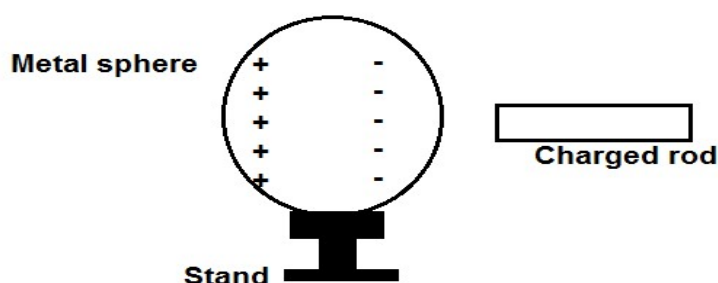


FORM TWO PHYSICS BANK OF QUESTIONS

1. STATIC ELECTRICITY

1.1. Concept of Static Electricity

1. Define the following terms:
 - a) Static Electricity.
 - b) Electrostatics.
 - c) Electric charge.
 - d) Electrostatic force.
2. Explain the origin of charges.
3. List two types of charges.
4. State the fundamental law of static electricity.
5. Describe three (3) methods of charging a body.
6. Explain why:
 - a) nylon clothes crackles as you undress.
 - b) petrol vehicles usually have a length of a metal chain hanging down touching the ground.
 - c) some clothes tend to cling onto the body of a body.
 - d) TV screen becomes dusty after a while.
7. After walking across a carpeted floor you sometimes get a mild electric shock when you touch a metal door knob. Explain how this happens
8. When a charged rod is held close to a metal sphere placed on an insulated stand, the charge distribution on the sphere is also shown in the fig below



- a) What is the sign of charge on the rod?
 - b) Describe a simple method to charge the rod.
 - c) Explain why the far side of the metal sphere has a positive charge.
 - d) What happens to the charges on the metal sphere, if the charged rod is moved away from the sphere?
- 9.
- #### 1.2. Detection of Charges
2. Draw and label a diagram of a leaf electroscope and describe its structure.
 3. With aid of diagrams explain how the sign of charge is determined by using an electrophorus.
 4. Explain the process of charging a leaf electroscope by;

- a) Contact method.
 - b) Induction method.
- 5. Explain the process of discharging a leaf electroscope.
- 6. Describe the applications of electroscope.
- 7. State and explain three methods through which an electroscope can be charged.
- 8. A sharp needle was brought close to the cap of a charged gold – leaf electroscope .Explain why the leaf collapsed.
- 9. State what happen in the following conditions.
 - a) An ebonite rod is rubbed with fur
 - b) A negatively charged electroscope's cap is touched by a neutral glass rod (c) A proof plane is inserted in a hollow and tested for charge

1.3. Conductors and Insulators

- 2. Define the following terms:
 - a) Conductor
 - b) Insulator
- 3. Distinguish between conductor and insulators.

1.4. Capacitors

- 1. Define the following terms:
 - (i) Capacitor
 - (ii) Capacitance
 - (iii) Dielectric
 - (iv) A Farad
- 2. Mention four (4) types of capacitors
- 3. A capacitor of capacitance of $100\ \mu\text{F}$ is being charged. The potential difference between plates is $4\ \text{V}$. How much charge will accumulate on the plates during the period of charging?
- 4. With aid of diagrams explain the processes of:
 - a) Charging a capacitor
 - b) Discharging a capacitor
- 5. Three capacitors A, B and C are arranged in series. Their capacitances are given as $10\ \mu\text{F}$, $20\ \mu\text{F}$ and $30\ \mu\text{F}$ respectively. Calculate the value of a single capacitor that could replace them.
- 6. An electric circuit has three capacitors arranged in parallel to a cell. If the p.d, V across each plate is the same, calculate the total capacitance.
- 7. Describe three (3) affecting capacitance.
- 8. Two capacitors of $10\ \mu\text{F}$ and $15\ \mu\text{F}$ are connected in (i) series and (ii) parallel. What is the effective capacitance for (i) and (ii)?
- 9. Determine the effective capacitance obtained when two capacitors each of $20\ \mu\text{F}$ are connected first in parallel and then in series.

10. It is required to obtain effective capacitance of 3 μF , there are two capacitors; the first is 12 μF , what will be the value of the other capacitor. State the way it will be connected to the first.

11. Show that for capacitors arranged in a series configuration the effective capacitance is given by:

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \dots + \frac{1}{C_n}$$

12. State the appliances that use capacitors.

13. Calculate the charge stored in a capacitor of 100 μF capacitance when connected to a 2 V d.c. supply.

14. Two capacitors of capacitance 10 μF and 15 μF are connected in:
(a) series (b) parallel. Calculate the effective capacitance in each case.

15. The charge stored in a capacitor of capacitance 7200 μF is 32.4 mC. Calculate the

e.m.f. of the battery charging the capacitor.

16. A capacitor of two parallel plates separated by air has a capacitance of 15 pF. A potential difference of 18 volts is applied across the plate.

a) Determine the charge on the capacitor.

b) If the space between is filled with mica, the capacitance now increases to 240 pF. How much more charge can be put on the capacitor using the 18 volts supply.

17. Four capacitors of capacitance 2.4 μF , 3.6 μF , 4.0 μF and 2.0 μF are connected in series to a potential difference of 15.0 V. Find:

a) The effective capacitance

b) The total charge

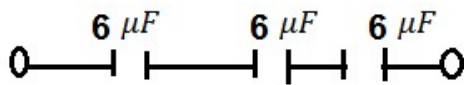
18. Two capacitors of capacitance 2.5 μF and 3.5 μF connected in series are connected to two other capacitors each of capacitance 4.0 μF which are connected in parallel to each other. If the circuit is supplied by a potential difference of 20.0 V, find: a) The effective capacitance

b) The voltage on each capacitor

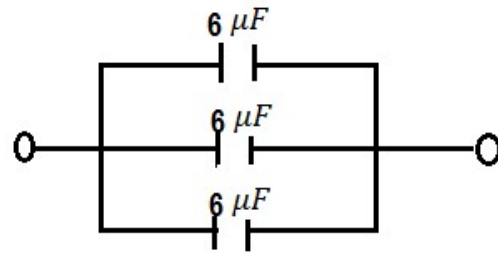
c) The total charge

d) The charge on each capacitor.

