

VIDEO SPEECH TRANSCRIPTION/TRANSLATION OF THE WINNING PROJECTS VIDEOS (ENGLISH)

“Hot or cold? Use the thermometer” IES Benlliure (Valencia) ([VIDEO](#), [TEXT](#))
PRIZE, PHYSICS DEMONSTRATIONS CATEGORY - ESO 2015

We're students of the S. Benlliure from València, in the 1st year high school (“3º E.S.O.” in Spain). We're Estibaliz Dorado, Adrián Chust, Ismael Gisbert and Sandra Martínez. Our project is called “Hot or cold? Use the thermometer” Hot or cold? Since we're kids we all have the feeling of what is hotter or what is colder. But why is that? It is due to the fact that in our organism we have the thermal sense, which is related to the touch. But this is subjective, so is it enough for science? No, in science we measure properties, that is, we use magnitudes. And when we talk about hot or cold, we refer to the temperature and to the instruments needed to measure it: thermometers. We said that the temperature is the magnitude which gives us the feeling of hot or cold, so we're going to try to define it. According to the kinetic-molecular theory, matter consists of particles in continuous movement. The velocity of these particles increases or diminishes with temperature. That's why we say that it's related to the velocity of the particles of a system and it doesn't depend on its size. How does a thermometer work? A thermometer is an instrument by which we measure the temperature of a system that is in contact with it, in thermal equilibrium. And what is thermal equilibrium? When we put in contact two systems at different temperatures, the particles of the hotter system go faster and they transfer energy to the particles of the colder system. The transferred energy from the hotter to the colder system is called heat. First we tried to reconstruct the thermoscope that was made by Galileo in Padua. This consists of a bulb with air and a recipient with liquid. By heating the flask, what we do is increasing the pressure. That is, the particles collide faster against the walls and it needs to go out from somewhere. From where? From the capillary, pushing the liquid downwards. When we take out the heat it's produced a suction effect which makes it to go up. It not only depends on the variations of temperature of the bulb, but also on the atmospheric temperature. This is the Galileo's thermometer, we didn't build it nor did Galileo. It was built by Ferran II of Medici around the 1654. It consists of a tube with both sides sealed, which makes it independent from the external pressure and it has alcohol inside and balls with different masses of liquids. When changing the temperature of the alcohol, it changes its density and floatability. The one which marks the temperature would be the inferior one of the superior group, or one of the neutrals if it were left to the half. In this case, it marks 24 °C. Then, we tried to make a thermometer built with a plastic bottle, but we found a problem. The walls aren't rigid, so when making pressure the liquid is increased. The thermometric variables are the volume of the liquid and the volume of the gas. Therefore, when heating the recipient, it not only depends on the volume of the liquid, but the air also pushes upwards. That's why we decided not to calibrate it and leave it as a thermoscope. Afterwards, we built another thermoscope using a flask, a holey top, a capillary and a colored liquid and we left air inside. What happened when we tried to calibrate it was that the liquid went out. We found out that there affected two thermometric magnitudes, the increasing of the volume of the liquid and of the gas, when increasing temperature. That's why we also left it as a thermoscope. Then we

separate the air and the liquid in two different recipients. It goes up when we heat it. We calibrated it from 20°C to 30°C. Even if it's a very small interval of temperatures and it's not very effective, we know that when calibrating it, it's already a thermometer. After that we make a liquid thermometer and we achieved to take out all the air from inside. The first try was with an Erlenmeyer flask like this one, but the quantity of the liquid was excessive, so getting the thermal equilibrium was very difficult. So, we decided to diminish the quantity of liquid putting a recipient of 50 ml of a medicine. We calibrated it using the melting and boiling points of the water, using baths. For the ones of 0°C we employed a recipient of water, salt, hash ice. And for the one of the 100°C, one of boiling water. According to Celsius, between these two marks of reference there should be 100 subdivisions, but we decided each mark to be 25°C. And when calibrating a thermoscope, we get a thermometer. My classmate Sandra said that Celsius employed a point of reference for his scale, the melting and boiling points of water and that this last one was 100 degrees in his scale. So let's do the following experiment. Let's heat water up to 100°C and close the top of a thermometer. Soon we see that it stops boiling, but when we cool it we see that it boils again, and that it would carry on boiling even below 60°C. That's what happens when heating first the flask, the gas that was inside expanded and it went out from it. Then, when cooling, it has been compressed and it made lower pressure on the liquid. In way that the particles of water need lower energy to change to the gaseous state. That's why we say that the boiling temperature of water is 100°C with one atmosphere of pressure. Afterwards, we made four thermometers with four different thermoresistances. We got three linear ones and the other one exponential. We covered them with Teflon and we calibrated them. We got different graphs and we can show them. We're going to use the exponential thermoresistance, which is this one, and when putting it inside a bath, it would mark a resistance both in NTC as in PTC. The NTC would be the ones that got down the resistance when increasing the temperature, and the PTC the ones that got up the temperature with the resistance. So it marks a value of temperature and we could take the value of the temperature with the graph. We first made the graphs as we do it in Physics, the independent variable in the x-axis, which is the temperature, and the dependent variable, the resistance, in the y-axis. But as we wanted to use the thermometer we changed the axes and we employed the independent variable for the resistance and the dependent one for the temperature. In conclusion, in this work we learned that in science we can't say that a system is hot or cold, we have to measure its temperature. For that we employ thermometers and they've evolved along the history of science. A thermoscope tells us if the temperature changes, but it's not enough. We need to get a value and for that we need to calibrate it to get a thermometer.

