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PHYSICS WITH BAJRANGI- CONCEPTS OF KINEMATICS OF CLASS IX INTEGRATED WITH COMMON INCIDENCES FROM RAMAYANA

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ABSTRACT

In India, we have our rich heritage of mythogy which is a source of insipiartion and motivation for all of us. We have two famous Epic Mythologies, Ramayana and Mahabharata. In both of these ancient Hindu literature, a very famous heroic character is involved named Shri Hanuman ji Maharaj(Bajrangbali). This paper is an effort to use terminologies and incidences related to Hanuman ji in explaining the basic concepts of Kinematics in Grade IX and XI Physics. This may be the way to motivate the students and inculcating values by quoting the strength of Hanuman ji and also covering the concpets parallely. This may also be treated as innovative tactics of integrating art with Physics and our major heroic character of Ramayana i.e. Shri Hanuman.

KEYWORDS – Physics, Bajrangbali, Hanuman, Values, Kinematics.

1. INTRODUCTION

Like most other children in India, Hanuman was my favourite hero in childhood. We would listen to heroic acts and incidences of hanuman in the service of Lord Rama. It was so fascinating to hear how he could fly like a bird in the air carrying mountains. Knowing, that he was essentially a monkey made him particularly adorable to us as children. His pranks always had a childlike quality.

The readers in English can see the original story in the Ramayana by C. Rajagopalachari published by Bharatiya Vidya Bhawan. (Rajagopalachari 1983) A fuller version is available in the original Valmiki Ramayana translated by Makhan Lal Sen and first published in Calcutta in 1927. (Sen 1989) Since Hanuman is a very popular mythological figure, there are also other versions of the story with minor variations in other Puranas & folk literature.

2. THE STORY OF HANUMAN

Hanuman was known as the son of monkey King Kesari and his mother Anjana but he had a divine birth. The mother princess Anjana was one day roaming in the hills when God of wind (Pawan or Vayu or Marut) spotted her and was captivated by her beauty. As a result of this union, Hanuman was born who is like his father, God of wind, had the powers to fly and reach any part of the earth. As an, infant he once flew up to catch the sun, when the king of the heavens Indra, got annoyed and threw his thunderbolt at him. Hanuman survived the thunderbolt but it broke his jaw – that is why the name “Hanuman”. (In Sanskrit HANUMAN or HANUMAT means prominent jaw).

The other name for Hanuman, popular in South India is ANJANEYA or son of Anjana. The God of wind (Vayu) got very upset with this action of Indra to his son Hanuman and stopped the wind from blowing. The life came to a standstill on earth. Indra apologized and along with other gods bestowed many boons on child Hanuman.

Now with these new powers, Hanuman became very mischievous as a child. He would pick up articles of Rishis (holy men) while they were in prayers and fly away. This would greatly annoy the Rishis and they threw a curse at Hanuman that he would lose his power to fly. Hanuman was naturally very upset and told mother Anjana about it who pleaded with the Rishis for forgiveness. Finally, the Rishis relented and modified the curse to say that Hanuman will not lose his divine power to fly but he will henceforth lose the knowledge about his powers till reminded about it at an appropriate time by some wise man. The story then moves to Ramayana where King Sugreeva, a monkey king and friend of Lord Rama, has sent a mission to search for Queen Sita, the wife of Lord

Rama, who had been kidnapped by demon Ravana to Lanka. The monkey party headed by crown prince Angad, Hanuman and others reach Land's-end and face the sea across which is the island of Lanka. They are all quite despaired to see the intervening sea.

There is hurried consultation on what to do. Some members of the mission say they may leap some distance but not all the way to Lanka. Angad says he may perhaps succeed in reaching Lanka but may not have enough power to come back. Jambavan, an aged bear and the senior-most member of the party says he could have done it in his youth but not now in his old age. Then Jambavan turns to Hanuman and says, "Why are you sitting silent and dejected in a corner? Do you know who you really are? You are "Pawan Putra" – son of God of wind. You have the power to fly and reach any corner of the earth. Unfortunately, you are not aware of your own powers". Jambavan then narrates to Hanuman the story of his birth and childhood curse. Listening to this Hanuman gets back his powers and confidence. He assumes his great size and flies to Lanka, meets Sita and the story of Ramayana continues. In the further story, Hanuman does many more heroic deeds like bringing "Sanjivini" herbs from the Himalayas for the revival of Lakshmana and so on, but it is the intervention by Jambavan that transforms Hanuman into a great hero for the rest of the Ramayana.

3. USE OF INDIAN MYTHOLOGICAL EVENTS IN PHYISCS WITH REFRENCE OF HANUMAN

By using references and Terminologies based on Hanuman ji, The Following Content can be covered and related values can also be integrated by the teacher so that the students in the class may feel motivated.

Content

Motion, Distance, Displacement, Speed, Velocity, Acceleration, Scalar and Vector quantity, Uniform and Non-Uniform motion, Graphs (Position-Time, Velocity Time), Three equations of motions for uniformly accelerated body and its derivation by graphical Method.

Learning Objective

- Learners will be able to understand the relative concept of rest and motion
- Learners will be able to differentiate between distance & displacement, speed & velocity
- Graphical analysis of different situations like rest, uniform motion, non-uniform motion, uniform acceleration etc.
- Understands the difference between acceleration and retardation
- Able to classify the physical quantity under Scalar and Vector Category.

