



Importance of Physics

What is the importance of physics?

Hope this article will make the learning more fun and interesting. Let's see what you will study in Std. XI-XII. Based on the topics you will master mind you can understand how physics is important for you.

Physics is the study of nature and natural phenomenon. Scientists discovered the rules that govern the nature.

Let's select few chapters of physics.

Motion:



When it rains, you inclined your umbrella to protect yourself from rain. As you run faster your inclination of umbrella will be more and more.

Though we are in a stand still train and side by train runs we feel our train is moving. Relative velocity explains reason behind such facts.





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How does a motor cyclist move inside a circular cage in circus? Have you seen Well of death (mout ka kuan in fun fair), how does they motor cyclist moves in a horizontal circular path and still able to maintain balance.

Suppose you are in a bicycle/motor cycle and taking a turn at a very high speed, you need to incline your bicycle to keep balance. How much inclination or bending required depends on your speed.



What holds such huge mass like moon or INSAT series satellites which make them to move around earth? Read carefully centripetal force.

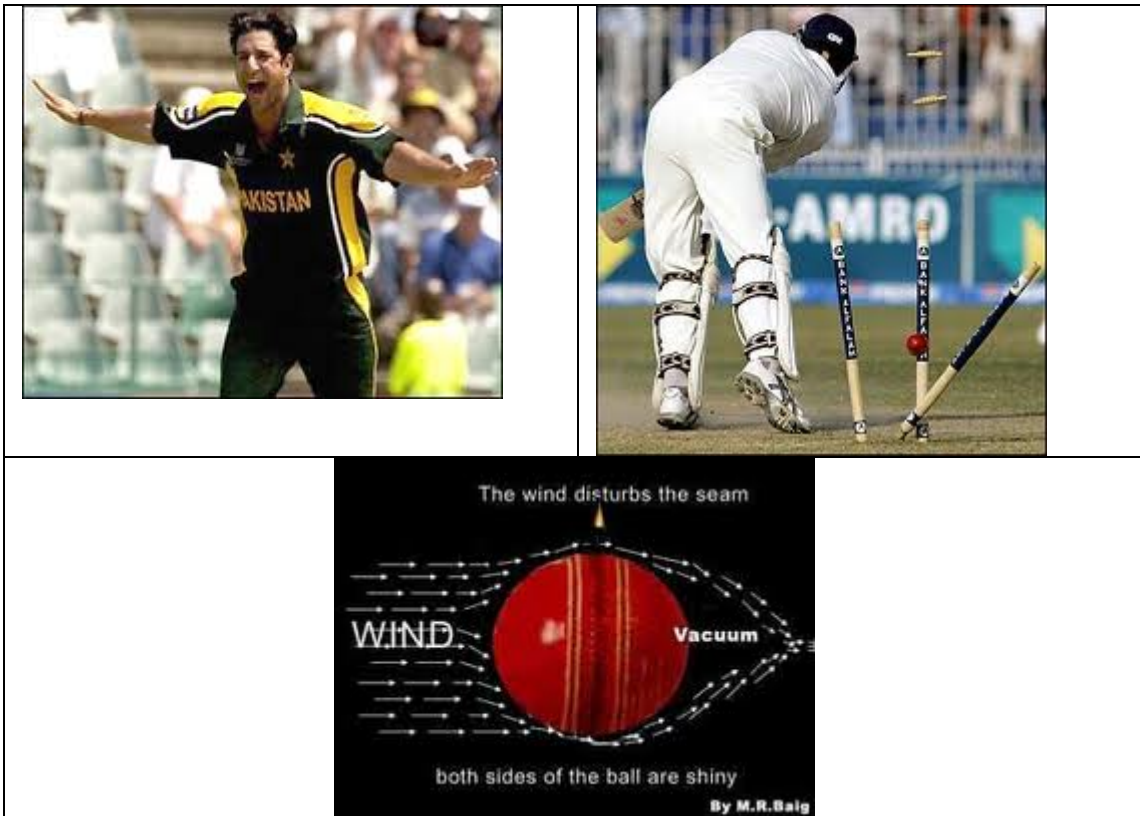


During war have you seen anti missile technology, whenever a missile fired its projectile track detected and before it hits objects on earth intercepted in air.