“Weigh your own force” Centro Educativo Gençana (Godella) ([VIDEO](#), [TEXT](#))
HONORABLE MENTION, PHYSICS DEMONSTRATIONS CATEGORY - ESO 2015

Now we'll present to you our project called “Weigh your own force”, which has been carried out thanks to the help of our teachers of physics and Technology, who are Bibiana Moreno and Miguel Zahonero, respectively. Did you ever get wrong when saying “My weight is...” when it actually is mass. Did you ever wonder what your weight in another planet would be? Does a body have to be bigger in order to weigh more? Up coming next we'll answer all these interesting questions for you. First we're going to begin by a demonstration to explain the concepts of mass, weight, volume and density, which are the principal properties of matter. And in order to help us with this explanation we'll use these pieces here. The mass is simply the quantity of matter that a body has and the volume is the space filled by the body. If we observe the pieces we have here we can see that they have different volume, but if we weigh them we would see that they all have the same mass. However, these other pieces here have the same volume but different mass. What is weight? So, weight is the force by which a celestial body is attracted to another one. It's measured in Newtons and the instrument we use in order to measure it is the dynamometer, which is this one here. These pieces here, as they have different masses, they weigh different Newtons. In this case, this one weighs 2 N, and this one weighs 0.4 N. The density is the relation between mass and volume and in the International System it's measured in kg/m^3 . With this experiment here we wanted to show what force you should make to lift a bottle of 0.25 kg in Uranus. Here in Saturn, in Jupiter, in Mars and in all the other planets. In order to do that, we had to base it on the formula of weight, which is the mass times the gravity of the planet. Then we had to multiply the 0.25 kg times the gravities that we have here. As we wanted to represent the force you had to make, we had to change the mass, and for that we had to divide the weight in the planet by the gravity in the Earth. And lastly these planets are ordered by scale taking as reference that the distance between Venus and the Earth is of 1 cm. Finally, in our last explanation I would like to answer the question of whether a body has to weigh more because of the fact of being bigger and what it depends on. If we take these two planets we could say that the biggest one weighs more, whereas if we weigh them, the smallest one would give us a higher feeling of weight. Actually, the eight ones weigh the same. And which is the aim of doing this? To represent the average densities of each planet. What we did was first taking the densities of each planet in kg/m^3 , then passing them to kg/cm^3 , so as to have the volume in these units. Once we have these data and with the mass of 0.25 kg, we could invert the formula of density: density equals to mass divided by volume. And we said it was volume equals to mass divided by density, which gave us those data in cm^3 . After that, as we wanted to know the edge in order to do the development and then build the cubes, we did the cubic root of each of these data we got. And finally we concluded that the smaller the volume with a fixed mass, the bigger the density. The bigger the volume with a fixed mass, the smaller the density. With this, the Earth is one of the smallest planets, but also it's the densest of all of them. Whereas Saturn is one of the biggest ones but it's the least dense. And as a conclusion, we would like to say that for us astronomy is a good

pretext to affirm and consolidate, while we know better our place in the universe, such important concepts but at

different concepts as they're mass, weight, volume and density. Thank you for your attention and we hope you liked it.

“Imitating a radiotelescope with sound” Centro Nuestra Señora Del Socorro (Valencia) ([VIDEO](#), [TEXT](#)) HONORABLE MENTION, PHYSICS DEMONSTRATIONS CATEGORY - ESO 2015

Our experiment consists of imitating a radiotelescope, which is an instrument specialized in receiving frequencies of weak intensity. They work with light waves, and we're going to work with sound waves, which even if they're waves of different nature, they still have the same property of reflection that all the waves have. Analyzing the spectrum of sound of this room we can see that the intensity of the lowest frequencies is the strongest and the frequencies of the strongest intensities are lower. That's why we're going to use very high frequencies for our telescope, which are the least used ones now. The intensity of those frequencies in relation to the noise of now is going to give a very high ratio, which is going to allow us to work with it. In order to catch well the signal we put a frequency filter which allows us to focus on a range of frequencies to detect only our signal. As we're going to use a signal between 18500 Hz and 19500 Hz we can see the signal perfectly. As we're going to see now in the screen, with the filter we can see the frequency perfectly. It's seen a peak which can be distinguished clearly from the high frequencies and that will allow us to carry out the experiment well. First, we measure the level of noise that is seen at high frequencies, where we decided that our telescope will work at: 18500-19500 Hz. Any signal below that level won't be detectable by our device. We use this interval because, even though our signal is weak, it also will be more detectable. With our antenna already built, the first operation is looking for our star. For that we had to learn that parabolic antennas which normally are used to detect signals via satellite are designed with their focus out of the center of the parabola, so that not to cover the antenna and not to tilt it very much. In order to put the antenna in horizontal is needed to tilt it about 22° as ours, and not to hit the antenna against the stick of the pole we'll invert it and we'll put the focus up. Now someone sends a frequency and we have to be able to determine the range and calculate the SNR of our signal. Now if they get closer very fast, we would see how the lower frequencies turn out to be higher. And the opposite, if they get farther, the frequencies would turn out to be lower. That is called “Doppler effect”, and it's been used in real telescopes and has something to do with the universe expansion. To simulate our star we're going to use this speaker which will allow us to emit high frequencies, and with a mobile phone and an application we can control the emitted frequency. So, we'll go far, to emit and receive it well. I'll tell you some of the uses it has, for instance, there are people which use quasi inaudible frequencies for computer science pirating, to spy, or to listen to nature, for example. Now a final reflection, for instance, that telescopes are placed far



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from the focus where people normally live, frequencies aren't emitted in a natural way by the atmosphere and that it's important for the frequency filter to isolate our signal from the environmental noise.

“IMAGEN-ADAS” Centro Educativo Gençana (Godella) ([VIDEO](#), [TEXT](#))
HONORABLE MENTION, PHYSICS DEMONSTRATIONS CATEGORY - ESO 2015

Hi, I’m David Pla. I come from Gençana School and our project is called “IMAGEN-ADAS”. We all have instruments in our daily life, the performance of which is based on lenses, such as eyeglasses or a magnifying lens. But we’ve never gotten into their physical principles. In this project we pretend to get into the physical principles of lenses, especially the convergent ones. For that, we developed two experiments: the building of two telescopes, one terrestrial and the other one astronomical, and the building of an optical bench. With this optical bench we’re going to calculate the focal distance of the lenses employed in the telescopes. Before beginning to explain it, you have to know two basic concepts, which are: focal point and focal distance. The focal point is the point of the optical axis where all the rays of light coming from the infinite converge. In this experiment we observe very well that the focus would be this point here. The focal distance would be the distance between the lens and the focal point. Our experiment of the optical bench consists of a source of light, a lens, a slit which works as an object, and a screen to visualize the image plane. To understand how images are formed, we draw several ray diagrams, which we have at our back. We see how the created image can be real. Here, for instance, the image has the same size as the object. In this case the image is formed with a bigger size than the object and it’s a real image. And in the case the image is virtual, it’s because the object is placed between the focal point and the lens, so it’s formed with the continuation of rays, as we can see here. With our experiment of the optical bench, which is this, we’ll calculate the focal distance of the lenses used in the telescopes. For that we use the following equation:

$$\frac{1}{s} + \frac{1}{s'} = \frac{1}{f'}$$

You need to know that s is the distance between the lens and the object, and s' is the distance between the object and the screen. We took different measurements of s and s' , and we calculated the average value to obtain f' . With this experiment we obtained the focal distance. Afterwards, we built these telescopes, one terrestrial and the other one astronomical. The terrestrial one consists of three lenses and here you can see the axis, which can be tilted, a wheel to focus the image and a screw with no end to move it horizontally. The astronomical telescope has the same mechanism but it consists of two lenses and it gives an inverted image.