Introduction

- In our daily life, we see lots of things moving. If we take the example of Hanuman ji Flying from one place to another place (An Example of Reaching Lanka may be considered), then his position got changed w.r.t time and w.r.t reference point then Hanuman ji is said to be in motion.

Figure 1 – Hanuman Ji Leap to Lanka

- In scientific terms an object is said to be in motion if it changes its position with the passage of time and if it does not change its position with the passage of time then it is said to be at rest.

Value Integration – Courage of Hanuman Ji and Respect for Jambavan Ji as he is the one who motivated Hanuman to recognize his true potential. It shows that the teacher's role is very important in the Student's life and student's acceptance of the guidelines of the teacher is also very important to achieve success in life.

Motion and Rest is a Relative Term

- Both the motion and rest are relative terms and Respective Positions of Observer are responsible for it for example if we Go to Bajrangbali's Temple and bow down in front of him for some time then neither position of the devotee changes nor is the position of Bajrangbali is Changing hence the devotee and Bajrangbali is considered to be at rest w.r.t devotee and vice versa whereas of devotee start taking a round of Bajrangbali (Parikrama) hence the position of both (Bajrangbali and devotee) is changing w.r.t each other hence they are said to be in Motion.

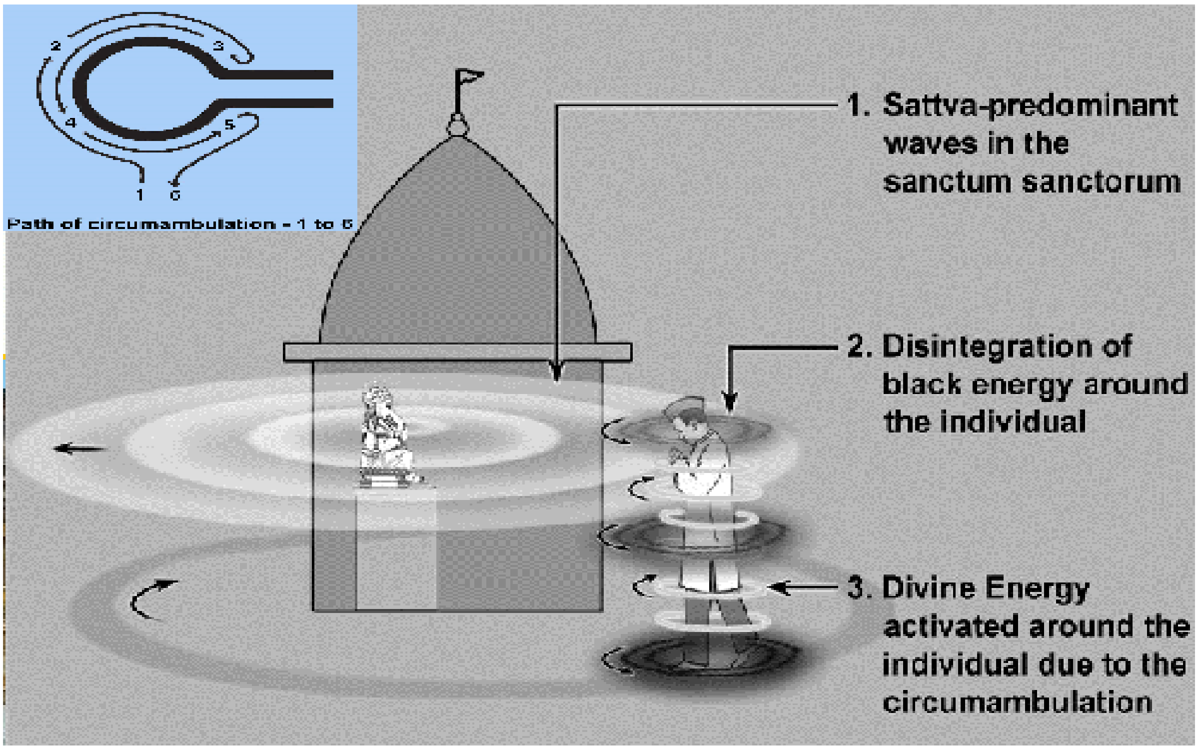

Figure 2 - Parikrama of the Temple (circumambulation)

