Course: General Science (6404)
Semester: Autumn, 2021

Assignment No.1

Q.1 Fill in the blanks with suitable words.

i. The mirror whose inner cursed surface is polished is called_____.
(Concave mirror)

ii. Acceleration of the body is _____proportional to be applied force.
(Directly)

iii. Neutron carries _____ charge. **(NO)**

iv. The formula of calcium oxide is_____ **(CaO)**

v. The atoms which have 2 electrons in outermost orbits follow _____rule.

vi. The _____formula shows the simplest ratio between atoms of the elements.

vii. Solar system was discovered in _____.

viii. In 1995 _____ discovered X-rays. **Wilhelm Roentgen**

ix. First antibiotics, penicillin was discovered in **1928** by Alexander x.

x. Kinetic Molecular Theory is very useful in explaining the **properties** of the states of matter in terms of energy of particles and forces that act between them.

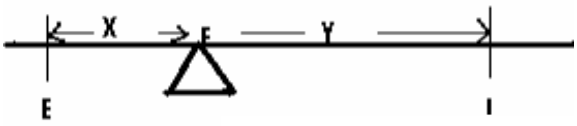
Q.2 Write principles of lever. What are kinds of pulley? Write where lever and pulley are used in our daily life.

Principle of lever

In all types of lever, the moment of effort is always equivalent to the moment of load provided it is in equilibrium state. Hence,

Effort x Effort arm = Load x load arm

Mechanical Advantage of Lever A typical lever is shown in the fig. The "X" is the effort arm whereas "Y" is the load arm. According to principle of lever Effort x Effort arm = Load x load arm E x X = L x Y L / E = X / Y As Mechanical Advantage = load / Effort M.A = L / E



Mechanical Advantage of lever = Effort Arm / Load Arm

Kinds of pulley

1. Fixed Pulleys

Fixed pulleys are the most common type of pulleys, and the most simple, for that matter. As the name suggests, the pulley stays in a fixed position throughout its use. You typically fix this pulley to a wall, ceiling, or any other stationary platform. That means that once you install this pulley, it stays there permanently unless you remove it and install it elsewhere.

With fixed pulleys, the amount of pressure or force you apply on the pulling side is the amount of that it will exert on the lifting side. With absolutely zero-efficiency, most people wonder why anybody would want to

buy a fixed pulley system. However, a fixed pulley system is mostly for changing lift or pull direction in a large network of pulleys.

So although it has absolutely no efficiency, it's very necessary for most industries and workshops. If you only need one pulley for your tasks, then buying a fixed pulley for the job would be very unwise. However, these types of pulleys are great for flagpoles and curtains

2. Moveable Pulleys

Moveable pulleys are the exact opposite of fixed pulleys. That's because unlike fixed pulleys, moveable pulleys can actually move from their position. This makes them ideal for various applications and a staple for a lot of industries.

Moveable pulls actually move with the load, so the force you use to pull the pulley multiplies on the lifting side. You attach these pulleys to the object that you're going to lift and detach it once you're done lifting it. That means you can't change the direction of the object that you lift.

Due to its efficiency, this type of pulley is ideal for lifting very heavy objects. You can thus find these pulleys in cranes for construction and utility elevators. They are also used in various industries for heavy lifting.

3. Compound Pulleys

You get a compound pulley when you combine a fixed pulley with a movable pulley. These types of pulleys put together the usefulness of fixed and moveable pulleys in a single system. That means the fixed pulley can change direction, and the moveable pulley can multiply the pulling force.

You attach the object on the movable pulley, while the moveable pulley attaches to the fixed pulleys using a rope. These types have an added advantage over other pulley types because you can change both the direction of the pull and the lifting.

4. Block and Tackle Pulleys

The block and tackle pulley is a special type of pulley, which greatly reduces the amount of pulling effort. This is not a fixed pulley, but an elaborate network of several pulleys, both fixed and movable. All the pulleys in the system are parallel to each other.

This parallel arrangement means that fixed pulleys are parallel with other fixed pulleys in pairs, and moveable pulleys the same. Each compound pair, two fixed and moveable pulleys, pair joins other pairs to form a network of these pulleys.

You can trace back this pulley system to Archimedes, the famous inventor, and mathematician of ancient Greek. These types of pulleys are great for sailboats, car garages, and workshops where lifting heavy objects is the norm. They are also excellent for construction and boat lifts.

5. Conveyor Pulleys

Conveyor pulleys, as the name suggests, are pulleys for conveyor belts. These pulleys change the direction of the conveyor belt. You can find them at the end of conveyor belts.

They consist of locking assemblies and end disks that are flexible. They have no other application outside of changing direction in conveyor belts.

