Biology

THE FUNDAMENTAL UNIT OF LIFE

WHAT ARE LIVING ORGANISMS MADE UP OF

The fundamental level in the organization of living world is the cellular level cells arebasic units of life andstudy of cells in all aspects ofstructure and function

DISCOVERY OF CELL

ROBERT HOOKE

A VAN LEEUWENHOCK

M JSCHLEIDEN

T SCHWANN

RUDOLF VIRCHOW

SCIENTISTS DISCOVERRD NAMED and formulated the cell theory

Unicellular and multicellular organismS

The organisms made up of single cells are called unicellular organisms the organisms which are made up of number of cells are called multicellullllllllar organisms

OSMOSIS

Types of osmosis

Exosmosis

Ennnndosmosis

Osmotic solutions

Hypotonic   solution

Isotonic solution

Hypertonic solution

Cell structure

Cell wall

Nucleus

Cytoplasm

Cellwall and its functions

Shape

Strength

Protection

Environmental variations

Nucleus is made up of following parts

Nuclear envelope

Nuclear sap

Nucleolus

Chromatin material

Cytoplasm cell organelles present in cytoplasm are

Endoplasmic reticulum

Golgi apparatus

Lysosomes

Mitochondria

Plastids

Ribosomes

Vacuole

Endoplasmic reticulum

It is resonisble for protein synthesis ‘support; and detoxification

Golgi apparatus

It is involved in repair and synthesis of cell membrane

Golgi apparatus

It is involved in repair of cell membrane it also takes part in storage modification and packaging ofvarious biochemical

Lysosomes they help in destruction of foreign particles they also help in digestion they remove dead and worn out cellular organelles

Mitochondria they help in cellular respiration and provide energy

Plastids are of three types

Leucoplast

Chioroplast

Chromoplast

Vacuoles three types

Sap vacuole

Food vacuole

Contractile vacuole

Ribosomes

Site of protein synthesis

Differences between aplant cell and an animal cell

TOPIC DIVERISTY IN LIVING ORGANISMS

DIVERSITY is the occurrence of different forms of living which differ from one another in external appearance size colour pattern behavior habitat etc

BASIS OF CLASSIFICATION

ARTIFICAL SYSTEM OF CLASSIFICATION

NATURAL SYSTEM OF CLASSIFICATION

Hierarchy of classification

KINGDOM

PHYLUM

clasSFAMILY

SPECIES

Two kingdom classification biologists divided the living world into two kingdoms

Kingdom plantae

Kingdom animalia

DRAWBACKS IN TWO KINGDOM CLASSIFICATION

CERTAIN ORGANISMS DID NOT STRICTLY FIT EITHER UNDER PLANT OR ANIMAL KINGDOM

Five kingdom classification

MONERA

PROTISTA

FUNGI

ANIMALIA

PLANTEA

Kingdom plantae

Kingdom plantae into two subkingdoms

SUBKINGDOM CRYPTOGAMAE

SUBKINGDOM   PHANAEROGAMAE

Cryptogamaeis divided into three divisions

Thallophyta

Bryophyte

Pteridophyta

Thallophyta do not have a well differentiated body design

Bryophyte   it is a division of non vascular plants   and have an embryo stage in their life ccccycle

Pteridophyophyta it is a division of seedless vascular plants

SUBDIVISIONGYMNOSPERMAE

SUBDIVISION ANGIOSPERMAE

CLASS DICTOLYDONEAE

CLASS MONOCOTYLEDONEAE

DICOTYLEDONEAE   seeds possess two cotyledons

Monocotyledoneae   single cotyledon in their seeds

KINGDOM ANIMALIA CHARACTERISTICS

NUTRITION

GROWTH

LOCOMOTION

MUSCULAR AND NERVOUS SYSTEM

ORGANISATION

PHYLUM PORIFERA

PHYLUM COELENTRATA   EXAMPLEShydra.' Seaanemone.,jellyfish

PHYLUM PLATYHELMINTHES   EXAMPLES liverfluke,planaria .tapeworm

PHYLUM NEMATODA   examples   ascaris,hookworm,pinworm

PHYLUM ANNELIDA   examplesearthworm .leech,nereis

PHYLUM ARTHOPODA   EXAMPLESbutterfly,spider,centipede,housefly

PHYLUMMOLLUSCA   examplesoctopus,pila,snail

PHYLUM ECHINODERMATA examples   seacucumber,starfish

SUBPHYLUM VERTEBRATA

SUPERCLASS PISCES examples torpedo,lionfish .seahorse

CLASS AMPHIBIA examples frog , saiamander ,toad

CLASSREPTILLIA turtle,chameleon ,king cobra

CLASS AVES example os strich .duck ,pigeon crow

CLASSMAMMALIA examples rat, dog ,kangaroo .whale

TOPIC LIFE PROCESSES

What are life processes

MAINTENANCE

METABOLISM

RESPIRATION

GROWTH

TRANSPORTATION

EXCRETION

IRRITABILITY

NUTRITION

IMPORTANCE OF NUTRITION

TYPES OF NUTRITION

AUTOTROPHIC NUTRITION

HETROTROPHIC NUTRITION

Autotrophic nutrition mode of nutrition in which organisms make their own food

Photosynthesis

RAW MATERIALS FOR PHOTOSYNTHESIS

Chlorophyll

Carbondioxide

Water

Sunlight

Photosynthesis green parts of the plant prepare food in presence of sunlight water and carbondioxiide and give oxygen as a by product

MECHANISM OF PHOTOSYNTHESIS

Photosynthesis occurs in two steps photochemical and biochemical

PHOTOCHEMICAL PHASE[LIGHT OR HILL REACTION]

THIS PHASE is driven by light reaction it occurs in following steps

PHOTOLYSIS OF WATER

PRODUCTION OF REDUCING AGENT HYDROGEN

PRODDUCTION OF MOLECULAR OXYGEN

PHOTOPHOSPHORYLATION

BIOSYNTHETIC PHASE [DARK REACTION]

NUTRITION IN HUMAN BEINGS

Alimentary canalconsists of

Mouth

Buccal cavity

Tongue

Teeth

Small intestines

Large intestines

RESPIRAT Salivary glands

Oesophagus

Stomach

IONbiochemical process ofbreakdown of organic compoundsinside living cells realizing energy at various steps

EXCHANGE OF GASES IN PLANTS

EXCHANGE OF GASES IN ANIMALS

RESPIRATION IN HUMMMAN BEINGS

Respiratory tract has number of components

Nostrils

Nasal chambers

Pharynx

Larynx

Trachea

Bronchi

Lungs

External respiration

Internal respiration

AEROBIC RESPIRATION

ANAEROBIC RESPIRATION

TRANSPORTATIONmovement of materials from one part to another it occurs in all living organisms

TRANSPORTATION IN HUMAN BEINGSin human body transportation is is carried out by blood lymph and heart

BLOOD is made up of two components

Plasma

Blood corpuscles are of three types

Red blood corpuscles[erythrocytes]

White blood corpuscles[leucocytes

Blood platelets][thrombocytes]

four chambers of heart

right auricle

left auricle

right ventricle

left ventricle

TRANSPORTATION IN PLANTS conducting vessels xylem and phloem

XYLEM composed of

Tracheids

Vessels

Xylem parenchyma

Xylem fibres

PHLOEM composed of

Sieve tubes

Companion cells

Phloem parenchyma

Phloem fibres

elimination of waste products from the body called excretion

EXCRETION IN UNICELLULAR ORGANISMS

EXCRETION IN MULTICELLULAR ORGANISMS

EXCRETION IN HUMAN BEINGSin human beings excretion occurs through a urinary systemit has

A pair of kidneys

A pair of ureters

Urinary bladder

Urethra

MECHANISM OF URINE FORMATION IT has four components

Glomerular filtration

Reabsorption

Tubular secretion

Concentration of the urine.

SUBJECT: SOCIAL STUDIES

NAZISM & RISE OF HITLER

- Under the shadow of second world war had waged a Genocidal war –killing of no. of people on the basis of their ethnicity , religion . It resulted in mass murder of selected groups of selected groups of innocent civilians of Europe'
- Selected groups included : 6 million Jews , 2 lakh Gypsies , 1 million Polish & 70,000 Undesirable Germans .
- Nazi's devised an unprecedented means of killing by gassing them (poisoning by noxious gas) .
- Birth of WIEMAR REPUBLIC : Germany , the powerful Empire in the early years of 20th century fought the first world war (1914-18) alongside Austrian Empire .
- Realised that they will gain a quick victory .
- Germany made initial gains by occupying France & Belgium .
- ALLIES: An alliance of Nations joining together to fight a common enemy . Allied powers were initially led by UK & France .They were joined by the USA & USSR In 1941 .They fought against the AXIS powers namely GERMANY , ITALY & JAPAN .
- Allies strengthened by US entry in 1917 won defeating GERMANY .
- Defeat of Imperial Germany gave an opportunity to Parliamentary parties to recast German Polity .
- National Assembly met at Weimar & established a democratic constitution .
- Deputies were elected to German Parliament or Reichstag.
- This republic was not well received by its own people because of the terms it was forced to accept after Germany's defeat .
- Peace treaty at Versailles with the Allies was a harsh & humiliating peace.
- Germany lost its : Overseas colonies , 13% of its territories , 75% of its iron 26% of its coal to France , Poland , Denmark .
- Also Allied powers demilitarised Germany to weaken its power.
- Germany was forced to pay compensation amounting 6 billion pounds.
- Effects of War :
  1. War had a devastating impact on the entire continent both psychologically & financially .
  2. Europe turned into one of the debtors .
  3. The Republic carried the burden of war guilt & national humiliation .
  4. Financially crippled by being forced to pay compensation .
  5. Those who supported the WEIMAR REPUBLIC , mainly socialists , Catholics , and Democrats became easy targets mockingly called NOVEMBER CRIMINALS .
  - POLITICAL RADICALISATION (FAVOURING THE FUNDAMENTAL CHANGE) : It was heightened by the Economic crisis in 1923 .
  - Germany fought wars on loans.
  - It had to pay reparations in gold.
  - Eventually, Americans intervened & bailed Germany out of the crisis by introducing Dawes Plan – terms of reparation to ease the financial burden on Germans .
  - THE YEARS OF DEPRESSION: Years between 1924-28 saw some stability but not in actual .
  - German investment depend on short term loans , largely from USA.
  - This support was withdrawn when WALL STREET EXCHANGE (financial capital of world)crashed in 1929.
  - It created state of panic , START OF GREAT ECONOMIC DEPRESSION .

- Over the next three years , between 1929 & 32 , the National income of USA fell by half.
- Germany's economy was worst hit by the economic crisis .
- By 1932 , industrial production was reduced to 40%.
- Workers lost their jobs. No. of unemployed touched an unprecedented 6 million.
- Middle class, small businessmen, self-employed suffered a lot .
- These section were filled with a fear of PROLETARIANISATION-an anxiety of being reduced to the ranks of the living . Politically, WEIMAR was fragile . Lasted for 239 days.
- People lost their confidence in the democratic parliamentary system which seemed to offer no solutions.
- HITLER'S RISE OF POWER: The crisis in the economy , polity & society formed the background to Hitler's rise of power.
- In 1919, he joined a small group called the German Workers Party .
- He subsequently took over the organisation & renamed it the NATIONAL SOCIALIST GERMAN WORKERS PARTY .This came to be known as NAZI PARTY.
- It was during the Great Depression that Nazism became a MASS MOVEMENT.
- Nazi's stirred hopes for a better future.
- By 1932, it had become the largest party with 37% votes.
- He promised to build a strong nation , undo the injustice of the VERSAILLES TREATY , & restore the dignity of the German people.
- Having acquired power, Hitler set out to dismantle the structures of democratic rule.
- On March 1933, the famous Enabling Act was passed . This Act established Dictatorship in Germany.
- RECONSTRUCTION: Hitler assigned the responsibility of economic recovery to the Economist HJALMAR SCHACHT who aimed at full production & full employment.
- Hitler wanted to gobble up the entire Europe.
- Hitler chose war as the way approaching Economic crisis.
- Resources were to be accumulated through expansion territory.
- In September 1940, a Tripartite pact was signed between Germany, Italy & Japan strengthen Hitler's claim to International power.
- By the end of 1940, Hitler was the pinnacle of his power.
- THE NAZI WORLD VIEW: According to this, there was no equality between people, but only a racial hierarchy .
- In this view , blonde , blue-eyed , Nordic German Aryans were at the top where Jews were located at the lowest rung.
- Hitler's racism borrowed from Charles Darwin & Herbert Spencer.
- Nazi argument was simple: the strongest race would survive & weak ones would perish .
- The other aspect of Hitler's ideology: LEBENSRAUM-living space. He believed new territories had to be acquired for settlement.
- Hitler created a racial community of Pure Germans by physically eliminating all those who were seen as undesirable .
- Jews had been stereotyped as killers of Christ and Usures.
- Jews lived in separately marked areas called GHETTOS.
- RACIAL UTOPIA: Poland was annexed. Polish children who look like Aryans were forcibly snatched from their mothers and examined by race experts. If they passed the racial test, they were raised in German families, if not deposited in orphanages where most perished.

- STEPS TO DEATH: YOU HAVE NO RIGHT TO LIVE AMONG US AS CITIZENS; NO RIGHT TP LIVE AMONG US ; NO RIGHT TO LIVE.
- YOUTH IN NAZI GERMANY: Hitler felt that a strong Nazi society could be established only by teaching children Nazi ideology.
- All schools were cleansed & purified. Jews as teachers were dismissed. 10 year old had to enter JUNGVOLK (for children below 14 years of age).
- HITLER YOUTH: Where they learnt to worship war, glorify aggression & violence, condemn democracy, and hate Jews & undesirable.
- THE NAZI CULT OF MOTHERHOOD: Children in Nazi were repeatedly told that women were radically different from men. Boys were taught to be aggressive, masculine & steel-hearted. Girls had to become good mothers & rear pure blooded Aryan children. Women were punished who bore undesirable children. Women were awarded for boring many children.
- THE ART OF PROPAGANDA: Nazi's never used the word 'kill' or 'murder' in their official communication .They used language & media with care.
- KNOWLEDGE ABOUT THE HOLOCAUST: Jews wanted the world to remember the atrocities & sufferings they had endured during Nazi killing operations also called the HOLOCAUST.