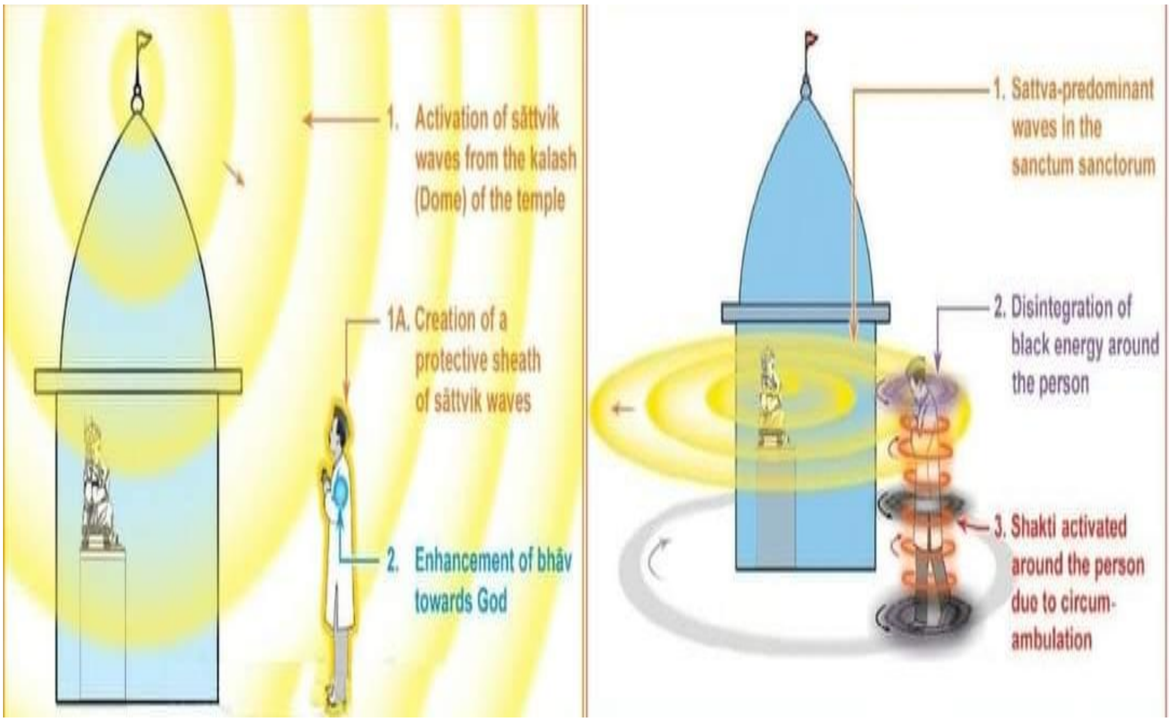

Figure 3 – Circumambulation of Hanuman Ji's Temple

Figure 4 – Circumambulation Performed by Devotee

- Simplest case of motion is **rectilinear motion** which is the motion of the object in a straight line.

Figure – 5 Kapi is running Straight on a line (Rectilinear motion)

- In our description of the object, we will treat the object as a point object.
- Object under consideration can be treated as a point object if the size of the object is much smaller than the distance traveled by it in a reasonable time duration for example Normal Height of Hanuman Ji considered to be 40-60 feet and the distance travelled by him to bring Sanjeveeni from Dronagiri Mountain is close to 5000 Km i.e, Hanuman ji can be treated as point object as his height is very less as compare to the distance traveled by him.

Figure 6 - Google Map Showing Distance from Sri Lanka to Dronagiri Parvat

Figure 7 - Dronagiri Parvat and Hanuman ji may be treated as point object

Value Integration

After covering the content sense of Trust Compassion and Determination of Hanuman ji must be taught to the Students as Ram Ji Appreciated Bajrangbali by "tum mam priya bharathei sam bhai" which means Oh Hanuman you are like brother Bharat to me. By Saying this Lord Rama appreciated Bajrangbali's efforts. Appreciation for the team members is one of the Leadership Skills that must be taught to the students.

Motion along a straight line

- The simplest type of motion is the motion along a straight line.
- Two different quantities **Distance** and **Displacement** are used to describe the overall motion of an object and to locate its final position with reference to its initial position at a given time.

4. DISTANCE

- **Distance** in physics, is the length of the path (the line or curve) described by an object moving through space. Distance is independent of direction. Thus, such physical quantities that do not require direction for their complete description are called **scalars**.

Displacement

- When a body moves from one position to another the shortest distance between the initial and final position of the body along with its direction is known as **displacement**.
- Displacement has both direction and magnitude for its complete description and hence such physical quantities are called **vectors**.
- The distance traveled by a moving body cannot be zero but the final displacement of a moving body can be zero.

Understanding Distance and Displacement by Motion of Kapi (Hanuman ji) in a straight line

- **If Kapi Moves to different positions in the following figure, then we may calculate the distance and displacement of Kapi for different cases as shown in the following table.**

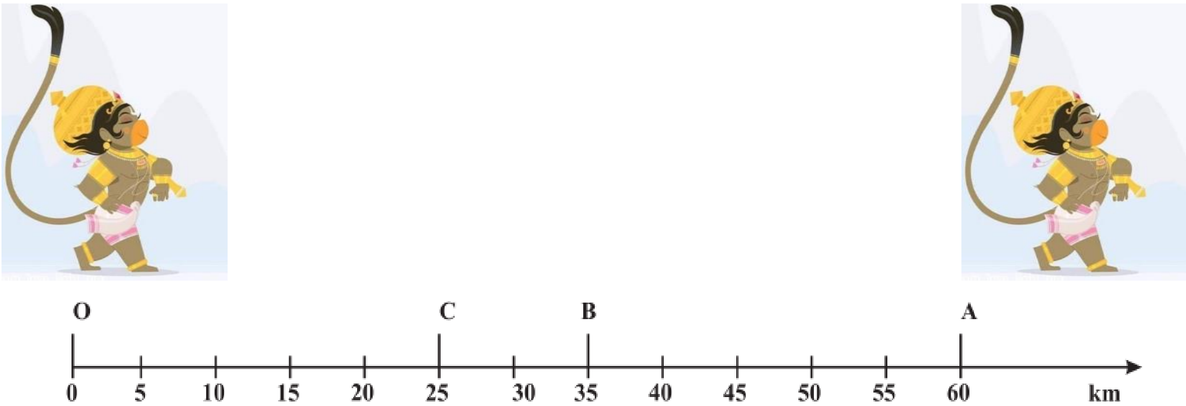

Figure 8– Kapi Moving in a Straight line.

