



Physics

**FTNA Past Paper Questions
and Answers by Topic**

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20. Temperature
21. Sustainable Energy Sources

Form I

Introduction to Physics

Introduction to Laboratory Practice

Measurement

Force

Archimedes Principle and Law of Flotation

Structure and Properties of Matter

Pressure

Work, Energy and Power

Light

Form II

Static Electricity

Current Electricity

Magnetism

Forces in Equilibrium

Simple Machines

Motion in Straight Line

Newton's Laws of Motion

Temperature

Sustainable Energy Sources

1. Multiple Choice Questions

2020

1. For each of the items (i) - (xx), choose the correct answer from among the given alternatives and write its letter in the box provided.

- (i) Physics is the study which deals with matter. What does it relate to?
A Power B Energy
C Force D Work
- (ii) What does someone pay for if he/she buys sugar from the shop?
A Mass B Density
C Volume D Weight
- (iii) What is a 20,000 g mass equal to?
A 2 tonnes. B 2 kg. C 2000 kg. D 20 kg.
- (iv) Which one will need much force to pull or push than the other between 10 kg of stone and 10 kg of cotton?
A 10 kg of stone will need much force than 10 kg of cotton.
B 10 kg of cotton will need much force than 10 kg of stone.
C Same force will be needed in both.
D 10 kg of stone is heavier than 10 kg of cotton.
- (v) Relative density of a substance is 2.5. What is its density?
A Equal to the density of water.
B Greater than the density of water.
C Equal to the volume of water displaced.
D Less than the density of water.
- (vi) Why does a body float in a fluid?
A Because its density is greater than the density of the fluid displaced.
B Because its density is less than the density of fluid.
C Because the weight of the fluid displaced is equal to its weight.
D Because the weight of the fluid displaced is less than its weight.
- (vii) Which of the following forces can cause the mosquito larva to float on water?
A Surface tension B Adhesive forces.
C Friction forces. D Cohesive forces.
- (viii) Which phenomenon explains the assertion that the narrower the tube the further the water rises?
A Capillarity B Diffusion
C Osmosis D Brownian movement
- (ix) Which pair of the following parameters affects pressure at any point in a liquid at rest?
A Density and volume B Depth and area
C Area and volume D Depth and density

-
- (x) What is the SI unit for power?
A Joule per metre B Metre per second
C Metre per second² D Joule per second
- (xi) What will be the number of images formed when two plane mirrors are set perpendicular to each other?
A 4 B 3 C 5 D 2
- (xii) Which device is used for detecting small electric charges?
A Proof plane B Capacitor
C Electrophorus D Gold leaf electroscope
- (xiii) What is the equivalent resistance of two resistors of $4\ \Omega$ and $6\ \Omega$ connected in parallel?
A $0.66\ \Omega$ B $10\ \Omega$ C $2.4\ \Omega$ D $1.5\ \Omega$
- (xiv) What is the name of the region surrounding a magnet in which the magnetic force is exerted?
A Magnetic field B Magnetic shielding
C Magnetic pole D Magnetic domain
- (xv) The moment of a force about a point is 1120 Nm . If the magnitude of the force is 5600 N , what is the perpendicular distance between the point and the line of action of the force?
A 5 m B 6720 m C 0.2 m D 4480 m
- (xvi) Which of the following groups of machines represents the first class levers?
A Wheel barrow and bottle openers
B Fishing rod and sugar tongs
C Crowbar and claw hammer
D Nutcracker and pair of scissors
- (xvii) Which of the following will be a suitable graph to represent the motion for a body moving in a straight line with a uniform acceleration?
A Distance against time graph. B Acceleration against time graph.
C Velocity against time graph. D Displacement against time graph.
- (xviii) What force is required to give a mass of 40 kg an acceleration of 0.2 m/s^2 ?
A 200 N B 0.005 N C 8 N D 20 N
- (xix) Which of the following devices is used for measuring the upper fixed point of a thermometer scale?
A Hydrometer B Hypsometer
C Thermometer D Barometer
- (xx) Which of the following is not one of the sources of sustainable energies?
A Water B Wind C Sun D Dry cell

2019

1. For each of the items (i) - (xx), choose the correct answer from the given alternatives and write its letter in the box provided.

- (i) Why Physics, Chemistry and Biology are natural science subjects?
A They need practical and theory work for learning.
B They need only theory for learning.
C They need practical work only.
D They need only observation.

(ii) Which of the following is a safety precaution in the Physics laboratory?
A Doing experiment in the laboratory
B Handling of apparatus in the laboratory
C Use equipment with care in the laboratory
D Do anything in the laboratory

(iii) Which instrument will you use to measure accurately the inside diameter of a bottle neck?
A tape measure.
B micrometer screw gauge.
C metre rule.
D Vernier calipers.

(iv) Which of the following statements is correct about mass?
A It is measured by beam balance
B It is measured by spring balance
C It varies with place
D It can be zero.

(v) A hydrometer is an instrument used to measure
A the volume of liquids.
B the density of liquids.
C the density of solids.
D the volume of solids.

(vi) When a body of mass M, is lifted through a height h, it possesses the energy known as
A kinetic energy.
B chemical energy.
C light energy.
D potential energy.

(vii) If the angle between two plane mirrors is 60° , what will be the number of images?
A 2
B 3
C 4
D 4

(viii) The presence of charge in a material can be demonstrated by
A electrophorus.
B earth wire.
C gold leaf.
D electroscope.

(ix) A current of 0.2 A flows through a resistor of 4Ω . The potential difference across a resistor is
A 20 V
B 0.8 V
C 0.05 V
D 8 V

- (x) The process of removing magnetism from a material is known as
A polarization. B demagnetization.
C magnetization. D magnetizing.

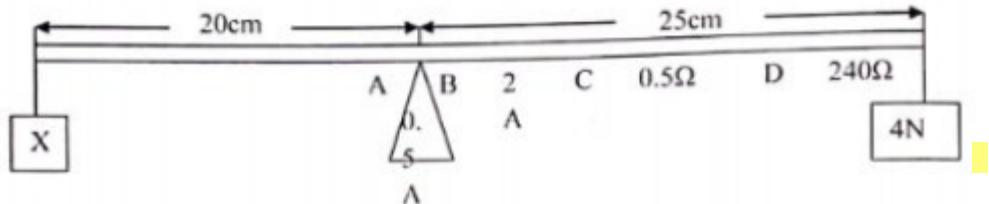
(xi) How can a real image be distinguished from a virtual image?
A Real image is inverted while virtual image is upright
B Real image is upright while virtual image is inverted
C Virtual image is formed by convergent rays while real image is formed by divergent rays
D Real image is formed by convergent rays while virtual image is by divergent rays

(xii) Why an atom is electrically neutral?
A It consists of equal number of electrons
B It consists of equal number of protons and electrons
C It consists of equal number of electrons and neutrons
D It consists of equal number of protons and neutrons

(xiii) A potential difference of 12V is applied across a resistor of resistance $24\ \Omega$. The current in a circuit is
A 0.5 A B 2 A C 0.5 Ω D 288 Ω

(xiv) If a North pole is used in the stroking method of magnetization, the end where the stroking begins is
A South pole. B North pole. C West. D East.

(xv) Figure 1 shows a ruler balanced by placing the loads at its ends. What is the weight of X?



- (xvii) Distance between two moving objects will change if
A both are moving with the same velocity.
B both have the same acceleration.
C both have different acceleration.
D both have no acceleration.

- (xviii) Which of the following best illustrates Newton's third law?
A Inertia
C Rocket propulsion
B Momentum
D Circular motion

- (xix) The temperature of a body of -40°C in Kelvin (K) scale is
A 313 K B 233 K C 272 K D -40 K

- (xx) Which of these resources of energy is non-renewable?
A Wave energy
C Radian energy
B Biofuels
D Fossil fuel

2018

SECTION - A

1. For each of the items (i) – (xx), choose the correct answer among the given alternatives and write its letter in the box provided.

- (i) Any substance that has mass and occupies space is known as
A energy.
B matter.
C universe.
D nature.

- (ii) A set of techniques used by scientists to investigate a problem refers to
A data interpretation.
B scientific method.
C performing an experiment.
D data presentation.

- (iii) A vernier caliper is used to measure
A distance of a car.
B diameter of a wire.
C mass of a car.
D length of a table.

- (iv) A force which prevent a body to slide is called
A stretching force.
C frictional force.
B restoring force.
D compressional force.

- (v) The ability of a body to float in a fluid is known as
A the law of up thrust. B the law of Archimedes.
C the law of floatation. D floating.

- (vi) One of the following is the condition for a body to float in water.
A The mass of a floating body is greater than displaced water.
B The density of the body must be less than the density of the fluid.
C The up thrust due to the liquid must be small than weight of body.
D The displaced water is less than the floating body.

- (vii) In a solid state the force of attraction between molecules is greater because particles are
A closely packed together. B somehow apart.
C not closely packed together. D moved so randomly.

- (viii) The phenomenon that is observed when maize flour poured on top of water is called
A diffusion. B capillarity.
C surface tension. D osmosis.

- (ix) Density and height are factors which affect pressure in
A solid. B solid and liquid.
C liquid. D gas.

- (x) When a body is performing a work, is said to have
A moment. B energy.
C momentum. D work.

- (xi) Which of the following unit could be used for kinetic energy?
A Kg B N C JS D NM

- (xii) Materials that allows only part of light to pass through them are called
A transparent. B translucent. C opaque. D newton.

- (xiii) What term refers to the stationary accumulation of charges on object?
A Current electricity B Static electricity
C Charging D Polarization

- (xiv) The rate of flow of electrons in a material is called
A charging. B potential difference.
C electric current D resistivity.

- (xv) Which of the following materials can magnetically be made strong?
A Nickel and Copper B Steel and Brass
C Cobalt and Iron D Cobalt and Copper

- (xvi) The point where the force of gravity can be considered to act is called
A centre of gravity B centre of mass.
C centre of weight. D equilibrium.

- (xvii) The rate of change of velocity of a body is known as
A uniform speed. B acceleration.
C distance. D displacement.

- (xviii) Why the mechanical advantage is less than three in a single rope three pulleys system?
A Because the effort may vary.
B Due to load rose.
C Because the upper pulley does not move.
D Due to friction on pulleys

- (v) A hydrometer is an instrument used to measure
A the volume of liquids.
B the density of liquids.
C the density of solids.
D the volume of solids. []

(vi) When a body of mass M is lifted through a height h, it possesses the energy known as
A kinetic energy. B chemical energy.
C light energy. D potential energy. []

(vii) If the angle between two plane mirrors is 60° , then the number of images will be
A 2 B 3 C 4 D 5 []

(viii) The presence of charge in a material can be demonstrated by
A electrophorus. B earth wire. C gold leaf. D electroscope. []

Community

- (ix) A current of 0.2A flows through a resistor of 4Ω . The potential difference across a resistor is
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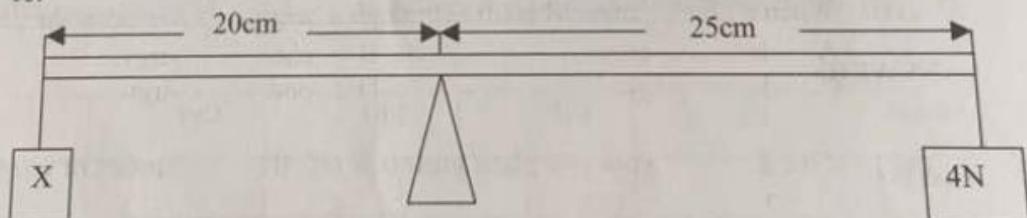


Figure 1

- A 5N B 0.5N C 100N D 200N

- (xvi) Which of the following is an example of a third class lever?
A Scissors B Fishing pole
C Pliers D Nut cracker

- (xvii) Distance between two moving objects will change if
A both are moving with the same velocity.
B both have the same acceleration.
C both have different acceleration.
D both have no acceleration.