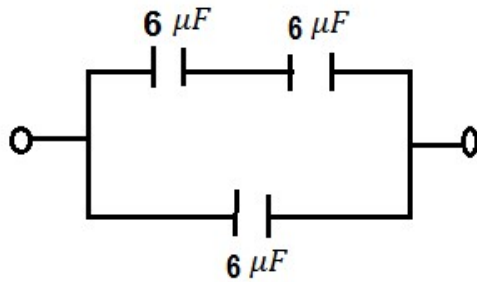
19. Determine the effective capacitance in each of the following diagram:



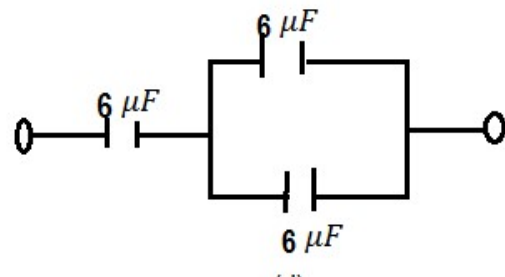
(a)



(b)

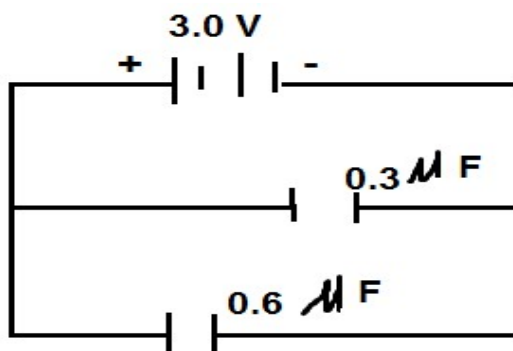


(c)



(d)

- 20.a) Determine the effective capacitance of the circuit below (b) What is the value of the stored charge?



1.5. Charge Distribution along the Surface of a Conductor

2. Describe the charge distribution on the surface of a conductor.
3. Describe the distribution of charges along:
 - (a) A negatively charged spherical conductor
 - (b) A negatively charged pointed metal rod

1.6. Lightning Conductor

2. Define the following terms:
 - a) Lightning
 - b) Lightning conductor
 - c) Thunderstorm
3. Describe the mode of action of a lightning conductor.
4. Why does lightning strike in zigzag pattern?
5. Mention at least five losses which are due to lightning strikes.

2. CURRENT ELECTRICITY

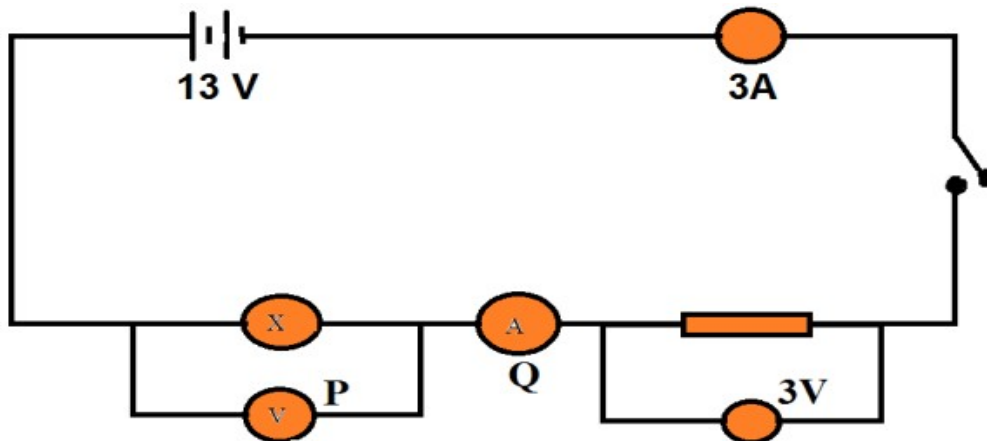
2.1. Concept of Current Electricity

1. Define the following terms;
 - (a) Current electricity
 - (b) Electric current
 - (c) Coulomb
2. List down five (5) sources of electricity.
3. Explain five (5) uses of electricity.

2.2. Simple Electric Circuits

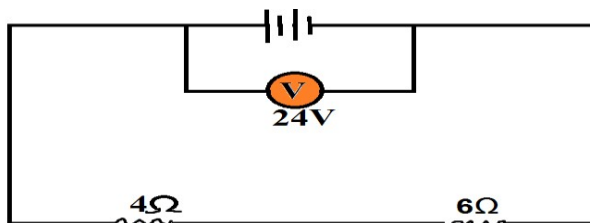
1. Explain three (3) major components of simple electric circuit.
2. List down ten (10) electric circuit devices and draw their respective symbols.
3. Define the following terms:
 - (a) Voltage
 - (b) Volt
 - (c) Resistance
 - (d) Potential difference
 - (e) Resistors
4. State Ohm's law.
5. State an instrument used to measure:
 - (a) Electric current.
 - (b) Potential difference
6. State SI unit of:
 - (a) Electric current
 - (b) Potential difference
 - (c) Resistance
 - e.
7. Explain four (4) factors affecting the resistance of a conductor.
8. An electric current of 0.12 A passes a certain point along a conducting wire. How much electric charge is flowing past this point in a minute?
9. A resistance wire of $20\ \Omega$ is connected across a battery of 5 V. Calculate the current in the circuit.
10. An ohmic conductor has a voltage drop of 9 V measured across it. The current flowing in the conductor is 3 mA. What is its resistance?
11. A current of 0.25 A flows through a circuit of voltage 10 V across a bulb. What is the resistance of the bulb?
12. What do you understand by an ohmic conductor?
13. If a p.d. of 6.0 V is measured across the ends of a wire of resistance $12\ \Omega$, (i) Determine the current that flows through it.

- (ii) Calculate the p.d. that is required to produce a current of 1.5 A flowing through it.
14. A current of 100 mA flows through a 5 k Ω resistor. Determine the p.d across the resistor.
15. Three resistors of 2 Ω , 3 Ω and 6 Ω are connected in series to 3 V battery. What is the current in the circuit?
16. Two resistors of 6 Ω and 12 Ω are connected in parallel, (i) Draw the schematic diagram of the circuit.
(ii) Determine the total resistance of the circuit.
(iii) Calculate the p.d. of the circuit when the current across it is 5 A.
17. Two resistors of resistances 2 Ω and 4 Ω are connected to a circuit. Calculate the resistance of the circuit when:
(a) Resistors are connected in parallel
(b) Resistors are connected in series
18. Calculate the reading of the voltmeter, P and the ammeter, Q in the electric circuit battery.