S.N	Path	Distance (Km)	Displacement (Km)
1	O to A	60	60
2	O to A to B	85	35
3	O to A to C	95	25
4	O to A to O	120	0
5	If We Consider -5 at the Left of O as Point D (O to A to D)	125	-5

From Above Table It is Clear that distance always increases as Irrespective of Moving Forward or Backward whereas the Magnitude of Displacement is same as Distance, If Kapi moves forward but as soon as Kapi starts backward motion magnitude of displacement decreases. Hence it is clear that displacement gives an indication of direction. Therefore, distance is Scalar quantity and displacement is vector quantity.

Uniform and Non-Uniform Motion

- In Figure - 8 If a Kapi covers equal distances in equal intervals of time then he is said to be in **uniform motion**.
- In Figure 8- If Kapi covers unequal distances in equal intervals or equal distances in unequal intervals then he is said to be in **non-uniform motion**.

Speed

- **Speed** is defined as the total distance traveled by the object in the time interval during which the motion takes place. SI unit of speed is meter per second. So,

$$speed = \frac{distance\ travelled}{time\ taken} = \frac{s}{t}$$

- where s is the distance travelled by the body and t is the time taken by the body to travel distance s.
- Speed of a body gives us the idea of how slow or fast that body is moving.
- The ratio of the total distance to total time taken by the body gives its average speed. The speed of a body at a given instant is its instantaneous speed.

$$speed = \frac{total\ distance\ travelled}{total\ time\ taken}$$

- A body is said to have constant or uniform speed if it travels an equal distance in equal intervals of time.
- Example – Distance of Dronagiri Parvat (one side) is 2518 Km (2518000 m) from Sri Lanka hence the total distance of to and fro Journey would be 5036 km (5036000 m) and Hanuman ji Took 2 hrs (7200 Seconds) to bring Sanjeevni booti from there hence the Speed of Hanuman Ji can be considered as
- Speed of Hanuman ji = 5036Km/2hrs = 2518 km/h
  Speed of Hanuman ji (SI unit) = 5036000m/7200 sec = 699.4 m/s

Figure –9 Kapi's to and fro Journey to Dronagiri Parvat from Sri Lanka

Velocity

The rate of change of displacement of a body with the passage of time is known as **velocity** of the body. The Velocity of an object is measured in meter per second in SI units.

- Velocity is nothing but the speed of an object moving in a **definite direction**.
- The velocity of an object can be uniform or variable. It can be changed by changing the object's speed, direction of motion or both.
- So, the velocity of a body is a **vector quantity** involving both distance and displacement whereas the speed of a body is a **scalar quantity** and it only has magnitude and does not have a specific direction.
- Thus a body is said to be moving with **uniform velocity** if it covers equal distances in equal intervals of time in a specified direction.
- A body is said to be moving with non-uniform velocity if it covers unequal distances in equal intervals of time and vice-versa in a specified direction or if it changes the direction of motion.
- The velocity of a body can be changed in two ways first by changing the speed of the body and second by changing the direction of motion of the body by keeping the speed constant. Also, both speed and direction of the body can be varied in order to change the velocity of the body.
- When the velocity of the object changes at a uniform rate, then average velocity is given by the arithmetic mean of initial velocity and final velocity for a given period of time. That is,

$$v = \frac{displacement}{time\ taken}$$

Note: *u* is the initial velocity of the object and *v* is the final velocity of the object.

Figure 10 – Velocity of Revolving Gada by Hanuman Ji

If Hanuman ji is revolving his gada in a circular way, then the tangent drawn at any point gives the direction of velocity at that particular point hence we can say that velocity is changing at every point as shown by arrows (at different positions) to change in direction of gada in a circular motion.

Acceleration

- Acceleration is a measure of the change in the velocity of an object per unit time and mathematically it is given as

$$Acceleration = \frac{change\ in\ velocity}{time\ taken}$$

- If the velocity of Kapi changes from an initial value u to the final value v in time t, the acceleration a is given by,

Figure- 11 – Accelerated Kapi

Acceleration of Kapi = (v – u)/t

- Kapi has uniform acceleration if it travels in a straight line and its velocity increases by an equal amount in equal intervals of time for example freely falling bodies, motion of a ball rolling down the inclined plane etc.
- Kapi has non uniform acceleration if its velocity increases or decreases by unequal amounts in equal intervals of time.
- If acceleration is in the direction of the velocity, then it is positive acceleration and if it is in the direction opposite to the direction of velocity then it is negative and the negative acceleration is termed retardation.
- SI unit of acceleration is ms^{-2}.

Equations of uniformly accelerated motion

- There are three equations of bodies moving with uniform acceleration which we can use to solve problems of motion

First Equation of motion

The first equation of motion is v=u+at, where v is the final velocity and u is the initial velocity of the body.