Have you seen maximum speed limit say 40 KM/Hr like board while moving through a curved bridge? How does civil engineer calculate such speed limit? Exceeding such precautionary speed limit often causes accident as your vehicle practically loses contact with ground.



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How does cricketer swing ball, often fast bowler use wind current and succeed to do in-swing, out-swing, Yorker physics helps you to understand the reason of swing.

Gravitation:

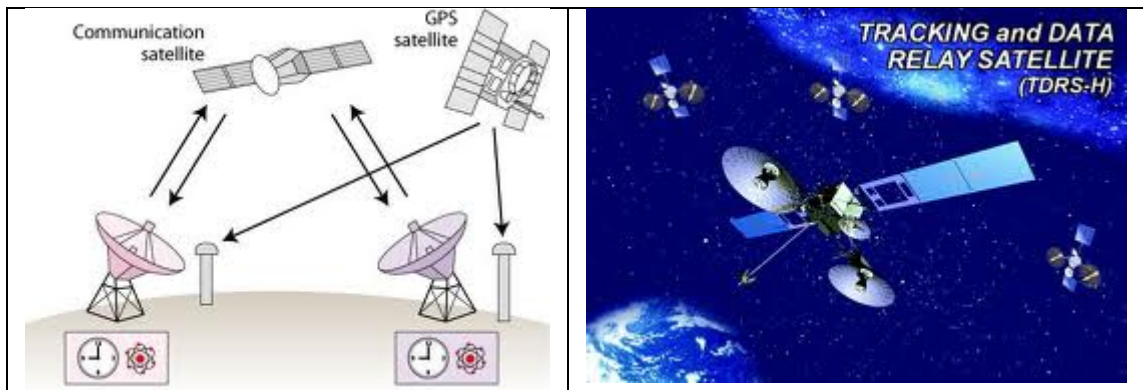
Sir Isaac Newton said, apple feels attraction towards earth that's why it falls to ground. Such a simple observation led us to find natural laws of gravitation and we understood to some extent how does the such vast universe maintaining balance.

Do you know we have in India 6 lakhs villages and our farmers/fisher men gets help from weather forecasting? This forecasting takes place by taking snap of wind/cloud/atmosphere over a region using our satellite.

At what speed we should project the satellite? at what distance it should be kept from earth so that it will rotate once in 24 hours. In physics we call it Geo-Stationary orbit. You will calculate and surprise others after studying chapter of Gravitation.



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Your Tata sky/dish tv/airtel direct to home TV works based communication satellite.



Just now while I was writing this article for you India launched PSLV-C₂₀ at 6.01 PM 25-Feb-2013 from Satish Dhawan Space Centre at Sriharikota, 100km north of Chennai. The 44.4m PSLV carrying a payload weighing 668.5kg lifted off from the launch pad. You know this is 22nd consecutive success — also marked the second highest number of satellites being flown in a launch vehicle by the Indian Space Research Organization (ISRO). This makes us confident and proud over and above helps to earn foreign currency, such is dynamic and important is your physics subject.

Elasticity:

For making building, fly-over, bridge how does civil engineers works out what kind metal beam required for making it stable?