NATURAL DISASTER

- Disasters occur when hazards meet vulnerable situations. A disaster is a natural, man-made or technological event that causes significant physical damage or destruction, widespread loss of life or drastic change to the environment.
- HAZARD: is a situation that poses a level of threat to life, health, property or environment .A hazard becomes a disaster when it hits an area affecting the normal life.
- MITIGATION is an effort to reduce loss of life& property by reducing the impact of disasters. Mitigation is taking preventive actions before the next disaster happens in order to reduce human & financial consequences.
- DISASTERS CAN BE NATURAL OR ANTHROPOGENIC:
- A NATURAL DISASTER is an event that is caused by natural hazards & leads to loss of life & damage to physical infrastructure & environment. Examples of natural disasters are 2004 Indian Ocean Tsunami, 2005 Muzaffarabad Earthquake, 2005 Waltengo snow avalanche , 2010 cloudburst in Leh, Landslides etc.
- ANTHROPOGENIC OR MAN-MADE DISATERS: cause serious damages to life , property & environment due to human induced activities. Examples are 1984 Bhopal Gas Tragedy, 1994 Kumbakonam school fire, terrorist attacks, bomb blasts, road & rail acidents, global warming.
- EARTHQUAKE: An earthquake is a sudden shaking of earth's surface due to release of energy in the Earth's crust.

  EPICENTRE: Is the point on the earth's surface that is directly above the focus, the point where an earth originates.Earthquakes generate seismic waves which can be detected with a sensitive instrument called a seismograph. Liquefaction is an earthquake-induced phenomenon when saturated, loose, granular soils lose shear strength & behave as a liquid.

- LANDSLIDES: If you happen to travel by road on Jammu-Srinagar National Highway especially during rainy seasons, you must have seen large blocks of rocks or mountain debris slide on the way. During such phenomenon, vehicles are often stopped for some time until the road is cleared. Incidents of landslides can also be seen in areas where activities such as excavation for roads or buildings take place.

- SNOW AVALANCHES: About 200 person were killed in January 1995 after avalanches buried the highway connecting Srinagar and Jammu. Five buses plunged off the highway into valley below near Jawahar Tunnel. AVALANCHE means down slope movement of snow. It is a large mass of snow that moves rapidly don a mountain slope sweeping & grinding everything in its path.
- FLOODS: Floods are temporary inundation of large regions as a result of rivers overflowing their banks because of heavy rains, high winds, cyclones, storm surge along coast, tsunami, melting of snow or cloud burst. About 12% of total land area is prone to floods.
- DROUGHT & FAMINE: Drought can be defined as a shortage of water for an unusually long period. A situation of drought occurs generally when a region receives consistently below average precipitation. Famine is a widespread scarcity of food, caused by several factors including crop failure , population unbalance , or government policies.
- CLOUD BURST: The cloud burst is a disastrous weather event in which , the heavy rainfall occurs over a localized area at a faster rate. The rate of rainfall may b of the order of 100mm per hour.

ELECTORAL POLITICS

- Modern democracy is indirect democracy. Indirect democracy functions through the representatives of people .The representatives are elected by the people through the system of periodic elections. The system of election comprises of many important elements. They are the electorate, constituency, candidate & agency which conducts the election.
- All the citizens above the age of 18 years & living in a particular territorial area are called the electorate.
- The unit of territorial area from which one candidate is to be eected is called constituency.
- The election to the Lok Sabha, State Legislative Assemblies, Panchayats & Municipalities are direct elections.
- The election to the office of the President, Vice President, & Rajya Sabha are indirect elections.
- The election to the Lok Sabha is called GENERAL ELECTION. It is held after every 5 years .The entire country is divided into 543 constituencies & from each constituency one member is elected on the basis of first past the post system.
- JAMMU & KASHMIR ASSEMBLY ELECTIONS: The Legislative Assembly of the J&K is elected for a term of 6 years. It has 87 members.
- Elections are thus all about political competition. The most obvious form is the competition among political parties.
- Makers of our constitution thought of a special system of reserved constituencies for the weaker sections e.g., Scheduled Caste (SC), & Scheduled Tribes (ST).
- VOTER LIST: Once the constituencies are decided , the next step is to decide who can & who cannot vote. In a democratic election, the list of those who are eligible to vote is prepared much before the elections & given to everyone . This list is officially called the Electoral Roll & is commonly known as VOTER LIST.
- NOMINATION OF CANDIDATES: Anyone who can be a voter can also become a candidate in elections. The only difference is that in order to be a candidate, the minimum age is 25 years , while it is only 18 years for being a voter.
- ELECTION CAMPAIGN: The main purpose of election is to give people a chance to choose the representatives, the government & the policies they prefer. Therefore, it is necessary to have a free & open discussion about who is a better representative, which party will make a better government or what is a good policy. This is what happens during election campaigns.

- POLLING & COUNTNG OF VOTES: The final stage of an election is the day when the voters cast or poll their vote. That day is usually called the election day.

DRAINAGE

- The term drainage describes the river system of an area .
- The area drained by a single river system is called a drainage basin.
- A close observation on a map will indicate that any elevated area , such as a mountain or an upland, separates two drainage basins . Such an upland is known as WATER DIVIDE.
- The drainage system in India is mainly controlled by the broad relief features of the subcontinent. Accordingly, the Indian rivers are divided into two major groups: the Himalayan rivers & the Peninsular rivers.
- Most of the Himalayan rivers are perennial while the peninsular rivers are seasonal.
- The major Himalayan rivers are the Indus, the Ganga & the Brahmaputra. These rivers are long, & are joined by many large & important tributaries. A river along with its tributaries may be called a RIVER SYSTEM.
- The headwaters of the Ganga, is called the BHAGIRATHI.
- The Brahmaputra rises in Tibet East of Mansarowar lake.
- The main water divide in Peninsular India is formed by the Western Ghats, which runs from north to south close to western coast.
- RIVER POLLUTION: The growing domestic , municipal, industrial & agricultural demand for water from rivers naturally affects the quality of water. A heavy load of untreated sewage & industrial effluents are emptied into the rivers.This affects not only the quality of water but also the self-cleansing capacity of the river.
- The River Chenab is formed of two main streams the Chandra & the Bhaga.`

MONEY & BANKING

- The term ‘money’ is derive from the latin word ‘moneta’.
- Money as medium plays an important & crucial step & in turn eliminates the need for double coincidence of want.
- Stages of evolution of money:
    1. Animal money e.g., hunting stage animals.
    2. Commodity money e.g., stones, tea , rice etc.
    3. Metallic money e.g., gold , silver , copper etc
    4. Paper money e.g., government notes
    5. Plastic money e.g., debit card , credit card etc.
- Saving Bank Account: is the simplest form of bank account which can be opened by any individual for encouraging savings.
- A cheque is a paper instructing the bank to pay a specific amount from the persons account to the person in whose name the cheque has been issued.
- Types of Bank:

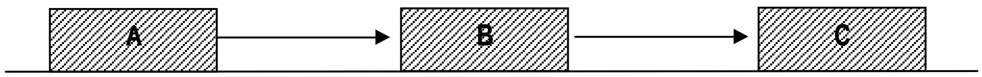
1. Commercial Bank : accepts deposits of money from the people & also uses money with it for lending purposes i.e., loan. E.g., SBI , PNB, BOI etc.
2. Central Bank: Is apex financial institution of a country . It issues notes controls & regulates monetary policy of a country e.g., RBI
3. Cooperative bank : In India , many banks are run by cooperative societies by the laws of the state in which they are operating .Two types : agricultural & non-agricultural.

Physics

MOTION

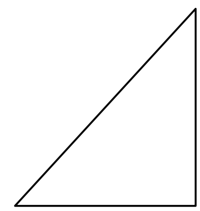
Motion: *When an object changes its position continuously with respect to the position of the other objects with the passage of time, the object is said to be in motion.*

e.g. – If an object say a car starts from a point A and after 10 minutes it reaches at a point B and after next 10 minutes it reaches the point C. So position of car is changing continuously with respect to its starting point A, so it is in motion.



Motion and rest are relative: *Motion is a relative term; it is clear from the following example.*
Example – If A, B, C are three persons. B and C are sitting in the car and A is standing outside the car. When the car starts moving B and C are changing their position with respect to A. So B and C are in motion with respect to A, but B and C are not changing their position with the passage of time and with respect to the seat of the car, so B and C are said to be in rest with respect to the moving car. So it is clear that motion and rest are relative.

Displacement: *Displacement is the change in position of an object in any particular direction, while distance is the actual length of path travelled by any object to reach its final position.*
e.g. If a person moves 4 km from A to B and 3 km in north from B to C.
Therefore, Distance travelled from A to C = AB + BC = 4 + 3 = 7 km
And, displacement = AC (Shortest possible distance in a particular direction)



Uniform Motion: *If a body travels equal distances in equal intervals of time, then the body is said to have uniform motion, no matter how small these intervals may be.*

e.g. 0 — 10 — 20 — 30 — 40 — 50 (seconds)
A — 10m — B — 10m — C — 10m — D — 10m — E — 10m — F (distance)

If a car travelling from A to F (50 km) with a distance of 10 meters each from a to B, B to C, C to D, D to E and E to F in equal intervals of time 10 seconds, then the car is said to have uniform motion.

Non – uniform Motion: *A body is aid to have non uniform motion if it travels unequal distances in equal intervals of time.*

e.g. 0 — 15 — 15 — 15 — 15 (seconds)
A — 5m — B — 35m — C — 40m — D — 50m — E (distance)

A car travelling different distances from A to B, B to C, C to D and D to E in equal intervals of time of 15 seconds has a non – uniform motion.

Scalar quantities: *Those quantities which are completely described by a magnitude alone are called as scalar quantities or those quantities which have only magnitude and no direction are known as scalar quantities. e.g. mass, length, time, Temperature, Density, Volume etc. are scalar quantities.*

Vector quantities: *Those quantities which are completely described if direction is also given with magnitude are called as vector quantities. i.e. those quantities which posses both magnitude as well as direction are known as vector quantities. e.g. Displacement, weight, Velocity, Acceleration, force, momentum etc. are vector quantities.*

Speed: *The rate of change of motion of a body with respect to time is known as speed of a body. i.e. The distance travelled by a body in unit of time is called its speed or the ratio of distance travelled to the time taken.*

Therefore, Speed = Distance travelled /Time taken

If distance travelled is S and time taken is T, then speed V will be written as $V = S / T$

Average Speed*: The average speed of a body is the total distance travelled divided by the total time taken to cover this distance.*

Average Speed = total distance travelled / Total time taken

The S.I. unit of distance is meter (m) and time is seconds (s), so S.I. unit of average speed is meter per second i.e. m/s or ms^{-1}.

Uniform Speed*: A body is said to have uniform speed if it travels equal distances in equal intervals of time. No matter how small these time intervals may be.*

Velocity*: the velocity of a body is defined as the distance travelled by a body in a particular direction. i.e. the rate of change of sped in a particular direction.*

i.e. velocity = Distance travelled in a given direction / Time taken

But the distance covered in a given direction is called as displacement

Therefore, Velocity = distance / Time taken

Or $V = S / T$

The unit of velocity is same as that of speed. i.e. meter per second or m/s or ms2.

Uniform Velocity*: If an object moves on a straight line and covers equal distances in equal intervals of time. It is said that the object has uniform velocity. The velocity of an object at any given instant of time is called as instantaneous velocity. i.e. the velocity of an object at the starting instant of time is known as the initial velocity and the velocity at the final instant of the time is known as its final velocity.*

Distinguish between speed and velocity:

SPEED	VELOCITY
1. Speed is the rate of change of position of an object with respect to time. 2. It is the ratio of distance travelled by an object to the time taken. 3. It is a scalar quantity.	1. Velocity is the rate of change of position of an object with respect to time in a particular direction. 2. It is the ratio of displacement of an n object to the time taken. 3. It is a vector quantity.

Average velocity*: The average velocity of an object is defined as the arithmetic mean of the initial and final velocity for a given period of time, that is*

Average Velocity = Initial velocity + Final velocity / 2

Acceleration: *The acceleration of an object is defined as the rate of change of its velocity with respect to time, and is denoted by 'a'.*

Therefore, Acceleration = change in velocity / Time taken

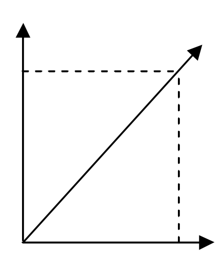
Or $a = v - u / t$

Since unit of velocity is m/s and that of time is second(s), so the S.I. unit of acceleration is m/s^2 *or* $m/s^{-2.}$ *The acceleration is a vector quantity.*

Uniform acceleration*: A body is said to have a uniform acceleration if it travels in a straight line and its velocity increases by equal amounts in equal intervals of time.*

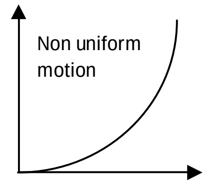
Non – uniform acceleration*: A body is said to have a non uniform acceleration if its velocity increases by unequal amounts in equal intervals of time.*

Distance – Time graph*: A graph showing the variation of distance of a moving object with time is called as distance – time graph. When a body moves with uniform speed, it will travel equal in equal intervals of time. So for uniform speed a graph of distance travelled against time will be a straight line.*



We take any line graph and draw a perpendicular AB on the time axis (x – axis). It is clear from the graph that AB represents distance and OB represents time.