19. Calculate the combination resistance in
- A)
- B)
- C)

20. Consider the figure below



Calculate P.d
across: a)
4 Ω

b) 6 Ω

21. Two resistors of resistance 10 Ω and 50 Ω respectively are to be connected between two points A and B. What will be the resistance between A and B if the two resistors are to be connected in
- (a) series
 - (b) parallel

3. MAGNETISM

3.1. Concept of Magnetism

1. Define the following terms:
 - (a) Magnetism
 - (b) Magnet
 - (c) Magnetic force
 - (d) Magnetic materials
 - (e) Non-magnetic materials
 - (f) Magnetic poles
 - (g) Magnetic domains
 - (h) Magnetic dipoles
2. Explain types of magnets.
3. Describe properties of magnets.
4. Mention five (5) shapes of magnets.
5. Explain applications of magnets.
6. Explain the concept of ferromagnetic materials and list three (3) of them.

3.2. Magnetization and Demagnetization

1. Define the following terms: (a) Magnetization
(b) Demagnetization
2. Explain three (3) methods of aligning domains of ferromagnetic materials.
3. Explain three (3) methods of destructing alignment of domains of ferromagnetic materials.
4. How can you store magnets for effective and durable use of their magnetism?
5. In which part of a fridge or microwave oven do magnetic strips installed? Why?
6. What are practices to be observed when storing magnets?

3.3. Magnetic Fields of a Magnet

1. Define the following terms: (a) Magnetic field
(b) Magnetic lines of force

- (c) Neutral point
- (d) Magnetic shielding
- 2. Explain five (5) properties of magnetic lines of force.
- 3. Explain how a region can be shielded from magnetic field.
- 4. Illustrate magnetic lines of force between:
 - (a) Like poles
 - (b) Unlike poles

3.4. Earth's Magnetic Field

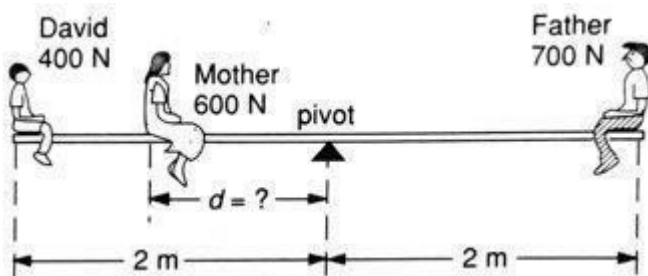
1. With help of diagram explain the phenomenon of earth's magnetism.
 2. Define the following terms:
 - (a) Angle of declination
 - (b) Angle of inclination
 - (c) Magnetic meridian
 - (d) Geographical meridian
 3. Explain four (4) applications of earth's magnetic field.
 4. Explain why freely suspended bar of magnet, its North Pole usually points upward.
-

4. FORCES IN EQUILIBRIUM

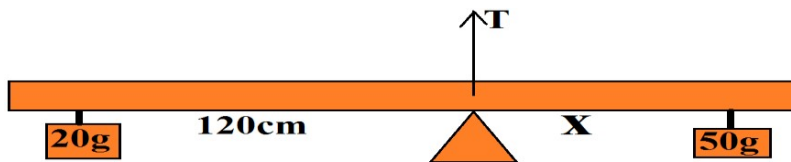
4.1. Moment of a Force

5. What is moment of force?
6. Explain the effects of turning force.
7. State the principle of moments.
8. Describe applications of the principle of moments in daily life.
9. What is centre of mass?
10. How can turning force cause rotation?
11. What are conditions for a moment of force about a point to occur?
12. What is the condition for a system to be in a rotational balance?
13. Explain two factors in which a moment of force depends.
14. Why it is easier to open a nut by a long spanner than a shorter one?
15. Why is the knob on a door placed as far as possible from hinges?
16. Explain the application of the principle of moments in a see-saw.
17. A uniform metre rule is pivoted at its centre O with a knife edge. A 20 g mass is placed at the 10 cm mark and a 50 g mass at 40 cm mark. At what mark must a second 50 g mass be placed for the system to be in rotational balance?
18. A uniform rod with a mass of 120 g and a length of 130 cm is suspended by a wire at point of 80 cm from one end. What mass must be hung on the rod for it to be in equilibrium? What will be tension (T) in the wire?

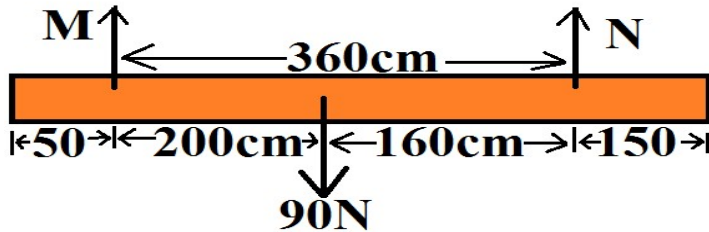
19. Abu has a mass of 60 kg, and he is sitting on a see-saw at a distance of 2.5 m from the pivot. Calculate the moment due to his weight. ($g = 10 \text{ N/kg}$)
20. A uniform half metre rule is freely pivoted at the 15 cm mark and balances horizontally when a body of mass 40 g is hung from 2 cm mark. Draw a clear force diagram of the arrangement and calculate the mass of the rule.
21. It is found that a uniform wooden latch 100 cm long and mass 95 g balances on a knife edge when a 5 g mass is hung 10 cm from one end. How far is the centre of the latch?
22. A line of action of a force of 90 N acts at a perpendicular distance of 2.5 m, from a point. Find the moment of the force.
23. A 100 g weight is suspended 45 cm from the pivot, of a light rod. If a weight w is suspended 20 cm from the pivot balance the 100 g weight. Find weight w .
24. A uniform metre ruler is pivoted at its centre. A 20 g mass is placed at the 10 cm mark and a 50 g mass at the 40 cm mark. At what mark must a second 50 g mass be placed for the system to be in rotational balance?
25. A uniform rod with a mass 120 g and a length of 130 cm is suspended by a wire from a point 80 cm from the rod's left end. What mass must be hung from the right end of the rod for it to be in equilibrium? What will be the tension of the wire?
26. David and his father are sitting at the end of a seesaw 2 m from the pivot while David's mother is sitting at a distance d from the pivot. The seesaw balances as shown in the figure below. Determine d .