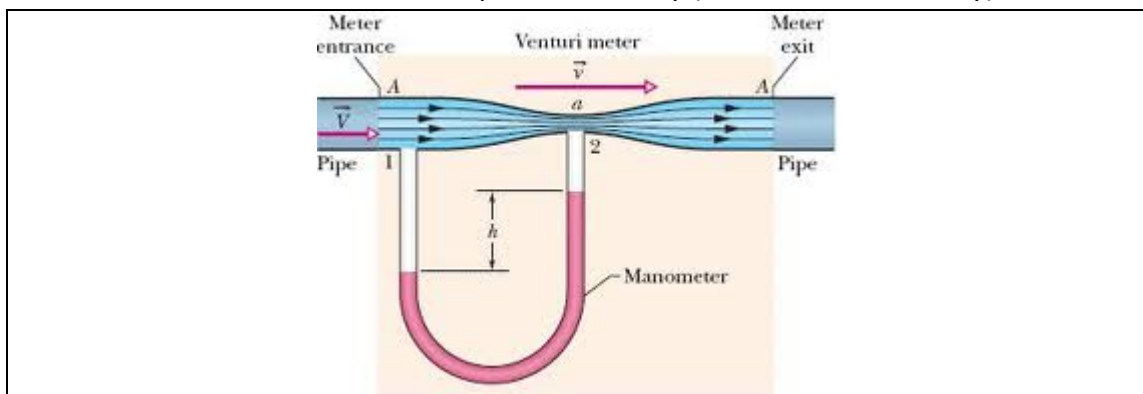
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Surface Tension:



Why hot coffee/tea appears for teasy? Why water when sparkled takes shape of small spheres (droplets) ?

Viscosity: We know that if we fall from a wall of height 4 m we will strike ground with less speed than if we fall from a height of say 10 m. So with this reasoning water drops are falling from a great height, why it is not taking the speed of bullet? You will find answer of such facts in the chapter of viscosity (read terminal velocity).



If you are using finit spray to get of mosquito have you ever wondered how does not it work?

Now very useful facts:



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Why we are told not to stand near a running train? I will use this opportunity to explain this here as it will help you to understand the reason. When train moves speed of air is very high, physics says product of speed and pressure should remain same. So if speed is high, pressure has to be low then only balance will be maintained isn't it? naturally surrounding pressure is more, as per natural law air travels from the region of high pressure to low pressure hence air at the back of yours will try to rush in towards train, you will feel a force pushing you towards the train, so you should not stand in railway platform close to running train. So knowing this fact I think now you will feel the thrill of this subject.

Errors in measurement:

Now take the case of pendulum, say first 20 oscillations you measured took 23 seconds, what we do? We repeat such observation to more number of times say next 20 oscillations took 22 seconds, next 20 took 24 seconds, next 20 took 21 seconds. To know exactly what time it takes for 1 oscillation we find the mean (arithmetic average) then divide by 20 to know time period. Thus statistics helps to reduce errors in measurement.

Units and dimensions:

It helps to establish relation between physical quantities, finding units of physical quantity, knowing whether given relationship is dimensionally correct or not.

Vectors and Scalars:



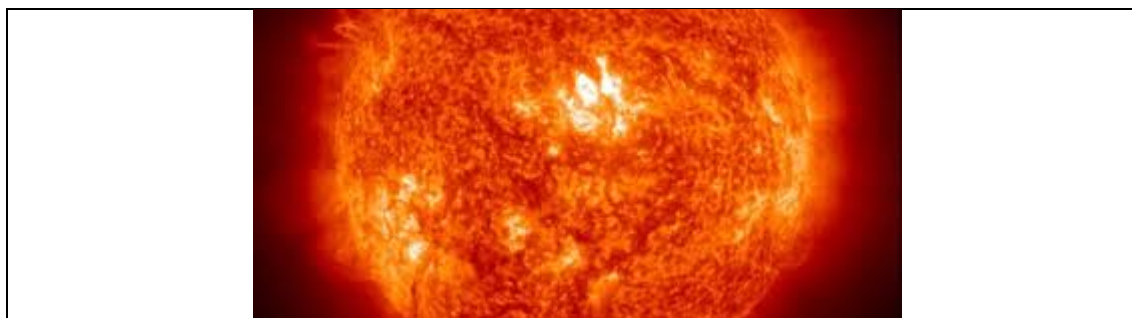
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Do you play carom board? Sometimes we strike in such a way that side push of striker lets coin pocket. At what speed, which direction you should play the shot to get resultant motion in desired direction physics helps you to understand this. (see component of a vector).

Heat:

Thermometry: When your temperature is high, it is thermometer you look for? it measures your body temperature. It is based on principle of volume expansion of Mercury with temperature, as temperature rises so is its height? Nowadays of course people are using digital thermometer so need not bother to see the very faint mercury column of thermometer and shake it again and again.