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- (xx) Which of these resources of energy is non-renewable?
A Wave energy B Bio fuels
C Radiant energy D Fossil fuel

2015

- I. For each of the items (i) – (xx), choose the correct answer among the given alternatives and write its letter in the box provided.

- (i) A beam balance is used to measure
A Weight B Mass C Volume D Density.
- (ii) Which of the following is **not** a form of energy?
A Chemical B Nuclear C Heat D Joule.
- (iii) The speed of 72km/hr is equivalent to
A 120m/s B 1200m/s C 20m/s D 200m/s.
- (iv) To minimize zero error the pointer of the instrument should be adjusted
A at zero mark B before zero mark C after zero mark
D at the middle mark.
- (v) The region around a magnet is called
A Magnetization B Demagnetization C Magnetic field
D Magnetic domains.
- (vi) The tendency of an object to fall or drop to lower levels in a fluid is called
A Floating B Sinking C Upthrust
D Buoyant.
- (vii) The ability of a material to return to its original shape after deformation is called
A plasticity B plastic deformation C elastic limit
D elasticity.
- (viii) The energy associated with areas of frequent earthquakes is known as
A Tidal energy B Solar energy C Geothermal energy
D Wind energy.
- (ix) The image formed by plane mirror is always
A real B inverted C magnified
D left-right reversal.
- (x) An instrument used to store electric charges is called
A Capacitance B Capacitor C Resistor
D Inductor.
- (xi) A huge discharge of static electric charges between two clouds is called
A radar B thunder C lightning
D lightning conductor.
- (xii) Electric current is expressed as
A quantity of charge per unit time B voltage per unit time
C resistance per unit voltage D charge per unit voltage.

(xiii)	The pressure exerted by a force of 120N over an area of 10cm^2 is A 20000N/m^2 B 2000N/cm^2 C 12000N/m^2 D 120000N/cm^2 .	<input type="checkbox"/>
(xiv)	The change in momentum of an object to which force is applied within a very short of time is called A inertia B moment C impulse D deceleration.	<input type="checkbox"/>
(xv)	Molecular forces that are exerted between molecules of the same kind are known as A adhesive B cohesive C upthrust D surface tension.	<input type="checkbox"/> <input type="checkbox"/>
(xvi)	The point of support about which a bar or lever turns is referred to as a A pointer B load arm C fulcrum D pulley.	<input type="checkbox"/>
(xvii)	The rate at which work is done is called A energy B watt C joule per unit time D power.	<input type="checkbox"/>
(xviii)	The state of balance of a body is known as A equilibrium B static equilibrium C dynamic equilibrium D neutral equilibrium.	<input type="checkbox"/>
(xix)	Water is unsuitable as a thermometric liquid because it A boils at 80°C B freezes at -112°C C wets glass D does not wet glass.	<input type="checkbox"/>
(xx)	Which of the following is the property of gravitational force? A It is repulsive in nature B It acts over a very long distance C It is much stronger D It is non-central force.	<input type="checkbox"/>

2. Matching Items

2020

2. Match each item in List A with a response in List B by writing its letter below the number of the corresponding item in the table provided.

LIST A	LIST B
(i) The energy which is associated with the volcanic areas.	A Wind energy.
(ii) The energy due to afforestation and deforestation.	B Solar energy.
(iii) Natural resources that are used in the production of electricity without damaging the environment.	C Hydroelectric energy.
(iv) The energy generated by means of large propeller on tall tower.	D Wood energy.
(v) The energy produced by the Sun.	E Tidal energy.
	F Geothermal energy.
	G Sustainable energy sources.

ANSWERS

LIST A	(i)	(ii)	(iii)	(iv)	(v)
LIST B	F	D	G	A	B

2019

2. Match the items in **List A** with a correct response in **List B** by writing a letter of a correct response below the corresponding item number in the table provided.

List A	List B
(i) An instrument that measures length, depth, internal and external diameters.	A Measuring cylinder
(ii) An instrument that measures volumes of liquid.	B Pipette
(iii) An instrument that measures force of pull	C Vernier caliper
(iv) An instrument that transfers a specific amount of liquid from one container to another.	D Glass tumbler
(v) An instrument that measures body temperature.	E Spring balance
	F Clinical thermometer
	G Magdeburg experiment

Answers

List A	(i)	(ii)	(iii)	(iv)	(v)
List B	C	A	E	B	F

2018

2. Match each item in **List A** with a correct response in **List B** by writing a letter of a correct response below the number of the corresponding item in **List A** in the table provided

List A	List B
(i) The force used to operate a machine.	A Knife.
(ii) An example of 3 rd class lever.	B Lever.
(iii) Ratio of number of teeth in a driven wheel to the number of teeth in driving wheel.	C Inclined planes.
(iv) The force that causes an efficiency of a machine to be less than 100%.	D Friction.
(v) It is used to lift heavy weights with the least effort.	E Wheelbarrow.
	F Effort.
	G Velocity ratio.

Answers

List A	(i)	(ii)	(iii)	(iv)	(v)
List B	F	A	G	D	B

2017

2. Match each item in **List A** with a correct response in **List B** by writing a letter of a correct response below the number of the corresponding item in **List A** in the table provided.

List A	List B
(i) An instrument that measure length, depth, internal and external diameters.	A Measuring cylinder.
(ii) An instrument that measure volumes of liquid.	B Pipette.
(iii) An instrument that measure force of pull.	C Vernier caliper.
(iv) An instrument that transfer specific amount of liquid from one container to another.	D Glass tumbler.
(v) An instrument that measure body temperature.	E Spring balance.
	F Clinical thermometer.
	G Magdeburg experiment.

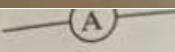
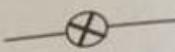
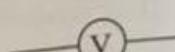
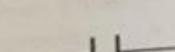
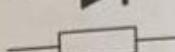
ANSWERS

List A	(i)	(ii)	(iii)	(iv)	(v)
List B	C	A	E	B	F

2015

2. Match each item in **List A** with a correct electric symbol in **List B** by writing its letter below the number of the corresponding item in the table provided.

LIST A	LIST B
(i) Supplies electrical energy.	A.
(ii) Convert electrical energy to heat and light.	B.
(iii) Impedes the flow of current.	C.
(iv) Detect the presence of current.	D.
(v) Measures current.	E.
(vi) Stores charge.	
(vii) Measures potential difference.	
(viii) Opens and closes a circuit.	

F.	
G.	
H.	
I.	
J.	
K.	

ANSWERS

List A	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
List B	E	G	K	C	F	I	H	A

3. Fill in the Blank Items**2020**

3. Complete each of the following statements by writing the correct answer in the spaces provided:

- (i) A complete measurement is called _____
- (ii) Efficiency of a machine is always less than 100% due to _____
- (iii) The linear momentum of a body of mass 5 kg moving with a velocity of 2 m/s is _____
- (iv) A region of total shadow on a screen is _____
- (v) The shape of the surface of water in a clean glass tube is _____

Answers :

- i. Physical quantity
- ii. Friction
- iii. 10 kgm/s
- iv. Umbra
- v. Concave meniscus

2019

3. Complete each of the following statements by writing the correct answer in the space provided.
- (i) Basic physical proportions of measurement which cannot be obtained from any other proportions by either multiplication or division are called
 - (ii) Staircases, winding roads uphill, wedges and a screw are physical examples of
 - (iii) The resistance of a body to change its state of rest is called
 - (iv) Objects which emit light when they are hot are called
 - (v) Materials which obey Hooke's law are known as

Answers :

- i. Fundamental physical quantity
- ii. Inclined plane
- iii. inertia of rest
- iv. Incandescent object
- v. Brittle or plastic/or elastomeric materials

2018

3. Complete each of the following statements by writing the correct answer in the space provided.
- (i) Mass of a body is defined as.....
 - (ii) The resultant of a force which overcomes resistance refers to.....
 - (iii) A force which produces an acceleration of 1m/s^2 in a mass of 1kg is called.....
 - (iv) The proper term for a light which passes through different media is.....
 - (v) A point just after elastic limit is called.....

Answers :

- i. *The quantity of matter inside the body*
- ii. *Work input/work/effort*
- iii. *Newton/N*
- iv. *Refraction*
- v. *Yield point*

2017

3. Complete each of the following statements by writing the correct answer in the space provided.
- (i) Basic physical proportions of measurement which cannot be obtained from any other proportions by either multiplication or division are called.....
 - (ii) Staircases, winding roads uphill, wedges and a screw are physical example of
 - (iii) The resistance of a body to change its state of rest is called
 - (iv) Objects which emit light when they are hot are called
 - (v) Materials which do not obey Hooke's law are known as.....

Answers :

- i. Fundamental quantity
- ii. Inclined plane

- iii.** Inertia of rest
- iv.** Incandescent objects
- v.** Brittle/stiff materials/inelastic material/plastic materials

2015

3. Complete each of the following statements by writing the correct answer in the space provided.
- (i) The quantity of space that an object occupies is known as.....
 - (ii) Occurs when a body's rate of change of displacement is constant
 - (iii) A physical quantity measured by using thermometer is referred to as.....
 - (iv) Causes an object to rotate or turn about a fixed point.....
 - (v) The angle between the geographic north and the magnetic north is called.....

Answers :

- 1.**
- 2.** Uniform velocity
- 3.**
- 4.** Turning force
- 5.** angle of declination

4. Introduction to Physics

5. Introduction to Laboratory Practice

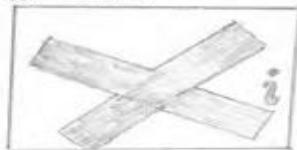
2015

6. (a) What is meant by First Aid?
.....
- (b) Draw the symbols or warning signs for each of the following:
- (i) Irritant.
 - (ii) Danger of an electric shock.
 - (iii) Toxic.
 - (iv) Flammable.

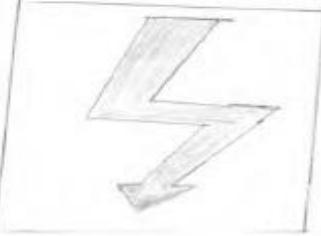
6. (a) What is meant by First Aid?
is the help or assistance given to a sick or an injured person before getting professional treatment.

(b) Draw the symbols or warning signs for each of the following:

(i) Irritant.



(ii) Danger of an electric shock.



(iii) Toxic.



(iv) Flammable.