“Electric generators” IES El Clot (Valencia) ([VIDEO](#), [TEXT](#))
HONORABLE MENTION, PHYSICS DEMONSTRATIONS CATEGORY - ESO 2015

We’re students of last year of middle school (“2º E.S.O” in Spain) from “El Clot” High School and we’re Carlos Fernández, Néstor Freixa, Belén González and Clara Martínez.

Our tutor is Jose Luís Marqués and we came to explain electric generators and their performance. The electric current is due to the motion of electric charges inside a material.

We have two types of currents: alternating current and direct current. The direct current is due to the motion of a flow of charges in the same sense. However, in the alternating current they change of sense many times per second. An electric generator is every device capable of maintaining a voltage difference between two points, transforming in this way the mechanical energy into electrical energy. We created an alternator, which transforms the mechanical energy into electrical energy, some batteries that transform chemical energy into electrical energy and a photoelectric cell which transforms light energy into electrical energy. I’m going to explain what an alternator is. An alternator is an electric machine which transforms mechanical energy into electrical energy. In Europe it’s commonly used with a frequency of 50 Hz, that is, which changes its polarity 50 times per second. In the beginning alternators were based on Faraday’s law, which consists of the fact that a conductor under the action of a variable magnetic flux will transform into electric tension. In order to change the flux we can change the angle between the magnet and the coil. The bigger the speed of the magnet, the bigger the potential difference. This is a photoelectric cell. A photoelectric cell is an electronic device which allows to transform the light energy into electrical energy through a copper plate and another one of rusted copper, which contains copper oxide and it’s a semiconductor. That means that if it gets illuminated, it’ll produce electrical energy and if it’s not, it won’t. This is a galvanic voltaic cell, which is a electrochemical cell which obtains electrical energy from the oxidation-reduction (REDOX) chemical reactions which take place inside it. In the REDOX reactions electrons are transferred from some reactives to other ones. If these electrons circulate within a conductor we have an electric current. Normally it consists of two different metals connected by a salty bridge. This is not the type of battery we use at home, which has a unique galvanic cell, but another type of battery which consists of several cells. We got the conclusion that it’s possible to transform different types of energies into electrical energy.

“Man overboard” Colegio San José de la Montaña (Chestre) ([VIDEO](#), [TEXT](#))
HONORABLE MENTION, PHYSICS DEMONSTRATIONS CATEGORY - ESO 2015

We’re students from the “San José de la Montaña” School in Chestre and we come to present the project “Man overboard” which is based on the Archimedes’ principle. I’m David. I’m Clara. I’m Laura. And I’m Jose. Laura is going to explain to you what the Archimedes’ principle is. As we know, Archimedes’ principle describes how a body totally or partially immersed in steady water suffers a buoyant force, from the bottom upwards, equal to the weight of the fluid volume which is displaced. We took this principle to daily life, applying it to a life jacket. For that, Clara is going to explain how we built it. In order to do this life jacket, we simply used recyclable materials and here we have an explanation of what we used. Here we have the bottles of water, which we introduced in the pockets of our T-shirts. Apart from that, we also added a harness here,

because the more close-fitted it'll be, the bigger the floatability of the jacket will be. And

this is the result of our jacket. We always thought about the environment and we used recycled material for that. Now we're going to explain the floatability condition. As we well know, the bottles are going to give us the necessary buoyant force to be able to float. For that we also discarded the same life jacket we already wear, which is the air volume inside our lungs. The pushing necessary to float is given by the bottles full of air. And now we're going to explain the two ways of building our jackets. As we said, the first one is putting the bottles inside the pockets here, or cutting some T-shirts by the half and making some inner pockets and sewing two T-shirts with the bottles in between them, and putting here the harness so as not to let it go away. But, we'll ask ourselves, how many bottles do we need? For that we will only need some calculations with which we'll check our corporal mass, our corporal density and the volume of our lungs. We calculated the average volume and it's 5.2 L. With the corporal density there is also an average value. Using these calculations we got these notes. Here it's all tested. And we checked that a person with a mass of 60 kg will need around 1.5 L in order to float. Therefore we put bottles of 0.5 L inside each pocket, but because of the security factor we multiplied it by two, because imagine we're in a cruise or anywhere and we never know our exactly corporal mass, because it can change from one day to another. The security factor is very important because that can save our life or cause our death. So, this is our project and we hope you've enjoyed it.

“The dark side of Light” IES Benlliure (Valencia) ([VIDEO](#), [TEXT](#))

HONORABLE MENTION, PHYSICS DEMONSTRATIONS CATEGORY – “BACHILLERATO” 2015

We're a group of students from 3rd year Benlliure High School (“1º Bachillerato” in Spain). She's Sofia, she's Reyes, she's Samira and I'm Irene; and our project is called “The dark side of light”. So, why the dark side of light? Well, the light has properties that we see directly with our eyes, as color or intensity. But we can't detect if its electromagnetic field is vibrating in one way or another, if it is changing, etc. That is, the so-called polarization, which I'm going to explain, we can't detect it directly with our eyes, therefore, we called it “The dark side of Light”.

The aim of this work is explaining what the light and the polarization are, apart from seeing what uses they have. We'll observe and analyze some phenomena from daily life where polarized light appears. We will show a home-made polariscope to study the photoelasticity of some materials; and we'll relate Optics to chemical analysis, making and using two polarimeters. So, what is polarization? To understand polarization, first, we have to know that light has a double nature: it acts as a wave and as a particle. Therefore, we can explain polarization taking light as a wave and as a particle, but we're going to explain it only from the point of view of acting as a wave. The light appears as a transverse electromagnetic wave, that is, it doesn't need a material medium to propagate and it vibrates in all the planes of the space perpendicular to the propagation direction. If light is in such a way we said, something which vibrates in all



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the planes of space, we have the so-called natural light. But if in some way we get it to vibrate in only one plane, we will obtain polarized light. So, we talk about polarization when we get light to vibrate in only one plane of the space.

Polarization can be achieved by absorption, reflection, birefringence or scattering. Polarization by absorption is obtained by these polarizer filters or Polaroid.