27. A heavy uniform beam AB of weight 500 N is supported at its ends. The beam carries a weight of 300 N at a distance of 1.5 m from the end A. If the beam is 4 m long. Find the thrust/tension/reaction at A and B.
28. The diagram below shows a 150 g rod balanced at its centre of gravity. A 20 g mass is placed 120 cm from the pivoted point
- Find the value of x
 - What upward force/reaction/tension does the pivot exert on the rod?

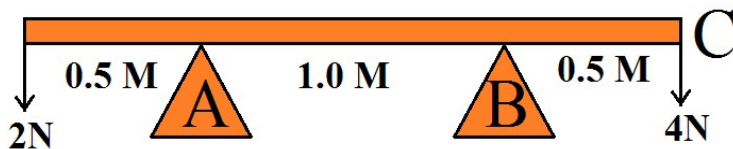


29. From the diagram below calculate reaction M and N



30. From the diagram below calculate

- (i) Reaction A and B
- (ii) Additional weight at C will just tilt the beam about B?



31. The line of action of a force 48N is at perpendicular distance of 1.5m from the point. Find the moment of the force about the point.
32. The moment of a force about a point is 1120Nm. If the magnitude of a force is 5600N, find the perpendicular distance between the point and the line of action of the force.
33. The moment of a force is 1000 Nm. If the line of the force is at perpendicular distance of 100m, find the magnitude of a force.
34. If 150 N of force is applied on a spanner of 10 cm to open a nut. What is the length on a spanner when a force of 60 N is applied?
- 35.

4.2. Centre of Gravity

1. What is centre of gravity?
2. Describe on how to determine the centre of gravity of:- (a) regular shaped body; and (b) irregular shaped body.

4.3. Types of Equilibrium

1. Explain the conditions for equilibrium.
2. Write short notes about:- (a) Stable equilibrium
(b) Unstable equilibrium
(c) Neutral equilibrium
3. Explain the applications of conditions of stable, unstable and neutral equilibrium in daily life.
4. Why are luggage compartments located at the bottom of a bus?
5. State the conditions for stability of an object.

5. SIMPLE MACHINES

5.1. Concept of Simple Machines

1. What is simple machine?
2. Define the following terms:- (a) Effort
(b) Load
(c) Mechanical Advantage
(d) Velocity Ratio
(e) Efficiency
3. List six (6) types of simple machines
4. Explain with examples significances of simple machines.
5. A person whose mass is 100 kg lifts a box of mass 500 kg by standing on one end of a lever. How much mechanical advantage does the lever provide to the person as he/she lifts the box?
6. A machine having a velocity ratio of 5 requires 600 J of work to raise a load of 400 N. If the load moves a distance of 0.5 m, calculate the mechanical advantage and efficiency of the machine.
7. When a machine pressed by effort moved down a distance of 100 cm, while the load is raised through 25 cm at the same time. Find the velocity ratio.
8. An athlete exerts a force of 100 N while running 100 m race, if he uses 50,000 J of food energy. Calculate his efficiency.
9. In a certain machine a force of 10N moves down a distance of 3cm in order to raise a load of 10N through a height of 0.5cm. Calculate the velocity ratio of the machine.
10. A certain machine is designed in such a way that a force of 150N is used to lift load of 600N. What is the mechanical advantage?
11. A simple machine was used to raise a load of weight 3920N through a height of 3.5m by applying an effort of 980N, if the distance moved by the effort was found to be 20m, find.
 - (a) The mechanical advantages.
 - (b) The velocity ratio.
 - (c) The efficiency of the machine.

5.2. Levers

1. What is a lever?
2. Mention three parts of a lever.
3. With help of diagrams describe three (3) classes of levers. Give three (3) examples in each class.
4. Explain the uses of levers.
5. A certain first class lever of length 2.5 m has a velocity ratio of 12 and an efficiency of 85%.
 - (a) How far from the fulcrum is the effort applied?
 - (b) What effort is required to lift a load weighing 75 N?

6. A lever system of velocity ratio 45 overcomes a load of 4,500 N when an effort of 105 N is applied to it. Calculate:
 - (a) the mechanical advantage of the lever system.
 - (b) its efficiency
 - (c) the percentage of the work input which is used to overcome friction in the system.
7. A see-saw of length 3.2 m has an efficiency of 70 % with a velocity ratio of 10.
 - (a) Which class is this lever?
 - (b) How far from the fulcrum is the effort applied?
 - (c) Calculate the effort required to lift a load of 90 N.
8. An effort of 100 N is applied on a wheelbarrow carrying a load of 500 N with velocity ratio of 8. If the effort acts 2.5 m from the fulcrum, calculate:
 - (a) load arm
 - (b) efficiency of the machine
 - (c) the percentage of the lost work input
9. A certain third class lever with velocity ratio of 0.6 is acted by an effort at a point 1.6 m from the fulcrum. At which point the load can be placed.
10. A force of 30 N is applied at one end of a crowbar and adjust overcomes a resistance of 150 N at the lid of a case. Find mechanical advantage.
11. In a certain machine , a force of 10 N moves down a distance of 5 cm in order to raise a load of 100 N through a height of 0.5 cm. calculate velocity ratio of the lever.
12. A machine with velocity ratio of 6 required 800J of work to raise a load of 600 N through a vertical distance of 1 m. find efficiency and mechanical advantage.

5.3. Pulleys

1. What is a pulley?
2. With help of diagrams describe types of pulleys.
3. Explain the uses of pulleys.
4. A pulley system is made up of 8 pulleys. An effort of 200 N is applied on pulley system. If the pulley system has an efficiency of 80 %, what is the maximum load that can be raised by the effort applied?
5. Determine the effort required to lift a load of 100 N using:
 - (a) a single fixed pulley
 - (b) a single movable pulley
 - (c) combination pulley system made up of 5 pulleys
 - (d) compare your results. Which is a suitable pulley to use in this case? Why is it suitable?
6. A simple machine has a velocity ratio of 5, and it is 80 % efficient. What effort would be needed to lift a load of 200 N with the aid of this machine?