The First equation of motion gives the velocity acquired by body at any time t. Now we know that acceleration

$$a = \frac{change\ in\ velocity}{time\ taken} = \frac{Final\ velocity - initial\ velocity}{time\ taken}$$

-

so, a = (v−u)/t

and, at=v−u

rearranging the above equation we get the first equation of motion which is

v=u+at…………………………(i)

Second Equation of motion

- The Second equation of motion is

$$s=ut+(1/2)\ at^2$$

where u is initial velocity, a is uniform acceleration and s is the distance traveled by body in time t

Second equation of motion gives distance travelled by a moving body in time t

To obtain second equation of motion consider a body with initial velocity u moving with acceleration a for time to its final velocity at this time be v. If body covered distance s in this time t, then average velocity of the body would be

$$average\ velocity = \frac{initial\ velocity + final\ velocity}{2} = \frac{u+v}{2}$$

Distance travelled by the body is

$$s = \frac{u+v}{2} \times t$$

From first equation of motion,

v=u+at

So putting first equation of motion in above equation we get,

$$s = \frac{(u + u + at)t}{2}$$

S = ut + (½) at²

Third equation of motion

Third equation of motion is: $v^2=u^2+2as$ (where u is initial velocity, v is the final velocity, a is uniform acceleration and s is the distance travelled by the body)

This equation gives the velocity acquired by the body in travelling a distance s

Third equation of motion can be obtained by eliminating time t between first and second equations of motion. So, first and second equations of motion respectively are

v=u+at

$S = ut + (½)\ at^2$

Rearranging first equation of motion to find time t we get

$$t = \frac{(v - u)}{a}$$

Putting this value of t in second equation of motion we get

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

Rearranging it we get

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

These three equations of motion are used to solve uniformly accelerated motion problems and following three important points should be remembered while solving problems

- If a body starts moving from rest its initial velocity u=0
- If a body comes to rest i.e., it stops then its final velocity would be v=0
- If a body moves with uniform velocity, then its acceleration would be zero

Graphical representation of motion

- A graph is a pictorial representation of the relation between two sets of data of which one set is of dependent variables and the other set is of independent variables.
- To describe the motion of an object, we can use line graphs. In this case, line graphs show dependence of one physical quantity, such as distance or velocity, on another quantity, such as time.

Distance Time Graphs

- The change in the position of an object with time can be represented on the distance-time graph.
- In this graph, time is taken along the x-axis and distance is taken along the y-axis.
- Distance time graphs of a moving body can be used to calculate the speed of the body as they specifically represent velocity.
- The distance time graph for a body moving at uniform speed is always a straight line as distance travelled by the body is directly proportional to time as shown below in the figure 1.

- The distance time graph for a body moving with non-uniform speed is a curve and is shown below in the figure 2.

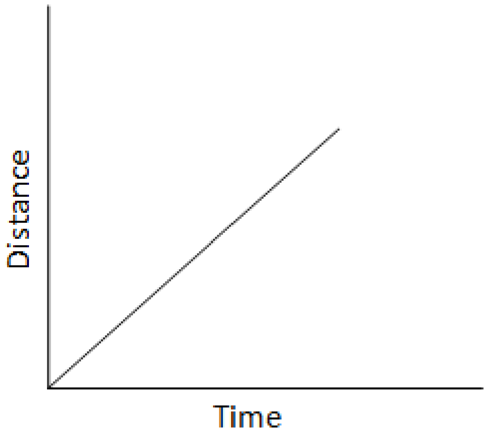

Figure 1: - Distance time graph for uniform speed

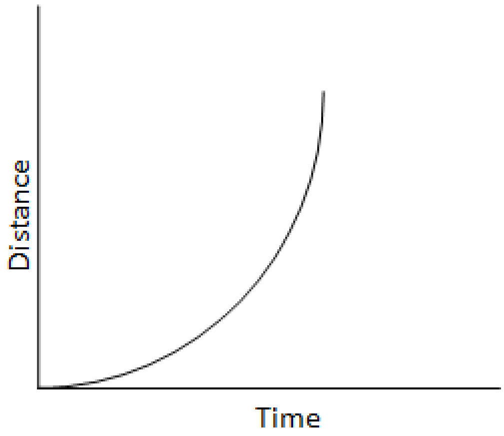

Figure 2: - Distance time graph for non uniform speed

- The distance time graph is parallel to time axis when the object is at rest and is shown below in figure 3.

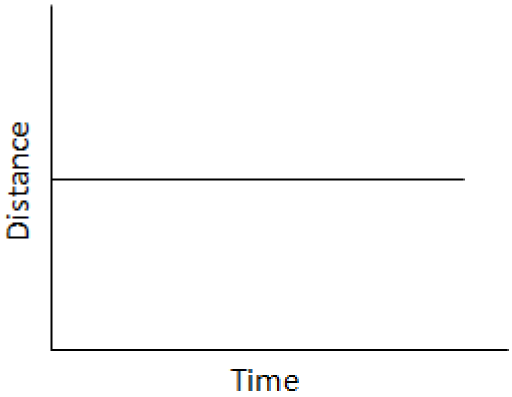

Figure 3: - Distance time graph for objects at rest

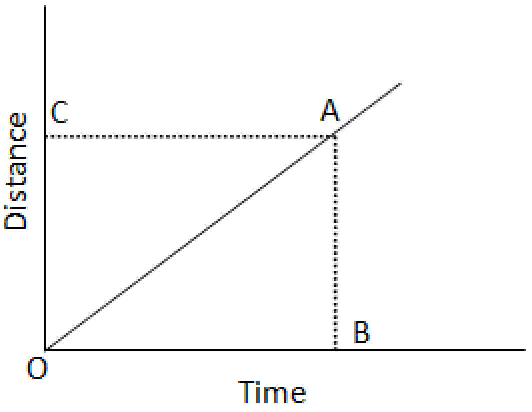

Figure 4: - Calculation of speed from distance time

To calculate speed of the body from distance time graph say at point A first draw a perpendicular AB on time axis and a perpendicular AC on distance axis so that AB represents the distance travelled by the body in time interval OB and since we know that, (Slope of the distance-time graph gives speed)

$$speed = \frac{distance\ travelled}{time\ taken} = \frac{AB}{OB}$$

Velocity time graphs

- The variation in velocity with time for an object moving in a straight line can be represented by a velocity-time graph.
- In this graph, time is represented along the x-axis and the velocity is represented along the y-axis.
- The product of velocity and time give displacement of an object moving with uniform velocity. The area enclosed by velocity-time graph and the time axis will be equal to the magnitude of the displacement.