This grating is a big scale representation of a chain of polymers. These would be the chains of polymers. All the waves that vibrate in perpendicular, in the so-called transmission axis, would pass through, however, the ones that vibrate in parallel would be absorbed. Therefore, we get polarized light from natural light. This polarized light vibrates in only one plane and with a lower intensity because part of the initial light has been absorbed by the polarizing filters. So far, all of this is clear, but what would happen if we put another polarizing filter to the already polarized light? If the two filters have the same orientation, the light that would pass through the first one, will pass the second one as well. But as we turn the orientation of the second one to a 90° angle, we are losing intensity, obtaining the so-called crossed polarizers, which block completely the pass of the light. This would be the polarization by absorption. Other ways of obtaining polarized light is, for example, the polarization by reflection. When natural light reaches a flat surface which acts as a medium of separation between two other media, the light suffers simultaneously the phenomena of reflection and refraction. When the reflected and refracted light form a 90° angle, the reflected light is totally polarized. But if they form any other different angle, it is partially polarized.

The point is that any reflection which reaches us is already partially or totally polarized, so we can eliminate it with polarized sunglasses, which have two vertical polarizing filters; and to test they're polarized we can use the method of the crossed polarizers, which my mate explained. Another kind of technological uses of polarization are the polarized filters that use the cameras to eliminate the reflections. For example, you can see how the polarizing filter of the camera eliminates the reflected light on the glass cabinet. Another way of obtaining the polarized light is scattering. When natural light reaches a particle, it absorbs the light and radiates it in all directions with incoherent and not polarized patterns, except for the perpendicular directions to the propagation direction of the original wave. For instance, a scattering polarizer would be the atmosphere which surrounds us, due to the air particles. And finally, the polarization by birefringence is only produced in materials as calcite, plastics under stress or cellophane.

And what is birefringence? Birefringence is the capacity that some materials have to modify the speed of light depending on the angle of propagation of it in the material. Due to this difference of velocities a mismatch between the light waves is created that we observe as colors after an analysis with the analyzer. The more colors we visualize in a birefringent material, the bigger the tension it suffers is.

This technique is very useful in the fabrication process, because with it we can study the tensions in a birefringent piece. Ford uses this method to find out the tensions that a car glass stands, for example.

So far, we have talked about the types of polarization and one of its applications, as the polariscopes. Now we are going to talk about polarimeters.



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And what is polarimetry? It's the measurement of angular rotation of polarized light by an optically active substance. That is, a substance capable of turning the plane of polarization of the polarized light when it passes through it. Because of that, we use polarizers. We built a vertical one and a horizontal one. We begin with the vertical one. The polarimeter consists of a source of natural light, which has a polarizer on it. In the middle we will put the substance under analysis and where the goniometer is placed we

will put an analyzer. We will put the goniometer at zero and we see that it's dark. But at the time of placing an optically active substance, as saccharose, we see that light passes through again. As saccharose is a dextrorotatory substance, we turn the goniometer clockwise until we see it dark again. And thanks to that, we determine its rotatory power. If we change and we put fructose, which is also optically active, we see that the same happens, but as the fructose is a levorotatory substance we would have to turn the goniometer in the opposite sense. In the horizontal polarimeter we didn't need to put any polarizer, because the light emitted by the laser is already polarized. When we have a not optically active substance as water, when the goniometer is at zero, we don't see any light on the screen. But if we put an optically active substance, now the screen is illuminated and we can proceed in the same way as with the vertical polarimeter. With this experiment we also tried to determine the concentration of sugar in some fizzy drinks as Seven-up and a sweet liquor and we didn't get the same results that the manufacturers mention. We think that this is due to the fact that our polarimeters are elementary, thus inaccurate, or because the analyzed drinks may have not only saccharose but other active substances with different rotatory powers.

“Tube of Quincke-Sound velocity measure” IES Número 1 (Jávea) ([VIDEO](#), [TEXT](#))
HONORABLE MENTION, PHYSICS DEMONSTRATIONS CATEGORY – “BACHILLERATO” 2015

Hi, we're from the number 1 of Xàbia High School. I'm Arthur Knegtel, he's Héctor Cruañes and she's Andrea Romere. The objective of our research is measuring the speed of sound. For that, we built this device which inserts a sound wave which is bifurcated in the two sides and afterwards it comes here, it adds and produces interference, which are recorded by the microphone and taken to the oscilloscope of the computer. The experiment is called “Tube of Quincke” and it allows to measure the variation in wavelength, as we can see here. Then, knowing the frequency that is given by the alternating source of frequencies, we can calculate the speed of sound. It's built with tubes of PVC of 60 cm, 40 and 60 cm, forming two “U”s. And we also have in one of the sides, two extra tubes of PVC, with a lower diameter with which we can change the wavelength. What happens here is that we produce waves from the speaker, they go upwards and they get together in the microphone, and then two things can happen, a destructive interference when the peaks attack each other or a constructive interference when the peaks help each other and then we hear it higher. What do we do? We measure the first destructive interference which is when it's heard lower and the second time which is heard lower. Thus it matches with the wavelength. As we said previously, the aim is calculating the speed of sound. For that we'll put a frequency given by the source



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of alternating current and we'll calculate the wavelength with the distance that we have to lengthen in order to calculate two destructive interferences and consecutive. Let's do a demonstration. What we do is keeping opening the tube and when we find the first destructive interference we write down the distance. The first length is 7.5 cm. Now we're looking for the next destructive interference. 17.5 cm. Now what we'll do in order to calculate the wavelength, we'll do a difference: $17.5 - 7.5 = 10$ and we multiply by 2, because both tubes have been lengthened the same distance, so we get 20 cm. Now we substitute in the equation of the

speed, which is the wavelength in meters (0.2 m), times the frequency in Hz, which in this case is 1701.12 Hz. We do the operation. $0.2 \text{ m} \times 1701.12 \text{ Hz} = 340 \text{ m/s}$. The speed which is found in the books, the tabulated one. To affirm our calculations, what we did was a graph as far as the wavelength is concerned and the periods. And with a linear regression, which is a mathematical method which relates variables, we got a straight line where the speed is 347.9 m/s and with a correlation coefficient of 0.99. The conclusions we got are that we can't use the voice in order to do this experiment because the voice is a superposition of waves and it's not a constant sound.