7. While lifting a load of 200 N using a lever, an effort of 80 N moved through a distance of 20 cm to lift the load through a distance of 4 cm. Calculate:
 - (a) the work done by the effort.
 - (b) the efficiency of the system.
 - (c) the effort applied.
8. A block and tackle system consisting of 5 pulleys is used to raise a load of 400 N through a height of 10 cm. If the work done against friction is 100 J, calculate:
 - (a) the work done by the effort.
 - (b) the efficiency of the system. (c) the effort applied.
9. If an effort of 60 N is needed to lift a load of 150 N with three-pulley system, what is the efficiency of this machine?
10. A block and tackle pulley system has a VR of 4, if a load of 100 N is raised by using force of 50 N. Find the mechanical advantage and Efficiency.
11. A simple pulley system has velocity ratio of 3, if its efficiency is 90%. Find load which can rise by an effort of 100 N.

5.4. Inclined Plane

1. What is an inclined plane?
2. Explain the uses of inclined planes.
3. A force of 600 N is used to move a load of 3,000 N up an inclined plane. Given that the slanted height and the vertical height of the plane are 18 m and 3 m respectively, determine:
 - (a) the velocity ratio of the plane
 - (b) the mechanical advantage of the plane
 - (c) the efficiency of the plane
4. A 200 kg crate is to be loaded onto the bed of a truck that is 1.4 m above the ground. A metal ramp of 5 m long is leaned against the truck bed, and the crate is pushed up along it. Neglecting the frictional forces:
 - (a) calculate the force required to push the crate up the inclined plane at constant velocity.
 - (b) calculate the mechanical advantage of the incline. (c) determine the efficiency of the machine.
5. A trolley is pulled up an inclined plane 2 m high using a force of 4 N. If the mass of the trolley is 1 kg:
 - (a) what is the mechanical advantage of the plane?
 - (b) find its velocity ratio. (c) find its efficiency.
6. An effort of 20 N raises a bag up an inclined plane by 10 cm. If the mechanical advantage of the inclined plane is 10, calculate the load distance.
7. A loaded wheelbarrow weighting 800 N is pushed up an inclined plane by a force of 150 N parallel to the plane, if the plane rises 50

cm for every 400 cm length of the plane. Find the velocity ratio, mechanical advantage and efficiency.

5.5. Screw Jack

1. Define the following terms:- (a) Screw
(b) Screw jack
2. Explain the uses of screw jack.
3. A screw jack has 5 threads per centimetre. If the length of the turning arm is 20 cm, determine the velocity ratio of the screw jack. (Take $\pi = 3.14$)
4. A screw jack which has 5 threads per cm is used to lift a car weighing 20,000 N. If the length of the turning arm is 40 cm, and the efficiency of the screw jack is 90% find:
 - (a) the velocity ratio of the jack.
 - (b) the mechanical advantage of the jack.
 - (c) the minimum force required to raise the car. (Take $\pi = 3.14$)
5. A screw jack has an efficiency of 40% and it is used to lift a load of 400 kg. If its pitch is 0.5 cm and the effort arm is 0.5 m long, find the effort required.
6. The pitch of a screw jack is 0.5 cm. When used to raise a load, the handle turns through a circle of radius 40 cm. What is the *MA* of the screw jack if its efficiency is 25%? (Take $\pi = 3.14$)
7. The *VR* of a screw jack is 420. If it has 10 threads per centimetre, calculate the length of the turning lever.
8. A screw jack has 8 threads per centimetre of length. If the length of the turning handle is 10 cm, calculate the velocity ratio of the screw jack.
9. The handle of the screw jack is 35 cm long and the pitch of the screw is 0.5 cm. what force must be applied to the end of the handle when lifting a load of 2200 N, when efficiency of the jack is 40%.

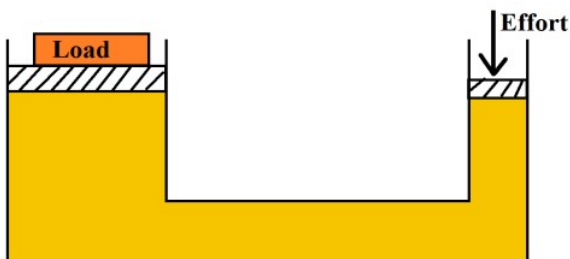
5.6. Wheel and Axle

1. Describe the structure of wheel and axle.
2. Explain the uses of wheel and axle.
3. Why does a cyclist often zigzag when going up a hill?
4. Imagine that you are riding a bicycle. How many simple machines are in your possession?
5. What is the significance of the gearwheel as a simple machine?
6. A wheel and axle has a velocity ratio of 6. Determine the radius of the wheel if the radius of the axle is:
 - (a) 5 cm
 - (b) 8 cm
 - (c) 12 cm

7. A wheel and axle with an efficiency of 90% is to be used to raise a load of 10,000N.
The radius of the wheel is 40 cm while that of the axle is 5 cm. Calculate:
 - (a) The velocity ratio of the wheel and axle
 - (b) The mechanical advantage of the wheel and axle
 - (c) The effort required to raise the 10,000 N load.
8. A crank handle with a length of 30 cm is attached to an axle with a radius of 5 cm and is used to lift a bucket of water from a deep well. If the bucket of water weighs 120 N and friction is negligible,
 - (a) How much force is required to turn the crank?
 - (b) Find the number of turns of the crank required to raise the bucket to the surface if the well is 510 m deep.
9. Find the VR of wheel and axle system if the load gear has 60 teeth, and the driven gearwheel has 20 teeth.
10. A gearwheel A has 20 teeth. It is used to drive a gearwheel B with 80 teeth.
 - (a) Calculate the velocity ratio.
 - (b) If wheel A rotates three times every second, how many times does wheel B rotate in a second?

5.7. Hydraulic Press

1. With help of diagram describe the structure of hydraulic press.
2. Explain the mode of action of a hydraulic press.
3. Explain the uses of hydraulic press.
4. A hydraulic machine has a piston *P* of cross-sectional area 5 cm² and a piston *Q* of cross-sectional area 50 cm². Find the velocity ratio of the system.
5. If the VR of hydraulic machine is 441, and the distance moved by the effort piston is 7 m, calculate the distance moved by the load.
6. The efficiency of a press is given as 75%. If the radius of the load piston is 3 cm while that of the effort piston is 1.5 cm, calculate:
 - (a) The velocity ratio
 - (b) The mechanical advantage of the press
7. The diagram below shows a hydraulic press being used to lift a container weighting 100000 N.



