POLITEKNIK MALAYSIA
SEBERANG PERAI

ADVANCE INCLINE PLANE

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STUDENTS CONFIRMATION

"We recognize this work is the work of our own except each of which we have explained the source"

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ABSTRACT

Final year project is compulsory subject for every student who are pursuing their diploma. It is necessary for all the students to fully complete this course, as a mechanical engineering student, we are required to identify laboratory problems and occurrences. We are then obligated to come up with a solution by designing a project to overcome the issue.

The ultimate goal of this project is to aid mechanical engineering students to understand the working principle of lab equipment which is included in their syllabus. Inclined Plane is a major role in lab practice. In addition, there is need for students have to know to use the inclined plane. This project presents an inclined plane which is automatically move which enable the students to find the friction force.

Methodology can be the analysis of the principle of methods, rules and postulates by a discipline. The systematic study of methods that are, can be or have been applied within a particular procedure. Methodology includes a philosophically coherent of theory, concepts or ideas as they relate to a particular discipline of field of inquiry.

TABLE OF CONTENT

CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION

Today we will explore a simple tool that you might not know much about it. It's called an inclined plane. Does anyone know what inclined plane means? Inclined is when something is titled, so that part is touching a lower point in space than the other. A plane is anything that is large and flat such as wood.

An inclined plane is a large flat object that is titled so that it goes from a lower point in space to a higher area. An inclined plane also a simple machine without moving parts, used to increase the height of an object.

Angle of inclination is the angle that the inclined surface makes with the horizontal ground. The greater the angle the greater the effective weight of the object, but the shorter the distance of the top of the inclined surface.

In the real world, when things side down ramps, friction opposes the motion down the ramp. The force of friction is proportional to the force from the ramp that balances the component of gravity that is perpendicular to the ramp.

Friction is the resistive forces that obstruct the motion of a body when one tries to slide object along a surface. The friction force acts parallel to the surface in contact, opposes the relative velocity of the body with respect to the surface, and its magnitude depends on the nature of the particular materials that are rubbing together, but not on other variables, such as the area of contact.

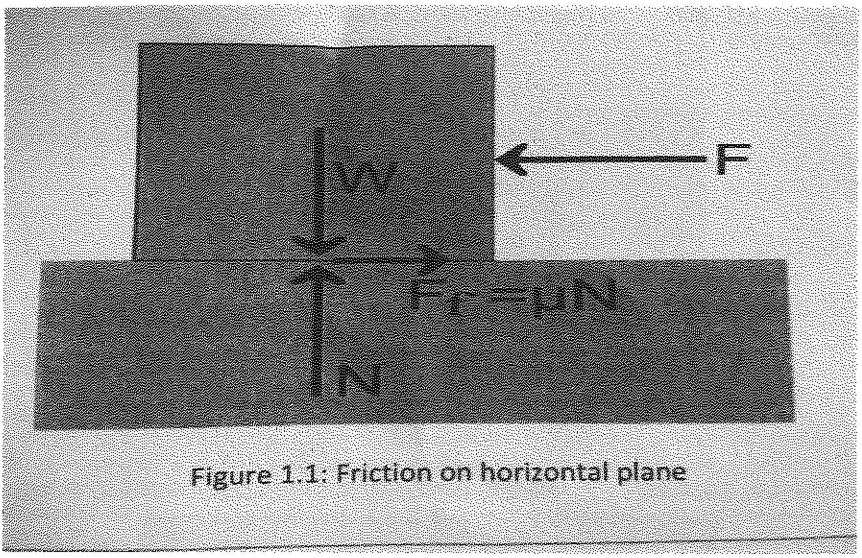


Figure 1.1: Friction on horizontal plane

The coefficient of friction is a value which describes the ratio of the force of friction between two bodies and the force pressing them together. The coefficient of friction depends on the materials used and if the bodies are moving or not. In equilibrium, the applied force will increase or decrease gradually until the system starts to move. The condition is called static friction