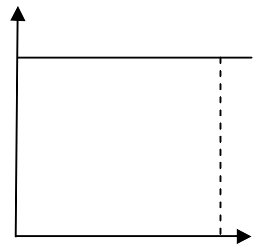
Since, speed = Distance travelled / Time taken ⇨ speed = AB / OB



Now, If the speed of the body is non uniform, then the graph between distance travelled and time is curved line called as parabola. Hence, from the graph it is clear that if the graph is a straight line then the speed is uniform and if the graph of a body is a curved line, then its speed is non uniform.

Speed – time graph: There are three cases of speed time graph for a moving body.

i. **Speed time graph when the speed remains constant**: A speed time graph for a body moving with constant speed is a straight line is parallel to the time axis. In other words if the speed – time graph of a body is a straight line parallel to the time axis, the speed of the body is constant. Since the speed of the body is constant or uniform, there is no acceleration, and hence there is no question of finding the acceleration from such a speed time graph.



We know that Speed = distance / Time

=> Distance = Speed X Time

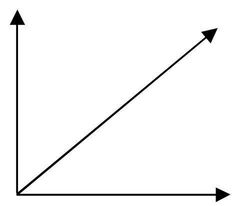
Now, Speed at C = CB, But CB = OA

Speed at C = OA, Time at C = OC

Distance = OA X OC

⇨ Distance travelled = Area of rectangle OABC

ii. **Speed time graph when speed changes at a uniform rate**: When a body moves with uniform acceleration, its speed changes by equal intervals of time. In other words, the speed becomes directly proportional to time. Thus, the speed – time graph for a uniformly changing speed (or uniform acceleration) will be a straight line.



We know that

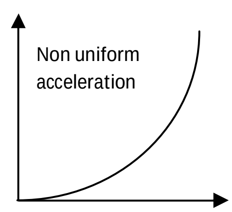
Acceleration = Change in Speed (velocity) / Time taken

The change in speed is represented by PQ whereas time taken is equal to OQ.

So, Acceleration = PQ / OQ,

But PQ/OQ is the slope of the speed time graph OP, Therefore the slope of a speed time graph of a moving body gives its acceleration.

iii. **Speed time graph when the acceleration is non uniform**:



When the speed of a body changes in an irregular manner, then the speed time graph of the body is a curved line. Even now, the distance travelled by the body is given by the area between the speed time curve and the time axis. So it is clear that the velocity time graph for non uniform acceleration is a curved line called parabola.

Equations of motion (Mathematical representation):

1. **First equation:** Consider a body having initial velocity ‘u’. Suppose it is subjected to a uniform acceleration ‘a’, so that after time 't’ seconds final velocity becomes ‘v’.

   Therefore, rate of change of velocity = $v – u / t$

   => Acceleration = $v – u /t$

   => $a = v – u / t$

   => $at = v – u$

   or $v – u = at$ => $v = u + at$ --------------- (i)

2. **Second equation:** Let the initial velocity of a body is ‘u’ and final velocity ‘v’ with acceleration ‘a’. we know that

   Average velocity = $u + v /2$ and Distance = Average velocity x time

   => $S = (u+v)\, t / 2$

   => $S = (u + u + at)t / 2$ By using equation (i)

   $S = (2u + at)t / 2$

   => $S = 2ut + at^2 / 2$

$S = 2ut / 2 + at^2 / 2$

=> $S = ut + ½ at^2$ ------------(ii)

3. **<u>Third equation</u>:** We know that $S = ut + ½ at^2$ Second equation of motion

And $v = u + at$ First equation of motion

=> $v – u = at$

=> $v – u / a = t$

Therefore, $S = u(v – u / a) + ½ a(v – u / 2)^2$

$S = uv – u^2 /a + ½ a (v^2 + u^2 -2uv)/a^2$

$S = uv – u^2 / a + v^2 + u^2 – 2uv / 2a$

$S = (2uv – 2u^2 + v^2 + u^2 – 2uv) / 2a$

$S = (– u^2 + v^2)/ 2a$

=> $2aS = v^2 – u^2$

Or $v^2 – u^2 = 2aS$

***<u>Circular motion</u>**: The motion described by a body in a circular path is called a circular motion. In this type of motion the direction of the body does not remain same, but remains changing at every point.*

Examples of circular motion are:

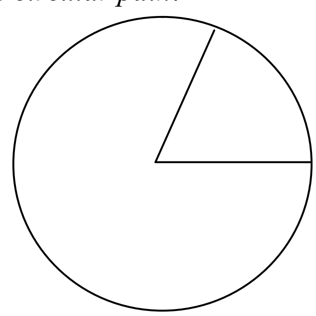
i. Earth moving on its axis.
ii. A bus moving at the angle of a road.
iii. Motion of electric fan running at a particular speed.
iv. Movements of hands of a clock.
v. Motion of wheel of a running vehicle.

***<u>Average velocity</u>**: The angular velocity of a body is defined as the angular displacement per unit time. i.e. the ratio of the angular displacement of a body to the time taken by it. Angular velocity is represented by omega 'ω'*

Or $\omega = \Theta$ radians / t Seconds. => $\omega = \Theta / t$ radians per second.

The S.I. unit of angular velocity is radians per second.

***<u>Relation between linear velocity and angular velocity:</u>** Suppose a body is moving with a uniform linear speed v in a circular path of radius 'r', when the body moves from point A to B with uniform linear speed v covers distance 'S' in time 't' seconds it subtends an angle 'θ' at the centre of the circular path.*



So, Angle in radians = Length of arc / Radius of circle.

Therefore, $\Theta = s / r$ ---------- (i)

Now linear speed = Distance travelled / time taken

$v = s / t$ => $v \times t = s$ ---------(ii)

Substituting Equation (i) in equation (ii) we get

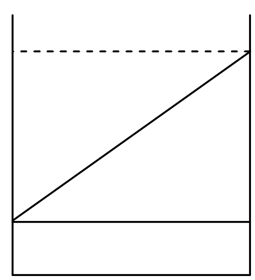
$\Theta = v \times t / r$ => $\Theta / t = v / r$

But Angular velocity = Angular displacement / Time taken

i.e. $\omega = \Theta / t$

Therefore $\omega = v /r$ => $\omega r = v$ or $v = \omega r$

***<u>Graphical representation of equations of motion</u>**: Let a body moves with an initial velocity 'u' final velocity 'v' and acceleration 'a' during time 't'. Suppose its motion is represented by velocity time graph. It is clear from the graph that the body has an initial velocity 'u' at A and changes at a uniform rate from A to B in time t seconds. The final velocity of the body becomes v and it is equal to BD in the graph.*



Now Initial velocity (u) = OA = CD

Final velocity (v) = BD

Time (t) = AC = OD

Change in velocity = v – u = BD – CD = BC

Since Acceleration $a = v – u/ t$ => $at = v – u$

=> $v = u + at$

When the velocity of the body remains constant say 'u' throughout the motion.

Then distance covered = Area of rectangle OACD

$\Rightarrow s = OA \times AC \quad \Rightarrow \quad S = u \times t$

But if velocity goes on increasing constantly with time, the distance covered = area of trapezium OABD

$\Rightarrow s = OA \times AC + \frac{1}{2} AC \times BC$

$\Rightarrow s = ut + \frac{1}{2} t \times at$

$\Rightarrow s = ut + \frac{1}{2} at^2$

Now, distance travelled by body = area of trapezium OABD

$\Rightarrow s = \frac{1}{2} (OA + DB) \times OD$

$\Rightarrow s = \frac{1}{2} (u + v) \times t$

$\Rightarrow s = \frac{1}{2} (u + v) \times (v - u / a)$

$\Rightarrow s = (v + u)(v - u) / 2a$

$\Rightarrow 2as = v^2 - u^2$ *Or* $v^2 - u^2 = 2as$

[*Because* $v - u = at \Rightarrow v - u = at$ $\Rightarrow v - u / a = t$]

Textual questions:

Q1. An object has moved through a distance. Can it have zero displacement? If yes, support your answer with an example.

Ans: Yes, an object even after it has moved through a distance, it can have zero displacement. As we know distance is just length of the path an object has covered irrespective of its direction or position with reference to certain point, where as the shortest distance measured from the initial to the final position of an object is known as the displacement. For example, an object starts from point A and after covering a distance of say 50 meters, reaches at point B. Here after, it again moves back to point A.

A >-----------50 m-------------> B
<-----------50 m-------------<

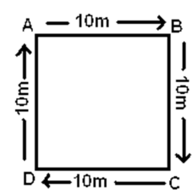
Here the distance covered by object is = AB + BA = 50 m + 50 m = 100 m

Whereas displacement of object is = AB - BA = 50 m - 50 m = 0 m

As initial position of object is same as that of its final position hence its displacement, which is distance measured from the initial to the final position, is zero.

Q2. A farmer moves along the boundary of a square field of side 10 m in 40 s. What will be the magnitude of displacement of the farmer at the end of 2 minutes 20 seconds from his initial position?

Ans: Suppose, a farmer moves along the boundary of a square field of side 10 m in 40 s as shown in the figure given below.



Distance cover by the farmer as he moves from A to B to C to D to A, along the boundary wall of square field = *Perimeter of Square field*

= *4 x side of square field*

= 4×10 *m*

= *40 m*

$\therefore$ *speed of farmer* = *40 m/40 s*

= *1 m/s*

Distance covered by farmer in 2 minutes 20 seconds = *Speed × Time*

= 1 *m/s* $\times [(2\times60)$ *s* $+ 20$ *s*$]$

= *140 m*

Number of round in covering 40 m of distance along the boundary wall = *1 round*

$\therefore$ *Number of round in covering 140 m of distance along the boundary wall* = $1\times140/40$ *rounds*

= *3.5 round*

= $3\,^1/_2$ *rounds*

Which means the farmer will be at point C just diagonally opposite of point A

∴ *Relative Displacement of farmer from point A at the end of 3 $^1/_2$ round will be = length of AC which can be determined by the mathematical theorem as given below :*

$$AC = \sqrt{AB^2} + \sqrt{BC^2}$$
$$= \sqrt{10^2} + \sqrt{10^2}$$
$$=10\ \sqrt{2^2}$$
$$= 10 \times 1.414\ m$$
$$= 14.14m$$

Q3. Which of the following is true for displacement?
(a) It cannot be zero. (b) Its magnitude is greater than the distance travelled by the object.
Ans: Both of the statements are not true as
(a) Displacement can be zero (b) Its magnitude is either less or equal to the distance travelled by the object

Q1. Distinguish between speed and velocity.
Ans: The speed of an object is the distance covered per unit time, and velocity is the displacement per unit time. The speed is a scalar quantity as it has just magnitude where as velocity is a vector quantity as it has both direction as well as magnitude. The speed can be changed by the distance travelled by a body in a particular time where as the velocity can be changed by changing the object's speed, direction of motion or both.

Q2. Under what condition(s) is the magnitude of average velocity of an object equal to its average speed?
Ans: The magnitude of average velocity of an object is equal to its average speed, only when it is moving in a straight line.

Q3. What does the odometer of an automobile measure?
Ans: Odometer of an automobile measures the distance covered by an automobile. All Automobiles are fitted with Odometer. Earlier Odometer used to be mechanical device, now a days we have electronic odometer.

Q4. What does the path of an object look like when it is in uniform motion?
Ans: The path of an object looks like a straight line when it is in uniform motion

Q 5. During an experiment, a signal from a spaceship reached the ground station in five minutes. What was the distance of the spaceship from the ground station? The signal travels at the speed of light, that is, $3 \times 10^8\ m\ s^{-1}$
Ans:

Speed of Signal (v)	= *Speed of light*
	$=3 \times 10^8\ ms^{-1}$
Time taken by Signal to reach the ground station (t)	= *5 minutes*
	$= 5 \times 60$ *seconds*
	= *300 seconds*
Distance between the spaceship and the ground station (S)	= *vt*
	$= 3 \times 10^8\ m\ s^{-1} \times 300\ m$
	$=9\times10^{10}\ m$

Q1. When will you say a body is in (i) uniform acceleration? (ii) nonuniform acceleration?
Ans: (i) A body is said to be in uniform acceleration if it travels in a straight line and its velocity increases or decreases by equal amounts in equal intervals of time
(ii) A body is said to be in nonuniform acceleration if the rate of change of its velocity is not constant .

Q2. A bus decreases its speed from 80 km h^{-1} to 60 km h^{-1} in 5 s.
Find the acceleration of the bus.
Ans:

Initial Speed of the Bus (u) $= 80$ km h^{-1}
$= (80 \times 1000)/ (60 \times 60)$ ms^{-1}
$= 800/36$ ms^{-1}

Final Speed of the Bus (v) $= 60$ km h^{-1}
$= (60 \times 1000)/ (60 \times 60)$ ms^{-1}
$= 600/36$ ms^{-1}

Time in transition (t) $= 5$ s

The acceleration of the Bus (a) $= (v-u) / t$
$= [(800/36) - (600/36)] / 5$ ms^{-2}
$= (-200/36) / 5$ ms^{-2}
$= 5.55 / 5$ ms^{-2}
$= 1.11$ ms^{-2}

Q3. A train starting from a railway station and moving with uniform acceleration attains a speed 40 km h^{-1} in 10 minutes. Find its acceleration.