- If a body moves with a constant velocity then velocity time graph for this body would be straight line parallel to time axis as shown below in the figure 5

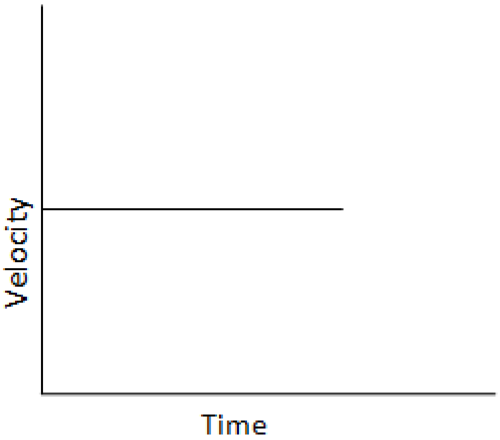

Figure 5: - Velocity time graph when speed remains constant (no acceleration)

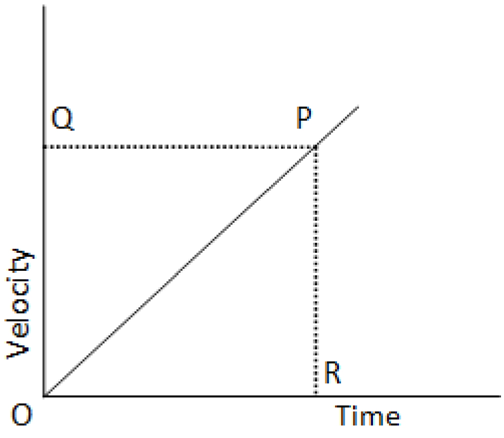

Figure 6: - Velocity time graph showing uniform acceleration

- The velocity time graph of uniformly changing velocity is shown in figure 6 and is a straight line. We can find out the value of acceleration using the velocity time graph.
- For calculating acceleration at time corresponding to point R draw a perpendicular RP from point R as shown in figure 6 and we know that

$$a = \frac{change\ in\ velocity}{time\ taken}$$

Here change in velocity is represented by PR and time taken is equal to OR. So,

$$Acceleration = \frac{PR}{OR}$$

which is equal to the slope of velocity time graph. So we conclude that slope of velocity time graph of moving body gives its acceleration.
- The distance travelled by moving body in a given time will be equal to area of triangle OPR as shown in figure 6

$$Distance\ travelled = Area\ of\ triangle\ OPR = \frac{1}{2} area\ of\ rectangle\ ORPQ$$

so,

$$Distance\ travelled = \frac{1}{2} \times OQ \times OR$$

- When the velocity of a body changes in an irregular manner then velocity time graph of the body is a curved line.

5. EQUATIONS OF MOTION BY GRAPHICAL METHOD

a. Equation for velocity time relation

- Consider the velocity-time graph of an object that moves under uniform acceleration as shown below in the figure 7.
- From this graph, you can see that initial velocity of the object is u (at point A) and then it increases to v (at point B) in time t. The velocity changes at a uniform rate a
Again from figure it is clear that time t is represented by OC, initial velocity u by OA and final velocity of object after time t by BC.

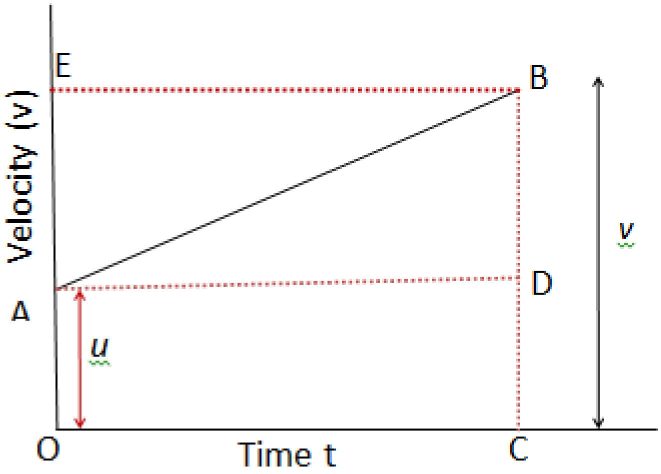

Figure 7: v-t graph

From graph as given in figure 7 it is clear that BC=BD+DC=BD+OA, So we have

v=BD+u ……………… (1)

We should now find out the value of BD. From the velocity-time graph (Fig. 7), the acceleration of the object is given by

$$a = \frac{change\ in\ velocity}{time\ taken} = \frac{BD}{AD} = \frac{BD}{OC} = \frac{BD}{t}$$

which gives, BD=at

putting this value of BD in equation 1 we get

v=u+at

which is the equation for velocity time relation.