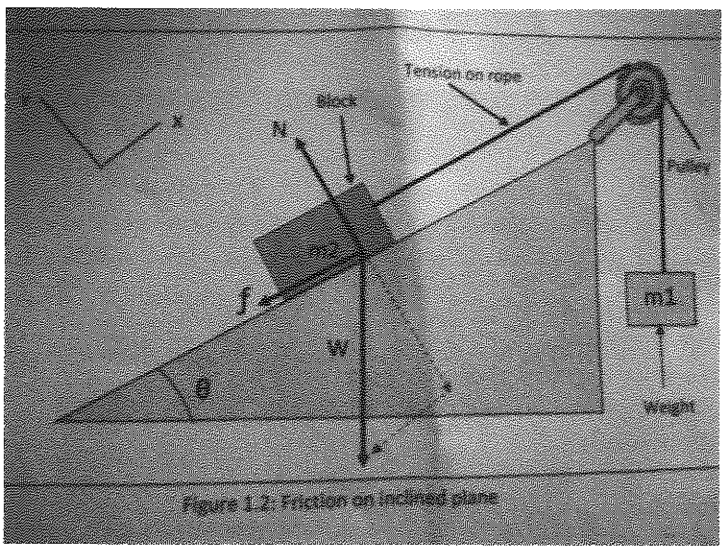
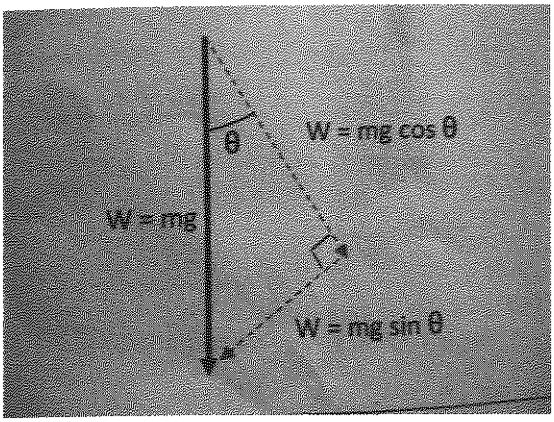


Figure 1.2: Friction on inclined plane


W = mg cos θ
θ
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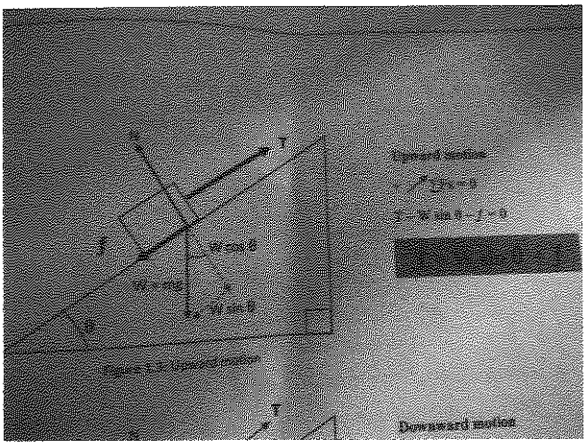
T
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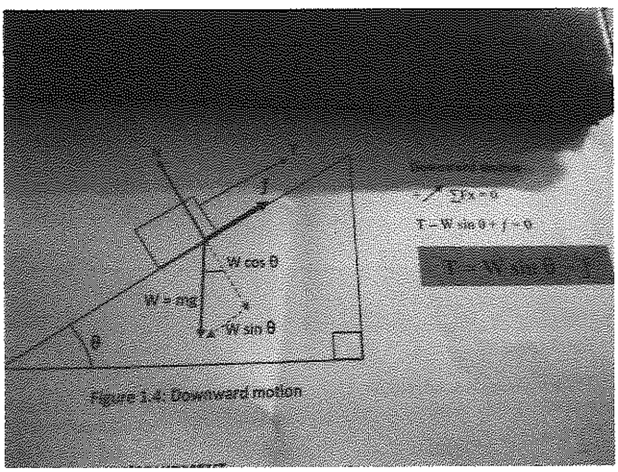
Upward motion
T – W sin θ – f = 0
Downward motion


W cos θ
W = mg
W sin θ
θ
T – W sin θ + f = 0
Figure 1.4: Downward motion

1.1 PROBLEM BACKGROUND

Inclined plane are mostly use in schools and collages.Inclined plane used during lab activities.But inclined plane have some problems.