Radii of the effort and load piston are 20 cm and 50 m respectively, if the efficiency of the hydraulic press is 90%. Determine

- (a) Velocity ratio

- (b) Mechanical advantage
- (c) Minimum Effort
- (d) The distance the container raised through if the effort piston pushed through 1 m

6. MOTION IN STRAIGHT LINE

6.1. Distance and Displacement

1. What is motion?
2. Explain two (2) types of motion.
3. Distinguish between distance and displacement.
4. State SI unit of:
 - (i) Distance
 - (ii) Displacement
5. Mariana runs twice round a field track of length 500 m. (a) What distance does she cover?
(b) What is her displacement from starting point?
6. A car moves 8 km due South and suddenly changes its direction and moves another 6 km due West. Determine:
 - (a) the total distance covered.
 - (b) the displacement of the car.

6.2. Speed and Velocity

1. Distinguish between speed and velocity.
2. State SI unit of:
 - (i) Speed
 - (ii) Velocity
3. What is average velocity?
4. An object travelled a distance of 20 m to the right in 4s and then 12 m to the left 3 s. For its total motion, what were its average speed and its average velocity?
5. A ball is dropped from a height of 20 m above the ground. It hits the ground in 2 s and bounces back up to a height of 12.7 m in 1.6 s. What is its average velocity?
6. A car travels 6,000 m in 30 s. What is its average speed? Why is its actual speed usually different from its average speed?
7. What is the average speed of an athlete who runs 1,500 m in 4 minutes?
8. A bus increases its speed steadily from 10 m/s to 20 m/s in one minute. (a) What is its average speed during this time?
(b) How far does it travel while increasing its speed?
9. An object starts from rest and takes 2 hours to cover a distance of 160 km. How fast is the object moving?
10. An object travelled 20m to the right in 4s and then 12m to the left in 3s, for its total motion, what were its average speed & its average velocity?

11. A ball is dropped from a height of 20m above the ground. It hits the ground in 2s and bounces back up to a height of 12.7m in 1.6s. What are its average velocity.
12. A 100m runner finishes the race in 10s. What is her average speed?

6.3. Acceleration

1. What is acceleration?
2. State SI unit of acceleration.
3. What is retardation?
4. An object is initially moving at 15 m/s to the right. Eight seconds later, it is moving at 5 m/s to the left. During those eight seconds, what is the object's acceleration?
5. A car accelerates from 5 m/s to 20 m/s in 3 seconds. What is the car's acceleration
6. A car starts from rest and accelerates uniformly at a rate of 4 m/s^2 for 5 s. It maintains a constant velocity for 20 seconds. The brakes are then applied and the car decelerates for 3 s. Find:
 - (a) The maximum velocity attained.
 - (b) The total distance covered.
7. A body is thrown upward with a velocity 20 m/s. It returns to the ground at the same position after 8 s.
 - (a) Sketch a graph of velocity against time for the motion.
 - (b) From the graph, determine the distance travelled and the total displacement.
8. Mariana drove her car from rest to a speed of 30 m/s in 10 s. She maintained his steady speed for 10 s, after which she applied the brakes and stopped after 5 s.
 - (a) Draw a graph of speed against time.
 - (b) From the graph in (a) above calculate:
 - (i) the total distance travelled.
 - (ii) the time taken for the whole journey.
 - (iii) the maximum speed attained.
 - (iv) the area under the graph.
9. What is meant by uniform speed, uniform velocity and uniform acceleration?
10. An object is moving at 15 m/s to the right after 8 sec later it is moving at 5 m/s to the right, what was the acceleration of the object?
11. A car brakes and slows down from 20 m/s to 5 m/s in 3 sec. find its acceleration.
12. A car travels at 45 m/s and decreases its velocity uniformly to 20 m/s in 5 sec. find acceleration.

13. A car travel with uniform velocity of 30m/s for 5 second and then comes to rest 10 second with uniform deceleration.
 - i. Draw a velocity-time graph of the motion.
 - ii. Find the total distance travelled.
 - iii. Find the average.
14. A body accelerates uniformly from velocity of 40 m/s to a velocity of 50 m/s in 4sec.

find

 - a) Draw a velocity-time graph of the motion.
 - b) Acceleration of the body
 - c) The total distance travelled by the body in metre

6.4. Equations of Uniformly Accelerated Motion

1. Derive equations of uniformly accelerated motion
2. A car starts to move from rest and accelerate uniformly at the rate of 2 m/s^2 for 6 s. It then maintains a constant speed for 30 s. After the brakes are applied, it decelerates uniformly to rest in 5 s. Calculate:
 - (a) the total distance covered in metres. (b) the maximum speed reached.
3. A train travelling at 30 km/h stops when its brakes are applied. The train suffers a deceleration of 2 m/s^2 .
 - (a) How long does the train take to come to rest? (b) What is its final velocity?
4. An object travelling at 10 m/s accelerates at m/s^2 in 8 seconds.
 - (a) Calculate the final velocity
 - (b) How far does it travel for 8 seconds?
5. A car moves with uniform velocity of 12 m/s for 6 s. It accelerates at 2 m/s^2 for 4 s. It then travels for 2 more seconds with uniform velocity. The car finally decelerates to a stop in 15 seconds. Calculate
 - (a) the distance traveled in 5s; and
 - (b) average velocity for the journey, assuming that the journey is in straight line.
6. An object with initial velocity of 20 m/s moves due to North at an acceleration of 8 m/s^2 for 5 s. What is the total displacement during this time?
7. A car is travelling at 20 m/s along a straight road. The brakes are applied for 5 s causing a retardation of 3 m/s^2 . Find the car's final velocity.
8. Starting from rest, a car accelerates uniformly at 2.5 m/s^2 for 6sec. the constant speed is maintained for one third of a minute. The brakes are then applied making the car to retard uniformly to rest in 4sec. find
 - (a) Draw speed time graph
 - (b) Maximum speed in km/h

- (c) Displacement covered in km
9. A car accelerates uniformly from rest to a speed of 15km/h in 10s, Find:
- (a) The acceleration in m/s^2
 - (b) Distance covered in meters

6.5. Motion Under Gravity

1. What is force of gravity?
2. What is the acceleration due to gravity? How is it determined?
3. A body moved vertically upward to maximum height of 20 m. Calculate
 - (a) the initial velocity; and
 - (b) the time taken to reach the maximum height.
4. A stone falling down a well takes 2 s to reach the water surface. Calculate (a) the velocity with which the stone hits the water surface; and (b) the distance of the water surface from the top of the well shaft.
5. An object is thrown vertically upwards with an initial velocity of 50 m/s.
 - (a) How long will it take to reach its maximum height?
 - (b) To what height will it rise?
 - (c) What will be its velocity when it returns to its starting point? (d) How long will it be in the air?
6. A stone is thrown vertically upward from the ground with a velocity of 30 m/s. find
 - (a) Maximum height reached
 - (b) Time taken for maximum height
 - (c) Time taken for reach ground again
 - (d) The velocity reached half-way to the maximum height
7. An object is thrown straight up with an initial velocity of 50 m/s
 - (a) How long will take to reach its maximum height (b) To what height will it rise?
 - (c) What will be its velocity when it returns to its starting point? (d) How long will be in the air?