Ans:

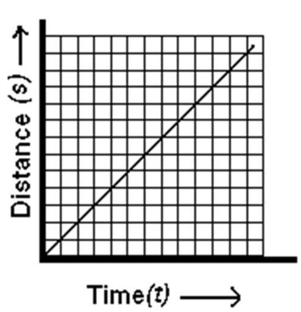
Initial Speed of the Train (u) $= 0$ ms^{-1}

Final Speed of the Train (v) $= 40$ km h^{-1}
$= (40 \times 1000)/ (60 \times 60)$ ms^{-1}
$= 400/36$ ms^{-1}

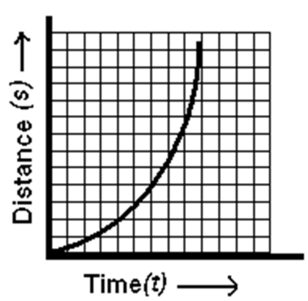
Time in transition (t) $= 10$ minutes
$= 10 \times 60$ s
$= 600$ s
$= 600$ s
$= 600$ s

The acceleration of the Train (a) $= (v-u) / t$
$= [(400/36) - 0] / 600$ ms^{-2}
$= (11.11) / 600$ ms^{-2}
$= 0.0185$ ms^{-2}

Q1. What is the nature of the distance-time graphs for uniform and non-uniform motion of an object?
Answer :
(i) For uniform speed, a graph of distance travelled against time is a straight line and not inclined along the time axis.
(ii) For uniform speed, a graph of distance travelled against time is a

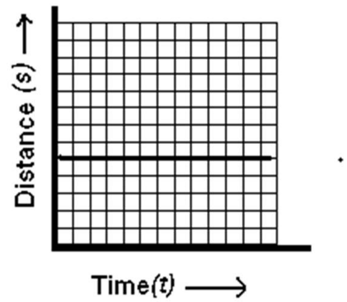


Distance-time graph of an object moving with uniform speed



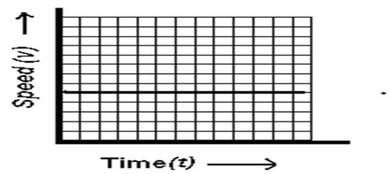
Distance-time graph for a car moving with non-uniform speed

Q2. What can you say about the motion of an object whose distance-time graph is a straight line parallel to the time axis?
Ans: Motion of an object whose distance-time graph is a straight line parallel to the time axis is not moving at all and is in state of rest as shown in the figure below :



Distance-time graph of an object at rest

Q3. What can you say about the motion of an object if its speed-time graph is a straight line parallel to the time axis?
Ans: The motion of an object if its speed-time graph is a straight line parallel to the time axis indicates that the object is moving with uniform speed.



Speed-time graph of an object moving with uniform speed

Q4. What is the quantity which is measured by the area occupied below the velocity-time graph?
Ans: The area occupied below the velocity-time graph measures the distance covered by the object.

Q1. A bus starting from rest moves with a uniform acceleration of 0.1 m s^{-2} for 2 minutes.
Find (a) the speed acquired, (b) the distance travelled.

Ans: Here as given, Initial speed (u)	*= 0*
Acceleration (a)	*=0.1 m s^{-2}*
Time in transition (t)	*=2 minutes*
	=2 × 60 seconds= 120 s
We know that Final speed	*= u + at*
∴ (a) the speed acquired	*= 0 + 0.1 m s^{-2} × 120 m s^{-1}*
	= (1/10)120 ms^{-1}
	= 12 ms^{-1}
We know that distance(s)	*= ut + (1/2)at^2*
∴ (b) the distance travelled.	*= 0 ×120 + (1/2) × 0.1×$(120)^2$*
	= 0 + (120 × 120) /2 × 10
	= 14400/20 = 720 m
	=720 m

Q2. A train is travelling at a speed of 90 km h^1 Brakes are applied so as to produce a uniform acceleration of -0.5 m s^{-2}Find how far the train will go before it is brought to rest.
Answer :

Given Initial speed of train (u)	$=90$ km h^{-1}
	$= (90\ 1000) / (60\times60)$ m s^{-1}
	$= 25$ m s^{-1}
Final speed of train (v)	$= 0$ ms^1
Braking acceleration (a)	$= -0.5$ m s^{-2}
We know 2as	$= v^2 - u^2$
Or distance (s)	$=(v^2-u^2)/2a$
∴ Distance covered by the train before it came to rest	$=(0^2-25^2)/(2\times-0.5)m$
	$= -(25\times25)\times10/-1$ m
	$=625$ m

Q3. A trolley, while going down an inclined plane, has an acceleration of 2 cm s^{-2}. What will be its velocity 3 s after the start?
Answer :

Initial Velocity of trolley (u)	$=0$ cms^{-1}
Acceleration (a)	$= 2$ cm s^{-2}
Time (t)	$= 3$ s
We know that final velocity (v)	$= u + at$
	$= 0 + 2 x 3$ cms^{-1}

∴ The velocity of train after 3 seconds = 6 cms^{-1}

Q4. A racing car has a uniform acceleration of 4 m s-2. What distance will it cover in 10 s after start?
Ans:

Initial Velocity of the car (u)	$=0$ ms^{-1}
Acceleration (a)	$= 4$ m s^{-2}
Time (t)	$= 10$ s
We know Distance (s)	$= ut + (1/2)at^2$
∴ Distance covered by car in 10 second	$= 0\times10 + (1/2)\times4\times10^2$
	$= 0 + (1/2)\times4\times10\times10$ m
	$= (1/2)\times400$ m
	$= 200$ m

Q5. A stone is thrown in a vertically upward direction with a velocity of 5 m s^{-1} If the acceleration of the stone during its motion is 10 m s^{-2} in the downward direction, what will be the height attained by the stone and how much time will it take to reach there?
Ans:

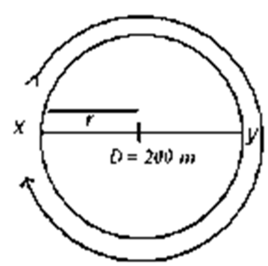
Given Initial velocity of stone (u)	$=5$ m s^{-1}
Downward of negative Acceleration (a)	$= 10$ m s^{-2}
We know that 2 (a)(s)	$= v^2 - u^2$
∴Height attained by the stone (s)	$= (0^2-5^2)/ 2 \times (-10)m$
	$= -25/-20$ m
	$= 1.25$ m
Also we know that final velocity (v)	$= u + at$
or Time (t)	$= (v-u)/a$

∴ Time (t) taken by stone to attain the height(s) = (0-5)/- 10 s = 0.5 s

Q1. An athlete completes one round of a circular track of diameter 200 m in 40 s. What will be the distance covered and the displacement at the end of 2 minutes 20 s? Distance covered by the athlete
Ans:

Diameter of circular track (D)	*= 200 m*
Radius of circular track (r)	*= 200/2=100 m*
Time taken by the athlete for one round (t)	*= 40 s*
Distance covered by athlete in one round (s)	*= 2π r*
	= 2 × (22 / 7)×100
Speed of the athlete (v)	*= Distance / Time*
	= (2 × 2200)/(7 × 40)
	= 4400 / 7 × 40
∴ Distance covered in 2 minutes 20 seconds (s) or 140 s	*= Speed (s) × Time(t)*
	= 4400 / (7 × 40) × (2×60 + 20)
	= 4400 /(7 × 40) × 140
	= 4400 × 140 /7 × 40
	=2200 m
Number of round in 40 s	*=1 round*
Number of round in 140 s	*=140/40*
	=3 ½

After taking start from position X, the athlete will be at position Y after 3 $^1/_2$ rounds as shown in figure

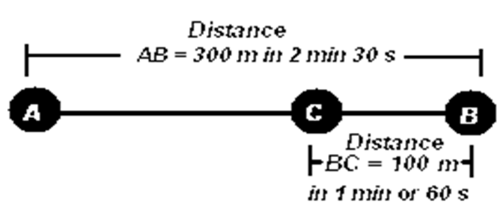


Final Position of athlete after 3 1 2 round
XY Diameter of circle 200 m

∴ Hence Displacement of the athlete with respect to initial position at X	*=XY*
	= Diameter of circular track
	= 200 m

Q2. Joseph jogs from one end A to the other end B of a straight 300 m road in 2 minutes 30 seconds and then turns around and jogs 100 m back to point C in another 1 minute.
What are Joseph's average speeds and velocities in jogging (a) from A to B and (b) from A to C?
Ans:

Total Distance covered from AB	*= 300 m*
Total time taken	*= 2 × 60 + 30 s*
	=150 s



∴ Average Speed from AB = *Total Distance / Total Time*

$=300/150\ m\ s^{-1}$

$=2\ m\ s^{-1}$

∴ Velocity from AB = *Displacement AB / Time* $= 300/150\ m\ s^{-1}$

$=2\ m\ s^{-1}$

Total Distance covered from AC $=AB + BC$

$=300 + 200\ m$

Total time taken from A to C = *Time taken for AB + Time taken for BC*

$= (2\times60+30)+60\ s$

$= 210\ s$

∴Average Speed from AC = *Total Distance /Total Time*

$= 400 /210\ m\ s^{-1}$

$= 1.904\ m\ s^{-1}$

Displacement (S) from A to C $= AB – BC$

$= 300\text{-}100\ m$

$= 200\ m$

Time (t) taken for displacement from AC $= 210\ s$

∴Velocity from AC = *Displacement (s) / Time(t)*

$= 200 / 210\ m\ s^{-1}$

$= 0.952\ m\ s^{-1}$

Q 3. Abdul, while driving to school, computes the average speed for his trip to be 20 km h^{-1}*. On his return trip along the same route, there is less traffic and the average speed is 30 km* h^{-1}*. What is the average speed for Abdul's trip?*

Ans: Let us assume:

The distance Abdul commutes while driving from Home to School $= S$

Let us assume time taken by Abdul to commutes this distance $= t_1$

Distance Abdul commutes while driving from School to Home $= S$

Let us assume time taken by Abdul to commutes this distance $= t_2$

Average speed from home to school v_{1av} $= 20\ km\ h^{-1}$

Average speed from school to home v_{2av} $= 30\ km\ h^{-1}$

Also we know Time taken from Home to School t_1 $=S/v_{1av}$

Similarly Time taken from School to Home t2 $=S/v_{2av}$

Total distance from home to school and backward $= 2\ S$

Total time taken from home to school and backward (T) $= S/20+ S/30$

∴ Average speed (V_{av}) *for covering total distance (2S)* = *Total Distance/Total Time*

$= 2S/(S/20 +S/30)$

$= 2S/[(30S+20S)/600]$

$= 1200S / 50S$

$= 24\ kmh^{-1}$

Q4. A motorboat starting from rest on a lake accelerates in a straight line at a constant rate of 3.0 m s^{-2} *for 8.0 s. How far does the boat travel during this time?*

Ans:

Given Initial velocity of motorboat $u = 0$

Acceleration of motorboat a $= 3.0\ m\ s^{-2}$

Time under consideration t $= 8.0\ s$

We know that Distance s $= ut + (1/2)at^2$

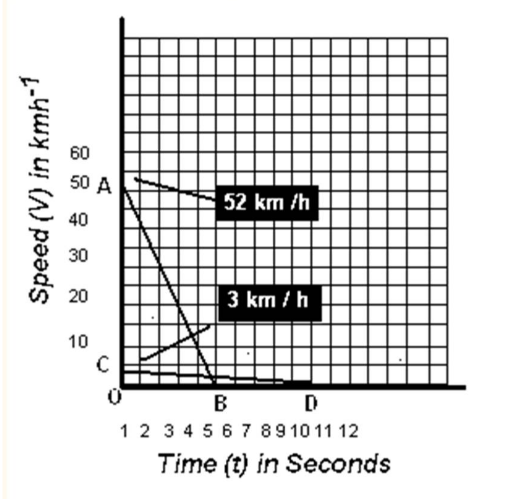
∴ *The distance travel by motorboat* $= 0 \times 8 + (1/2)3.0 \times 8^2$

$= (1/2) \times 3 \times 8 \times 8$ m

$= 96$ m

Q5. A driver of a car travelling at 52 km h^{-1} applies the brakes and accelerates uniformly in the opposite direction. The car stops in 5 s. Another driver going at 3 km h^{-1} in another car applies his brakes slowly and stops in 10 s. On the same graph paper, plot the speed versus time graphs for the two cars. Which of the two cars travelled farther after the brakes were applied?

Ans: As given in the figure below AB (in red line) and CD (in red line) are the Speed-time graph for given two cars with initial speeds 52 kmh^{-1} and 3 kmh^{-1} respectively.



Distance Travelled by first car before coming to rest =Area of △ OAB

$= (1/2) \times OB \times OA$

$= (1/2) \times 5\ s \times 52\ kmh^{-1}$

$= (1/2) \times 5 \times (52 \times 1000)/3600)$ m

$= (1/2) \times 5 \times (130/9)$ m

$= 325/9$ m

$= 36.11$ m

Distance Travelled by second car before coming to rest =Area of △ OCD

$= (1/2) \times OD \times OA$

$= (1/2) \times 10\ s \times 3\ kmh^{-1}$

$= (1/2) \times 10 \times (3 \times 1000)/3600)$ m

$= (1/2) \times 10 \times (5/6)$ m

$= 5 \times (5/6)$ m

$= 25/6$ m

$= 4.16$ m

∴Clearly the first car will travel farther (36.11 m) than the first car (4.16 m).

Q6. Fig 8.11 shows the distance-time graph of three objects A, B and C. Study the graph and answer the following questions:

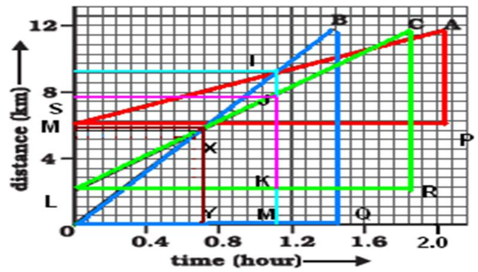
(a) Which of the three is travelling the fastest?