6. Cone Pulleys

Cone pulleys get the name "cone" because of their uncanny resemblance with a cone. The pulley consists of several pulley wheels stacked on top of each other, with the smallest one at the top. This makes the pulley system look like a cone.

This assembly of pulley wheels allows the operator to change the speed of the pulleys' lift. Smaller wheels require less pulling force, but also produce lower lifting force. These pulleys work on the same principle

Uses of Lever in our daily life

The door handle on a car

Ordinary light switch, any kind of flip switch or toggle switch.

A shovel (the upper part of the shovel is the fulcrum point resting on top of soil, against which one levers to remove soil from bottom of hole).

Screwdriver if used to pry open a paint can, etc.

Many on off switches, the ones that look like a small lever (not sliders, but some buttons have an internal lever not visible).

The pop top on a can, if when you pull it, it pivots on the attach point (fulcrum) to open the can. Definitely a force multiplier.

Most kinds of triggers (guns, electric tools, etc.) though sometimes most of the mechanism is hidden in the body of the device.

Parking brake lever, even the pedal kind.

Hood opening lever, even the kind with an in-dash pull (which via cable activates a lever).

Certain types of latches on windows and some doors.

Old fashioned turntable raise/lower tonearm lever.

Many kinds of buttons operate a lever internally, for example to open the door to a microwave.

Refrigerator that has a step pedal to open it probably uses a lever.

Car jack,the kind you pump up and down.

A wooden board or metal rod that you use to "pry" something.

Many types of catches or latches used to fold or lock in position things like chairs and step ladders, even if it uses a pull cord to activate the lever.

Many types of locking latches on tool boxes, coolers, etc.

A knife switch, whether electrical or mechanical in purpose.

Any sort of ratchet device is operated via a lever.

Uses of pulley in our daily life

1. Wells

Wells are one of the oldest applications that make use of a pulley. To draw water from a well, the handle of the bucket is tied with one end of the rope and is thrown in the well. The other end of the rope is given to the user who applies pull force to it. The axle of the movable pulley helps reduce the amount of input force while pulling up the bucket filled with water from the well.

2. Elevators

One of the most common applications of a pulley mechanism in the engineering domain lies in the construction of elevators. The elevators/lift make use of high tensile ropes that help to move it up and down as per the user requirement. In the absence of a pulley, a complex arrangement of heavy motors is required to pull the cables, and thereby causing the lift to move.

3. Exercise Equipment

A number of gym and exercise equipment consist of a rope that is attached with weights on one end, whereas the other end of the rope passes over the pulley and is given to the user. When the user pulls the free end of the rope, the force gets transferred to the user's body, helping him/her to strengthen the muscles. Most of the cable machines used in athletic training centres, for example, a seated cable row, employ a cable-pulley arrangement and are commonly referred to as pulley machines.

4. Theatre Curtains

Unlike regular curtains, a theatre curtain is not pulled manually. A separate mechanism is used that helps the user roll and unrolls the theatre curtains with the help of a cord. When the cord is pulled down, the curtains get lifted up with the help of a pulley mechanism. Here, the pulley is used for the purpose of reducing the efforts required to draw the curtains on or off the stage.

5. Construction Equipment

A pulley mechanism helps the lifting of heavy objects much easier as compared to picking up the weight manually. Hence, it is most frequently used in construction equipment that requires the lifting and dumping of hefty and bulky objects. Some of the construction machines that make use of a pulley mechanism are cranes, a gun tackle, a yard and stay tackle.

6. Flagpoles

Flag poles are usually very tall, which makes flag hoisting a very difficult job to be done manually. However, if a mechanism of a rope and pulley is used to do the task, it becomes easy and seems effortless. To unfurl a flag on a flagpole with the help of pulleys, a user attaches the rope with the flag and pulls the rope. When the rope attached to the top of the pole is pulled via a pulley wheel, it causes the flag to move upward.

7. Blinds

Blinds used on a window move up and down very smoothly. A simple pulley machine is used to serve the purpose. The cord of the blind is attached to the axle wheel of a pulley. Hence, when the cord is pulled, the pulley causes the blinds to go up.

8. Rock Climbers

A rock climber uses a pulley mechanism to ease the process of climbing. A pulley mechanism is usually used to divert or change the direction in which the force is applied. As the climber pulls the rope in the downward direction, the pulley system helps him/her move in the upward direction.

9. Garage Doors

A garage door is quite bulky and heavy, making it very difficult to be operated manually. To make this process easier, a set of four pulleys is attached to the top corners of the garage door. These pulleys are connected via a low mass string that helps the door to move up and down smoothly.

Q.3 what happens during a chemical reaction? Explain different categories of chemical reaction with the help of examples.

During a chemical reaction

Any substance is composed of atoms arranged in a specific way. In a chemical reaction these atoms are changing their arrangement, and that changes the nature of the substance.