7. NEWTON'S LAWS OF MOTION

7.1. First Law of Motion

1. State Newton's first law of motion.
2. What is inertia?
3. Explain types of inertia.
4. Explain why the following situations arise:
 - (a) Mangoes fall down when the mango tree is shaken.
 - (b) A ball thrown vertically upwards by a passenger inside a train moving with constant velocity returns to the thrower.

- (c) Dust particles are removed from a carpet by striking the carpet with a stick.
 - (d) When a person jumps into a moving lorry from behind, she falls backwards.
5. A front-wheel drive car is travelling at constant velocity. (a) What are forces acting on the moving car?
- (b) Draw a sketch to illustrate the forces acting on the car.
 - (c) Passengers in a car are advised to fasten seat belts. Explain in terms of Newton's first law of motion, how can a safety belt reduce injuries.

7.2. Second Law of Motion

1. State Newton's second law of motion.
2. Define linear momentum.
3. A saloon car of mass 1,000 kg is moving with a velocity of 60 km/h. What is its momentum?
4. Suppose you exert an upward force of 10 N on a 3 kg object. What will be the object's acceleration?
5. A tennis ball whose mass is 150 g is moving at a speed of 20 m/s. It is then brought to rest by one player in 0.05 s. Calculate the average force applied.
6. An unbalanced force of 12 N acts on a mass of 2 kg. Calculate
 - (a) the resulting acceleration; and
 - (b) the force that could give a body of 10 kg the same acceleration.
7. A body at rest is acted upon by a force for 20 s. The force is then withdrawn, and the body moves a distance of 60 m in the next 5 s. If the mass of the body is 10 kg, calculate the magnitude of the force.
8. A train of mass 22,400 kg moving at the rate of 112 km/h is brought to rest in 24 s by the action of the brakes. Calculate the braking force.
9. A trolley of mass 5 kg rests on a smooth horizontal track. A forward force of 4.5 N is applied to the trolley. Find the acceleration of the trolley.
10. A car moves with an acceleration of 5 m/s^2 . If its mass is 2,000 kg, find the force with which the car is moving.
11. A man of mass 1000 kg is moving with a velocity of 60 km/h. find its momentum
12. Suppose you exert an upward force of 10 N on a 3kg object. What will be the object acceleration?
13. A trolley of mass 20 kg loaded with a bag of maize of mass 100 kg rest on a smooth horizontal track. If two opposing forces of magnitude 55 N and 90 N are applied to the trolley, find
 - (a) the acceleration of the trolley;

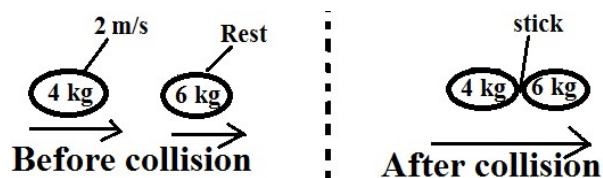
- (b) the direction of the resulting motion; and
- (c) the distance travelled by the trolley in 4s.

7.3. Conservation of Linear Momentum

1. What is collision?
2. Distinguish between elastic and inelastic collisions
3. State the principle of conservation of linear momentum.
4. Define an impulse and state its SI units.
5. A 3 kg hammer is used to drive a nail into a piece of wood. If at the time of impact, the hammer's speed is 5 m/s and it drives the nail 1 cm into the wood, calculate
 - (a) the acceleration of the hammer;
 - (b) the force exerted;
 - (c) the time of impact; and
 - (d) the impulse
6. A rocket of mass 2×10^4 kg is launched by applying a force of 5×10^4 N for 20 s. Calculate the velocity it attains at the end of 20 s.
7. Find the average force needed to change the velocity of a 20,000 kg lorry from rest to 13.6 m/s in 20 s.
8. A force of 5N acts on a body for 3×10^{-6} s.
 - (a) Find the impulse.
 - (b) If the mass of the mass of the body is 5 g, calculate the change in velocity.
9. A car of mass 1,800 kg is moving at an initial velocity of 20 m/s. It hits a wall and stops after covering 1.8 m. What is the average stopping force that the wall applied on the car?
10. A 1,000 kg car collides with a 5,000 kg truck. During the collision, the truck exerts a force of 10,000 N on the car. What are the accelerations of the car and the trunk?
11. A 4 kg object is moving to the right at 2 m/s when it collides elastically head-on with a stationary 6 kg object. After the collision, the velocity of the 6 kg object is 1.6 m/s to the right.



- (a) What is the velocity of the 4 kg object after collision?
 - (b) What is the total KE before and after collision?
12. The same two objects as in question 11 collide, but this time they stick together after the collision. What will be their velocity after collision? Is the total kinetic energy conserved?