(b) Are all three ever at the same point on the road?

(c) How far has C travelled when B passes A?

(d) How far has B travelled by the time it passes C?

Ans: Drawing x and y coordinates from points A, B and C we get:



Speed of object A = Slope of MA

= AP / MP

= 4/2.2 kmh^{-1}

= 1.81 kmh^{-1}

Speed of object B = Slope of OB

= BQ / OQ

= 12/1.4 kmh^{-1}

= 8.57 kmh^{-1}

Speed of object C = Slope of LC

= CR / LR

= 8/1.4 kmh^{-1}

= 5.71 kmh^{-1}

(a) Object B is travelling the fastest

(b) None of three are ever at the same point on the road as their graph LM, OB and LC do not coincided simultaneously at any point.

(c) C has travelled a distance JK = IM-KM = 9.14-1.14 km =8 km when B passes A.

(d) B has travelled a distance XY = 6 km when B passes C.

Q 7. A ball is gently dropped from a height of 20 m. If its velocity increases uniformly at the rate of 10 m s^{-2}, with what velocity will it strike the ground? After what time will it strike the ground?

Ans: Let us assume, the final velocity with which ball will strike the ground be 'v' and time it takes to strike the ground be 't'

Initial Velocity of ball u =0

Distance or height of fall s =20 m

Downward acceleration a =10 m s^{-2}

As we know, 2as =v^2-u^2

$v^2 = 2as + u^2$

$= 2\times10\times20 + 0$

$= 400$

∴ Final velocity of ball, v = 20 ms^{-1}

$t = (v-u)/a$

∴Time taken by the ball to strike = (20-0)/10

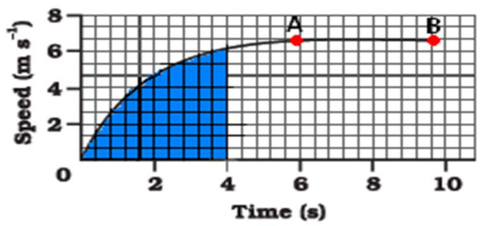
= 20/10 = 2 seconds

Q8. The speed-time graph for a car is shown is Fig. 8.12.

(a) Find how far does the car travel in the first 4 seconds. Shade the area on the graph that represents the distance travelled by the car during the period.

(b) Which part of the graph represents uniform motion of the car?

Ans:



(a)The shaded area with blue color under Speed-time graph represents the distance which the car will travel in first 4 second.
(b) The straight line part of graph, from point A to point B represents a uniform motion.

Q9. State which of the following situations are possible and give an example for each of these:
(a) an object with a constant acceleration but with zero velocity
(b) an object moving in a certain direction with an acceleration in the perpendicular direction.
Ans: Both the situations are possible.
(a) An object with a constant acceleration can still have the zero velocity. For example an object which is at rest on the surface of earth will have zero velocity but still being acted upon by the gravitational force of earth with an acceleration of 9.81 ms^{-2} towards the center of earth.
(b) When an athlete moves with a velocity of constant magnitude along the circular path, the only change in his velocity is due to the change in the direction of motion. Here, the motion of the athlete moving along a circular path is, therefore, an example of an accelerated motion where acceleration is always perpendicular to direction of motion of an object at a given instance. .

Q10. An artificial satellite is moving in a circular orbit of radius 42250 km. Calculate its speed if it takes 24 hours to revolve around the earth.

Ans: Let us assume An artificial satellite, which is moving in a circular orbit of radius 42250 km covers a distance 's' as it revolve around earth with speed 'v' in given time 't' of 24 hours. = 42250 km

Radius of circular orbit r $= 42250 \times 1000$ m

Time taken by artificial satellite t = 24 hours

$= 24 \times 60 \times 60$ s

Distance covered by satellites =circumference of circular orbit

$=2\pi r$

∴ *Speed of satellite v* $=(2\pi r)/t$

$=[2\times (22/7)\times 42250 \times 1000] / (24 \times 60 \times 60)$

$=(2\times 22\times 42250\times 1000) / (7 \times 24 \times 60 \times 60)\ m\ s^{-1}$

$=3073.74\ m\ s^{-1}$

FORCE AND LAWS OF MOTION

Force: *The force is defined as an external influence which tends to set a stationary body in motion or tends to change the speed and direction of a moving body or which tends to make the moving body to come to rest.*

Force is a vector quantity with magnitude as well as direction. The S.I. unit of force is 'Newton'.

Unit of force: *The S.I. unit of force is Newton, and is defined as the force required to produce an acceleration of 1 m/s^2 in a body of mass 1 kilogram.*

*i.e. 1 Newton = 1 kg * 1 m/s^2 or 1N = 1 kgm/s^2*

From the unit of force, it is clear that force is the product of mass and acceleration.

i.e. Force = Mass x Acceleration

Effects of Force: *Some of the important effects of force are.*

i. *A force can change the speed of a stationary or moving body. i.e. it can make a stationary body to move and increase or decrease the speed of a moving body.*
ii. *It can change the direction of motion f a moving body.*
iii. *It can change the shape and size of a body.*

***Force and its relation to motion**: When a force is applied to a body it can essentially have effects.*

i. *It can change the state of rest or motion of a body, or*
ii. *It can deform a body i.e. change its shape.*

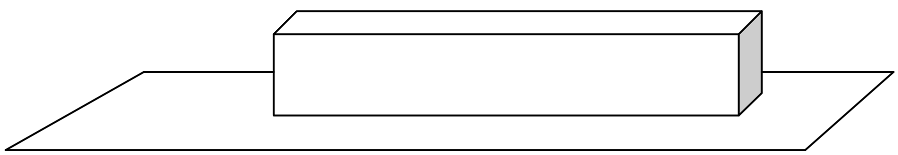
A force can produce two kinds of motion, i.e. translator and rotatory. A body is said to have translatory motion if on applying a force on it, each constituent part of the body suffers the same displacement at the same time. So when a force is applied to an object, it can have the following affects on its translatory motion.

i. *A force can move an object originally at rest.*
ii. *A force can move an object and can increase and decrease its speed.*
iii. *A force can change the direction of motion of an object.*

Hence, we can say that a force produces acceleration in the body to which it is applied. Thus if a body is found to accelerate we must say that unbalanced force is being acting on it. Thus clarifies that force is related with motion.

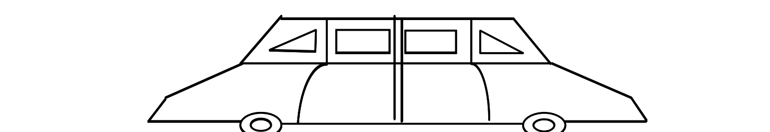
***Balanced Forces**: When the resultant of all the forces acting on a body is zero, then the forces are said to be balanced forces. A body under the balanced forces does not change position of rest or of uniform motion and it appears as if no force is acting on it.*

e.g. Suppose a heavy box is lying on the ground, when we push it. It will not move though four forces are acting on it. i.e. The force of our push, force of gravity and force of reaction. Since the four forces are acting on the box and it does not move at all. This shows that the resultant of all forces acting on it is zero. Therefore, the box behaves as if no force is acting on it. Thus the forces acting on the stationary box are balanced forces.



***Unbalanced force**: When the resultant of all the forces acting on an object is not zero, then the forces are called as unbalanced forces. When unbalanced forces act on a body, they produce a change in its state of rest or of uniform motion.*

e.g. suppose a toy car is lying on the ground. When we push it, it will move. There are four forces acting on it. i.e. force of our push, force of friction, force of gravity and the force of reaction of ground. In this case the force of gravity on the car and the force of reaction of ground are equal and opposite. So they balance each other. But the force of our push is however greater than the force of friction. So they cannot balance each other. Thus the resultant of all forces acting on the toy car is not zero and therefore the forces are unbalanced.



***Impulse of force**: An impulse of force is that force which act on a body for very short time. It is equal to the force acting on the body and the time taken for which it reacts.*

i.e. impulse = force x time or Impulse = F x T

The S.I. unit of impulse is Newton – Second i.e. Ns.

***Inertia**: Inertia is the property or tendency of a body to resist any change in its state of rest or of uniform motion in a straight line. So, inertia is the property of object that they remain to continue in the state of rest or of uniform motion till external force acts on them.*

The measure of inertia of an object depends upon the mass of the object. So a heavier object has more inertia than lighter object. The different forms of inertia are: inertia of rest, motion and direction.

i. ***Inertia of rest**: It is the tendency of an object to maintain its state of rest against some external force. E.g. when a passenger is sitting in a bus and the bus starts moving forward, suddenly the passenger experiences a jerk backwards. This is due to the reason when the bus starts moving suddenly, the lower part of the passenger in contact with the bus is set into motion in the forward direction, but the upper part of the body continues to remain in the rest because of inertia of rest.*

ii. ***Inertia of motion***: *It is the tendency of a material body to maintain its state of motion (uniform motion). e.g. When a man jumps out of a running bus, he falls with his head forward. This is due to the fact that on jumping out of running bus, his feet comes to rest suddenly while the rest of the body tends to remain in motion.*

iii. ***Inertia of direction***: *It is the tendency of a material body to maintain its direction of motion. e.g. if a stone is fastened at one end of a piece of string is whirled and the string breaks, the stone flies off along the tangent of a circle described by the swirling string.*

Newton's first law of motion: *The Newton's first law of motion states that "A body at rest will remain at rest, and a body in motion will continue to remain in motion in a straight line with a uniform speed, unless it is not compelled by an external force to change its state if rest or motion."*

Examples:

i. *If a book is lying on the table or coin is lying on the floor, it is in rest and will remain in rest till we are not lifting or pushing it, so to change the state of book or coin, external force is required.*
ii. *We have seen a moving bicycle comes to rest when we stop peddling, because two external forces are still acting on it. First is the force of friction between tyres and surface of road and second gravitational force of earth. If there was no air resistance and no friction to oppose the motion of the bicycle, then according to the first law of motion, a moving bicycle would go on moving forever. It would not stop itself.*
iii. *When a bowler bowls a ball towards a batsman, who hits it along the ground to a fielder at the fence. It slows down while moving on the ground due to the friction with ground and the air resistance against the ball.*

Newton's second law of motion: *Newton's second law of motion states that "The rate of change of momentum of a body is directly proportional to the applied force, and takes place in the direction of force."*

i.e. $\quad$ Force ∞ Change in momentum / Time taken

Suppose a body of mass 'm' having initial velocity 'u', then its initial momentum is 'mu'. Suppose a force 'F' acts on the body for time 't' and causes final velocity to be 'v'. The final momentum of the body will be 'mv'.

Now $\quad$ Change in momentum = mv – mu

Therefore, $\quad F \infty (mv - mu) / t$

$\Rightarrow \quad F \infty m (v - u) / t$ $\quad$ ---------------- (i)

But $\quad$ Acceleration = Change in velocity / Time taken

$\Rightarrow \quad a = v - u / t$ $\quad$ --------------- (ii)

By Substitute equation (ii) in equation (i) we will get $\quad F \infty m. a$

Thus force applied on a body is directly proportional to the product of its mass and acceleration.

Now $\quad F = K. m. a$

Where 'K' is the constant of proportionality and S.I. units the value of K = 1

$\Rightarrow \quad F = 1. m. a$

or $\quad F = m . a$

i.e. $\quad$ Force = mass x acceleration

Newton's third law of motion: *Newton's third law of motion states that "To every action there is equal and opposite reaction." Or In other words "when a force is exerted by one object on the other object, the other object also exerts an equal force on the first object but in opposite direction".*

The force exerted by first object on the second object is called action and the force exerted by the second object on the first object is called as reaction.

Example: We take two similar spring balances P and Q and coupling them hook to hook. Attach one end of spring balance P to a hook R fixed on a wall. We pull the spring balance Q towards our own side. i.e. we apply some force on balance Q by pulling it and note sown the reading on the scales of both the spring balances. We will repeat the same activity more than once with different force and note down the spring balances are same. So the activity shows that the spring balances is equal and opposite reaction.

Momentum: *The momentum of a body is defined as a product of its mass and velocity.*

i.e. $\quad$ Momentum = Mass x Velocity $\quad$ or $\quad M = m \times v$

Where M = momentum, m = mass of the body and v = velocity of body. The S.I unit of momentum is Kg.m/s or $kgms^{-1}$ (Sometimes momentum is also denoted by P instead of M. In that case the equation for momentum is P = mv)

<u>Relationship between momentum and force</u>*: Suppose a force acts on a body of mass 'm' for time 't' and changes its velocity from u to v then by the Newton's second law of motion.*

Force = mass x acceleration.

=> F = m . a ------------------- (i)

But, Acceleration = change in velocity / time taken

=> a = v – u / t -------------------- (ii)

From equations (i) and (ii) we get F = m . (v – u) / t

=> F = mv – mu / t

Since v and u are final and initial velocity. So 'mv' and 'mu' are final and initial momentum respectively.

Therefore, Force = Final momentum – initial momentum / time taken

=> Force = Change in momentum / time

=> Force = Rate of change of momentum

Or Mass x Acceleration = Rate of change of momentum

<u>Relationship between force and acceleration</u>*:*

According to Newton's second law of motionForce = mass x acceleration

i.e. F = m .a

or F / m = a

or a = F /m

From the above relation it is clear that "The acceleration produced in a body is directly proportional to the force acting on it and inversely proportional to the mass of the body. Thus, if the mass of a body is doubled, its acceleration will be halved and if the mass is halved then the acceleration will get doubled (provided the force will remain same).