6. Measurement

2015

4. (a) What is meant by capillary action.....
- (b) Differentiate between the following terms:
- (i) Magnetization and demagnetization.
- (ii) Luminous and non-luminous bodies.
- (iii) Regular and irregular reflection of light.
- (iv) Conductor and insulator.

4. (a) What is meant by capillary action... Is. It's cause or fall of liquid in a narrow tube.
- (b) Differentiate between the following terms:
- Magnetization and demagnetization.
Magnetization is the process of adding magnetism to the substance while demagnetization is the process of removing magnetism from the substance
 - Luminous and non-luminous bodies.
Luminous bodies are bodies which produce light while non-luminous bodies are those which do not produce light.
 - Regular and irregular reflection of light.
Regular reflection of light is the reflection which occurs on the smooth surface while irregular reflection occurs on the rough surface
 - Conductor and insulator.
Conductors are those materials which allow the flow of electric current while insulators are the material which do not allow flow of current

2015

5. (a) (i) Define friction.....
- (ii) Identify three effects of force.
5. (a) (i) Define friction. Is the force which prevents the body from sliding or is the resistance force of motion of an object on the surfaces.
- (ii) Identify three effects of force.
- (i) Force can change the shape of the body.
 - (ii) Force can cause the body at rest to move.
 - (iii) Force can cause the body in motion to stop or increase its velocity or speed.

7. Force

2015

- (b) (i) Define density and give its SI unit.

- (ii) List three applications of density in real life.

- (b) (i) Define density and give its SI unit.

Density is the mass per unit volume of substance.
SI unit is kg/m^3 or kg m^{-3} .

- (ii) List three applications of density in real life.

(i) It helps in making various structures Example Aeroplane
(ii) It helps in identification of gemstones and rocks
(iii) It helps to recognize the pure substances by considering their densities Example Pure milk.

8. Archimedes Principle and Law of Flotation

9. Structure and Properties of Matter

10. Pressure

2020

6. (a) Why is it easier to cut a bar of soap using a thin piece of wire than a thick one?

- (b) State four applications of atmospheric pressure.

- (c) A car of mass 8000 kg has one of its tyres having an area of 50 cm^2 in contact with the ground. If this is four wheel drive vehicle, calculate the pressure exerted on the ground by the car.

6. (a) Why is it easier to cut a bar of soap using a thin piece of wire than a thick one?
 ...It is easier to cut a bar of soap using a thin piece of wire than a thick one because the thin piece of wire has a small surface area which enables it to exert more pressure on the soap, making it easier to cut.

(b) State four applications of atmospheric pressure.

- (i) Siphon.....
- (ii) Bicycle pump.....
- (iii) Jet pump.....
- (iv) Force pump.....

(c) A car of mass 8000 kg has one of its tyres having an area of 50 cm^2 in contact with the ground. If this is four wheel drive vehicle, calculate the pressure exerted on the ground by the car.

Data given.

$$\text{Mass of the car} = 8000 \text{ kg}$$

$$\text{Area of one tyre} = 50 \text{ cm}^2$$

$$\text{Pressure} = ?$$

$$\text{Recall; Pressure} = \frac{\text{Force}}{\text{Area}}$$

$$\begin{aligned} \text{Since it's a four wheel drive, total} \\ \text{area} &= 4 \times 50 \text{ cm}^2 \\ &= 200 \text{ cm}^2 \\ 1 \text{ m}^2 &\geq 10,000 \text{ cm}^2 \\ ? &\geq 200 \text{ cm}^2 \end{aligned}$$

Solution.

$$\frac{200 \text{ cm}^2 \times 1 \text{ m}^2}{10,000 \text{ cm}^2} = 0.02 \text{ m}^2$$

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

$$\begin{aligned} \text{Force} &= \text{mass} \times \text{acceleration} \\ &= 8000 \text{ kg} \times 10 \text{ m/s}^2 \end{aligned}$$

$$= 80,000 \text{ N}$$

$$\begin{aligned} \text{Pressure} &= \frac{80,000 \text{ N}}{0.02 \text{ m}^2} \\ &= 4,000,000 \text{ N/m}^2 \\ &\approx 4,000,000 \text{ Pa} \end{aligned}$$

∴ The pressure exerted on the ground is
 $4,000,000 \text{ Pa.}$

2019

9. (a) What are the uses of the following devices?

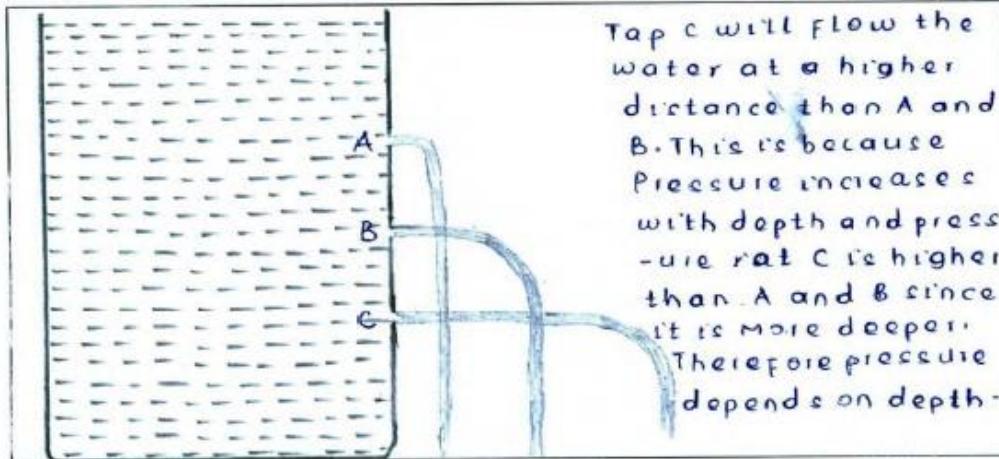
- (i) Manometer
- (ii) Hare's apparatus (inverted U-tube)
- (iii) U-tube
- (iv) Barometer

(b) Why a big Elephant manages to walk comfortably in muddy soil without sinking while a human being may sink easily?

.....

(b) Draw a well labeled diagram which demonstrates that liquid pressure depends on depth.

9. (a) What are the uses of the following devices?
- Manometer is used to measure gas pressure.....
 - Hare's apparatus (inverted U-tube). Measure the density of immiscible liquids.....
 - U-tube is used to measure the density of immiscible liquids.....
 - Barometer used to measure atmospheric pressure.....
- (b) Why a big Elephant manage to walk comfortably in mud soil without sinking while human being may sink easily?
 This applies to the concept of pressure that the larger the surface area in contact, the smaller the pressure and vice versa. Elephant's foot has a larger surface area compared to human being's hence the pressure between its foot and the ground is low enabling it to walk comfortably.
- (c) Draw a well labeled diagram which demonstrates that liquid pressure depends on depth.



2019

6. (a) State Pascal's principle of pressure
-
-
-
-
-
- (b) What are the three factors that affect the liquid pressure?
-
 -
 -
- (c) Calculate the area of an object if the pressure exerted is 0.2 N/m^2 and its force is 2 N.

6. (a) State the Pascal's principle of pressure
 states that "when any external force applied to a surface of an enclosed liquid Pressure will be Transmitted equally throughout a liquid"

(b) What are the three factors that affect the liquid pressure?

- (i) Height / Depth
- (ii) Density of the liquid
- (iii) Gravitation due to Acceleration

(c) Calculate the area of the object if the pressure exerted is 0.2 N/m^2 and its force is 2 N.

Data Given

$$\text{Pressure} = 0.2 \text{ N/m}^2$$

$$\text{Force} = 2 \text{ N}$$

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

$$0.2 \text{ N/m}^2 = \frac{2 \text{ N}}{A}$$

$$\frac{0.2 \text{ N/m}^2 \times A}{0.2 \text{ N/m}^2} = \frac{2 \text{ N}}{0.2 \text{ N/m}^2 \times 10}$$

$$A = \frac{20 \text{ N}}{2} = 10 \text{ m}^2$$

$$\therefore \text{Area} = 10 \text{ m}^2$$

2018

6. (a) List down four uses of hydraulic press.

- (i)
- (ii)
- (iii)
- (iv)

(b) Why a hole at the bottom of a ship is more dangerous than the one that is near the surface?

(c) Calculate the pressure at the bottom of the sea water of 52m deep, if the density of water is 1025 Kg/m^3 . Take the acceleration due to gravity (g) as 10N/Kg .

6. (a) List down four uses of hydraulic press.
- Is used in car brake system.
 - Used to raise heavy loads in harbours.
 - Used to compress items in industries e.g. cotton balls.
 - Used in ship building to lift heavy loads.
- (b) Why a hole at the bottom of a ship is more dangerous than the one that is near the surface? The hole at bottom of the ship is more dangerous because the pressure exerted at the bottom by the water is very high compared to that near the surface. So the hole at the bottom may lead to sinking of the ship.
- (c) Calculate the pressure at the bottom of the sea water of 52m deep, if the density of water is 1025 Kg/m³. Take the acceleration due to gravity (g) as 10N/Kg.

Soln

$$h = 52 \text{ m}$$

$$\rho_{\text{water}} = 1025 \text{ kg/m}^3$$

$$g = 10 \text{ N/kg}$$

from

$$P = \rho gh$$

$$P = \rho hg$$

$$P = 52 \times 1025 \text{ kg/m}^3 \times 10 \text{ N/kg}$$

$$P = 533000 \text{ N/m}^2$$

$$\therefore P = 533000 \text{ N/m}^2$$

2018

9. (a) A water can has three holes punched the first at the bottom, the second at the middle and the third hole almost at the top. If water is filled in the can, how will the water spurt through the bottom and the top hole?
- (b) (i) Why is it easier to cut a piece of meat with sharp knife than when using blunt knife?
- (ii) The tip of a needle of hypodermic syringe has a cross-sectional area of $1 \times 10^{-6} \text{ m}^2$. If a doctor applies a force of 20 N to a syringe that is connected to the needle, what is the pressure exerted at the tip of needle?
- (c) The small piston of hydraulic press has an area of $3.0 \times 10^{-4} \text{ m}^2$ and the bigger piston has an area of $2.0 \times 10^{-2} \text{ m}^2$. The two pistons are in the same level. If the force of 120 N is applied to the small piston, calculate the force required to be applied to the bigger piston to stop it moving.

9. (a) A water can has three holes punched the first at the bottom, the second at the middle and the third hole almost at the top. If water is filled in the can, how will the water spurt through the bottom and the top hole? ~~the water at the bottom will spurt far distance because it comes with high pressure and the top hole water will spurt nearer distance to the water can because it has low pressure.~~

- (b) (i) Why is it easier to cut a piece of meat with sharp knife than when using blunt knife? ~~sharp knife has a small area which exert gives high pressure when cutting the meat unlike to blunt knife which have high large area and gives low pressure when cutting.~~

- (ii) The tip of a needle of hypodermic syringe has a cross-sectional area of $1 \times 10^{-6} \text{ m}^2$. If a doctor applies a force of 20 N to a syringe that is connected to the needle, what is the pressure exerted at the tip of needle?

Soln.