13. A trolley A of mass 1.5 kg is travelling at 6 m/s. It collides with a stationary trolley B of 2 kg. After the collision, the two continue travelling together at 3 m/s.
 - (a) Calculate the momentum of A before collision.
 - (b) Calculate the momentum of A after collision.
 - (c) Why is there a change in momentum of A?
 - (d) Determine the kinetic energy of each trolley after the collision.
14. A car A of 2,000 kg travelling at 10 m/s has a head-on collision with a car B of 500 kg. If both cars stopped on colliding, what is the velocity of B?
15. Calculate the resultant force needed to accelerate a space shuttle of mass 3.0×10^6 kg from rest to 600 m/s in 33 s.
16. A bullet of mass 10 g leaves a gun of mass 500 g with a velocity of 100 m/s. Find the velocity of the gun coil.
17. During a collision, a truck applies a force of 20000N on a 250 kg van for 0.5 seconds. Determine the impulse experienced by the van.
18. A net force of 15 N is exerted on an encyclopedia to cause to accelerate at a rate of 3 ms^{-2} . Determine the mass of the encyclopedia.
19. A trolley of mass 400 g has a velocity of 600 cm/s. Calculate the momentum of the trolley.
20. Suppose that a sphere is accelerating at rate of 2 m/s^2 . If the net force is tripled and the mass is halved, then what is the new acceleration of the sphere?
21. Determine the momentum of a 1000 kg truck moving Northwards at a velocity of 20 m/s.
22. An athlete has a westward momentum of 5000 kgm/s. If the athlete has a mass of 75 kg, at what velocity is he moving?
23. A cricket ball of mass 180 g travelling at 25 m/s is hit towards the bowler at 15m/s. The impact lasts for 0.04 s. Find: (a) the impulse (b) the average force applied
24. An unbalanced force of 12 N acts on a mass of 2 kg. Calculate
 - (a) The resulting acceleration
 - (b) The force that would give a body of 10 kg the same acceleration
25. Trolley A of mass 6 kg is rolling across a smooth horizontal desk with a velocity of 0.8 m/s. The trolley collides with a stationary trolley B of mass 2 kg. After the collision the trolleys couple and move off together in the direction in which A was

- travelling .Calculate the velocity of the trolleys after the collision.
26. A body of mass 8 kg moving with a velocity of 20 m/s collides with another body of mass 4 kg moving with a velocity of 10 m/s in the same direction .The velocity of the 8 kg is reduced to 15 m/s after collision .If the bodies do not stick together after the collision, calculate the velocity of the 4 kg body.
27. A 1000 kg cannon launches a cannon ball of mass 10 kg at a velocity of 100 m/s. At what speed do the cannon recoil?

7.4. Third Law of Motion

1. State Newton's third law of motion.
2. Distinguish between action and reaction forces.
3. Explain applications of Newton's third law of motion.
4. A gorilla has a mass of 50 kg, and it climbs on a rope which can stand a maximum tensional force of 600 N. Do you expect the rope to break if the gorilla:
 - (a) Climbs up with an acceleration of 6 m/s²?
 - (b) Climbs with uniform speed of 5 m/s?
 - (c) Falls down the rope while holding it due to gravitational force?
 - (d) Climbs down with an acceleration of 4 m/s²?
5. A pilot jumps from a plane on an air cushion. His speed is 24 m/s. The average force of the cushion on the body while he/she is being stopped is 9,400 N. If his/her mass is 70 kg, calculate the distance he will sink into the cushion.
6. A person standing in a lift holding a spring balance with a load of 5 kg suspended from it. What is the reading on the spring if the lift is descending with an acceleration of 3.8 m/s²?
7. A 3 kg hammer is used to drive a nail into a piece of wood. If at the time of impact the hammer's speed is 5 m/s and it drives the nail 1 cm into the wood. Calculate
 - (a) The acceleration
 - (b) Force exerted on the nail by hammer
 - (c) Time of impact
 - (d) The impulse
8. Explain the following phenomena using Newton's third law of motion
 - (a) An inflated balloon is released and shoots all around the room
 - (b) The recoil of a rifle when fired
 - (c) The launch of a rocket
 - (d) A hammer driving a nail into a block of wood.
9. A 80 kg man stands in a lift .Calculate the force he exerts on the floor of the lift when the lift is (Assume $g = 9.8 \text{ m/s}^2$)
 - (a) Stationary (ANS: $F = 780$)

- (b) Ascending upward at 2 m/s^2 (ANS: $F = 940 \text{ N}$) (c) Moving with a constant velocity (upward) 4 m/s .

8. TEMPERATURE

8.1. Concept of Temperature

1. What is temperature?
2. State SI unit of temperature.
3. Describe three (3) temperature scales.

8.2. Measurement of Temperature

1. What is the instrument used to measure temperature?
2. What is thermometric property?
3. Mention five (5) thermometric properties.
4. Explain why mercury is better liquid for measuring temperature than alcohol.
5. What is the fundamental interval of a thermometer?
6. Describe mode of action of liquid-in-glass thermometer.
7. If the temperature of nitrogen liquid is 77 K what is the temperature reading in Celsius and Fahrenheit scales?
8. What is meant by fixed points of a thermometer?
9. Describe how you will calibrate a clinical thermometer?
10. Explain limitations of clinical thermometer.
11. What are precautions of using clinical thermometer?
12. Explain characteristics of thermometric liquid.
13. Why water is not used as a thermometric liquid?
14. What are disadvantages of mercury as thermometric liquid?
15. Distinguish between clinical thermometer and laboratory thermometer
16. Differentiate the Celsius scale from Kelvin scale.
17. Convert the following Kelvin (K) temperatures to Celsius ($^{\circ}\text{C}$) temperatures:
 - (a) 300 K
 - (b) 293 K
18. Convert the following Celsius ($^{\circ}\text{C}$) temperatures to Fahrenheit ($^{\circ}\text{F}$) temperatures:
 - (a) 58°C
 - (b) 100°C
19. Convert -40°C to $^{\circ}\text{F}$.
20. The upper fixed point of a thermometer is 23 cm above the lower fixed point. If the upper fixed point is 90°C while the lower fixed point is 25°C , What is the temperature when the mercury thread is 14 cm above the lower fixed point?
21. After being mixed with impurities, the melting of ice was found to be -22°C . What is this temperature in Kelvin?

9. SUSTAINABLE ENERGY SOURCES

9.1. Water Energy

1. By using diagrams explain the generation of electricity from water.
2. Explain advantages and disadvantages of hydropower plants.

9.2. Solar Energy

1. Explain conversion of solar energy to electric energy.
2. What are applications of solar energy?
3. Explain the contribution of sun to other sources of energy.

9.3. Wind Energy

1. Explain wind as a source of energy.
2. What are applications of wind energy?
3. Explain advantages and disadvantages of wind as a source of energy.

9.4. Sea Wave Energy

1. Explain a sea wave as a source of energy.
2. Explain the conversion of sea wave energy to electric energy.
3. Explain advantages and disadvantages of sea wave as a source of energy.

9.5. Tidal Energy

1. Explain tides as a source of energy.
2. Explain the conversion of tidal energy to electric energy.
3. Explain advantages and disadvantages of tides as a source of energy.

9.6. Geothermal Energy

1. Explain a geothermal as a source of energy.
2. Explain the conversion of geothermal energy to electric energy.
3. Explain advantages and disadvantages of geothermal energy as a source of energy.