<u>Law of conservation of momentum</u>*: It states that "Momentum is never created nor destroyed" i.e. when two bodies act upon one another, their total momentum remains constant (or conserved) provided no external forces are acting. (The momentum gained by one body is equal to momentum produced by another body)*

Example: Suppose a speeding truck hits a stationery car due to which the car starts moving. In this collision, the velocity of truck decreases but the velocity of car increases. Due to this the momentum of trucks decreases and the momentum of car increases. It has been found that the increase in the momentum of car is equal to the decrease in the momentum of the truck, so there is no loss of momentum in the collision of truck and car, only the transference of momentum from truck to car has taken place, and hence the momentum is conserved. It is also known as the principle of conservation of momentum.

<u>TEXTUAL QUESTIONS</u>

Question.1: Which of the following has more inertia?

(a) A rubber ball and a stone of the same size.

(b) A bicycle and a train.

(c) A five rupee coin and a one rupee coin.

Answer: (a) stone (b) train (c) five rupee coin.

Question.2: In the following example, try to identify the number of times the velocity of ball changes: "A football player kicks a football to another player of his team who kicks the football towards the goal. The goalkeeper of the opposite team collects the football and kicks it towards a player of his own team." Also identify the agent supplying the force in each case.

Answer: The velocity of the ball changes three times. First time, the velocity changes when the football player of one team kicks the ball. Second time the velocity changes when another player of the same team kicks the football. Third time the velocity changes when the goalkeeper of the opposite team kicks the football. The agent supplying the force in each case, have been underlined.

Question.3: Explain why some of the leaves may get detached from a tree if we vigorously shake its branch.
Answer: Before shaking the branches the leaves are at rest. When the branches are shaken, they come in motion at once while the leaves tend to remain at rest due to inertia of rest. As a result leaves get detached from the branches and fall down.

Question.4: Why do you fall in the forward direction when a moving bus brakes to a stop and fall backwards when it accelerates from rest?
Answer: When a moving bus brakes to a stop, the lower part of our body in contact with bus comes to rest while the upper part of our body tends to keep moving due to inertia of motion. Hence we fall forwards. When the bus accelerates from rest, the lower part of our body comes into motion along with the bus while the upper part of body tends to remain at rest due to inertia of motion and as a result which we fall backwards.

Question.5: If action is always equal to reaction, explain how a horse can pull cart.
Answer: The horse pulls the cart with a force (action) in the forward direction. Since every action has an equal and opposite reaction so, the cart also pulls the horse with an equal force (reaction) in the backward direction. As a result of which the two forces get balanced. But while pulling the cart the horse also pushes the ground with its feet in the backward direction. The reaction of the earth makes it forward direction along with the cart. This is how the horse applies force and pulls the cart.

Question.7: Explain why it is difficult for a fireman to hold a hose, which ejects large amount of water at a high velocity.
Answer: Water is ejected with a large forward force (action). As we know by Newton's third law of motion that every action has an equal and opposite reaction so, because of this action fireman experiences a large backward force or reaction. That is why he feels difficulty in holding the hose.

Question9:From a rifle of mass 4 kg a bullet of mass 50 gm is fired with an initial velocity of 35 ms^{-1}. Calculate the initial recoil velocity of the rifle.
Answer: Mass of bullet, m_1 = 50 gm = 0.05 kg.
Mass of rifle, m_2 = 4 kg.
Initial velocity of bullet, $u_1 = 0$
Initial velocity of rifle, $u_2 = 0$
Final velocity of bullet, $v_1 = 35\ ms^{-1}$
Final velocity of rifle, v_2 = ?
According to the law of conservation of momentum,
Total momentum after firing = Total momentum before firing,
Or, $m_1v_1 + m_2v_2 = m_1u_1 + m_2u_2$
Or, $0.05 \times 35 + 4v_2 = 0 + 0$
Or, $v_2 = -0.44\ ms^{-1}$
The negative sign indicates the direction of recoil (backward).

Question.10: Two objects of masses of 100 gm and 200 gm are moving in along the same line and direction with velocities of 2 ms^{-1} and 1 ms^{-1}respectively. They collide and after collision, the first object moves at a velocity of 1.67 ms^{-1}. Determine the velocity of the second object.
Answer: m_1 = 100 gm = 0.1 kg, m_2 = 200 gm = 0.2 kg,
$u_1 = 2\ ms^{-1}$, $u_2 = 1\ ms^{-1}$, $v_1 = 1.67\ ms^{-1}$, v_2 = ?
By the law of conservation of momentum,
$m_1v_1 + m_2v_2 = m_1u_1 + m_2u_2$
Or, $0.1 \times 1.67 + 0.2\ v_2 = 0.1 \times 2 + 0.23 \times 1$
Or, $v_2 = 1.165\ ms^{-1}$.
It will move in the same direction after collision.

Question.11: An object experiences a net zero external unbalanced force. Is it possible for the object to be travelling with the non-zero velocity? If yes, state the conditions that must be placed on the magnitude and direction of the velocity. If no, provide a reason.
Solution: Yes, an object may travel with a non-zero velocity even when the net external force on it is zero. A rain drop falls down with a constant velocity. The weight of the drop is balanced by the up thrust and the velocity of air. The net force on the drop is zero.

Question.12: When a carpet is beaten with a stick, dust comes out. Explain, why?
Solution: When a carpet is beaten with a stick it comes into motion at once. But the dust particles continue to be at rest due to inertia and get detached from the carpet.

Question.13: why is it advised to tie any luggage kept on the roof of a bus with a rope?
Solution: Due to sudden jerks or due to the bus taking sharp turns on the road, the luggage may fall down from the roof because of its tendency to continue to be either at rest or in motion in the same direction (inertia of motion). To avoid this, it advised to tie the luggage kept on the roof of a bus with a rope.

Question.14: A truck starts from rest and rolls down a hill with constant acceleration. It travels a distance of 400 m in 20 sec. Find its acceleration. Also find the force acting on it if its mass is 7 metric tones.
Solution: Here, $u = 0$, $s = 400$ m, $t = 20$ s
We know, $s = ut + ½ at^2$
Or, $400 = 0 + ½ a (20)^2$
Or, $a = 2\ ms^{-2}$
Now, $m = 7$ MT $= 7000$ kg, $a = 2\ ms^{-2}$
Or, $F = ma = 7000 \times 2 = 14000$ N **Ans.**

Question.6: A stone of 1 kg is thrown with a velocity of 20 ms^{-1} across the frozen surface of a lake and comes to rest after travelling a distance of 50 m. What is the force of friction between the stone and the ice?
Solution: Here, $m = 1$ kg, $u = 20\ ms^{-1}$ $v = 0$, $s = 50$ m
Since, $v_2 - u_2 = 2as$,
Or, $0 - 20^2 = 2a \times 50$,
Or, $a = -4\ ms^{-2}$
Force of friction, $F = ma = -4$N Ans.

Question.7: An 8000 kg engine pulls a train of 5 wagons, each of 2000 kg along a horizontal track. If the engine exerts a force of 40000 N and the track offers a friction force of 5000 N, then calculate:
(a) The net accelerating force;
(b) The acceleration of the train; and
(c) The force of wagon 1 on wagon 2.
Solution: Total mass, m = mass of engine + mass of wagons
Or, $m = 8000 + 5 \times 2000 = 18000$ kg.
(a) The net accelerating force, F = Engine force - Frictional force
Or, $F = 40000 - 5000 = 35000$ N
(b) The acceleration of the train, $a = F \div m = 35000 \div 18000 = 1.94\ ms^{-2}$.
(c) The force of wagon 1 on wagon 2
= The net accelerating force - (mass of wagon x acceleration)
$= 35000 - (2000 \times 1.94) = 31111.2$ N Ans.

Question.10: Using a horizontal force of 200 N, we intend to move a wooden cabinet across a floor at constant velocity. What is the force of friction that will be exerted on the cabinet?
Solution: The cabinet will move with constant velocity only when the net force on it is zero. Therefore, force of friction on the cabinet = 200 N, in a direction opposite to the direction of motion of the cabinet.

Question.11: Two objects each of mass 1.5 kg are moving in the same straight line but in opposite directions. The velocity of each object is 2.5 ms^{-1} before the collision during which they stick together. What will be the velocity of the combined object after collision?

Solution: Here, $m_1 = m_2 = 1.5$ kg, $u_1 = 2.5\ ms^{-1}$ $u_2 = -2.5\ ms^{-1}$

Let v be the velocity of the combined object after collision. By the law of conservation of momentum, Total momentum after collision = Total momentum before collision,

Or $(m_1 + m_2)\ v = m_1u_1 + m_2u_2$

Or $(1.5 + 1.5)\ v = 1.5 \times 2.5 + 1.5 \times (-2.5)$ *[negative sign as moving in opposite direction]*

Or $v = 0\ ms^{-1}$

Question.12: According to the third law of motion when we push on an object, the object pushes back on us with an equal and opposite force. If the object is a massive truck parked along the roadside, it will probably not move. A student justifies this by answering that the two opposite and equal forces cancel each other. Comment on this logic and explain why the truck does not move.

Solution: The logic is that Action and Reaction always act on different bodies, so they can not cancel each other. When we push a massive truck, the force of friction between its tyres and the road is very large and so the truck does not move.

Question.13: A hockey ball of mass 200 gm travelling at 10 ms^{-1} is struck by a hockey stick so as to return it along its original path with a velocity at 5 ms^{-1}. Calculate the change of momentum occurred in the motion of the hockey ball by the force applied by the hockey stick.

Solution: Change in momentum = $m\ (v - u) = 0.2\ (-5 - 10) = -3\ kg\ ms^{-1}$.

(The negative sign indicates a change in direction of hockey ball after it is struck by hockey stick. Magnitude of change in momentum = 3 kg ms^{-1}*).*

Question.16: An Object of mass 100 kg is accelerated uniformly from a velocity of 5 ms^{-1} to 8 ms^{-1} in 6 sec. Calculate the initial and final momentum of the object. Also find the magnitude of the force exerted on the object.

Solution: Here, $m = 100$ kg, $u = 5\ ms^{-1}$, $v = 8\ ms^{-1}$, $t = 6$ sec.

Initial momentum, $p_1 = mu = 500\ kg\ ms^{-1}$

Final momentum, $p_2 = mv = 800\ kg\ ms^{-1}$

The magnitude of the force exerted on the object, $F = (p_2 - p_1) \div t = (800 - 500) \div 6 = 50$ N.

WORK, ENERGY AND POWER

WORK*: Work is said to be done when the point of application of a force moves. Work done in moving a body is equal to the product of force created on the body and distance moved by the body in the direction of force.*

i.e. Work = Force x Distance travelled in the direction of force.

Or Work = Force x Distance or $W = F \times S$

Unit of work*: Since the unit of force is Newton (N) and that of distance is meter (m). Work is the product of force and distance. So, the unit of work is Newton meter and is written as Nm. It is also known as a joule. When a force of 1 Newton moves a body through a distance of 1 meter in its own direction, then the work done is known as 1 joule.*

i.e. 1 Joule = 1 Newton x 1 Meter or 1 J = 1 Nm

Hence the S.I. unit of work is Joule.

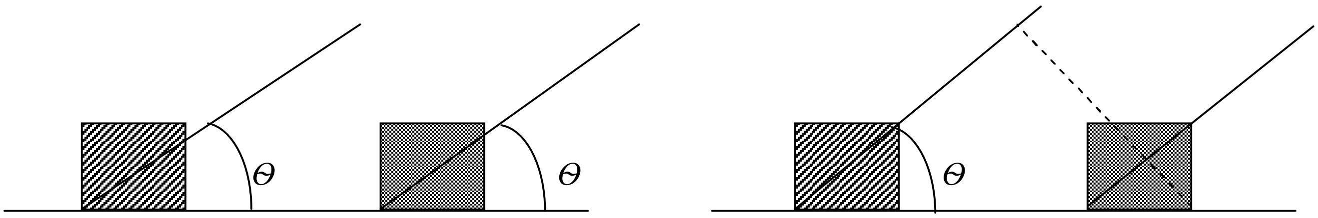
Relation of work with force and displacement*: Work done by a force is equal to the product of force and distance moved in the direction of force.*

i.e. Work done = Force x Distance moved in the direction of force.

Case I: ***When force and displacement are in the same direction****: Consider a wooden block placed on a flat table. Let a force(F) moves the wooden block through a distance (s) in its own direction. Then*

Work done = Force x Distance or W = F x S

Case II: ***when force and displacement are inclined at a certain angle to each other****: Let a wooden block to be pulled by a force 'F' which is inclined at a certain angle with the ground. Owing to this force, the wooden block moves from position A to the position B.*



In order to measure the work done we will find the projection of displacement AB in the direction of force 'F'. Now draw BP ⊥ AC, the projection AP is the distance moved in the direction of force 'F'.

Therefore, Work done = Force x distance moved in the direction of force.

Or W = F x length of projection

Or W = F x AB Cos Θ

Or W = F x S Cos Θ

[Because AP/AB = Cos Θ => AP = AB Cos Θ]

Case III: ***When force and displacement are perpendicular to each other:*** *The displacement is in a direction perpendicular to the force. Thus the projection of the displacement along the direction of the force 'F' is zero.*

Therefore Work done = Force x Projection of displacement in the direction of force.

Or W = F x zero = 0.

Positive work*: The work done is said to be positive when a force acts in the direction of motion of the body. Positive work done by a force increases the speed of a body.*

e.g. If we kick a football moving on the ground then the football starts moving and its speed increases due to the force applied. Hence the work done is said to be positive.

Negative work*: The work done is said to be negative, when a force acts opposite to the direction of motion of the body. Negative work done by a force decreases the speed of a body.*

e.g. A ball moving on the ground slows down gradually and ultimately stops due to the force of friction. The force of friction acts in opposite direction of motion of ball. So force of friction on the ball is negative. The work done in this case is said to be negative.