Oxidation-Reduction or Redox Reaction

In a redox reaction, the oxidation numbers of atoms are changed. Redox reactions may involve the transfer of electrons between chemical species.

The reaction that occurs when In which I2 is reduced to I- and S2O32- (thiosulfate anion) is oxidized to S4O62- provides an example of a redox reaction:

$2\ S_2O_3^{2-}(aq) + I_2(aq) \rightarrow S_4O_6^{2-}(aq) + 2\ I^-(aq)$

Direct Combination or Synthesis Reaction

In a synthesis reaction, two or more chemical species combine to form a more complex product.

$A + B \rightarrow AB$

The combination of iron and sulfur to form iron (II) sulfide is an example of a synthesis reaction:

$8\ Fe + S_8 \rightarrow 8\ FeS$

Chemical Decomposition or Analysis Reaction

In a decomposition reaction, a compound is broken into smaller chemical species.

$AB \rightarrow A + B$

The electrolysis of water into oxygen and hydrogen gas is an example of a decomposition reaction:

$2\ H_2O \rightarrow 2\ H_2 + O_2$

Single Displacement or Substitution Reaction

A substitution or single displacement reaction is characterized by one element being displaced from a compound by another element.

$A + BC \rightarrow AC + B$

An example of a substitution reaction occurs when zinc combines with hydrochloric acid. The zinc replaces the hydrogen:

$Zn + 2\ HCl \rightarrow ZnCl_2 + H_2$

Metathesis or Double Displacement Reaction

In a double displacement or metathesis reaction two compounds exchange bonds or ions in order to form different compounds.

$AB + CD \rightarrow AD + CB$

An example of a double displacement reaction occurs between sodium chloride and silver nitrate to form sodium nitrate and silver chloride.

$NaCl(aq) + AgNO_3(aq) \rightarrow NaNO_3(aq) + AgCl(s)$

Acid-Base Reaction

An acid-base reaction is a type of double displacement reaction that occurs between an acid and a base. The H+ ion in the acid reacts with the OH- ion in the base to form water and an ionic salt:

$HA + BOH \rightarrow H_2O + BA$

The reaction between hydrobromic acid (HBr) and sodium hydroxide is an example of an acid-base reaction:

$HBr + NaOH \rightarrow NaBr + H_2O$

Combustion

A combustion reaction is a type of redox reaction in which a combustible material combines with an oxidizer to form oxidized products and generate heat (exothermic reaction). Usually, in a combustion reaction oxygen combines with another compound to form carbon dioxide and water. An example of a combustion reaction is the burning of naphthalene:

$C_{10}H_8 + 12\ O_2 \rightarrow 10\ CO_2 + 4\ H_2O$

Isomerization

In an isomerization reaction, the structural arrangement of a compound is changed but its net atomic composition remains the same.

Hydrolysis Reaction

A hydrolysis reaction involves water. The general form for a hydrolysis reaction is:

$X^-(aq) + H_2O(l) \leftrightarrow HX(aq) + OH^-(aq)$

Q.4 Write a note on earth and its structure. Explain what are the results of rotation and revolution of earth?

Earth and its Structure

The Earth was formed about 4.5 billion years ago. It was a big cloud of gases and dust, which gradually cooled down to the solid Earth. It took millions of years to cool down and taking the shape of present day Earth. In the beginning the molecular oxygen was not present but with the passage of time many reactions took place and many substances of atmosphere was formed. Apart from it, a series of volcanic eruptions took place releasing gases and water vapours .These gases and vapours also formed atmosphere. These water vapours accumulated in the atmosphere and condensed to form clouds and rains. The water in the form of rains came to our Earth and was collected in hollows and deep places, and formed oceans. The surface structure of the earth continued to be changed due to the forces inside the Earth and hard crust was formed. The Crust split up into large blocks, called plates. Rocks were squeezed up to form new landmasses and mountains, when the plates pushed against each other. Plate movements continue today which sometimes causes earthquakes. The Earth consists of three layers; viz Crust, Mantle and Core. Core is the innermost part of the earth, mostly consisted of molten iron. Surrounding the Core is a layer of molten rock called Mantle. The uppermost layer is called Earth's Crust. Every activity that we do, takes place on Earth's crust. The Crust is composed of many plates, called tectonic plates.

Many persons believe that these plates float on the mantle and move and sometimes bump into each other causing shake. This shaking of plates is called Earthquakes. As we know, the Earth's surface is not all rock. The hydrosphere is the layer of water that covers 75% of the Earth's surface. And the atmosphere is the layer of the air above the surface that contains the Oxygen that supports life and also many other gases also.

