then -281.25 N.

C. A 70kg person is standing in an elevator that is accelerating upward at $2.0\frac{m}{s^2}$. What is the normal force that the scale reads? What would the scale read if he was accelerating downwards at $2.0\frac{m}{s^2}$?

Using the sum of forces you can determine that the normal force for the upwards acceleration is 826N, and the force on the downwards acceleration is 546N. (Does this match your personal experience??)