Zero work*: The work done is said to be zero when a force acts at right angles to the direction of motion of the body. Zero work done by a force has no effect on the motion of body.*

Energy: *The energy of a body is defined as its ability to do work. It indicates only the total amount of work done by the body and does not mention the time taken for work done. The amount of energy possessed by a body is equal to the amount of work it can do when its energy is released. Energy is a scalar quantity as it does not possess any direction.*

Unit of Energy: *The S.I. unit of energy is same as that of work i.e. Joule. One Joule of energy is defined as the energy required to do the work of one joule.*

Forms of Energy: *The various forms of energy are*

Kinetic energy	*Potential energy*	*Mechanical energy*	*Chemical energy*	*Light energy*
Heat energy	*Sound energy*	*Wave energy*	*Electrical energy*	*Nuclear energy*

Potential Energy : *The energy possessed by a body by due to its position or change in shape is known as potential energy. e.g.*

i. *A stone lying on the roof of the wall.*
ii. *The water stored in high rise dams, and*
iii. *Winding spring of a watch or a clock*

The stone, water and winding spring in the above examples possess potential energy. The potential energy is denoted by the symbol 'ϕ'

Kinetic Energy: *The energy possessed by a body due to its motion is called as kinetic energy. i.e. If a body is capable of doing work due to its motion, it is said to possess kinetic energy. e.g.*

i. *A bullet moving with a very high speed has kinetic energy capable of piercing a wooden target.*
ii. *The running water in a flowing river has kinetic energy.*
iii. *Wind (moving air) has kinetic energy to turn the blades of a wind mill.*

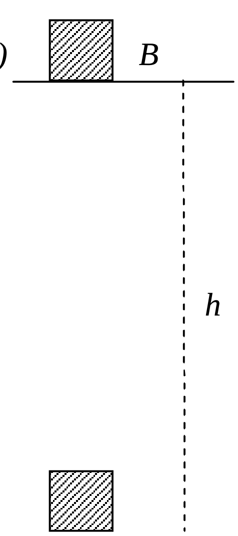
Derivation of expression for potential energy: *Let an object is placed in position A on the surface of the earth. A force of 'F' is applied on it to lift it vertically to a height of 'h' at position B.*

Since the force applied on the object is equal to gravitational force of earth acting on the body and in opposite direction.

Therefore, $F = G \times M_e \times m / R_e^2$ ------------- *(i)*

Where 'G' is gravitational constant, 'M_e' is mass of earth and 'R_e' is radius of earth, 'm' is the mass of the object.

But $g = G \times M_e / R_e^2$ ------------- *(ii)*



Where 'g' is the gravitational acceleration (acceleration due to gravitation)

By using equation (i) and (ii) we get

$F = g \times m$

Or $F = m \times g$

Now when the object is lifted vertically to a height 'h'

Work done = force x displacement

i.e. $W = F \times h$ *(distance = h)*

=> $W = m \times g \times h$ mg A

Since work done on the object or change in energy is same, then potential energy of an object at a height 'h' is 'mgh' or $\phi = mgh$

Derivation of expression for kinetic energy*: let an object is at a height of 'h' from the surface of the earth and its mass is 'm', then the potential energy of the object at the height 'h' is equal to 'mgh'.*

When the object starts falling from height 'h' we can calculate its velocity just before touching the surface of the earth.

Initial velocity of the object will be (u) = 0

Acceleration due to gravity will be = g

Height of the object = h

and Final velocity = v

We know that $v^2 - u^2 = 2as$ *by the third equation of motion*

=> $v^2 - 0 = 2\,g\,h$ => $v^2 = 2gh$

=> $v^2 / 2g = h$ ----------------- (i)

While reaching the surface of the earth, the total potential energy of the object will change to kinetic energy.

Therefore, *Kinetic Energy = Potential energy*

=> $K.E = m.g.h$

=> $K.E = m.g.(v^2/2g)$

=> $K.E = \frac{1}{2} mv^2$ *(by using eq. i)*

Law of conservation of energy*: According to the law of conservation of energy "Whenever energy changes from one form to another, the total amount of energy remains constant". In other words energy remains conserved during its transformation from one form to another. i.e. "energy is neither created nor destroyed".*

e.g. Suppose a ball of mass 'm' is raised to a height of 'h' above the ground. The work done in raising the ball gives it a potential energy equal 'mgh'. Now allow the ball to fall downwards. As the ball falls, its height 'h' above the ground decreases but as the ball falls its velocity 'v' constantly increases and therefore, its kinetic energy '$\frac{1}{2}mv^2$*' also increases. As the ball falls more and more, its potential energy is gradually converted into an equal amount of kinetic energy, but the sum of potential and kinetic energy of the ball remains same at every point during its fall. When the ball reaches the ground surface its potential energy becomes zero and its kinetic energy becomes maximum. At this stage, all the potential energy has been converted into kinetic energy. There is no destruction (loss) of energy, and the total energy remains conserved or constant. Thus proved that 'Energy has neither been created nor destroyed' but gets transformed from one form to another without any loss.*

Power*: The power is defined as the energy supplied per unit time. i.e. The rate of doing work with respect to the time is known as power. The S.I unit of the power is Watt and it is a scalar quantity.*

Power = Work done / Time taken

Or $P = W / T$

Or Power = Energy supplied / Time taken

***<u>Unit of Power</u>**: The S.I unit of power is watt, and is defined as the power which does the work at the rate of 1 joule per second or 1 watt is the power of an appliance which consumes energy at the rate of 1 joule per second.*

Or 1 watt = 1 joule/1 second

Or I watt = 1 j / 1 s

Or 1 watt = 1 joule per second

The watt is a small unit and the bigger units are kilowatt (KW) and megawatt (MW)

i.e. 1 Kilowatt = 1000 watts or 1 KW = 1000 W

and 1 Megawatt = 1000 Kilowatts or 1 MW = 1000 KW

Besides kilowatt and Megawatt, another unit for power is known as horse power (hp).

i.e. 1 Horsepower =746 watt or 1HP = 746 W = 0.75 Kilowatt

***<u>Transformation of energy from one form to another form</u>**: The change of one form of energy into another form of energy is known as transformation of energy.*

Examples:

i. *Suppose a stone is laying on the roof of a house .In this position all the energy of the stone is in the form of potential energy. When the stone is dropped from the roof it starts moving downwards towards the ground and the potential energy of the stone starts changing into kinetic energy. As the stone continues falling downwards, its potential energy goes on decreasing due to increase in height, but its kinetic energy goes on increasing due to increase in its velocity. In other words, the potential energy of the stone gradually gets transformed into kinetic energy, and by the time stone reaches the grounds, its potential energy becomes zero and entire energy will be in the form of kinetic energy. so, when a body is released from a height then the potential energy of the body is gradually transformed (or changed) into kinetic energy. Also when a body is thrown upwards, the kinetic energy of the body gradually transformed (or changed) into potential energy.*
ii. *At a hydroelectric power station, the potential energy of water gets transformed into kinetic energy and then to electrical energy.*
iii. *In a heat engine, the heat energy is converted into kinetic energy by the steam produced.*

<u>TEXTUAL QUESTIONS</u>

Question 1: A force of 7 N acts on an object. The displacement is, say 8 m, in the direction of the force. Let us take it that the force acts on the object through the displacement. What is the work done in this case?
Answer: When a force F acts on an object to displace it through a distance S in its direction, then the work done W on the body by the force is given by:

Work done = Force × Displacement

$W = F \times S$

Where, $F = 7$ N, $S = 8$ m

Therefore, work done, $W = 7 \times 8$

$= 56$ Nm

= 56 J

Question 1: When do we say that work is done?

Answer: Work is done whenever the given conditions are satisfied:

(i) A force acts on the body.

(ii) There is a displacement of the body caused by the applied force along the direction of the applied force.

Question 2: Write an expression for the work done when a force is acting on an object in the direction of its displacement.

Answer: When a force F displaces a body through a distance S in the direction of the applied force, then the work done W on the body is given by the expression:

Work done = Force × Displacement

$W = F \times s$

Question 3: Define 1 J of work.

Answer: 1 J is the amount of work done by a force of 1 N on an object that displaces it through a distance of 1 m in the direction of the applied force.

Question 4: A pair of bullocks exerts a force of 140 N on a plough. The field being ploughed is 15 m long. How much work is done in ploughing the length of the field?

Answer: Work done by the bullocks is given by the expression:

Work done = Force × Displacement

$W = F \times d$

Where, Applied force, F = 140 N, Displacement, d = 15 m

$W = 140 \times 15 = 2100$ J

Hence, 2100 J of work is done in ploughing the length of the field.

Question 1:

What is the kinetic energy of an object?

Answer: Kinetic energy is the energy possessed by a body by the virtue of its motion. Every moving object possesses kinetic energy. A body uses kinetic energy to do work. Kinetic energy of hammer is used in driving a nail into a log of wood, kinetic energy of air is used to run wind mills, etc.

Question 2: Write an expression for the kinetic energy of an object.

Answer: If a body of mass m is moving with a velocity v, then its kinetic energy is given by the expression, Its SI unit is Joule (J).

Question 3: The kinetic energy of an object of mass, m moving with a velocity of 5 m s^{-1} is 25 J. What will be its kinetic energy when its velocity is doubled? What will be its kinetic energy when its velocity is increased three times?

Answer: Expression for kinetic energy is

m = Mass of the object

v = Velocity of the object = 5 m s^{-1}

Given that kinetic energy, = 25 J

(i) If the velocity of an object is doubled, then $v = 5 \times 2 = 10$ m s^{-1}.

Therefore, its kinetic energy becomes 4 times its original value, because it is proportional to the square of the velocity. Hence, kinetic energy = $25 \times 4 = 100$ J.

(ii) If velocity is increased three times, then its kinetic energy becomes 9 times its original value, because it is proportional to the square of the velocity. Hence, kinetic energy = $25 \times 9 = 225$ J.

Question 1: What is power?

Answer: Power is the rate of doing work or the rate of transfer of energy. If W is the amount of work done in time t, then power is given by the expression,

It is expressed in watt (W).

Question 2: Define 1 watt of power:

Answer: A body is said to have power of 1 watt if it does work at the rate of 1 joule in 1 s,

i.e., 1 watt = 1j/1s = 1 j/s

Question 3: A lamp consumes 1000 J of electrical energy in 10 s. What is its power?
Answer: Power is given by the expression,

Work done = power /time

Energy consumed by the lamp = 1000 J

Time = 10 s

Therefore, power = 1000j/10 s = 100 W

Question 4: Define average power.

Answer: A body can do different amount of work in different time intervals. Hence, it is better to define average power. Average power is obtained by dividing the total amount of work done in the total time taken to do this work.

Question 1: Look at the activities listed below. Reason out whether or not work is done in the light of your understanding of the term 'work'.

- *Suma is swimming in a pond.*
- *A donkey is carrying a load on its back.*
- *A wind mill is lifting water from a well.*
- *A green plant is carrying out photosynthesis.*
- *An engine is pulling a train.*
- *Food grains are getting dried in the sun.*
- *A sailboat is moving due to wind energy.*

Answer: Work is done whenever the given two conditions are satisfied:
(i) A force acts on the body.
(ii) There is a displacement of the body by the application of force in or opposite to the direction of force.
(a) While swimming, Suma applies a force to push the water backwards. Therefore, Suma swims in the forward direction caused by the forward reaction of water. Here, the force causes a displacement. Hence, work is done by Seema while swimming.
(b) While carrying a load, the donkey has to apply a force in the upward direction. But, displacement of the load is in the forward direction. Since, displacement is perpendicular to force, the work done is zero.
(c) A wind mill works against the gravitational force to lift water. Hence, work is done by the wind mill in lifting water from the well.
(d) In this case, there is no displacement of the leaves of the plant. Therefore, the work done is zero.
(e) An engine applies force to pull the train. This allows the train to move in the direction of force. Therefore, there is a displacement in the train in the same direction. Hence, work is done by the engine on the train.
(f) Food grains do not move in the presence of solar energy. Hence, the work done is zero during the process of food grains getting dried in the Sun.
(g)Wind energy applies a force on the sailboat to push it in the forward direction. Therefore, there is a displacement in the boat in the direction of force. Hence, work is done by wind on the boat.
Question 2: An object thrown at a certain angle to the ground moves in a curved path and falls back to the ground. The initial and the final points of the path of the object lie on the same horizontal line. What is the work done by the force of gravity on the object?
Answer: Work done by the force of gravity on an object depends only on vertical displacement. Vertical displacement is given by the difference in the initial and final positions/heights of the object, which is zero. Work done by gravity is given by the expression,

$W = mgh$

Where, h *= Vertical displacement = 0*

$W = mg \times 0 = 0$ *J*

Therefore, the work done by gravity on the given object is zero joule.

Question 3: A battery lights a bulb. Describe the energy changes involved in the process.

Answer: When a bulb is connected to a battery, then the chemical energy of the battery is transferred into electrical energy. When the bulb receives this electrical energy, then it converts it into light and heat energy.

Question 4: Certain force acting on a 20 kg mass changes its velocity from 5 m s^{-1} to 2 m s^{-1}. Calculate the work done by the force.

Answer: Kinetic energy is given by the expression, ½ mv^2

Where,

v = velocity of the object

m = Mass of the object

(i) Kinetic energy when the object was moving with a velocity 5 m s^{-1}

(ii) Kinetic energy when the object was moving with a velocity 2 m s^{-1}

Work done by force is equal to the change in kinetic energy.

Therefore, work done by force = $40 - 250 = -210$ J

The negative sign indicates that the force is acting in the direction opposite to the motion of the object.

Question 5: A mass of 10 kg is at a point A on a table. It is moved to a point B. If the line joining A and B is horizontal, what is the work done on the object by the gravitational force? Explain your answer.

Answer: Work done by gravity depends only on the vertical displacement of the body. It does not depend upon the path of the body. Therefore, work done by gravity is given by the expression, W = mgh, Where, Vertical displacement, h = 0

$\therefore W = mg \times 0 = 0$

Hence, the work done by gravity on the body is zero.