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

$$P = \frac{20 \text{ N}}{1 \times 10^{-6} \text{ m}^2}$$

$$P = \frac{20 \text{ N}}{1 \times 10^{-6} \text{ m}^2}$$

$$P = \frac{2 \times 10^7 \text{ N}}{1 \text{ m}^2}$$

$$P = \frac{2 \times 10^7 \text{ N}}{1 \text{ m}^2}$$

$$P = 20000000 \text{ N/m}^2$$

\therefore Pressure exerted at the tip of needle is 20000000 pascal.

- (c) The small piston of hydraulic press has an area of $3.0 \times 10^{-4} \text{ m}^2$ and the bigger piston has an area of $2.0 \times 10^{-2} \text{ m}^2$. The two pistons are in the same level. If the force of 120 N is applied to the small piston, calculate the force required to be applied to the bigger piston to stop it moving.

Soln.

$$\text{Force}_1 = 120 \text{ N}$$

$$\text{Force}_2 = ? \text{ N}$$

$$A_1 = 3 \times 10^{-4} \text{ m}^2$$

$$A_2 = 2 \times 10^{-2} \text{ m}^2$$

From $P_1 = P_2$

$$\frac{\text{F}_1}{A_1} = \frac{\text{F}_2}{A_2}$$

$$\frac{120 \text{ N}}{3 \times 10^{-4} \text{ m}^2} = \frac{\text{F}_2 (x)}{2 \times 10^{-2} \text{ m}^2}$$

$$\frac{12 \times 10^4 \text{ N}}{3 \times 10^{-4} \text{ m}^2} = \frac{\text{F}_2}{2 \times 10^{-2} \text{ m}^2}$$

$$\frac{12 \times 10^4 \text{ N}}{3 \text{ m}^2} = \frac{\text{F}_2}{0.02 \text{ m}^2}$$

$$\frac{12 \times 10^4 \text{ N}}{3 \text{ m}^2} = \frac{\text{F}_2}{0.02 \text{ m}^2}$$

$$\frac{4 \times 10^5 \text{ N/m}^2}{1} \times 0.02 \text{ m}^2 = \text{F}_2$$

$$400000 \text{ N/m}^2 \times 0.02 \text{ m}^2 = \text{F}_2$$

$$8000 \text{ N} = \text{F}_2$$

$$\text{F}_2 = 8$$

Page 11 of 13
cc-18/PMA \therefore the force required is 8000N

2017

9. (a) What are the uses of the following devices?
- (i) Manometer.....
 - (ii) Hare's apparatus (inverted U-tube).....
 - (iii) U-tube.....
 - (iv) Barometer.....
- (b) Explain why a big Elephant manage to walk comfortably in mud soil without sinking while human being may sink easily?

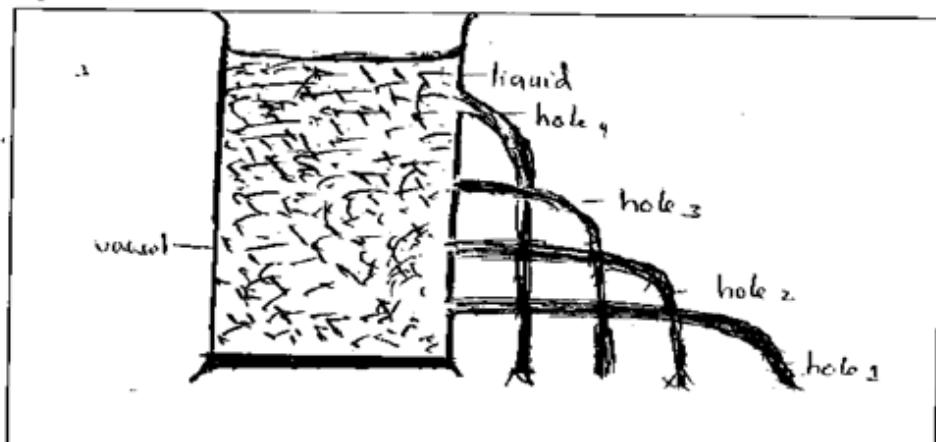
Candidate's Examinations

- (c) Draw a well labeled diagram which demonstrates that liquid pressure depends on depth.

9. (a) What are the uses of the following devices?
- (i) Manometer. It is used to measure gas pressure.....
 - (ii) Hare's apparatus (inverted U-tube). It is used to compare density of immiscible liquids.....
 - (iii) U-tube. It is used to compare the density of immiscible liquids.....
 - (iv) Barometer. It is an instrument used to measure the atmospheric pressure.....
- (b) Explain why a big Elephant manage to walk comfortably in mud soil without sinking while human being may sink easily?

A big elephant manage to walk comfortably in mud soil because the feet of the elephant are very large which increases the surface area and a large contact area decreases the pressure on the soil and it will not sink while a human being sinks this is because the feet of the human are small which decreases the surface area and a small minimum area increases the pressure on the soil which causes a human being to sink easily.....

- (c) Draw a well labeled diagram which demonstrates that liquid pressure depends on depth.



2017

6. (a) State the Pascal's principle of pressure
-
-
- (b) What are the three factors that affect the liquid pressure?
- (i)
- (ii)
- (iii)
- (c) Calculate the area of the object if the pressure exerted is 0.2N/m^2 and its force is 2N.

6. (a) State the Pascal's principle of pressure. An external pressure acting on a closed surface of the liquid is transmitted equally throughout the liquid.
- (b) What are the three factors that affect the liquid pressure?
- (i) Density of the liquid (P)
- (ii) Depth or height (h)
- (iii) gravitational acceleration (g)
- (c) Calculate the area of the object if the pressure exerted is 0.2N/m^2 and its force is 2N.

Soln.
Data. Pressure (P) = 0.2N/m^2 , Force (F) = 2N, Area (A) = ?

$$\text{Formula. Pressure (P)} = \frac{\text{Force (F)}}{\text{Area(A)}}$$

$$\therefore \text{Area (A)} = \frac{\text{Force (F)}}{\text{Pressure (P)}}$$

$$\text{Area (A)} = \frac{2\text{N}}{0.2\text{N/m}^2} = 10\text{m}^2$$

\therefore The area of the object is 10m^2

11. Work, Energy and Power

2020

5. (a) Which kind of energy is stored in objects like springs as a result of reversible deformation?

(b) Why there is no work done on the books when carried horizontally?

- (c) A ball of 0.2 kg is dropped from a height of 20 m. On impact with the ground, it loses 30 J of energy. Calculate the height it reaches on the rebound.

5. (a) Which kind of energy is stored in objects like springs as a result of reversible deformation?

Elastic Potential energy

- (b) Why there is no work done on the books when carried horizontally?

-There is no work done because the books aren't moving in the direction of the force applied (displacement)

- (c) A ball of 0.2 kg is dropped from a height of 20 m. On impact with the ground, it loses 30 J of energy. Calculate the height it reaches on the rebound.

Data given:

$$\text{Mass (m)} = 0.2 \text{ kg}$$

$$\text{Height (h)} = 20 \text{ m}$$

$$\text{gravitational force (g)} = 10 \text{ N/kg}$$

$$\text{lost energy (E)} = 30 \text{ J}$$

Required: Height of rebound (H)

$$\text{From: } P.E. = m \times h \times g$$

$$= 0.2 \times 20 \times 10$$

$$= \underline{\underline{40 \text{ J}}}$$

$$40 \text{ J} - 30 \text{ J}$$

$$= 10 \text{ Joules}$$

$$P.E. = m \times h \times g$$

$$10 = 0.2 \times H \times 10$$

$$10 = \frac{2H}{2}$$

$$H = 5 \text{ m}$$

∴ The height at rebound is 5 m

2019

4. (a) What do you understand by the following terms?
- Work
 - Energy
 - Power
- (b) Calculate the power of a pump which can lift 200 kg of water through a vertical height of 6 m in 10 seconds.
- (c) A 1000 kg car is travelling down the road at a speed of 15 m/s. How much kinetic energy does it have?

4. (a) What do you understand by the following terms?

- Work... Is the product of force and the distance covered in the direction of force.
Its SI unit is Joule (J).
- Energy... Is the ability to do work.
- Power... Is the rate at which work is done. The SI unit of power is Watts.

(b) Calculate the power of a pump which can lift 200 kg of water through a vertical height of 6 m in 10 seconds.

Soln

<u>Data given</u> mass = 200 kg height = 6 m time = 10 seconds <u>Power = ?</u>	$\begin{aligned} \text{Power} &= \frac{\text{Work done}}{\text{time}} \\ &= \frac{F \times d}{t} \\ &= \frac{m \times g \times d}{t} \\ &= \frac{200 \times 10 \times 6}{10} \end{aligned}$	$\begin{aligned} &= 200 \times 6 \\ &= 1200 \\ &= 1200 \text{ Watts.} \end{aligned}$
---	---	--

\therefore The power of the pump is 1200 Watts.

(c) A 1000 kg car is travelling down the road at a speed of 15 m/s. How much kinetic energy does it have?

Soln

$K.E = \frac{1}{2}mv^2$ <u>Data given</u> mass = 1000 kg speed = 15 m/s <u>K.E = ?</u> but, $K.E = \frac{1}{2}mv^2$	$\begin{aligned} \Rightarrow K.E &= \frac{1}{2}mv^2 \\ &= \frac{1}{2}(1000)(15)^2 \\ &= (500 \text{ kg})(225 \text{ m}^2/\text{s}^2) \\ &= 112500 \text{ kg m}^2/\text{s}^2 \end{aligned}$
---	--

\therefore The kinetic energy possessed is 112500 Joules.

2018

5. (a) What is energy?
- (b) Mention any four types of energy.
- (c) A minibus of mass of one and a half tonnes is moving with kinetic energy of 30000J. What is its velocity in Km/h?

5. (a) What is energy? Ability of doing work.....
- (b) Mention any four types of energy.
- Mechanical energy.....
 - Heat energy.....
 - Light energy.....
 - Chemical energy.....
- (c) A minibus of mass of one and a half tonnes is moving with kinetic energy of 30000J. What is its velocity in Km/h?

Soln:

$$K.E = \frac{1}{2} M V^2$$

Kinetic energy = 30000J

$$30000J = \frac{1}{2} \times 1600 \text{ kg} \times V^2$$

$$\frac{30000}{1600} = \frac{7.50}{2} \text{ kg} \times V^2$$

$$V^2 = \frac{14.0}{2} = 7.0 \text{ m/s}$$

$$V = \sqrt{7.0} = 2.65 \text{ m/s}$$

$$72 \text{ km/hr} \times \frac{20 \text{ m/s}}{20 \text{ m/s}} = 72 \times 2.65 \text{ km/hr}$$

$$= 188.4 \text{ km/hr}$$

$$\therefore \underline{\text{velocity is } 188.4 \text{ km/hr}}$$

2017

4. (a) What do you understand by the following terms?
- Work.....
 - Energy.....
 - Power.....
- (b) Calculate the power of a pump which can lift 200kg of water through a vertical height of 6m in 10 seconds, given $g = 10 \text{ m/s}^2$.

(c) Explain the meaning of the following terms.
(i) Kilowatt.....

(ii) Kilojoules.....

4. (a) What do you understand by the following terms?

- (i) Work... Is the product of force and distance moved in the direction of force.
- (ii) Energy... Is the ability to do work.
- (iii) Power... Is the rate at which work is done.

