Physics Chapter 1 Force

What is a force?

(I know, force isn't there in the ti

Remember Newton's First Law? You probably don't. What Newton basically said is that a body either stays at rest or stays in motion. In other words, the speed of the body remains unchanged on its own. (That makes sense, bodies don't suddenly start moving on their own!)

Now, what happens when you want to make something go faster? You push it. This 'push' is what we call force. Thus force is the physical cause responsible for a change in velocity.

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Hey, wait, what's velocity?

Well, velocity is just a fancy name for speed. But there's a catch-velocity is speed with direction.

Suppose you move 3 km east and then 4 km north. Now, if I ask you how much distance did you cover today, you'll answer 7 km. That's right.

Now, when you meet a scientist and he asks you, how much is your displacement? Don't give a blank stare. What he means is that "What is the distance that you covered from your starting point?" That's what displacement is.

Now, you can calculate the displacement is this case by using Pythagoras' Theorem.

Draw a diagram. You'll notice that your displacement is the hypotenuse of a right-angled triangle whose other sides are 3 and 4 km.

Displacement=root of (32 + 42)

=5 km

Now, if you've studied trigo(nometry) you'll be able to calculate that the angle of your displacement is 60o west of due North.

There, now you know all about displacement.

Now about velocity...

Suppose you took an hour to do your journey. I ask you, what was your speed? You'll say 7 km/hr. That's easy. Now, Mr. Scientist comes along and asks about your velocity. Don't say 7 km/hr. Velocity is displacement divided by time. Yep, you got it, your velocity is 5 km/hr. Now, you know all about velocity.

Acceleration??? Whatever's that?

Acceleration is velocity divided by time. And acceleration is also speed divided by time. I know... These scientists confusing everyone. Most of the time acceleration is velocity / time.

Now read on...to know the secrets behind the mysterious force causing acceleration.

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Now, Newton's Second Law-

In the last section, we defined force as something causing a change in velocity.

That is what we call a qualitative definition-in other words-it isn't really useful for doin' calculations. So, Newton was a smart guy, he declared to the world that force is equal to mass multiplied by acceleration. Or, a force can be measured by making it on a body of a known mass. We then measure the acceleration caused and -hey presto-we get the value of the force.

Now you might be wondering, how did this Isaac Newton get this formula. Surely, Concise Physics didn't exist at that time. Well, here's the secret: that's how we DEFINED FORCE. In other words, force is simply a term which we use to denote the product of a body's mass and acceleration. Now, you ask: WHY did we define force exactyly like that. Well, it's because it looked nice. THERE is NO other reason.

Concept: Force is the cause for an acceleration of a body.

Example: Take a ball which you threw from the balcony. You'll notice that the ball speeds up as it falls. In other words, it 'accelerates'. So what is causing this acceleration? Did you say gravity? Wrong! It's the 'force' exerted' by gravity that's causing this acceleration. You've probably mugged up that g=9.8 m/s. In other words, for every second that the body falls, it speeds up by 9.8 m/s.

Now a problem for you: you throw your iPhone weighing a 100 g out of the window (what all one does for physics!) . It accelerates by 9.8 m/s. So, what is the force acting on the body? It's m a. You might be tempted to simply multiply 100 and 9.8 . But don't forget the units here.

F= m a

If you did multiply 100 g and 9.8 m/s², the unit for force would be g m / s². Read on...

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SI - Sytemè Internationalè de Unitès

Yeah, it's French. A bunch of units that physicists decided upon as 'standard'. What that means is that all scientific stuff is written using meters and not miles. Naturally, ICSE is also inclined to follow SI, so you also should also do the same.

Length meter m

Mass kilogram kg (note this)

Time second s

Temperature Kelvin K

These are the ones you'll need.

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Now, back to forces. The SI unit for force is newton (note the small letters). Basically, that's just a fancy way of saying kg m/s2.

Go on. Multiply the SI units for mass and acceleration.

You get kg m/s2.

In other words, a an acceleration of 1 m/s2 in a body of mass 1 kg is caused by a force of 1 newton.

Back to the iPhone... the unit which you got there is g m/s². However, the SI unit is newtons. So you need to convert your answer to newtons. Or you can start out by converting mass and acceleration to their SI units, which in turn will give the SI unit for force.

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Newton's Third Law:

Try pusing a wall. You can feel another force on your hand. Well, forces ALWAYS occur in pairs. Action and re-action. The action and re-action forces are equal in magnitude HOWEVER they act on different bodies.

Example:

Rowing-You push the oar backwards. Oar exerts force on water backwards. Water pushes boat forwards. DIFFERENT bodies.

Now one for you-the earth is attracting a ball with a gravitational force of 100 N. (In other words, the weight of the body is 100 N). What is the re-action force in this case? Or is there no re-action? Calculate the acceleration caused by the re-action. (Use Google)

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Now Torque...