Firstly, the inclined plane is having problem on the accuracy. So this leads the student to obtained wrong information and get wrong reading.To prevent the problem,we use digital meter to get accuracy reading and avoid students from making mistakes.

1.2 OBJECTIVES

The main objective for this project is:

1. To make the reading and angle accurate

2. Easier to handle

1.3 SCOPE OF PROJECT

Scope project is an important element to make sure the project can be finish like how the schedule runs. So, scope project has to be followed to prevent the project out from the objective. Scopes of the project are:

a) Weight

The maximum weight that can be lifted is 5kg.

b) Height

The height can be adjust until 50cm.

1.4 CONCLUSION

The production of advance inclined plane is to prevent the problems that have arisen so that a lot of wrong reading can be prevented or reduced to a very low level. In chapter one, we have made a study about the wrong reading that students take during experiment.. So our group has decided to make advance inclined plane to overcome this problem. In the following chapter, our group will attribute the arisen problems by using appropriate theories, concept and research.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

In this chapter, we have made some research on and about all aspects of our project for the production of the "Advanced Inclined Plane". Our group found that there are several aspects that need to be addressed so that the products are high quality and can decrease the cost to not exceed more than budget that has been set.

2.1 Study on Existing Projects

In this chapter researcher describes the literature review and the researches that has been made for this project. The study was conducted on several types of inclined plane before. Furthermore there is a study of the components used in this project. By doing a study on a inclined plane before, there is a difference in every inclined plane that has been made. The first difference is in how it functions and procedures used to read the reading. Although there are differences in the way of functional improvement, many of which have similar uses.

2.2 Study On Design

Our group has selected two types of design after making a number of studies and references on the internet and finding books that can help us in selecting our project design. Two designs were selected by our team which is a adjustable height and digital reading. Non-adjustable and non-digital reading.

2.2.1 Non-Adjustable height on inclined plane

Adjustable height can be define as to move or change something so as to be in a more effective arrangement or desired condition.Furthermore, to change so as to suitable to or conform with something else.Adjustable height can easily move up or down within a height range.

Advantage

- Stable

Disadvantage

- Height cannot be adjusted

Without digital meter

Students cannot get accurate reading and it causes wrong reading. This causes for student to get wrong experiment and low marks.

Advantage

- Can have many readings.
- Save time by setting the angles.

Disadvantage

- not accurate reading
- the reading speed is slow .

At the end of the research of this design, we have decided to not choose this design because it is too old fashion, in which our group did not took any courses for this fields.

2.2.2 Advance inclined plane

A) Adjustable height

Adjustable height can be define as to move or change something so as to be in a more effective arrangement or desired condition.Furthermore, to change so as to suitable to or conform with something else.Adjustable height can easily move up or down within a height range.

Advantages :

- can move upwards and downwards

Disadvantages :

- easily can be lose

B) Digital meter

Digital meter is one that displays values as numerical values rather than as the position of a meter on a relative scale. A digital meter is a meter that gives a separate reading in the form of a decimal number for each given input quantity.

Advantages

- accurate reading
- reduce reading and interpolation errors.
- the reading speed is increased as it is easier to read

Disadvantages

- when the battery is low the reading meter will be dim
- expensive
- it can be difficult to find one for your specific needs

In conclusion, although this design has advantages and disadvantages, our group has decided to choose this design because it is more advance and easier to use by the students during experiment.

2.3 Review Of Existing Components

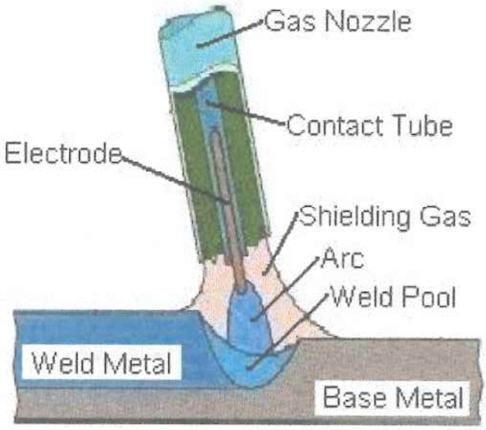
To produce an advance inclined plane is tend to do welding and use of lathe machine.