Temperature can be measured more accurately using other technique, physics helps you to measure temperature of furnace (say 2000 degree Celsius), surface temperature of Sun (about 6000 degree Celsius), core temperature of sun few lakh degree Celsius, isn't it interesting that you can measure temperature of distant object using the concept of radiation?

Calorimetry: Here you will learn that ice absorbs heat to convert to water, water absorbs heat to raise temperature up to 100 degree Celsius, and again it absorbs



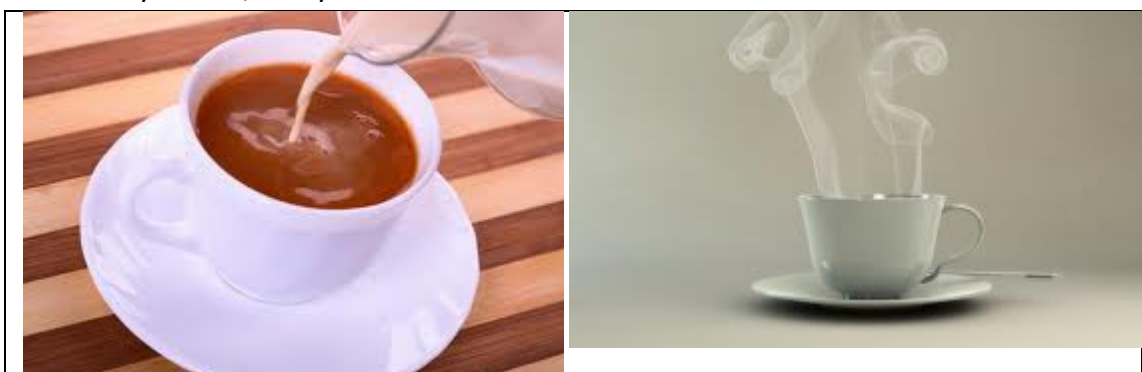
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heat to convert for 100 degree Celsius water to 100 degree Celsius steam. Heat required for state change i.e. ice to water, water to steam is called latent heat.

So if two non reactants say water and steam, water and heated iron ball, ice and water are mixed, you know their initial temperature, with the knowledge of physics you can guess the resultant temperature of mixture. It appears very odd why we should go for such activity but remember this is only working out principles, actually with this method you can find out how much heat required to raise temperature of given mass of solid/liquid using the principle of calorimetry. We call it specific heat capacity. You can also find how much heat required for changing state solid to liquid, liquid to gas.



Engines: Here you will come to know how the steam engines works, its efficiency. How the complete wheel moves one cycle. Of course here we will tell you about Thermodynamics, study of heat while in motion.



Cooling laws: Now it will attract your attention, say your guest will appear in 5 minutes, you wish to server hot cup of tea. You have half cup cold milk, half cup hot liquor. What should you do? Should you wait till your guest appear then mix up cold milk with hot liquor or you will mix now?

Again our Sir Isaac Newton gave the basic laws and told rate of cooling is proportional to difference of temperature. In this case if you keep hot liquor for 5 minutes, it will cool down very fast, but if you mix cold milk with hot liquor this will



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reduce temperature of mixture hence temperature difference will be less and cooling rate will be less so it will remain hot till your guest appear. Isn't it very practical where physics helping you to widen your common sense to server better?

Light:

Our eye:

One of the beautiful things you have is normal vision, your eyes helps to see things as it is. In physics you will come simple idea about how image forms with eye lens at retina, how your eye muscles (ciliary) muscles adjusts curvature of your eye lens when sometimes you see moon, stars (distant objects) then you read books (nearer objects). If your image goes behind retina how we can correct using lens also if image falls before retina then what type of lens required, what should be the power? Believe me all this things actually you can solve if you love physics.

Microscope/Telescope:

Want to view smaller objects using microscope? here you will come to know how lens in microscope produces magnified image of small objects. Go to depth of this chapter, your expertise level will become such that you can solve numerical problems as if you can construct of your own microscope.