Equation for position time relation

- Let us consider that the object has travelled a distance s in time t under uniform acceleration a. In Fig., the distance travelled by the object is obtained by the area enclosed within OABC under the velocity-time graph AB.
- Thus, the distance s travelled by the object is given by

s = area OABC (which is a trapezium)

s= area of the rectangle OADC + area of the triangle ABD, So

s= (OA×OC) + 1/2(AD×BD)

Substituting OA=u, OC=AD=t and BD=at, we get

s=(u×t)+1/2×(t×at)

or,

s=ut+1/2at²

which is the equation of position time relation

Equation for position velocity relation

- Again consider graph in figure. We know that distance travelled s by a body in time t is given by the area under line AB which is area of trapezium OABC. So we have

$$distance\ travelled = s = Area\ of\ trapezium\ OABC$$

$$s = \frac{(sum\ of\ parallel\ sides) \times height}{2} = \frac{(OA + CB) \times OC}{2}$$

Since OA+CB=u+v

and OC=t, we thus have

$s=(u+v)t^2$

From velocity time relation

t=v−ua

putting this t in equation for s we get

s=(u+v)(v-u) /2a

or we have

$\boldsymbol{v^2=u^2+2as}$

which is equation for position velocity relation.

Difference between Distance and Displacement

Distance	Displacement
It is the actual path traversed by the object during the course of motion	It is the difference between the initial and the final positions Ox = x – x where, x and x are final and initial 2 1 2 1 position respectively
It is a scalar quantity	It is a vector quantity
The distance travelled by an object during the course of motion is never negative or zero and is always positive The distance travelled is either equal or greater	The displacement of an object may be positive, negative or, zero during the course of motion The magnitude of displacement is less than or equal
than displacement and is never less than magnitude of displacement Distance Š |Displacement|	to the distance travelled during the course of motion
The distance depends upon the path travelled	The magnitude of displacement is independent of the path taken by an object during the course of motion

Difference between Speed and Velocity

Speed	Velocity
It is defined as the total path length travelled divided by the total time interval during which the motion has taken place	It is defined as the change in position or displacement divided by the time intervals, in which displacement occurs of
It is a scalar quantity	It is a vector quantity
It is always positive during the course of the motion	It may be positive, negative or zero during the course of the motion
It is greater than or equal to the magnitude of velocity	It is less than or equal to the speed

Note:

Scalar Quantity: The physical quantities which has only magnitude is called Scalar quantity (Example: Distance, Speed etc.)

Vector Quantity: The physical quantities which has magnitude as well as direction is called Vector quantity (Example: Displacement, Velocity etc.)

Uniform Circular Motion

- **Uniform circular motion** can be described as the **motion** of an object in a **circle** at a constant speed. As an object moves in a **circle**, it is constantly changing its direction. At all instances, the object is moving tangent to the **circle**.
- **Motion** of artificial satellites around the earth is an **example** of **uniform circular motion**. The gravitational force from the earth makes the satellites stay in the **circular** orbit around the earth. The **motion** of electrons around its nucleus.

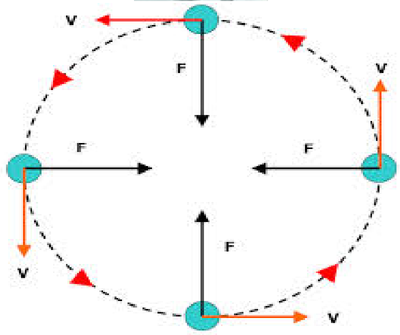

Figure 8 Uniform Circular motion

- The tangent drawn at any point gives the direction of velocity at that particular point (hint: tangent is line which touches the circle only at one point, shown by red mark, tangent is always perpendicular to radii of the circle).
- F marked in the diagram is centripetal force (Centre seeking force) acting towards the center of the circular path. This force makes the circular motion possible.
- In uniform circular motion the speed constant but the velocity is changing due to continuous change in the direction of the motion of a body, hence body is considered to accelerated body.

Unit System	Parameter	Unit
S.I System	Distance and Displacement	Meter (m)
S.I System	Speed and Velocity	m/s
C.G.S	Distance and Displacement	Centimeter
C.G.S	Speed and Velocity	cm/s
M.K.S	Distance and Displacement	Meter (m)
M.K.S	Speed and Velocity	m/s
8 to 30 Paramāṇus	Distance	1 trasareṇu (As per *Manusmriti*, one trasareṇu is the size of the smallest moving speck of dust visible to naked eye)

UNITS AS PER ANCIENT HINDU LITERATURE

Measurement	Equals to... (in Hindu measurement)	Notes
8 to 30 Paramāṇus	1 trasareṇu	As per *Manusmriti*, one trasareṇu is the size of the smallest moving speck of dust visible to naked eye.
8 trasarenus	1 bālāgra (tip of a hair strand)	
8 bālāgra	1 likhsha (size of a nit)	
8 liksha	1 yūka (size of a louse)	
8 yūkas	1 yava (width of barley grain of medium size)	
8 yava	1 aṅgula (finger-breadth)	Estimated between 1.73 cm (0.68 inches) to 1.91 cm (0.75 inches).