A) Gas Metal Arc Welding (MIG Welding)

Gas metal arc welding (GMAW), sometimes referred to by its subtypes metal inert gas (MIG) welding or metal active gas (MAG) welding, is a semi-automatic or automatic arc welding process in which a continuous and consumable wire electrode and a shielding gas are fed through a welding gun. A constant voltage, direct current power source is most commonly used with GMAW, but constant current systems, as well as alternating current, can be used. There are four primary methods of metal transfer in GMAW, called globular, short-circuiting, spray, and pulsed-spray, each of which has distinct properties and corresponding advantages and limitations.

Originally developed for welding aluminum and other non-ferrous materials, GMAW was soon applied to steels because it allowed for lower welding time compared to other welding processes. The cost of inert gas limited its use in steels until several years later, when the use of semi-inert gases such as carbon dioxide became common.

GMAW is the most common industrial welding process, preferred for its versatility, speed and the relative ease of adapting the process to robotic automation. Unlike welding processes that do not employ a shielding gas, such as shielded metal arc welding, it is rarely used outdoors or in other areas of air volatility. A related process, flux cored arc welding, often does not utilize a shielding gas, instead employing a hollow electrode wire that is filled with flux on the inside



List of Equipment Used in MIG Welding

i. Welding gun and wire feed unit

ii. Tool Style

iii. Power supply

iv. Electrode

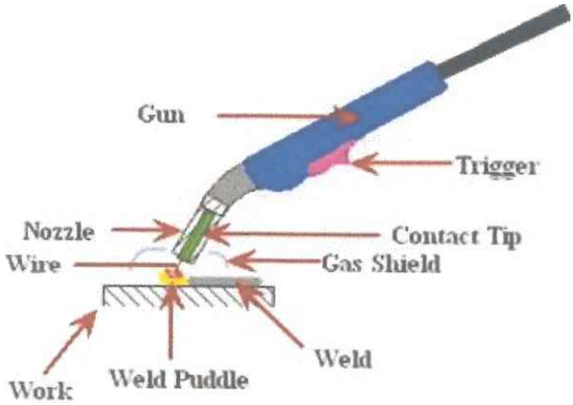
v. Shielding Gas

i) Welding Gun and Wire Feed Unit

The typical GMAW welding gun has a number of key parts—a control switch, a contact tip, a power cable, a gas nozzle, an electrode conduit and liner, and a gas hose. The control switch, or trigger, when pressed by the operator, initiates the wire feed, electric power, and the shielding gas flow, causing an electric arc to be struck. The contact tip, normally made of copper and sometimes chemically treated to reduce spatter, is connected to the welding power source through the power cable and transmits the electrical energy to the electrode while directing it to the weld area. It must be firmly secured and properly sized, since it must allow the passage of the electrode while maintaining an electrical contact.

Before arriving at the contact tip, the wire is protected and guided by the electrode conduit and liner, which help prevent buckling and maintain an uninterrupted wire feed. The gas nozzle is used to evenly direct the shielding gas into the welding zone—if the flow is inconsistent, it may not provide adequate protection of the weld area. Larger nozzles provide greater shielding gas flow, which is useful for high current welding operations, in which the size of the molten weld pool is increased. The gas is supplied to the nozzle through a gas hose, which is connected to the tanks of shielding gas. Sometimes, a water hose is also built into the welding gun, cooling the gun in high heat operations.