With the plot we had a correlation coefficient of 0.99. That affirms the dependence of the wavelength with the period. Finally, our range is between 1000 and 2000 Hz because below that we can't calculate the destructive interference because the dimensions of the experiment aren't adequate for it. And over that, changes are produced in the frequency that we think are due to the alternating current.

“Rings of Thompson” IES Massamagrell ([VIDEO](#), [TEXT](#))

HONORABLE MENTION, PHYSICS DEMONSTRATIONS CATEGORY – “BACHILLERATO” 2015

Hi, we're María, Claudia and María, from Massamagrell High School and our experiment is titled “Rings of Thompson”, which consists of making metallic rings levitate with a coil connected to the network and inside it we find nucleus of iron. The theoretical basis of our experiment is the phenomenon known as electromagnetic induction, which consists of inducing an electric current to another conductor, which can be the ring in this case, or a coil. The main aim of our experiment is testing how a coil by which it's circulating an alternating current generates a magnetic field around it. And the variation of this magnetic field is what generates an induced current in the other conductor. An electric current works in a similar way to a magnet. A magnet acts over another magnet around it or over another current. And it'll attract or repel it depending on its orientation. That can be shown through this brief experiment. In which, I, when closing the circuit, observe how the magnet around the circuit is attracted or repelled alternatively by the circuit. It's the same as a clip which is also attracted by a magnet. I, when closing the circuit, test how the clip is attracted by the circuit. And not when I disconnect. That current which circulates by the coil will be the one which generates a variable magnetic field because the sense of the alternating current is changing constantly, so that the lines of the magnetic field change as well. That alternating current which generated the variable magnetic field, will generate an induced current in

the other conductor. In this case it'll be our coil, which isn't connected to the main circuit and it's connected to a polypmeter. Originally it was connected to an analogic amperimeter, but the other was seen much better. But as we can test when connecting the circuit we see how changes from positive to negative values alternating because it's changing the sense of circulation. In order to perform our experiment we employed a rheostat, which is covered to avoid the danger of electrocution. We employed it to regulate the intensity which circulates by the coil. A rheostat is not more than a variable resistance, in which the bigger the intensity, the lower the resistance and the other way around. When an electric current starts to circulate by the coil that generates a magnetic field, which we will canalize through an iron nucleus. The variation

of its magnetic flux generates an induced current in the ring which has the opposite sense to that which circulates through the coil, as we can see in the following image. By being in opposite senses the currents repel to each other, that's why we observe that the ring levitates. We studied the factors on which the height where the ring levitates depend. That is, the strength that the ring experiences. We take into account that the force is proportional to the intensity of the induced current which circulates by the coil. One of the factors we studied is the number of iron nuclei. That is due to the magnetic field. The iron nuclei direct the magnetic field through them. When putting an extra nucleus, what we do is increasing a bit the intensity of the magnetic field. As the variation of the flux is equal to the magnetic field times the surface times the cosine of the angle, when increasing the intensity of the magnetic field, the flux increases, so it increases the intensity of the induced current in the ring and therefore the force which it suffers. The next factor we studied is the material of the ring. We dispose four rings made of different materials. One is of iron, which is a ferromagnetic material, inside a magnetic field it behaves in a different way. The next one is the brass, which as we can test doesn't levitate with any intensity. That is due to the fact that the resistivity of the material is very high, thus the induced intensity is too small. The one in copper, even if it has a lower resistivity than the one of the aluminium, should levitate at a higher height, but it levitates at a lower height, because the aluminium is lighter. That's why traditionally the experiment was performed with aluminium rings. The following factor we studied is the height depending on intensity. We employed this aluminium ring again and we wrote down the different heights changing the intensity. As we can test, and as we can see in this graph as well, the bigger the intensity, the bigger the height of the ring. So, we can conclude that height is proportional to intensity. That is due to the fact that when increasing the intensity, the intensity of the magnetic field also increases, and the variation of the magnetic flux increases, consequently so does the force which the ring experiences. Lastly, we studied the factor of the section. We employed these three rings of the same material and diameter. In order not to be influenced by the mass in our experiment, we adjusted the three ones to the mass of the biggest one. By section we refer to the width times the height and we employed the same experimental setup. We can see how depending on the section it levitates at different heights, as we can also test in these graphs. This is due to the fact that the section is inversely proportional to the resistance, and this one is inversely proportional to the intensity. The section is proportional to the intensity. And lastly we would like to point out how we performed this experiment at different intensities, and as we already said the height depends on the

intensity as well. If we increase the intensity, the height of the rings increases in the same measure.

“Hippodrome” IES Cid Campeador (Valencia) ([VIDEO](#), [TEXT](#))
PRIZE, TECHNOLOGICAL APPLICATIONS CATEGORY - ESO 2015

My name is Sandra and these are my classmates: Lawren, Joel and Enrique. Coming up next we are going to present the project “Hippodrome”, which we built at the Cid Campeador High School in Valencia, with the supervision of our technology teacher

Antonio Montero. At the beginning of the course we set out how to do a fun but also an instructive project. And after several ideas, we decided to do this game of horses, which we named the “Hippodrome”, which consists of three basic elements: The tracks where the horses run, the control panels with the indicators and markers of the winner horse, and finally the drawers of game, which allow to play up to 6 players at the same time. We’ll explain the transformation of the uniform circular motion to uniform linear motion. We’ll also point out the conservation of mechanical energy principle, based on the hypothesis of the inexistence of external forces. In order to put together several physical principles with the time variable afterwards. The aim of the game is obviously the fact that our horse reaches the goal the first one. The horse is displaced due to the electric energy which is activated by an electric motor as this one, which is coupled to some reducer gears, with a reduction of 23:1 to a screw with no end, which transmits its spinning to a pulley. As we can see, here we have a pulley-strap system, which transforms the uniform circular motion of the motor to the uniform linear motion of the horse. The displacement of the horses is directly proportional to the time, as far as the motor remains on. Now, Lawren will explain the physical foundations. How can you get energy for your horse? To get energy for your horse you have to make a bit of force, but only a bit. On making a force with a shovel in the direction of the displacement of the ball and realizing a small displacement with contact on the ball, we’re making a work that will be equal to the product of the force times the displacement done. This work will be an increment of the kinetic energy of the ball. Because of the mechanical energy conservation principle, based on the hypothesis of inexistent forces, as the friction, we can say that the initial mechanical energy will be equal to the final one. As we can see in this piece of drawers, when the ball falls by one of the holes, it’ll be conducted by a guided system to the aluminium lanes, closing the electric circuit which feeds this motor by this wire. The ball is going to do a uniformly accelerated motion. To achieve that the contact ball-lane becomes optimum we diminished the pendent of the lanes respect to the superior ramps, diminishing the acceleration of the ball in this way. In a uniformly accelerated motion, the time which takes to the ball to go down on the aluminium lanes will be equal to the square root of the displacement done. That is, the bigger the time the ball remains on the lanes, the bigger the time the circuit will be closed, and therefore, the farther our horse will get. If we put the ball inside the red holes, our horse will advance more than if we put it inside the green ones. The concrete times of the advances of our horses are: for the red holes, 3s; for the yellow ones, 2.4 s; and for the green ones