(b) Calculate the power of a pump which can lift 200kg of water through a vertical height of 6m in 10 seconds, given $g = 10 \text{ m/s}^2$.

Data given:

$$\text{Weight} = 200\text{kg} \times 10\text{m/s}^2 = 2000\text{N}$$

$$\text{height} = 6\text{m}$$

$$\text{time} = 10\text{seconds.}$$

$$\text{Power} = \frac{\text{work done}}{\text{time}}$$

$$\text{but, Work done} = PE$$

$$\begin{aligned}PE &= mgh \\&= 200\text{kg} \times 10\text{m/s}^2 \times 6\text{m} \\&= 12000\text{J}\end{aligned}$$

$$\text{Power} = \frac{\text{work done}}{\text{time}}$$

$$= \frac{12000\text{J}}{10\text{s}}$$

$$= 1200\text{Watts}$$

$$\therefore \underline{\text{Power} = 1200\text{W}}$$

(c) Explain the meaning of the following terms.

(i) Kilowatt... refers to the thousand watts (1000w).

(ii) Kilojoules... Refers to the thousand joules.

2015

9. (a) (i) Define potential energy.
-
- (ii) A ball of mass 0.5kg is dropped from a height of 10m and on impact with the ground it loses 30J of energy. Calculate the height it reaches on the rebound.
- Candidate's Examination Answer**
- (b) (i) State the principle of conservation of energy.
-
- (ii) Briefly describe the energy changes when the bob of a simple pendulum swings from one side to another.

9. (a) (i) Define potential energy.
 Is the energy possessed by the body due to its state of rest.

(ii) A ball of mass 0.5kg is dropped from a height of 10m and on impact with the ground it loses 30J of energy. Calculate the height it reaches on the rebound.

$P.E = mgh$
 $= 0.5\text{kg} \times 10\text{N/kg} \times 10\text{m}$
 $= 50\text{Nm}, 50\text{J} \rightarrow \text{before it loses } 30\text{J}$
 $50\text{J} - 30\text{J} = 20\text{J} \rightarrow \text{After losing }$ Data Given
 From $P.E = mgh$ Mass = 0.5kg
 $20\text{J} = 0.5\text{kg} \times 10\text{N/kg} \times h$ Height = 10m
 $\frac{20}{5} \text{K} = \frac{50}{5} \text{K} \text{ h} = 4\text{m.} \therefore \underline{\text{The height reached is 4m}}$ Energy lost = 30J
 $\underline{\text{Height reached = ?}}$

(b) (i) State the principle of conservation of energy.
 It states that "Energy can neither be created nor destroyed but it can be transformed from one form to another".

(ii) Briefly describe the energy changes when the bob of a simple pendulum swings from one side to another.

|||||

At point A and D \rightarrow A bob possesses maximum Potential energy due to its height.
 At point C \rightarrow A bob possesses maximum kinetic energy.
 At point B \rightarrow It possesses both kinetic and potential energies.

12. Light

2018

7. (a) Light is a form of energy. State any two characteristics of it which can be distinguished from other forms of energy.

(i)
(ii)

- (b) With the aid of a diagram, state the laws of reflection.

- (c) How many images can be formed if two mirrors are set?

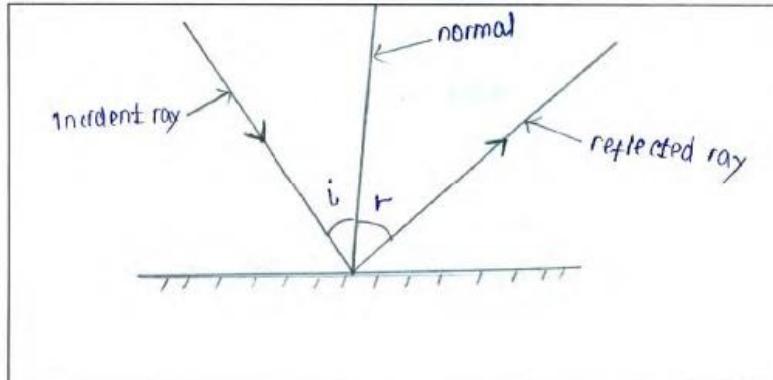
(i) At an angle of 60°

(ii) Parallel to each other.

7. (a) Light is a form of energy. State any two characteristics of it which can be distinguished from other forms of energy.

(i) It travel in straight line
(ii) It travel in fastest speed about 3×10^8

- (b) By the aid of a diagram state the laws of reflection.



First law

Incident ray, reflected ray and normal all ride from the same plane.

Second law

The angle of incident is equal to angle of reflection.

- (c) How many images can be formed if two mirrors are set?

- (i) At an angle of 60°

$$n = \frac{10}{60} - 1$$

$$n = \frac{6}{60} - 1$$

$$n = 6 - 1$$

$$n = 5$$

- (ii) Parallel to each other.

Number

Number of images are 5

In parallel mirror to each other number of images which formed are infinite

2017

7. (a) Define the term light.

- (b) By aid of a diagram state the laws of reflection.

- (c) How many images can be formed if two mirrors are set?

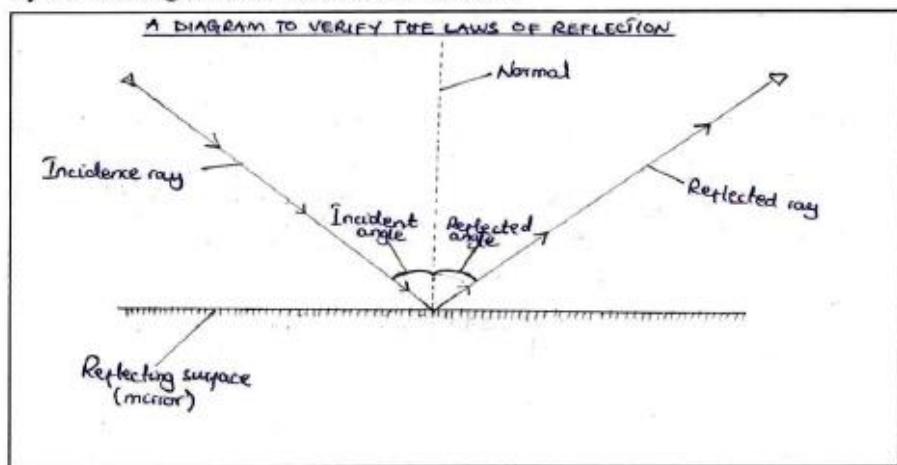
- (i) At angle of 60°

- (ii) Parallel to each other.

7. (a) Define the term light.

.....light is an invisible form of energy, which enables animals to see or stimulate their vision.

- (b) By aid of a diagram state the laws of reflection.



- (c) How many images can be formed if two mirrors are set?

- (i) At angle of 60° Soln.

From the formula

$$\text{No of images} = \frac{360^\circ}{\theta} - 1$$

$$= \frac{360^\circ}{60^\circ} - 1$$

$$= 6 - 1$$

$$= 5$$

\therefore number of images formed is 5

- (ii) Parallel to each other.

Soln. Parallel means 0° since no angle is formed.

$$\text{No of images} = \frac{360^\circ}{\theta} - 1$$

$$= \frac{360^\circ}{0^\circ} - 1$$

$$= \infty$$

\therefore number of images on parallel mirrors is undefined.

2015

10. (a) (i) Distinguish between a real and a virtual image.
-
.....
.....
- (ii) Calculate the number of images formed between two plane mirrors placed at 60° .
- (b) (i) List three applications of periscope in everyday life.
-
.....
.....
- (ii) State two properties of the final image formed in a periscope.

10. (a) (i) Distinguish between a real and a virtual image.
Real image is the image formed in front of the screen while the virtual image is formed behind of the mirror.

- (ii) Calculate the number of images formed between two plane mirrors placed at 60° .

Soln.

From
(i) $\text{number of images} = \frac{360}{\theta} - 1$ | $n = 6 - 1$
 $\theta = 60^\circ$ | $n = 5$

$$n = \frac{360}{60}$$

∴ Number of images = 5

- (b) (i) List three applications of periscope in everyday life.
- It is used in submarines to see things over ahead.
- It is used to see things around the corner.
- It is used in see above the heads of people in a crowd.
- (ii) State two properties of the final image formed in a periscope.
- The image is virtual.
- The image size is usually equal to the object's size.

13. Static Electricity

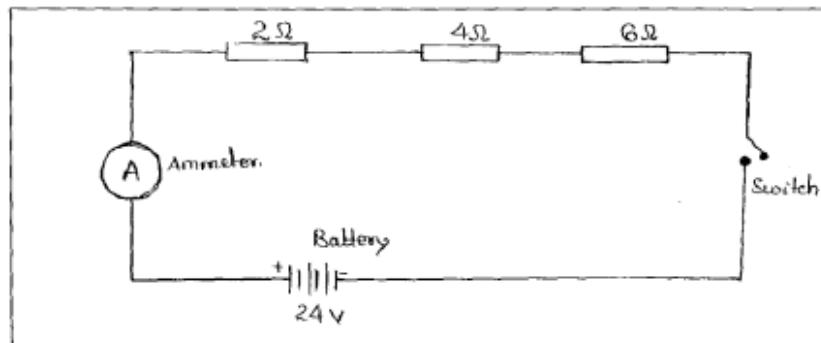
14. Current Electricity

2020

10. Three resistors of 2Ω , 4Ω and 6Ω are connected in series to a battery of e.m.f 24 V and have negligible internal resistance.
- Draw the circuit diagram including the battery, ammeter, switch and the three resistors.
 - Find the current flowing in the circuit drawn in 10(a) above.
 - Find the potential difference at the ends of each resistor in 10 (a).

- (i) Three resistors of 2Ω , 4Ω and 6Ω are connected in series to a battery of e.m.f 24 V and have negligible internal resistance.

- (a) Draw the circuit diagram including the battery, ammeter, switch and the three resistors.



- (b) Find the current flowing in the circuit drawn in 10 (a) above.

$$\text{Total resistance} = 2\Omega + 4\Omega + 6\Omega \\ \approx 12\Omega$$

$$I = \frac{V}{R}$$

$$I = \frac{24V}{12\Omega}$$

$$I = 2A$$

\therefore Current flowing in the circuit is 2A

- (c) Find the potential difference at the ends of each resistor in 10 (a).

Data:

$$I = 2A \quad R_1 = 2\Omega \quad R_2 = 4\Omega \quad R_3 = 6\Omega$$

$$V = ?$$

(i) Potential difference on the first Resistor.

$$V = IR = 2A \times 2\Omega = 4V$$

(ii) Potential difference on the first resistor = 4V

(iii) R_2

$$V = IR = 2A \times 4\Omega = 8V$$

(iv) Potential difference on the second resistor = 8V

(v) R_3

$$V = IR = 2A \times 6\Omega = 12V$$

(vi) Potential difference on the third resistor = 12V

2019

10. (a) Mention three uses of current electricity

-
-
-

- (b) Why is it advised to connect bulbs in parallel arrangement during installation of electricity in most buildings?
- (c) Form one students at Saku Secondary School who were conducting an experiment to verify Ohm's Law in the laboratory, were given the following instructions: *Connect in series a resistor R, a battery B of two cells, a switch K, an ammeter A and rheostat S. Then connect a voltmeter V across resistor R.* Draw a well labelled circuit representing this experiment.