The wire feed unit supplies the electrode to the work, driving it through the conduit and on to the contact tip. Most models provide the wire at a constant feed rate, but more advanced machines can vary the feed rate in response to the arc length and voltage. Some wire feeders can reach feed rates as high as 30.5 m/min (1200 in/min), but feed rates for semiautomatic GMAW typically range from 2 to 10 m/min (75–400 in/min).



ii) Tool Style

The top electrode holder is a semiautomatic air-cooled holder; compressed air is circulated through it to maintain moderate temperatures. It is used with lower current levels for welding lap- or butt joints. The second most common type of electrode holder is a semiautomatic water-cooled; the only difference being that water takes the place of air. It uses higher current levels for welding T- or corner joints. The third typical holder type is an automatic electrode holder that is water cooled, this holder is used typically with automated equipment.

iii) Power Supply

Most applications of gas metal arc welding use a constant voltage power supply. As a result, any change in arc length (which is directly related to voltage) results in a large change in heat input and current. A shorter arc length will cause a much greater heat input, which will make the wire electrode melt more quickly and thereby restore the original arc length. This helps operators keep the arc length consistent even when manually welding with hand-held welding guns. To achieve a similar effect, sometimes a constant current power source is used in combination with an arc voltage-controlled wire feed unit. In this case, a change in arc length makes the wire feed rate adjust in order to maintain a relatively constant arc length. In rare circumstances, a constant current power source and a constant wire feed rate unit might be coupled, especially for the welding of metals with high thermal conductivities, such as aluminum. This grants the operator additional control over the heat input into the weld, but requires significant skill to perform successfully.

Alternating current is rarely used with GMAW; instead, direct current is employed and the electrode is generally positively charged. Since the anode tends to have a greater heat concentration, these results in faster melting of the feed wire, which increases weld penetration and welding speed. The polarity can be reversed only when special emissive-coated electrode wires are used, but since these are not popular, a negatively charged electrode is rarely employed.

iv) Electrode

Electrode selection is based primarily on the composition of the metal being welded, the process variation being used, joint design and the material surface conditions. Electrode selection greatly influences the mechanical properties of the weld and is a key factor of weld quality. In general the finished weld metal should have mechanical properties similar to those of the base material with no defects such as discontinuities, entrained contaminants or porosity within the weld. To achieve these goals a wide variety of electrodes exist. All commercially available electrodes contain deoxidizing metals such as silicon, manganese, titanium and aluminum in small percentages to help prevent oxygen porosity. Some contain denitriding metals such as titanium and zirconium to avoid nitrogen porosity. Depending on the process variation and base material being welded the diameters of the electrodes used in GMAW typically range from 0.7 to 2.4 mm (0.028–0.095 in) but can be as large as 4 mm (0.16 in). The smallest electrodes, generally up to 1.14 mm (0.045 in) are associated with the short-circuiting metal transfer process, while the most common spray-transfer process mode electrodes are usually at least 0.9 mm (0.035 in).

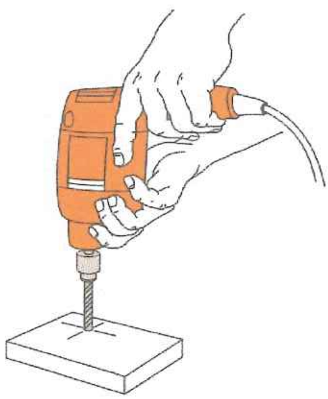
Shielding Gas

Shielding gases are necessary for gas metal arc welding to protect the welding area from atmospheric gases such as nitrogen and oxygen, which can cause fusion defects, porosity, and metal brittleness if they come in contact with the electrode, the arc, or the welding metal. This problem is common to all arc welding processes; for example, in the older Shielded-Metal Arc Welding process (SMAW), the electrode is coated with a solid flux which evolves a protective cloud of carbon dioxide when melted by the arc. In GMAW, however, the electrode wire does not have a flux coating, and a separate shielding gas is employed to protect the weld. This eliminates slag, the hard residue from the flux that builds up after welding and must be chipped off to reveal the completed weld.