6 fingers	1 pada (the breadth of a foot)	other sources define this unit differently: see Pada (foot)
2 padas	1 vitasti (span or distance between the tip of the forefinger and wrist)[13]	~ 22.86 cm (9 inches)
2 vitasti	1 hasta (cubit)	~ 45.7 cm (18 inches)
2 hastas	1 náriká	~ 91.5 cm (36 inches / 3 feet)
2 nárikás	1 dhanu	~ 183 cm (72 inches / 6 feet)
1 paurusa	a man's height with arms and fingers uplifted (standing reach	~ 192 cm (75 inches)
2,000 dhanus	1 gavyuti or gorutam (distance at which a cow's call or lowing can be heard)	
4 gavyutis	1 yojana	3.3 to 15 kilometers

6. CONVERSTION ACITIVITY TO CONCLUDE THE CHAPTER & TO SET GOOD MOOD OF THE LEARNERS

Scientific Aspect of Flight of Hanuman Ji-Fun Activity

While Meghnath is busy in learning more advanced sciences, Hanuman is flying around with his Air Molecule friends. The air molecules take the opportunity to teach Hanuman exactly what went on when he flew towards the sun.

Figure 9 Conversation between Hanuman and Air Molecules.

Hanuman: Hey Molecules, whatever took place while I was chasing the sun seemed like a dream. But now, I slowly remember experiencing several bizarre things.
Air Molecules: Like What Hanuman?
Hanuman: In the beginning till we reached the rainy clouds, everything seemed fined, but after flying a few kilometres past them, it was freezing why?
Air Molecules: To understand that, you will need to learn about gravity, air density, atmospheric Pressure and Temperature.
Hanuman: Whao! That seems like lot of science.
Air Molecule: Everything you experienced at that time is Science.
Hanuman: Fine. As long as you don't put me to sleep.
Air Molecule: Ha Ha! Don't Worry we will explain it to you in a way that you will understand. Now, tell me what do you know about Gravity.
Hanuman: Anything with certain mass will have some pulling force. For Planet like earth we call this as a Gravity, which tries to pull everything towards earth.
Air molecules: Exactly! Basically, everything that exists on Earth is being pulled towards the centre of Earth. The closer you are; the more gravity you experience.
Hanuman: Next, what is **density**?
Air molecules: It is simply the number molecules packed within a certain area; be it in air, a solid or liquid. Gases are less dense than solids and liquids because their molecules are far apart. With regards to air density, there are more air molecules closer to the ground. Do you know why?
Hanuman: Because the pull of gravity is more?
Air molecules: That's right! Now, let's move on to **temperature** ...

Hanuman: You mean, heat?
Air molecules: Temperature and heat are different. Heat is the transfer of thermal energy between molecules and measured in joules. Temperature is the average kinetic energy of molecules and is measured in Celsius, Kelvin or Fahrenheit.
Hanuman: What is kinetic energy?
Air molecules: Kinetic energy is the energy that a molecule possesses due to its motion. Don't confuse yourself. Just remember, kinetic means movement.
Hanuman: Okay. Let me see if I understand. When we are closer to Earth, there is more gravity; due to this, there is more density of air molecules; due to more density, there is more kinetic energy, and more kinetic energy means higher temperature. Am I right?
Air molecules: You are super smart, Hanuman! So, what do you think happens as we move away from the ground?
Hanuman: Gravity reduces…
Air molecules: Exactly. As gravity reduces, density of air molecules decreases, thus kinetic energy decreases, lowering the temperature.
Hanuman: So that is why we go to hill stations. The temperature is less there!
Air molecules: Shall I teach you a trick? It will be useful when you fly and reach great heights.
Hanuman: What's that?
Air molecules: As you move up every 1 km, the temperature drops by 5.45 to 6 degrees.
Hanuman: In that case, if the ground temperature is 30°C degrees, when I fly up 5 km, it becomes zero?
Air molecules: That's right. But this calculation works only until 20 km. After that it's different, as we would have crossed the ozone layer, and the sun's direct high energy radiation starts hitting the molecules.
Hanuman: Oh! I will remember that.
Air molecules: The concept of **pressure** is also similar. As there are more molecules closer to ground, there is more pressure.
Hanuman: Pressure is force per area, right?
Air molecules: Yes. More the number of molecules and movement, more the pressure. Lesser the air molecules, lesser the pressure.
Hanuman: Wow! It took my guru a whole year to make me learn all this! You are great teachers, Molecules.
Air molecules: Thank you! If you start looking at the science around you practically, it becomes more fun and magical.
Hanuman: I would love to learn more!

7. CONCLUSION

An Effort has been made in this paper to take a few references from Ramayana especially an incidence in which Hanuman Ji is involved and a few other synonyms of Hanuman Ji to explain the basic concepts of kinematics in Class IX and XI. Value Integration was also done as a sample in certain topics in the paper.

REFERNCES

1. N.N Wig, Hanuman Complex and its Resolution: An illustration of psychotherapy from Indian mythology, Special Article, *Indian Journal of Psychiatry, 2004, 46(I)25-28.*
2. Rajagopalachari, C. (1983) Ramayana published by Bharatiya Vidya Bhawan, Bombay. (1st Edition in 1951, 22nd Edition in 1983).
3. Jung, Carl G. (1950) Man and his symbols. Arkana – Penguin, London.
4. Kalyan Sri Hanuman Ank (Hindi) (1975), Kalyan Karyalay, Gita Press, Gorakhpur.
5. Shamasundar C. (1993) Therapeutic Wisdom in Indian Mythology. Am J Psychotherapy 47 (3) 443 – 449.
6. Vahia, N.S., Vinekar S.L., Doongaji D.R. (1966) Brit J Psychiatry 112, 1089 – 1092.
7. Venkoba Rao, A. (1980) Gita and Mental Sciences. Ind J Psychiatry, 22, 19 – 31.
8. J. Needham, *Science and Civilization in China*, Cambridge, London, 1956, Vol.1, pp. 108-209.