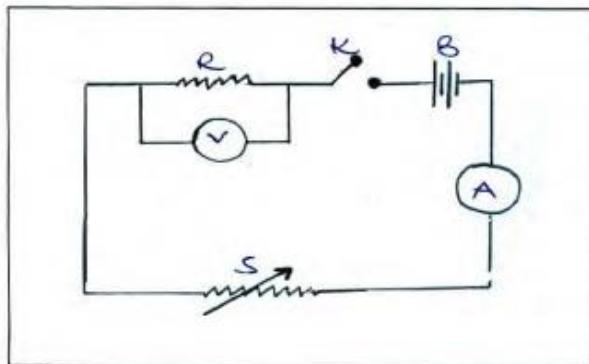
10. (a) Mention three uses of current electricity.

(i) Running different devices such as TVs
 (ii) Lighting light bulbs
 (iii) Magnetising magnetic materials and demagnetising magnets

- (b) Why is it advised to connect bulb in parallel arrangement during installation of electricity in most building?

When bulbs are connected in a parallel arrangement, the potential difference across the terminals of their wires remain the same but current changes. Hence, even if one light bulb stops functioning due to little or no current flowing, other light bulbs won't stop functioning.

- (c) Form one students at Saku Secondary School who were conducting an experiment to verify Ohms' law in the laboratory, were given the following instruction: *Connect in series a resistor R, a battery B of two cells, a switch K, an ammeter A and rheostat S. Then connect a voltmeter V across resistor R.* Draw a well labelled circuit representing this experiment.



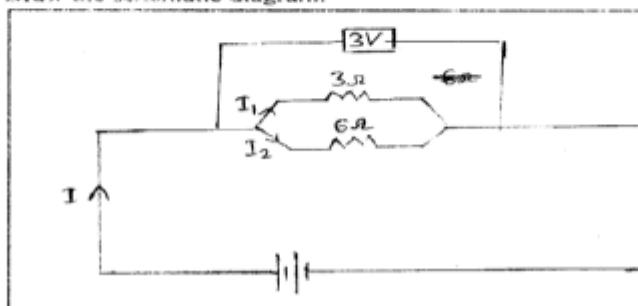
2018

10. (a) Define the word coulomb.

- (b) States Ohm's law.

- (c) Two resistors of 3Ω and 6Ω are connected in parallel to a 3V battery.
- Draw the schematic diagram.
 - Find the effective resistance of the circuit.
 - Calculate the current passing through a 6Ω resistor.

- 10 (a) Define the word coulomb. Coulomb is defined as the quantity of electric current of 1 Ampere flowing at a given point in 1 second.
- (b) State Ohm's law. The Ohm's law states that "the current flowing through a conductor is directly proportional to the voltage across it, provided that temperature and other physical factors remains constant."
- (c) Two resistors of 3Ω and 6Ω are connected in parallel to a 3V battery.
- Draw the schematic diagram.



- (ii) Find the effective resistance of the circuit.

$$R_1 = 3\Omega$$

$$R_2 = 6\Omega$$

Parallel connection, Effective resistance = $\frac{R_1 R_2}{R_1 + R_2} \quad \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{R_T}$ OR $\frac{R_1 R_2}{R_1 + R_2}$

$$\frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{R_T}$$

$$\frac{1}{3} + \frac{1}{6} = \frac{1}{R_T}$$

$$\frac{2+1}{6} = \frac{1}{R_T}$$

$$\frac{3}{6} = \frac{1}{R_T}$$

$$6 = 3 R_T$$

Effective resistance of the circuit is 2Ω

- (iii) Calculate the current passing through a 6Ω resistor.

Current passing through 6Ω = ?

Parallel connection have same pd distribution.

To calculate I_2 .

$$V = 3V$$

$$R = 6\Omega$$

$$I_2 = ?$$

From Ohm's law,

$$V = IR$$

$$\frac{3V}{6} = \frac{I \times 6}{6}$$

$$I_2 = \frac{V}{R} = 0.5A$$

∴ The current flowing through a 6Ω resistor is $0.5A$.

2017

10. (a) Mention three uses of current electricity.

(i)

(ii)

- (b) Explain why it is advised to connect bulb in parallel arrangement during installation of electricity in most building?

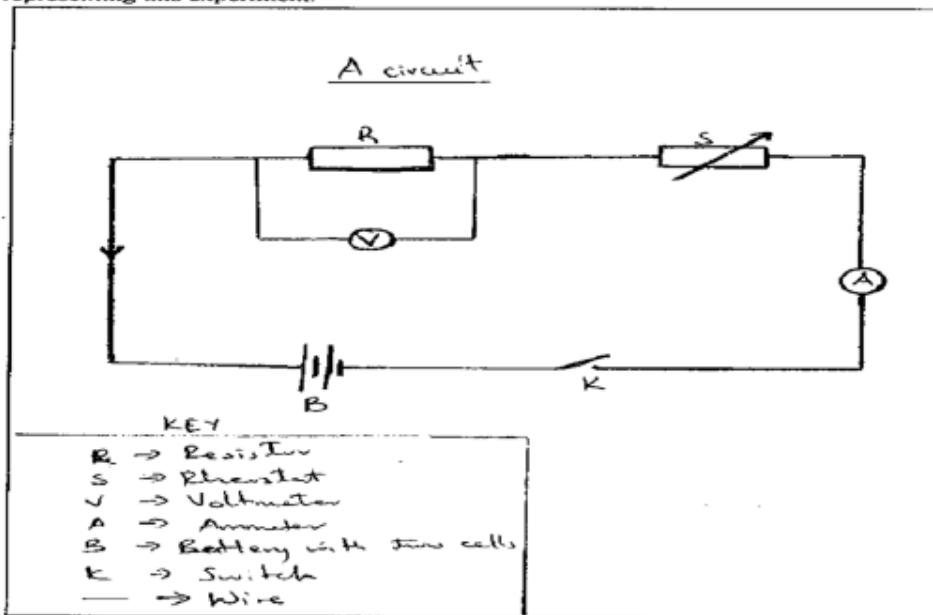
- (c) The form one students at Saku Secondary School who were conducting an experiment to verify Ohms' law in the laboratory, were given the following instruction: Connect in series a resistor R , a battery B of two cells, a switch K , an ammeter A and rheostat S . Then connect a voltmeter V across resistor R . Draw a well labelled circuit representing this experiment.

10. (a) Mention three uses of current electricity.
- Current electricity can be used for lighting bulbs.
 - Current electricity can be used to run machines.
 - Current electricity can be used also for heating purpose such as iron box and electric ovens.
- (b) Explain why it is advised to connect bulb in parallel arrangement during installation of electricity in most building?

It is advised to connect bulbs in parallel arrangement during installation of electricity in most buildings because the potential difference is transmitted equally in all the bulbs unlike in series arrangement.

Also, it is advantageous because switching on or off of one bulb does not affect the other bulbs since each bulb has its own voltage line.

- (c) The form one students at Saku Secondary School who were conducting an experiment to verify Ohms' law in the laboratory, were given the following instruction: Connect in series a resistor R , a battery B of two cells, a switch K , an ammeter A and rheostat S . Then connect a voltmeter V across resistor R . Draw a well labelled circuit representing this experiment.



15. Magnetism

16. Forces in Equilibrium

2020

7. (a) How does the centre of gravity of an extended body differ from the centre of mass of an object?

- (b) Why a person climbing up a mountain is observed to bend forward?

- (c) A moment of force of 320 Nm is formed when a force of 120 N is applied at right angle on the end of a spanner. How long is the spanner?

7. (a) How does the centre of gravity of an extended body differ from the centre of mass of an object?

Centre of gravity is a point where all the weight of a certain body are concentrated while centre of mass is a point where all the mass of a certain body is concentrated.

- (b) Why a person climbing up a mountain is observed to bend forward?

In order to keep the body's centre of gravity to be low so as the person can be stable while climbing the mountain.

- (c) A moment of force of 320 Nm is formed when a force of 120 N is applied at right angle on the end of a spanner. How long is the spanner?

Soln.
Data given

Moment of force 320Nm

Force 120N

Distance x

Moment of force = Force \times Distance

$$320\text{Nm} = 120\text{N} \times x$$

$$\frac{320\text{Nm}}{120\text{N}} = \frac{120\text{N}x}{120\text{N}}$$

$$x = \frac{320}{120}$$
$$x = \frac{8}{3}$$
$$= 2.67\text{m}$$

\therefore The length of the spanner is 2.67m

2019

8. (a) State the principle of moments.

.....
.....
.....

- (b) Distinguish between stable equilibrium and unstable equilibrium.

.....
.....
.....

- (c) A metre rule is pivoted about a point O as shown in Figure 2 and it is balanced by a load of 0.2 N.

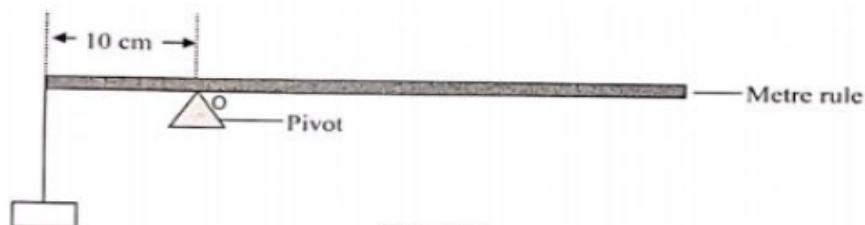


Figure 2

Calculate the mass of the rule.

8. (a) State the principle of moments.

In the system of rotational movement, the sum of clockwise moment about any point is equal to the sum of anticlockwise moment about the same point.

- (b) Distinguish between stable equilibrium and unstable equilibrium.

Stable equilibrium
⇒ It is a type of equilibrium in which an object tends to return to its original position after a small displacement while...

Unstable equilibrium
⇒ It is a type of equilibrium in which an object tends to move far away after a small displacement. It moves far away from the original position.

- (c) A metre rule is pivoted about a point O as shown in Figure 2 and it is balanced by a load of 0.2 N.

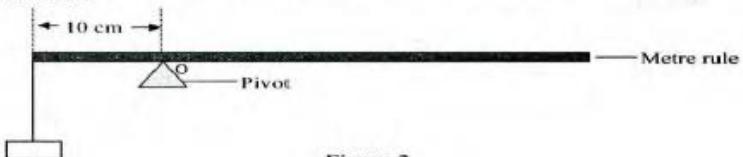
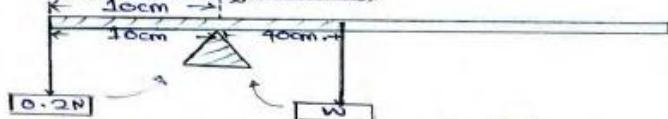


Figure 2

Calculate the mass of the rule.

Solution

Consider a Figure below:



Required to find the mass of a metre rule.

From principle of moment.