The choice of a shielding gas depends on several factors, most importantly the type of material being welded and the process variation being used. Pure inert gases such as argon and helium are only used for nonferrous welding; with steel they do not provide adequate weld penetration (argon) or cause an erratic arc and encourage spatter (with helium). Pure carbon dioxide, on the other hand, allows for deep penetration welds but encourages oxide formation, which adversely affect the mechanical properties of the weld. Its low cost makes it an attractive choice, but because of the reactivity of the arc plasma, spatter is unavoidable and welding thin materials is difficult. As a result, argon and carbon dioxide are frequently mixed in a 75%/25% to 90%/10% mixture. Generally, in short circuit GMAW, higher carbon dioxide content increases the weld heat and energy when all other weld parameters (volts, current, electrode type and diameter) are held the same. As the carbon dioxide content increases over 20%, spray transfer GMAW becomes increasingly problematic, especially with smaller electrode diameters.

Argon is also commonly mixed with other gases, oxygen, helium, hydrogen, and nitrogen. The addition of up to 5% oxygen (like the higher concentrations of carbon dioxide mentioned above) can be helpful in welding stainless steel, however, in most applications carbon dioxide is preferred. Increased oxygen makes the shielding gas oxidize the electrode, which can lead to porosity in the deposit if the electrode does not contain sufficient deoxidizers. Excessive oxygen, especially when used in application for which it is not prescribed, can lead to brittleness in the heat affected zone. Argon-helium mixtures are extremely inert, and can be used on nonferrous materials. A helium concentration of 50%–75% raises the required voltage and increases the heat in the arc, due to helium's higher ionization temperature. Hydrogen is sometimes added to argon in small concentrations (up to about 5%) for welding nickel and thick stainless steel workpieces. In higher concentrations (up to 25% hydrogen), it may be used for welding conductive materials such as copper.

Shielding gas mixtures of three or more gases are also available. Mixtures of argon, carbon dioxide and oxygen are marketed for welding steels. Other mixtures add a small amount of helium to argon-oxygen combinations, these mixtures are claimed to allow higher arc voltages and welding speed. Helium is also sometimes used as the base gas, with small amounts of argon and carbon dioxide added. However, because it is less dense than air, helium is less effective in shielding the weld than argon– which is denser than air. It also can lead to arc stability and penetration issues, and increased spatter, due to its much more energetic arc plasma. Helium is also substantially more expensive than other shielding gases. Other specialized and often proprietary gas mixtures claim even greater benefits for specific applications.



Drilling Machine

A drill is a tool fitted with a cutting tool attachment or driving tool attachment, usually a drill bit or driver bit, used for boring holes in various materials together. The attachment is gripped by a chuck at one end of the drill and rotated while pressed against the target material. The tip, and sometimes edges, of the cutting tool does the work of cutting into the target material. This may be slicing off thin shavings(twist drills or auger bits), grinding off small particles(oil drilling), crushing and removing pieces of the workpiece(SDS masonry drill), countersinking, counterboring, or other operations.

Drills are commonly used in woodworking, metalworking, construction and do-it-yourself projects. Specially designed drills are also used in medicine, space missions and other applications. Drills are available with a wide variety of performance characteristics, such as power and capacity.

Angle grinder

Battery-powered angle grinder

Angle grinder

An angle grinder, also known as a side grinder or disc grinder, is a handheld power tool used for grinding and polishing.

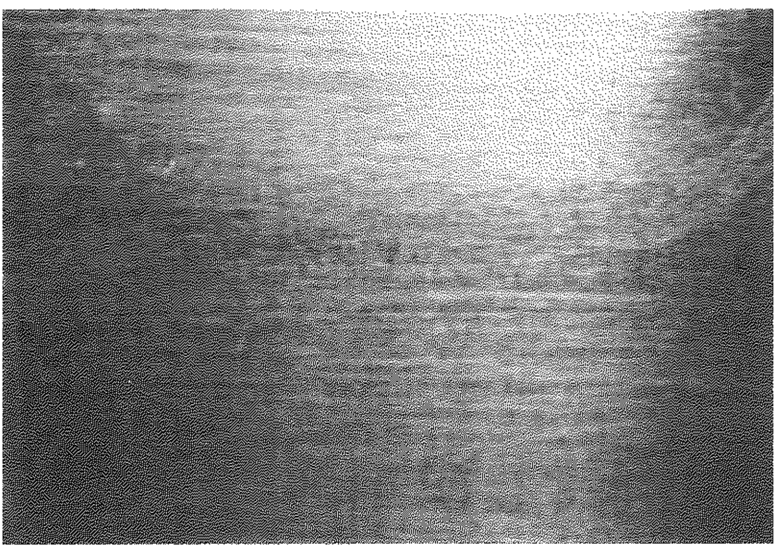
Angle grinders can be powered by an electric motor, petrol engine or compressed air. The motor drives a geared head at a right-angle on which is mounted an abrasive disc or a thinner cut-off disc, either of which can be replaced when worn. Angle grinders typically have an adjustable guard and a side-handle for two-handed operation. Certain angle grinders, depending on their speed range, can be used as sanders, employing a sanding disc with a backing pad or disc. The backing disc is typically made of hard plastic, phenolic resin, or medium-hard rubber depending on the amount of flexibility desired.