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1.5 s. Thanks to our device, we could transform our task of hitting balls in work for our horse. Coming up next Joel will explain to us the supply system. The supply of the system is done through a power supply recycled from a computer that we supply with this electric network. The voltage used is of 12 V in direct current, which allows the motors to turn faster, and the racing time not to be excessive. In the case that the recycled power supply gives problems we prepared an alternative supply, through an external source which is connected to these terminals. This commutator allows us to choose one supply mode or another. Now, my classmate Enrique will tell you the control system, which makes all of this possible. The control system is divided into two subsystems: the advancing and inversion of turn subsystem and the motion, stopping and signage system. The advancing and inversion of turn subsystem consists of a RLK of two commutated contacts which make the polarity of a motor of traction arrive, in the active state, forcing the horses to go in the advancing sense of

motion. When the RLK is resting, the polarization is inverted and it forces the horses to go backwards. The motion, stopping and signage subsystem consists of a commutator I_2 . For the commutator I_2 and the chain of series contacts, normally closed, of the finals of the race. When it's prepared, it activates the RLK and it forces the horses to go in the advancing sense. When a horse gets the goal, it opens its contact from the series chain of

the normally closed circuit and it makes the RLK to change to rest. Then the horses will come back, when the commutator is in the initialization position. Apart from the finals of race mentioned, two additional finals of race exist, one at the beginning and the other one at the end, so as to limit the travel of the horse. Now we're going to see it working.

"Air hockey robot" CC San Pedro Apóstol (Puerto de Sagunto) ([VIDEO](#), [TEXT](#))
HONORABLE MENTION, TECHNOLOGICAL APPLICATIONS CATEGORY - ESO 2015

Good morning, we're from the San Pedro Apóstol School, from Port de Sagunt, 2nd grade high school ("4^o E.S.O." in Spain). I'm Eric Padilla, my classmate here Vicente Catalán, David Monzón and Patricia García. Our project is an air-hockey, like the one in the recreational bars, but we changed a person by a robot. We did all of this in our Technology classes for three months, more or less. First we had the idea of making a hockey table for two people, but we searched for information and we saw a man that made a kind of project that is the one we've done, changing a person by a robot. We took the idea and we went on improving it little by little. And now my classmate Patricia will explain the pieces of the project. The materials are basically two wooden strips, between them we put four electric fans. First we had only two ones, but we saw that they didn't reduce the friction enough. So, we added more to manage to make the disk to slide better. On the other hand, there are three engines as well, which move three guide bars in the two axes, X and Y, what allows the green robot to move all around its part of the field. Finally, the camera. First we had a camera hanging from a stick, but we saw it wasn't working well, so we made a metallic structure that has a better base and is more stable.



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As my classmate explained, this is an air hockey table that we can find in recreational bars, and we have changed the player for a completely autonomous robot. The robot is connected to Arduino plate, which is connected to the computer. The computer has a program that turns the pieces of information from the camera into orders that will pass to Arduino and then to the engines, to make the engine move. All this works thanks to a PlayStation3 camera that captures all the table, records all the game and sends the video directly to the computer. In the computer we have the program that takes care of calculating the disc's trajectory, including the bounces as well, to make the robot move. It passes this trajectory to Arduino, and this to the robot. We have had problems with the light, because each time we changed position, we had to readjust the program. All this works thank to color filters, which we applied to make the camera to detect only the orange disc and the green robot. But each time we changed position, it changed the light and we had to readjust the program. In Experimenta the ceiling was covered and we could use a LED of constant light. I'm now going to explain the problems that we've had during the air hockey assembly process. The first problem we had was that at first the camera

was fastened only to a metallic stick, a bit slack. We thought to make a metallic structure to fasten the camera better and to make all the ground to be seen.

Another problem we had was the color discrimination. It depends on which type of ground is there, we have to put a discrimination or another, or change the parameters. Another problem we had was that at first we only had two electric fans below, which produced not much air up and we had to put two more of them, which made less friction possible. For the case you're in open space or under a non-constant illumination, we thought to put a constant light up there which produces a constant intensity in all the field.

"Mola que tremola" Centro Educativo Gençana (Godella) ([VIDEO](#), [TEXT](#))
HONORABLE MENTION, TECHNOLOGICAL APPLICATIONS CATEGORY - ESO 2015

Good morning, we're Sofia, Paco and Aitana, from Gençana Educational Center and we've done a project named "Mola que tremola" and that is what we're going to explain now. This is a research combined project of the areas of Technology, Physics, Mathematics and Biology and it's about showing if it's true the hypothesis that the pulse and the intuition diminish with age. In order to do this, as there are two variables, and they aren't quantitative, we designed these two experiments: the one that measures intuition and the one that measures pulse, to measure them quantitatively. We're now in the phase of compiling pieces of information, and we take advantage of this day because here there are people of different ages. And so, with the pieces of information compiled, we elaborate our own graph with the values of the mean and the median, so we can come to a conclusion. If our hypothesis is true, the graph would be descending, and if not, a rising one. Now I'll explain the more physical aspect of the prototypes. The more