Clockwise moment = Anticlockwise moment.

$$W \times 40 = 0.2 \times 10$$

$$\frac{40W}{40} = \frac{0.2}{40}$$

$$W = 0.05 \text{ N}$$

Page

But;

1 Kilogram = 9.8 Newton.

$$x \times 9.8 = 0.05 \text{ Newton}$$

$$x = \frac{0.05}{9.8} \text{ kg.}$$

$$x = \frac{5}{1000} \text{ kg.}$$

$$0.005 \text{ kg.}$$

∴ The mass of metre rule is 0.005 kg!

2018

4. (a) State two conditions for a body to be in equilibrium.

(i)

(ii)

- (b) Distinguish between centre of mass and centre of gravity

- (c) A uniform metre rule is balanced horizontally on a knife edge placed 5cm from B with a mass of 60g at B. Find the mass of the ruler.

4. (a) State two conditions for a body to be in equilibrium.
- Upward forces should be equal to downward forces.
 - Sum of clockwise moments should be equal to sum of anti clockwise moments.
- (b) Distinguish between centre of mass and centre of gravity.....
- Point
..... centre of gravity is the point where the weight
..... of a body is concentrated while centre of mass
..... is the point where the mass of a body is
..... concentrated.....
- (c) A uniform metre rule is balanced horizontally on a knife edge placed 5cm from B with a mass of 60g at B. Find the mass of the ruler.

$$\sum \text{clockwise} = \sum \text{anti clockwise}$$

$$60 \times 5 = x \times 45$$

$$\frac{300}{45} = \frac{45x}{45} \quad x = 6.666\ldots$$

\therefore Mass of the ruler is 6.67g

2017

8. (a) State the principle of moments.
- (b) Distinguish between stable equilibrium and unstable equilibrium.
- (c) A metre rule is pivoted about a point O as shown in Figure 2 and it is balanced by a load of 0.2 N.

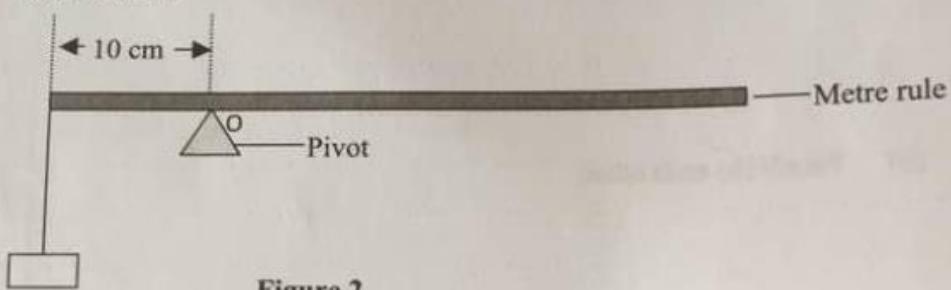


Figure 2

Calculate the mass of the rule.

8. (a) State the principle of moments.

The principle of moments states that "for the body to be in equilibrium level under the action of parallel forces the clockwise moments must be equal to the anticlockwise moments at any point in a plane."

- (b) Distinguish between stable equilibrium and unstable equilibrium.

Stable equilibrium is the type of equilibrium where the object can return to its original position after a small displacement. For the body to exhibit this it should have large area of base and its centre of gravity should be lowered.

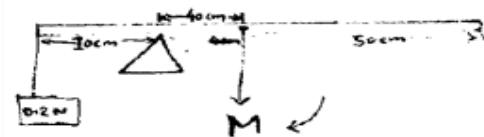
Unstable equilibrium is the one in which the object will not return to its original position after a small displacement. the body should have small area of base and high centre of gravity.

- (c) A metre rule is pivoted about a point O as shown in Figure 2 and it is balanced by a load of 0.2 N.



Figure 2
Calculate the mass of the rule.

Solution.



from the principle of moments.

Clockwise moments = anticlockwise moments.

$$M \times 40\text{cm} = 0.2\text{N} \times 10\text{cm}$$

$$M \times 40\text{cm} = 2\text{Ncm}$$

$$M = \frac{2\text{Ncm}}{40\text{cm}}$$

$$M = 0.05\text{N}$$

but
 ~~$\frac{1\text{kg}}{\text{m}} = 10\text{N}$~~
 ~~$\times 0.05\text{N}$~~

$$10\text{N} \times = 1\text{kg} \times 0.05\text{N}$$

$$\therefore M = \frac{1\text{kg} \times 0.05\text{N}}{10\text{N}}$$

$$\therefore M = 0.005\text{kg}$$

∴ The mass of the metre rule is 0.005 kg.

17. Simple Machines

2020

9. (a) Explain how the inclined plane makes it easier to move a load from a lower to a higher position.

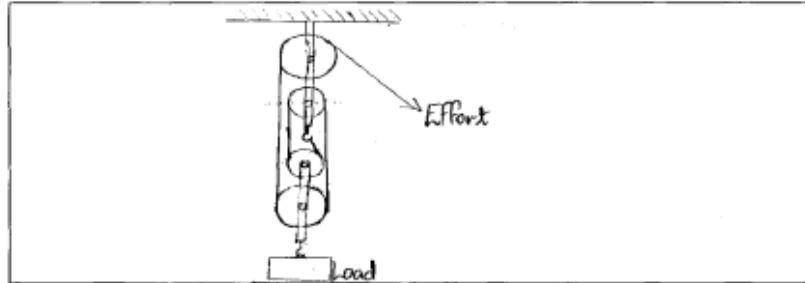
- (b) Draw a diagram of combined pulley system with velocity ratio of 4.

- (c) A pulley system is made up of 8 pulleys. An effort of 200 N is applied on the pulley system. If the pulley has an efficiency of 80%, find the:
- Mechanical advantage of pulley?
 - Maximum load that can be raised by the effort?

9. (a) Explain how the inclined plane makes it easier to move a load from a lower to a higher position.

The inclined plane has a slanted length which makes a higher effort distance, the longer the effort distance in a plane/inclined plane, the easier it is to move a load from one point to another.

- (b) Draw a diagram of combined pulley system with velocity ratio of 4.



- (c) A pulley system is made up of 8 pulleys. An effort of 200 N is applied on the pulley system. If the pulley has an efficiency of 80%, find the:

- (i) Mechanical advantage of pulley?

Data given Solution

$$\text{Velocity ratio} = \frac{\text{Number of pulleys}}{8}$$

$$\text{Effort, } E = 200\text{N}$$

$$\text{Efficiency, } \eta = 80\%$$

$$\text{Mechanical advantage} = ?$$

$$\text{Recall: } \frac{\text{Mechanical Advantage}}{\text{Velocity ratio}} \times 100\% = \text{Efficiency}$$

$$\text{So, } 80\% = \frac{\text{M.A.}}{8} \times 100\%$$

$$\text{M.A.} = \frac{80\%}{100\%} \times 8$$

$$\text{Mechanical Advantage} = 6.4$$

∴ The mechanical advantage of the pulley system is 6.4

- (ii) Maximum load that can be raised by the effort?

Solution

From the data given initially

$$\text{Effort} = 200\text{N}$$

$$\text{Load, } L = ?$$

$$\text{Recall: } \frac{\text{Mechanical Advantage}}{\text{Effort}} = \frac{\text{Load}}{\text{Effort}}$$

$$\text{But: } \text{Mechanical advantage} = \frac{\text{Load}}{200\text{N}}$$

$$6.4 \times \frac{\text{Load}}{200\text{N}}$$

$$\text{Load} = 200\text{N} \times 6.4$$

$$= 1280\text{N}$$

∴ The maximum load that can be raised by the effort is 1280N

2018

8. (a) Define the following terms as applied in Physics.

- (i) Machine.....

- (ii) Load.....

- (b) Why efficiency of machine is less than 100%? Briefly explain.

- (c) Simple machine was used to raise a load of weight 4000 N through a height 0.8 m using an effort of 800 N. If the distance moved by effort was 4.8 m, calculate the:
- Mechanical advantage.
 - Velocity ratio.

8. (a) Define the following terms as applied in Physics.

(i) Machine.....is anything that simplifies work.....

(ii) Load.....is the force that is overcome by a machine.....

(b) Why efficiency of machine is less than 100%? Briefly explain.
Efficiency and resistance is less than 100% because the some of the effort applied is used to overcome friction in order to move parts of a machine.

(c) Simple machine was used to raise a load of weight 4000 N through a height 0.8 m using an effort of 800 N. If the distance moved by effort was 4.8 m, calculate the:

- Mechanical advantage.

Given - Load 4000 N
- Effort 800 N
- MA ?

$$M.A = \frac{P.R}{E.F}$$

$$= \frac{4000}{800}$$

$$= 5$$

∴ Mechanical Advantage is 5

- (ii) Velocity ratio.

Given - DL = 0.8 m
- DE = 4.8 m
∴ VR = ?

$$VR = \frac{D.E}{D.L} = \frac{\text{(Distance moved by Effort)}}{\text{(Distance moved by load)}}$$

$$= \frac{4.8 \times 10}{0.8 \times 10}$$

$$= \frac{48}{8}$$

$$= 6$$

∴ Velocity ratio is 6

2015

8. (a) What is meant by the following terms as used in simple machines:
- Pitch of the screw.
-
- Velocity ratio.
-
- (b) A screw jack with a pitch of 0.1cm and a handle of length 21cm is used to lift a car of weight 528N. If the efficiency of the screw is 20%, Calculate the
- Velocity ratio.
 - Effort required to raise the car.

8. (a) What is meant by the following terms as used in simple machines:

- Pitch of the screw.
.....
- Velocity ratio.
.....

(b) A screw jack with a pitch of 0.1cm and a handle of length 21cm is used to lift a car of weight 528N. If the efficiency of the screw is 20%, Calculate the

- Velocity ratio.

Data,
Pitch = 0.1cm
Length (r) = 21cm
Load = 528N
Efficiency = 20%

$$V.R = \frac{\pi r}{\text{Pitch}} = \frac{2\pi r}{0.1} = \frac{132 \times 16}{0.1 \times 10} = 1320$$

∴ Velocity ratio = 1320 answer
- Effort required to raise the car.

Efficiency = $\frac{M.A}{V.R} \times 100\%$
 $20\% = \frac{M.A}{1320} \times 100\%$
 $20\% \times 1320 = M.A$
 100%
 $\therefore M.A = 264$

$M.A = \frac{\text{Load}}{\text{Effort}}$
 $264 = \frac{528N}{E}$
 $264E = 528N$
 $E = \frac{528N}{264}$
 $\therefore \text{Effort} = 2N$ answer

18. Motion in Straight Line

2020

4. (a) Write down the second and third equations of motion in a straight line.

.....
.....

- (b) Explain the following terms as they are applied in motion in a straight line:

(i) Velocity.

(ii) Retardation.

- (c) A stone is thrown vertically upwards with an initial velocity of 50 m/s.

(i) Calculate the time that the stone will take to return back to the thrower.

(ii) What will be the maximum height reached?

4. (a) Write down the second and third equations of motion in a straight line.

$$\text{S} = ut + \frac{1}{2}at^2$$
$$V^2 = u^2 + 2as$$

- (b) Explain the following terms as they are applied in motion in a straight line:

(i) Velocity.

..... is the rate of change of displacement whereby displacement is a distance from a fixed point to a specified position. Velocity it is a vector quantity having both magnitude and direction. It is a unit in m/s.