Question 6: The potential energy of a freely falling object decreases progressively. Does this violate the law of conservation of energy? Why?

Answer: No. The process does not violate the law of conservation of energy. This is because when the body falls from a height, then its potential energy changes into kinetic energy progressively. A decrease in the potential energy is equal to an increase in the kinetic energy of the body. During the process, total mechanical energy of the body remains conserved. Therefore, the law of conservation of energy is not violated.

Question 7: What are the various energy transformations that occur when you are riding a bicycle?

Answer: While riding a bicycle, the muscular energy of the rider gets transferred into heat energy and kinetic energy of the bicycle. Heat energy heats the rider's body. Kinetic energy provides a velocity to the bicycle. During the transformation, the total energy remains conserved.

Question 8: Does the transfer of energy take place when you push a huge rock with all your might and fail to move it? Where is the energy you spend going?

Answer: When we push a huge rock, there is no transfer of muscular energy to the stationary rock. Also, there is no loss of energy because muscular energy is transferred into heat energy, which causes our body to become hot.

Question 9: A certain household has consumed 250 units of energy during a month. How much energy is this in joules?

Answer: 1 unit of energy is equal to 1 kilowatt hour (kWh).

1 unit = 1 kWh

1 kWh = 3.6 × 106 J

Therefore, 250 units of energy = 250 × 3.6 × 106 = 9 × 108 J

Question 10: An object of mass 40 kg is raised to a height of 5 m above the ground. What is its potential energy? If the object is allowed to fall, find its kinetic energy when it is half-way down.

Answer: Gravitational potential energy is given by the expression, W = mgh

Where, h = Vertical displacement = 5 m

m = Mass of the object = 40 kg

g = Acceleration due to gravity = 9.8 m s−2

∴ W = 40 × 5 × 9.8 = 1960 J.

At half-way down, the potential energy of the object will be = 980 J.

At this point, the object has an equal amount of potential and kinetic energy. This is due to the law of conservation of energy. Hence, half-way down, the kinetic energy of the object will be 980 J.

Question 11: What is the work done by the force of gravity on a satellite moving round the earth? Justify your answer.

Answer: Work is done whenever the given two conditions are satisfied:

(i) A force acts on the body.

(ii) There is a displacement of the body by the application of force in or opposite to the direction of force.

If the direction of force is perpendicular to displacement, then the work done is zero. When a satellite moves around the Earth, then the direction of force of gravity on the satellite is perpendicular to its displacement. Hence, the work done on the satellite by the Earth is zero.

Question 12: Can there be displacement of an object in the absence of any force acting on it? Think. Discuss this question with your friends and teacher.

Answer: Yes. For a uniformly moving object Suppose an object is moving with constant velocity. The net force acting on it is zero. But, there is a displacement along the motion of the object. Hence, there can be a displacement without a force.

Question 13: A person holds a bundle of hay over his head for 30 minutes and gets tired. Has he done some work or not? Justify your answer.

Answer: Work is done whenever the given two conditions are satisfied:

(i) A force acts on the body.

(ii) There is a displacement of the body by the application of force in or opposite to the direction of force.

When a person holds a bundle of hay over his head, then there is no displacement in the bundle of hay. Although, force of gravity is acting on the bundle, the person is not applying any force on it. Hence, in the absence of force, work done by the person on the bundle is zero.

Question 14: An electric heater is rated 1500 W. How much energy does it use in 10 hours?

Answer: Energy consumed by an electric heater can be obtained with the help of the expression,

Where, Power rating of the heater, P = 1500 W = 1.5 kW

Time for which the heater has operated, T = 10 h

Work done = Energy consumed by the heater

Therefore, energy consumed = Power × Time

= 1.5 × 10 = 15 kWh

Hence, the energy consumed by the heater in 10 h is 15 kWh.

Question 15: Illustrate the law of conservation of energy by discussing the energy changes which occur when we draw a pendulum bob to one side and allow it to oscillate. Why does the bob eventually come to rest? What happens to its energy eventually? Is it a violation of the law of conservation of energy?

Answer: The law of conservation of energy states that energy can be neither created nor destroyed. It can only be converted from one form to another. Consider the case of an oscillating pendulum. When a pendulum moves from its mean position P to either of its extreme positions A or B, it rises through a height h above the mean level P. At this point, the kinetic energy of the bob changes completely into potential energy. The kinetic energy becomes zero, and the bob possesses only potential energy. As it moves towards point P, its potential energy decreases progressively. Accordingly, the kinetic energy increases. As the bob reaches point P, its potential energy becomes zero and the bob possesses only kinetic energy. This process is repeated as long as the pendulum oscillates.

The bob does not oscillate forever. It comes to rest because air resistance resists its motion. The pendulum loses its kinetic energy to overcome this friction and stops after some time. The law

of conservation of energy is not violated because the energy lost by the pendulum to overcome friction is gained by its surroundings. Hence, the total energy of the pendulum and the surrounding system remain conserved.
Question 16: An object of mass, m is moving with a constant velocity, v. How much work should be done on the object in order to bring the object to rest?
Answer: Kinetic energy of an object of mass, m moving with a velocity, v is given by the expression,
To bring the object to rest, amount of work is required to be done on the object.
Question 17: Calculate the work required to be done to stop a car of 1500 kg moving at a velocity of 60 km/h?
Answer: Kinetic energy,

Where, Mass of car, m = 1500 kg
Velocity of car, v = 60 km/h
Hence, 20.8 × 104 J of work is required to stop the car.

Question 18: In each of the following a force, F is acting on an object of mass, m. The direction of displacement is from west to east shown by the longer arrow. Observe the diagrams carefully and state whether the work done by the force is negative, positive or zero.
Answer: Work is done whenever the given two conditions are satisfied:

(i) A force acts on the body.
(ii) There is a displacement of the body by the application of force in or opposite to the direction of force.

Case I: In this case, the direction of force acting on the block is perpendicular to the displacement. Therefore, work done by force on the block will be zero.
Case II: In this case, the direction of force acting on the block is in the direction of displacement. Therefore, work done by force on the block will be positive.
Case III: In this case, the direction of force acting on the block is opposite to the direction of displacement. Therefore, work done by force on the block will be negative.
Question 19: Soni says that the acceleration in an object could be zero even when several forces are acting on it. Do you agree with her? Why?
Answer: Acceleration in an object could be zero even when several forces are acting on it. This happens when all the forces cancel out each other i.e., the net force acting on the object is zero. For a uniformly moving object, the net force acting on the object is zero. Hence, the acceleration of the object is zero. Hence, Soni is right.
Question 20: Find the energy in kW h consumed in 10 hours by four devices of power 500 W each.
Answer: Energy consmed by an electric device can be obtained with the help of the expression for power, Where,

Power rating of the device, P = 500 W = 0.50 kW
Time for which the device runs, T = 10 h
Work done = Energy consumed by the device
Therefore, energy consumed = Power × Time
= 0.50 × 10 = 5 kWh
Hence, the energy consumed by four equal rating devices in 10 h will be 4 × 5 kWh
= 20 kWh = 20 Units.

Question 21: A freely falling object eventually stops on reaching the ground. What happens to its kinetic energy?
Answer: When an object falls freely towards the ground, its potential energy decreases and kinetic energy increases. As the object touches the ground, all its potential energy gets converted into kinetic energy. As the object hits the hard ground, all its kinetic energy gets converted into heat energy and sound energy. It can also deform the ground depending upon the nature of the ground and the amount of kinetic energy possessed by the object.

Class 9th

Chapter 6 (Prose)

The Tempest I & II

Summary

Prospero was the Duke of Milan. He spent all time in the study of magic. So he left the state affairs to the care of his brother, Antonio. After sometime, Antonio grew greedy for paver. He joined the king of Naples and plotted against Prospero. Prospero along with his little daughter, Miranda were put in an old damaged ship to perish. Prospero's faithful and loyal servant ganzalo, put water, clothes, magic books of Prospero, food etc in the ship. Luckily the ship floated to a lonely island. There was a spirit Ariel, who was put in a pine tree, on this island. Prospero with his magic freed him and he became hiss servant. Once Antonio, king of Naples and his son Ferdinand came sailing in a ship ear the island. Prospero commanded Ariel to raise the storm in the sea. The ship caught in it. Prospero taught them a lesson. They felt sorry for their wrong doing Miranda and Ferdinand fall I love with each other. Prospero after testing Ferdinand's love for Miranda gave his daughters hand in Ferdinand's hand. All of them reconcile and live happily.

Use the following phrases and idioms in sentences of your own.

1. For one's sake: you should help your friend for my sake.
2. In favor of: I am not in favor of wrong things.
3. In the midst of: he stopped in the midst of his speech.
4. Keep ones head: keep your head in the difficult situation.
5. On one's head: there is a great responsibility on his head.
6. Remind of: she reminded me of her friend.

Make nouns of the following adjectives and verbs.

a.	Loyal	Loyalty
b.	Favorite	Favor
c.	Perform	performance
d.	Struggle	Struggle
e.	Magical	Magician
f.	Plot	Plotter
g.	Lose	Loss
h.	Guilty	Guilt
i.	Reconcile	Reconciliation
j.	Try	Trail
k.	Amaze	Amazement
l.	Give	Gift
m.	Imagine	Imagination
n.	Pretend	Pretence
o.	Repent	Repentance
p.	Treat	Treatment

Give the antonyms of:

a.	Good fortune	Misfortune
b.	Far	Near
c.	Innocent	guilty
d.	Evil	Noble
e.	Loss	Gain

f. Coward Brave
g. Perish Survive
h. Remember Forget
i. Loyal Disloyal

Poetry : I cannot remember my mother.

Summary:

The poet had lost his mother in his early childhood. He doesn't remember anything of his mother. He was young, when his mother died. He has not got worldly sense yet. However, he has a faint idea or recollection of her. A few things remind him of his mother.

Refer to glossary for word meaning.

What work do we use for the cradle song?

The word Lullaby is used for the cradle song.

Poem: on killing a Tree

Summary:

The poet paints the tree as a parasite and on ugly growth. The tree consumes the earth. It destroys the earth's fertility. The symbiotic meanings is that tree is compared to an evils of a society. A small blew or job of a tree will not kill an evil but it has to be pulled out from the earth completely with roots. In other words, we have to eradicate the evil completely from the society along with the roots.

Refer to glossary for word meaning:

The poet says NO in the beginning of the third stanza what does he mean by this?

The poet means to say that a tree cant be killed even by hacking or chapping . it has to be uprooted completely.

(Short – Stories) (Old Man At the Bridge)

Introduction:

Its is a was time story. An old man is seen sitting near a bridge. He sets motionless by the side of the road. He is tired as he was asked to leave son carlos because of artillery and he has walked 12 Kms. Everyone was leaving the old man was sitting and thinking about his animal where he was taking care of the soldier asks the old man to leave as the enemy was expected any time. The old man has the only consolation that cat know how to look after themselves. The wars change our lives our minds and one daily routine. Wars disturb everything and make in anxious and panicky.

Make sentences using the following word and expressions

1. Artillery : there was a danger of artillery in the town.
2. Cup: he seized power in a military camp in 1998.
3. Check post : the police have set up Varian check post in the city.
4. Out Post : the soldiers kept an eye on the enemy movements from their out Posts
5. Bridge Head : he soldiers were guarding the bridgehead

6. Cane Through : he has come through all his difficulties.
7. Staggers: the old man staggered to his feat.
8. Hurry : He left the office in hurry
9. To take care of : Precuts take of their children's
10. Blankly : when I asked him a question, he looked blankly at me.

Plays : A basket full of Sea – Trout

Introductions:

It's a play in which the supernatural has been used to create a sense of mystery and suspense there are fair characters in the play .

1. The Hon.Lord Find Horn (A Scottish Judge)
2. Willam Brodie of atton (a Scottish Land Lord)
3. Jean Lamond (A Peasant Women)
4. Colnel Lionel Attardyec (Chief Constable)

The scene of the play in the hall of a small shooting and fishing Lodge, in a lonely valley in the west highlands , it is a furnished and the atmosphere is one of loneliness bordering an the earth . lord find horn is a lawyer and his guest that right was William Brodie he is younger that find horn and belongs to same class upper middle , there are two more characters who doesn't appear on the stage . one is Jean Lamond's son and Nellie Salter who has been murdered and the whole play tries to solve the mystery of this murder hector lemand, jean Lamond's son was charged of murder of Nellie Salter. But he was freed as his evidence prove him guilty. His mother send him away and goes to meet the judge in the lodge . she talks them that she had come to thank the judge for freeing her son . she also make it that her son Hector won't be rearrested meanwhile the constable alonel attardyco came to the lodge to pay the visit to judge. He tell them that mrs Jean Lamond has committed suicide and her dead body has been recovered from the shore. Judge and bradie are spell bound. When they look for Mrs Lamond she is nowhere to be found the other character who does not appear on the stage is inspector . he sings up colonel attardyco and confirms the death of Mrs Lamonds calonel takes their leave and all three one horrified to see a basket full of sea trouts lting as the floor which mrs Lamond has brought for the judge as a gift if mrs jean was dead in the afternoon then who it was who has left the basked there bradie and the judge feel terrified to imagine that they had been talking to a spirit.

Do the following phrases in the lesson mean?

1. Wind is dying dawn – the wind is changing into gentle breeze .
2. My cup of tea – what is like or man interested in.
3. Solitary sort of fellow – one who leaves to be alone
4. Untidy and – an unpleasant result
5. Take one's word – believe someone
6. Go wrong – get spoilt
7. Clean sheet – having no ugly spot
8. Wide awake – fully cautions and alert
9. Get in – arrive at a place
10. Break one's hear – be disappointed