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visual part when it gets moving is the helices, which will spin thanks to an outside helix connected to a gears train that multiplies the speed, connected to the engine, to a RoboPro plate and a battery. And the battery and the RoboPro plate are connected to the two inner axes. They have positive and negative poles because of electricity. And these ones are connected to the plates of the helices, turning them into poles, too, and as they are separated this is an open circuit. When a player gets the ball and throws it to the helices, these ones will get together and this will make the circuit to close. So the RoboPro plate we designed will be activated. This is the pulse detector. We have used a triangulation to support the two panels and this is an open circuit too, we only have a battery, a RoboPro plate, a ring, the wire and the handle wire. These wires are positive and negative ones, and they are open as well, and when the player fails and the two wires touch each other, the circuit will be closed as well and the RoboPro will be connected, and that's what my classmate Paco is going to explain. Here we have the RoboPro circuit of the first circuit we have shown, also named “gyrostatic” and it can be divided in several sectors, three in this case. In this sector here we have the one that controls the speeds and the engine difficulties. We can see here, the three velocities of the engine. In this sector here the score and reinitialization of the system are controlled when the helix is hit or the photocell is blocked. Here we can see the photocell and here the switch that represents the helix

fans. And in this circuit here we have the one of the electroshiver or the pulse detector which is also divided in two sectors: the ones of the points and buttons of the screen, which marks on the punctuation of the program. Now my classmate Sofía will explain to you the rest of rules of the game and how to play. This prototype, the “girostatico” allows us to measure the capacity of intuition. For that we have to throw the ball about 20 cm height, allowing it to fall preferably on the fans to count a point regardless of hitting the target or not, falling by the funnel and passing through the photocell. At our school we did a study and we took the maximum and minimum values and with that we did a valuation table of the different punctuations. This prototype, called electroshiver, will allow us to measure the capacity of pulse of a person. To do that, the player has to go along the wire trying not to touch the other wire.

In this prototype we'll have 10 tries to do the maximum punctuation possible. When we begin the first phase we'll punctuate 100 principal points to the player. Each mistake the player makes will illuminate some lights and will restart the program. After that, when it'll be about to start the second phase, we'll add again 150 points in this case and when making mistakes the ring will sound and other lights will turn on. In the third phase, we'll add again and if the number of mistakes is bigger than 10, which is the maximum, the whole program will initialize to start with a new player.

“Ocular tracking: The power of you look” IES Campanar (Valencia) ([VIDEO](#), [TEXT](#))
HONORABLE MENTION, TECHNOLOGICAL APPLICATIONS CATEGORY – “BACHILLERATO” 2015



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I'm Jorge, from the “Campanar de València” High School and I came to the Fira Experimenta to present our project of ocular tracking. I'm going to talk about the introduction. What are the ocular tracking systems? It's a type of interaction system between man and machine. And what are these? So they're the ways that a person can communicate with a computer or with machines which contain computers. From the beginning of computers, these types of interactions have been manual, because people use hands for any daily activity as working, writing, eating, etc. For this reason keyboards or the mouse have been universal in the field of interaction between man and machine. Keyboards have been the first in being developed, which is based on the old writing machines. Whereas the mouse appeared in the 60's as a result of an experiment to achieve an improvement in the interaction between man and machine. That suggested the doubt of if a person can't, because of any reason - incapacity or occupation at that moment- or he or she simply won't use, for the sake of comfort, his or her own hands to communicate with a computer, how could he or she do that? Lately, lots of types of man-machine interaction systems have been appearing with different technologies, as for example gestures, voice, ocular movements, etc. And as 2015 is the international year of light and the technologies related to light, we focused on the studying of ocular tracking systems or eye-tracker, which consist of physical devices as cameras, lenses, lights, sensors or also signal analysis algorithms to transform the information received by the camera into coordinates and to know the precision and what point he or she is looking at. That is useful to control the cursor of the computer, which is shown to be faster than doing it manually with a keyboard or a mouse, or to register where a person looks at, how long

and how. The advantages it has are that choosing with the eyes is more natural, it requires less conscious effort and it's faster, as we said. Now my classmate will explain to you how it works. Hi, I'm Jessica and I'm from the “Campanar” High School and I'm in the 2nd grade of high school (“4^o E.S.O.” in Spain). We built the operation of the ocular tracker in two ways: the one of the glasses (high-mode) and the remote one. The two of them have a camera and infrared rays on the sides. What's the difference? The high-mode has the camera and the infrared rays very close to the user. Nevertheless, the remote one has the camera and the infrared rays at some distance from the user and near the computer. We used the infrared rays so as not to damage the human sight. So it doesn't bake nor itch the eyes. It has waves of 850 nm. We had to keep modifying the frequency of the infrareds because it is different than the environmental light. Now I leave you with my classmate. I'm Francisco Guill, I come from the “Campanar” high school and I'm going to explain the two setups we made. As my classmate explained, in both of them there is a camera and several LEDs that emit infrared radiation. In the glasses setup, even if you move the head, the camera doesn't experience any displacement in relation to the eye. In the setup where the camera is placed on the keyboard position, the user has to keep a firm position and mustn't move very much so that the camera doesn't lose the trace of the eyes. Now my classmate is going to explain the applications which this has in daily life. Hi, I'm Nicolás Liu, from “Campanar” High School as well, and I'm in the 2nd grade of high school (“4^o E.S.O.” in Spain). The applications of this project, apart from easing the use of computers to disabled people, it's also designed for the ergonomics of a normal person to use a computer. This project can be also applied to several games, from the simple ones to the harder ones. These



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cameras, which detect the eye, can be used in some sports to help us, as for instance basketball, when you wear the glasses, they can help you with your aim. Also when you're reading a text, the cameras can detect the difficulties you have in the comprehension of the text and they can extract the definitions of the words and they can help you in many things.

Now my classmate Nicolás is going to do both the calibration and the test of this setup we built. Now Nicolás is going to calibrate first in order to know the quality of the reflection of his own look in the webcam. He already finished the calibration, the computer evaluated the quality as 4 stars, so now it's testing, looking at the white dots you can see, to see if the computer has a correct response. Now he's going to press a button, so that its sight can control the cursor, and then he can kill the aliens of the videogame with which he's testing the program. He looks at them, and if the computer receives it well, the point is converted into a red point. Now my classmate will press “accept”, and will give the power to his sight and will carry out the game of the aliens as we call it. Now Nicolás is proceeding to kill the aliens with his sight, as you can appreciate. He already finished, he killed the 10 ones that appear, and there is the time average he spent to kill each alien. And this would be the complete process that we came to show.