(ii) Retardation.

..... is the rate of decrease in velocity of a moving body in a given time. Retardation is also known as Deseleration of a body.

- (c) A stone is thrown vertically upwards with an initial velocity of 50 m/s.

(i) Calculate the time that the stone will take to return back to the thrower.

40m

Data given

Initial velocity (u) = 50 m/s

Final velocity (v) = 0

Time taken = ?

From first Newton's law of motion $v = u - gt$

Formulae $a = v - u - gt$

$0 = u - gt$

$$gt = u$$

$$t = \frac{u}{g}$$

$$t = \frac{50}{10} = 5 \text{ s}$$

∴ The time that stone will take to return back to thrower is 10s.

(ii) What will be the maximum height reached?

50m

Formulae $h = ut - \frac{1}{2}gt^2$

Time taken to reach maximum height = $t = \frac{u}{g}$

$$t = \frac{50}{10} = 5 \text{ sec}$$

$$h = (50 \times 5) - \frac{1}{2} \times 10 \times 5^2$$

$$250 - \frac{1}{2} \times 10 \times 25$$

$$250 - 125 = 125 \text{ m}$$

∴ The maximum height reached is 125 m.

2019

5. (a) (i) Briefly explain the motion of an object under gravity by taking an example of a ball thrown straight up into the air.
- (ii) A car with a velocity of 60 km/h is uniformly retarded and brought to rest after 10 seconds. Calculate its acceleration.

5. (a) (i) Briefly explain the motion of an object under gravity by taking an example of a ball thrown straight up into the air.

When the ball is thrown straight up into the air, as the way it goes up, its velocity is decreasing. Hence when the velocity of the ball becomes zero, that is since it is moving opposite direction of gravitational force, then the force of gravity becomes active and pull the ball back in the center of gravity, thus the ball fall back.

- (ii) A car with a velocity of 60 km/h is uniformly retarded and brought to rest after 10 seconds. Calculate its acceleration.

Data:

Velocity, $v = 60 \text{ km/h}$

Time, $s = 10 \text{ seconds}$

Acceleration is?

Solution

60 km/hr into m/s

$$160 \text{ km} \times \frac{1000}{\text{hr}} = \frac{160 \text{ m}}{6} \text{ s}$$

$$a = \frac{v - u}{t} = \frac{0 - 100}{60}$$

$$a = \frac{100}{60} \text{ m/s}$$

$$a = \frac{100}{60} \times \frac{1}{10} = \frac{1}{6}$$

$$a = -0.667 \text{ m/s}^2$$

∴ acceleration is -0.667 m/s^2

2018

7. (a) What is meant by acceleration?
- (b) In which case the acceleration is said to be uniform?
- (c) A car with a velocity of 90 km/h is uniformly retarded and brought to rest after 10 seconds. Calculate its acceleration.

7. (a) What is meant by acceleration? *Acceleration is the product of Velocity with time.*
- (b) In which case the acceleration is said to be uniform? *If the rate of change of Velocity with time.....*
- (c) A car with a velocity of 90km/h is uniformly retarded and brought to rest after 10 seconds. Calculate its acceleration.

Solution

$$\text{Velocity} = 90 \text{ km/h}$$

$$\text{Time taken} = 10 \text{ Seconds}$$

$$\text{Acceleration} = ?$$

$$\text{Acceleration} = \text{Velocity} \times \text{Time taken}$$

$$\text{Acceleration} = 90 \text{ km/h} \times 10 \text{ s}$$

$$\underline{\text{Acceleration} = 900 \text{ km/h s}}$$

2015

5. (a) (i) What is acceleration?
- (ii) A car with a velocity of 60km/h is uniformly retarded and brought to rest after 10 seconds. Calculate its acceleration.
- (b) (i) Distinguish between distance and Displacement.....
- (ii) Provide one example of the law of inertia of a body.....
- (c) What mass will be given to a body with an acceleration of 7 m/s^2 by a Force of 3N?

5. (a) (i) What is acceleration?

..... Acceleration is rate of change of velocity or the change of velocity with time. It's SI unit is m/s^2 .

Demonstrated as $\frac{V_f - V_i}{t}$

- (ii) A car with a velocity of 60km/hr is uniformly retarded and brought to rest after 10 seconds. Calculate its acceleration.

Data: Velocity (v) = 60km/hr, time (t) = 10 seconds, acceleration = ?

$$\text{Acceleration } (a) = \frac{\text{Change in velocity}}{\text{time}} = \frac{V_f - V_i}{t}$$

Whereas, V_f = final velocity and V_i = initial velocity.

$$U = 60 \text{ km/hr} = \frac{60000 \text{ m}}{3600 \text{ s}} = 16.6 \text{ m/s} \approx 16.7 \text{ m/s}$$

$$a = \frac{V_f - V_i}{t}$$

$$a = \frac{0 \text{ m/s} - 16.7 \text{ m/s}}{10 \text{ s}} = -1.67 \text{ m/s}^2$$

\therefore Its acceleration is -1.67 m/s^2 or its retardation is 1.67 m/s^2

- (b) (i) Distinguish between distance and Displacement.

..... Distance is the longest length from one point to the other without considering the direction while

..... Displacement is the length from one point to the other in a specific direction.

- (ii) Provide one example of the law of inertia of a body. When the car

..... Starts moving forward the passengers fall backward. This shows that the passengers wanted to remain in their state of rest. This is the first law of motion.

- (c) What mass will be given to a body with an acceleration of 7 m/s^2 by a Force of 3N?

Given: 3N.

Data: acceleration (a) = 7 m/s^2 , Force (F) = 3N and Mass (m) = ?

Formula: Force = mass \times acceleration.

$$F = ma$$

$$\therefore m = \frac{F}{a}$$

$$\therefore m = \frac{3 \text{ N}}{7 \text{ m/s}^2}$$

\therefore The mass of a body is $3/7 \text{ kg}$ or 0.43 kg

19. Newton's Laws of Motion

2020

8. (a) State Newton's second law of motion.

- (b) Give two examples of the application of the Newton's third law of motion.

(i)

(ii)

- (c) A ball A of mass 100 g moving with a velocity of 5 m/s makes a "head-on" collision with a ball B of mass 500 g moving with a velocity of 1 m/s in the opposite direction. If A and B stick together after the collision;

- (i) Calculate their common velocity V.

- (ii) Identify the type of collision _____

8. (a) State Newton's second law of motion.
Newton's second law of motion state that, "The rate of change of momentum of an object is directly proportional to the applied force and takes place in the direction of force."
- (b) Give two examples of the application of the Newton's third law of motion.
(i) Rocket propulsion: Rockets remove some gas to the ground, which exerts a force on the ground, the ground then exerts a force equal to the one from the rocket and thus enables it to be launched.
(ii) Jumping: In jumping/bouncing, one exerts a force on the bouncing castle. On jumping, the bouncing castle then exerts a force equal to the person's force, onto the person, which enables the person to bounce back.
- (c) A ball A of mass 100 g moving with a velocity of 5 m/s makes a "head-on" collision with a ball B of mass 500 g moving with a velocity of 1 m/s in the opposite direction. If A and B stick together after the collision;
(i) Calculate their common velocity V.

Solution:

Data given:

$$\text{Mass of ball A, } M_A = 100 \text{ g} = 0.1 \text{ kg}$$

$$\text{Velocity of A, } u_A = 5 \text{ m/s}$$

$$\text{Mass of ball B, } M_B = 500 \text{ g} = 0.5 \text{ kg}$$

$$\text{Velocity of B, } u_B = -1 \text{ m/s}$$

Recall: Total momentum before collision = Total momentum after the collision

Momentum = $m \times v$

$$\text{So, } (M_A \times u_A) + (M_B \times u_B) = v(M_A + M_B)$$

$$\text{Mass A} = 0.1 \text{ kg}$$

$$\text{Mass B} = 0.5 \text{ kg}$$

$$\text{So, } (0.1 \text{ kg} \times 5 \text{ m/s}) + (0.5 \text{ kg} \times -1 \text{ m/s}) = v(0.1 \text{ kg} + 0.5 \text{ kg})$$

$$0.5 \text{ kg m/s} + -0.5 \text{ kg m/s} = v \times 0.6 \text{ kg}$$

$$\frac{0.5 \text{ kg}}{0.6 \text{ kg}} \times v = 0.5 \text{ kg m/s}$$

$$\text{Velocity} = 0 \text{ m/s}$$

∴ Their common velocity or v is 0 m/s.

- (ii) Identify the type of collision... Inelastic collision.

2019

- (b) (i) Distinguish between distance and Displacement
-
.....
.....
.....
.....
.....
- (ii) Provide one example of the law of inertia of a body
- (c) What mass will be given to a body with an acceleration of 7 m/s^2 by a Force of 3N?

(b) (i) Distinguish between distance and Displacement.....

Distance is the length from one fixed point to another without a specific direction. While displacement is the length from one fixed point to another in a specific direction.

(ii) Provide one example of the law of inertia of a body... a passenger in a car, when the car starts sudden moving in front the person moves back.

(c) What mass will be given to a body with an acceleration of 7 m/s^2 by a Force of 3 N?

Data:
Acceleration, $a = 7 \text{ m/s}^2$
Force, $F = 3 \text{ N}$
Mass, m is?
Formula: ~~$a = F/m$~~ $F = ma$

$$F = \frac{ma}{a}$$
$$m = \frac{F}{a}$$
$$m = \frac{3 \text{ N}}{7 \text{ m/s}^2}$$
$$m = 3/7 \text{ kg}$$
$$= 0.4285 \approx 0.429 \text{ kg}$$

\therefore Mass of body is 0.429 kg

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7. (a) (i) Write three equations of motion.

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- (ii) Distinguish between elastic and inelastic collision.

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- (b) (i) State the principle of conservation of linear momentum.

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- (ii) A 4kg object is moving to the right at 2m/s when it makes a head-on collision with a 5kg object moving with a velocity of 1m/s in the opposite direction. If both objects stick together after collision, calculate their common velocity.

7. (a) (i) Write three equations of motion.

$$\begin{aligned} \text{1/ } & v = u + at \\ \text{2/ } & s = ut + \frac{1}{2}at^2 \\ \text{3/ } & v^2 = u^2 + 2as \end{aligned}$$

- (ii) Distinguish between elastic and inelastic collision.

Elastic collision is the type of collision where both kinetic energy (K.E) and momentum are conserved while inelastic collision is the type of collision in which only momentum is conserved.

- (b) (i) State the principle of conservation of linear momentum.

When two or more bodies are collide together their total momentum remain constant if there is no any external force act upon them.

- (ii) A 4kg object is moving to the right at 2m/s when it makes a head-on collision with a 5kg object moving with a velocity of 1m/s in the opposite direction. If both objects stick together after collision, calculate their common velocity.

Solution

$$M_1v_1 + M_2v_2 = (M_1 + M_2)v_c$$

$$(4 \times 2) + (5 \times -1) = (4 + 5)v_c$$

$$8 - 5 = 9v_c$$

$$\frac{3}{9} = \frac{9v_c}{9} = 0.3 \text{ m/s}$$

Common velocity is 0.3m/s.

20. Temperature

21. Sustainable Energy Sources