Angle grinders are standard equipment in metal fabrication shops and on construction sites. They are also common in machine shops, along with die grinders and bench grinders.

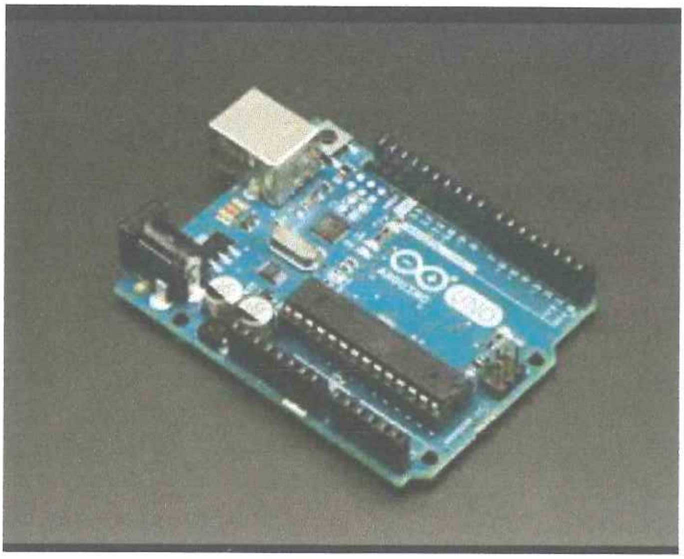
2.4 Study On Material

Our group has done some research on materials to be used for the production of the advance inclined plane. After doing some research, we find that it is easier to produce our project, if all the components are using the same type of material. Additionally, we have selected a few ingredients to compare before selecting the best material to use. The materials that were compared are:

1) Metal - They are typically hard, opaque, shiny and has good electrical and thermal conductivity. Metal are generally malleable.



2) Arduino - is a open source computer hardware and software company, project and user community. It can sense and control object in the physical world.



4. Plunger - Is to make the incline plane more stable.

Slope

The mechanical advantage of an inclined plane depends on its slope, its gradient or steepness. The smaller the slope, the larger the mechanical advantage, and the smaller the force needed to raise a given weight. A plane's slope *s* is equal to the difference in height between its two ends, or "*rise*", divided by its horizontal length, or "*run*". It can also be expressed by the angle the plane makes with the horizontal, θ.

Mechanical advantage

The mechanical advantage of a simple machine is defined as the ratio of the output force exerted on the load to the input force applied. For the inclined plane the output load force is just the gravitational force of the load object on the plane, its weight, F The input force is the force F_i exerted on the object, parallel to the plane, to move it up the plane. The mechanical advantage is The MA of an ideal inclined plane without friction is sometimes called ideal mechanical advantage while the friction is included is called the actual *mechanical advantages.*

Analysis

A load resting on an inclined plane, when considered as a free body has three forces acting on it:

- The applied force, F_i exerted on the load to move it, which acts parallel to the inclined plane.
- The weight of the load, F which acts vertically downwards
- The force of the plane on the load. This can be resolved into two components:
- The normal force F, of the inclined plane on the load, supporting it. This is directed perpendicular to the surface.
- The frictional force, F,$_f$ of the plane on the load acts parallel to the surface, and is always in a direction opposite to the motion of the object. It is equal to the normal force multiplied by the coefficient of static friction μ between the two surfaces.