Viewing rock show/watching cricket in ground/watching eclipse/conjugate stars you require telescope, once you devote 3 to 4 hours, you will come to know how does telescope (astronomical for stellar objects , terrestrial for objects on earth) works.

Velocity of light:

How can we measure such a huge speed? 1 lakh 86 thousand miles per second, don't worry read 2/3 hours you will come to know in detail.

Theory of light : Very interesting reflection,refraction,interference,diffraction all such light phenomenon explained.

Sound:

Very interesting part of sound is how to design auditorium, movie hall, conference hall. So next time if you find noise in your classroom think for a while whether room is constructed as per acoustically norms or not. In musical instrument section you



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study vibration of air columns. Open organ pipe and closed organ pipe, which sounds sweeter sound.

Approaching trains whistle frequency appears continuously increasing, receding trains whistle frequency appears continuously decreasing. This is Doppler's effect.

Using Doppler's effect of light, temperature of distant stars can be determined. I really enjoyed this part of physics, now I had no mystery of unknown in this horizon of science.

One tuning fork vibrating in front of a wire clamped at both ends can force the wire to vibrate, here you will come to know about free, forced vibration and Resonance.

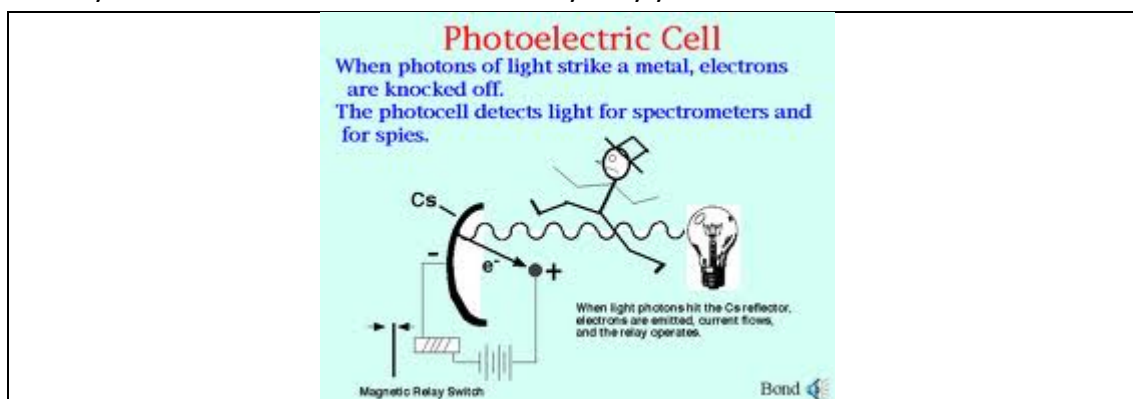
Electrostatics:

Can charge be stored? Yes using capacitor you can store charge? How does capacitor work, on what factors or parameters of capacitor charge storing capacity of capacitors depends. Have you seen opened radio, TV or any electronic circuit, capacitor is one of the components of electrical circuit. So you will come to know various types of capacitor, internal construction, theory behind stored charge.

When two charges are equal and opposite and placed at small distance apart we call it dipole, this is very important. Once you understand dipole many basic facts of chemistry will become easy for you to understand.

Modern Physics:

Here you understand Atomic structure. Mystery yet to be solved.