“Saving of energy through domotics” Colegio Ntra. Sra. De Fátima (Sueca) ([VIDEO](#), [TEXT](#)) HONORABLE MENTION, TECHNOLOGICAL APPLICATIONS CATEGORY - ESO 2015

Good morning, we come from the “Nuestra Señora de Fátima” School in Sueca and we're Francisco, Rafa, Belén and Elisa. We did this application more versatile so that we can understand better the mechanical transmission system, the electromagnetic induction and the programming of a mobile phone application. We also worked with the search of information, the programming of an application and the design of maps in the computer. We used materials as for instance the methacrylate painted in black. Afterwards we used plywood in order to do the walls of the house, the wire system and the motors. We also should say that the main component is this piece of Arduino, which gives Wi-Fi so that to control the rest of the house. I also want to explain the transmission of motion system implied in the door of the garage, which reduces the revolutions per minute that has the main motor so that not to close with a strong hit and become slower and steerable. We also took advantage of the physical principles of the induction in electromagnetism to explain, more or less, how do the direct current motors work. Besides, as you can see, we used the app to give controls to the house. In this way we can turn on or turn off the washing machine any other electric material. I'm going to explain you the transmission of motion system. As you can see, here there is a small scheme of this motor. You can test how the revolutions per minute at the beginning are very high, and finally the time is reduced to 8 s, the time it takes to open and close. That is thanks to these transmission of motion systems, which consist of two pinions, two



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pinions and finally a screw with no end to a corona. We also performed some practices of electromagnetism induction in order to explain how does a direct current motor work. In this practice we used a security motor which transforms 250 V to 11.5 V, and it creates a perpendicular field in these coils. In the first coil which has electric current it induces a magnetic field in the nucleus, which induces another electric current in the second one, which when switching on it turns on the bulb. And in this practice of here, we used a magnet, and when applying voltage to the battery at the borns, there are created two repulsion fields and it forces the coil to spinning. We think that we achieve to explain the physical phenomena involved in our project and that we could have added more things as for example movement detectors or sound detectors. And so far the explanation of our project. We hope you liked it. We’re going to do a brief demonstration of how does it work from the application. We can choose any room we want. For instance, the entrance which is that of there, we can turn it on or off. I’m going to explain the garage as well, as I previously said. The door opens thanks to the transmission of motion system. It has some tops so that not to go out. And afterwards we can close it in the same way. With the same system at the dining room: high, middle and low intensity. We incorporated regulators of intensity. And in the gallery as well, we put a small motor, which is this one of here. We can turn it off and on, as we want, and it is as it would be the washing machine. So far that’s all, we hope you liked it, and see you!

“Hi! Dràulica” IES Enric Valor (Silla) ([VIDEO](#), [TEXT](#))

HONORABLE MENTION, TECHNOLOGICAL APPLICATIONS CATEGORY – “BACHILLERATO” 2015

Hi, we come from the Enric Valor de Silla High School and we’re tutored by Elena Carbonell. My classmate Ángel Zanón and I, Amanda Strufaldi, are going to explain our project “Hi!Dràulica”. From the beginning of the time, people have used fluids, both liquids and gases to try to transmit movement or transform it. So, we’re going to explain two of our projects. One which works with compressed air, pneumatic, and the other one which works with liquids, hydraulics. We decided to do these projects basically because it was a way to demonstrate all of these physical principles. As my classmate said at the beginning, this machine works with hydraulics and this one with pneumatics. The only difference between both is the fluid we use. This one uses an uncompressible fluid, which is water in this case, and this one a compressible one which is air, which we compress with the aid of a compressor. Coming up next we’re going to explain the steps that we’ll do to build it and the material we used. First I’m going to explain the hydraulic hand, which at first we built on foam board, cardboard, syringe, flexible plastic tubes and also some wood sticks. But we were warned that when flexing it too many times, the articulations would lose rigidity at the time of movement. Then we decided to begin it from zero and to make it on plywood, as you can see. We chose the fluid to be water instead of oil, because at the time of doing practices we had several leaks, and we decided that as the force that we had transmitted was pretty weak, we

were spare of it when using water instead of oil. Secondly, we developed and built the pneumatic model.

It's a pneumatic arm which consist basically of plywood and pneumatic elements we got. In the beginning the model was smaller, what happened is that after doing a series of tests we saw that it didn't have the mobility we wanted, so we redesigned it, we built it again and we restructured the position of the pistons and we lengthened the superior arm, as you can see. We also lengthened the inferior arm and we got the desired mobility after some tests. Then we had a series of problems related to mobility, not with the arms but with the force, because the pistons we had used at first had a very small capacity and they didn't generate enough force to move the whole arm. So, we substituted the pistons by others of higher capacity as the ones you can see here, which are bigger, except for one which is here, the one of the lower capacity, but because we don't need more force in order to open the tweezers, and we substituted and regulated them so as to be as they should be. We used regulative valves of the flow, which allow us to control the input and output speed from the piston stems and we also have a series of valves of direction 5/2, which allow to block or permit the pass of air when we want. Now, my classmate will explain to you what is the function of each of our projects. I'll proceed to explain the first operation of the hydraulic hand. At first, this hand has a total of ten syringes. There are five syringes of 20 ml of capacity in the inferior part, which, through a flexible tube, are connected to other five syringes of 10 ml of capacity in the superior part, and thanks to Pascal law, as you can see here, the exerted pressure on one point of the liquid in this recipient is transmitted with the same value to each part of the total liquid in the recipient. Then when we act on any of the syringes, for instance this one, we can see the motion of the different fingers of our project and if we press it, it's stretched. Now my classmate will explain to you how the crane works. The operation of our pneumatic arm is basically the same as the one of our hydraulic hand. The circuit is very similar, it only has different

elements inside each one. In the pneumatic arm the circuit we have is simpler, as we can see here. The air comes in the compressor, which is under the table. After that it goes to the deposit where it is stored, it passes through a device which cleans it of impurities and it takes it directly to a valve of distribution 5/2. When coming to the valve of distribution 5/2, through a driving of a lever, in this case, the air comes in, continues going up and it gets to a regulation valve of flow, which regulates the quantity of air that will enter the piston. The air comes into the piston and the stem of it goes out to the maximum. After this, when pulsing again the lever in the other sense, the air comes out from the chamber, comes out again going through a regulation chamber of flow, regulating the quantity of air which comes out as well, it gets to the distribution valve again and it comes out by the exits of air it has. This crane in particular presents two circuits, the one we explained previously, which is a double effect piston, and also the one with tweezers, which uses a piston of simple effect by recoil by spring. In this case the circuit the circuit is almost the same, it only changes in the distribution valve part, it has a button instead of a lever. The air comes in again, we regulate the input with a regulation valve of flow, it comes into the piston and the stem goes out. What happens is that we can't control the output because it's closed alone with the recoil by spring. Now my classmate will explain the conclusions we found. After making some calculations with Pascal formula, which is $P=F/S$, we could learn a big amount of



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knowledge related to the field of industrial technology and Physics. We could see the difficulties we found about transmitting and transforming motion and the truth is that it also has been a pleasure to enjoy all of these practices.