Motions of the Earth

The Earth is in constant motion, revolution of earth around the Sun and its rotation around its own axis. These motions result a number of consequences like occurrence of days and nights, changes in seasons and climates in different areas and regions. Movement of the Earth around its axis and around the Sun can be easily understood by mounting a globe and rotating it around its axis, and movement of the earth around the sun can be illustrated easily.

1. Rotation

If you see at the figure 11, it looks somewhat tilted. The Earth completes its rotation in the time of one day. Rotation is also called spinning .The Earth spins around its axis from West to East. Rotation of the earth cause days and nights, the rate of rotation is approximately 1,038 miles per hour, decreasing to zero at the poles. Tilting of earth causes occurrence of different seasons.

2. Revolution

The motion of the Earth around the Sun is called revolution. Earth completes its revolution around the sun in the time of one year. The path on which earth revolves is called Earth's orbit. It is nearly an elliptical path. The mean distance of the Earth from the Sun is about 93million miles and the distance varies by 3 million miles, forming a slightly elliptical path. The revolution of the Earth around the Sun travels a distance of 595 million miles in 365 days, 6 hours, 9 minutes and 9.5 seconds. This means that average speed of the earth is 18 miles a second.

Q.5 A) Describe influence of the sun and the Moon on the Earth

Influence of the Sun and the Moon on Earth

The **sun** influences the earth in many ways. The Sunlight, warmth, and the chronology are the influences of the Sun, whereas moon has its own influences on the earth .They are gravity and its motion.

The sun is an ordinary star, one of about 100 billion in our galaxy, the Milky Way. The sun has extremely important influences on our planet: It drives weather, ocean currents, seasons, and climate, and makes plant life possible through photosynthesis. Without the sun's heat and light, life on Earth would not exist.

About 4.5 billion years ago, the sun began to take shape from a molecular cloud that was mainly composed of hydrogen and helium. A nearby supernova emitted a shockwave, which came in contact with the molecular cloud and energized it. The molecular cloud began to compress, and some regions of gas collapsed under their own gravitational pull. As one of these regions collapsed, it also began to rotate and heat up from increasing pressure. Much of the hydrogen and helium remained in the center of this hot, rotating mass. Eventually, the gases heated up enough to begin nuclear fusion, and became the sun in our solar system.

Other parts of the molecular cloud cooled into a disc around the brand-new sun and became planets, asteroids, comets, and other bodies in our solar system.

The sun is about 150 million kilometers (93 million miles) from Earth. This distance, called an astronomical unit (AU), is a standard measure of distance for astronomers and astrophysicists.

The **moon** orbits the earth due to the gravity of the earth. The moon also have gravitational power but moon's gravity is 1.6 where as the gravity of the earth is 10m/s2. By the way gravity pulls the Earth and Moon toward each other. Tides are caused (high tide and low tide) due to the gravity of the moon. The sun also has some influence here. The sun brings light and is also responsible for the warming up of the earth.

B) Define galaxies. Explain types of galaxies.

The Galaxies

A galaxy is a group of Stars and solar systems. A galaxy is so vast that it contains millions of stars. There is a number of galaxies present in our universe. A galaxy has a distinct shape, and shape depend upon the arrangement of the stars. There is one hundred thousand galaxies known to us. Galaxies come in four main types: Ellipticals, Spirals, Barred and Irregular. Galaxies are grouped together to form Clusters

Types of galaxies

The Milky Way Galaxy

On a dark night have you ever seen a band of lights stretched on the sky? This is called a milky way. The milky-way is composed of faint stars. The proof of the Milky Way consisting of many stars came in 1610 when Galileo used a telescope to study the Milky Way and discovered that it is composed of a huge number of faint stars. Our solar system is considered to be present at the center of the milky-way galaxy. The first attempt to describe the shape of the Milky Way and the position of the Sun in it was carried out by William Herschel in 1785 by carefully counting the number of stars in different regions of the sky.

Elliptical Galaxies

Elliptical Galaxies are the largest known galaxies. They are circular (Ellipsoidal), long, narrow or cigar shaped. They have relatively little inter-stellar matter. Elliptical galaxies are often made up of upto 1 trillion older stars. The formation of new stars is very rare due to less amount of dust and gases. This galaxy looks red due to red colored stars. Most stars remain close to each other due to forces of gravitation. They do not have black holes.

Spiral Galaxies

The name spiral is given due to the long thin elongations (arms) extending from the centre. Spiral galaxies consist of a rotating disk of, and a central bulge of generally older stars. Extending outward from the bulge are relatively bright arms. These galaxies are rich in dust and gas. In spiral arms stars are formed actively. Spiral galaxies are composed of millions of older stars in the center while arms have new stars. They also have black holes. Like the stars, the spiral arms rotate around the center, but they rotate with constant angular velocity. The spiral arms contain high density matter. As stars move through an arm, the velocity of each stellar system is changed by the gravitational force of the higher density.