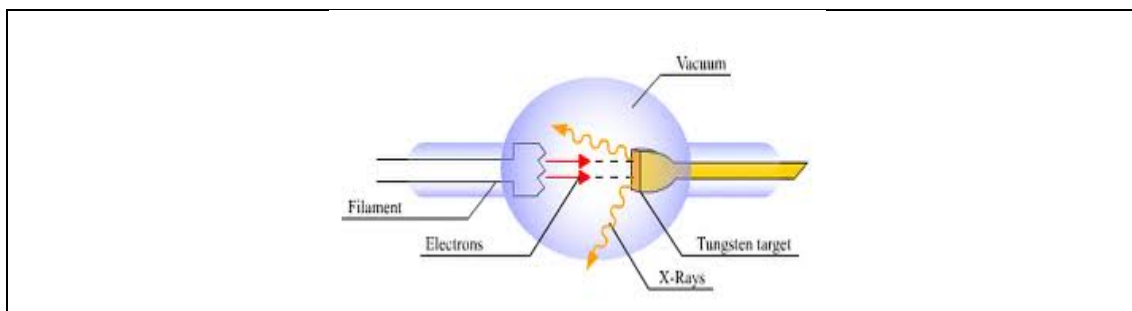




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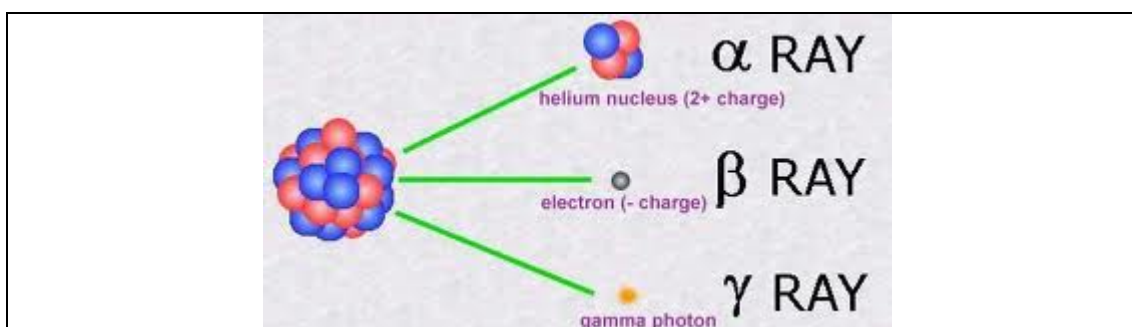
Photo electric effect: Have you seen clapping switch, one of my friend once did this project (practical) i.e. when you clap your house hold tube light/bulb will be automatically switched on. If you again clap it light will be switched off.

Have you seen street lights automatically switched off at day time but if it is cloudy day and vision is not clear (foggy) it automatically switched on. This happens through photo-electric cell. In physics we say when light incident on certain metal electron gets emitted, phenomenon is call photo-electric effect.



X-ray: How it emits, actually high speed electron when enters to the electric field of electrons its velocity decreased, energy decreased, decreased energy comes out in the form of radiation (X-ray), once struck the orbital electrons of target, hit electrons go to higher level, electron jumps from higher level and difference of energy emitted in the form of X-ray (more you will read when time will come).

When I studied this chapter, I was thrilled that I actually came to know the construction, mechanism, theory behind producing X-ray. Once it was a mystery and black box, it is crystal clear after reading 12 std. physics. In brief if high speed electron try to penetrate other orbital electrons electric field it gets resistance and its kinetic energy reduced, reduced kinetic energy comes out in the form of X-ray. Again once bombarded with target atom, transfers its energy, orbital electron absorbs energy and jumps to higher energy orbit thereby creating vacancy, this vacancy filled up by higher energy level electrons, moment these higher energy electrons comes to lower energy orbit, lost energy comes out in the form of X-ray. X-ray produced in such a simple technique.





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Radio-activity: Often we see such news that age of this tree is 4000 years, how can determine age of tree? you will come to know about this simple technique called radio-carbon dating.

Simply by changing atomic configuration i.e. by bombarding with atoms we can change the element itself.

We know world is now searching for alternative source of energy, petrol, coal, gas all together is not enough to meet our energy requirement. Though we are tapping solar energy, trying biological gas as alternative source of energy but one thing which actually coming up to every scientist mind is Nuclear energy. Energy through fission. When you will go through this chapter you will surprise to find 1 gm of uranium can give equivalent energy which can be produced by burning few Metric Tons of coal. How much metric ton of coal? This calculation I left it to you.

Digital-electronics:



It's a era of computers, ipad, notepad, but basic is 0 and 1, conversion of information to binary numbers. Central Processing Unit is a great boon of physics.

Hope you have realised importance of electricity and magnetism in our day to day life.