S.2 PHYSICS NOTES, 2020

INSTRUCTIONS TO STUDENTS

i) ***Copy the notes beginning from where you stopped with your teachers for instance form 2N should begin from diagram (iii) on wards***

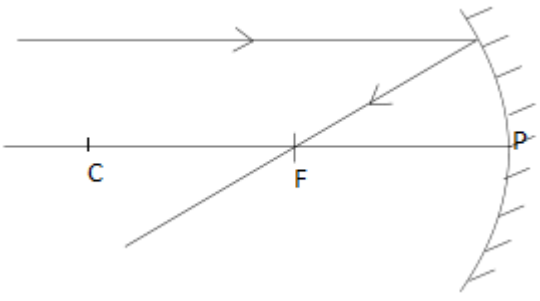
ii) ***For diagrams on scale diagrams, don't leave any spaces as the work will be done in your graph books with your teachers***

iii) ***Notes for*** **LINERAR MOTION** ***begin from where the notes for light end.***

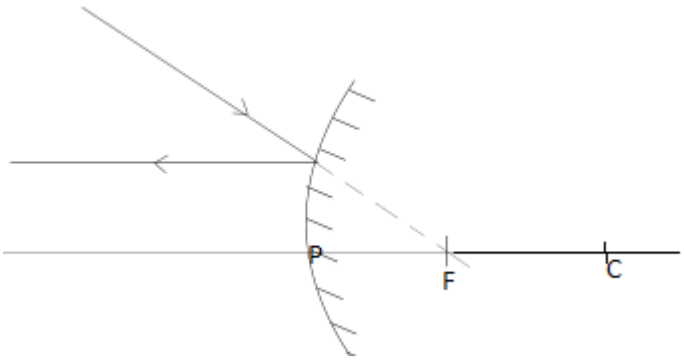
CONSTRUCTION OF RAY DIAGRAMS

Ray diagrams can be used to explain how and where a curved mirror forms images. The rays are drawn using any two of the following 3 principal.

1. A ray parallel to the principal axis is reflected through the principal focus.
   a) For a concave mirror

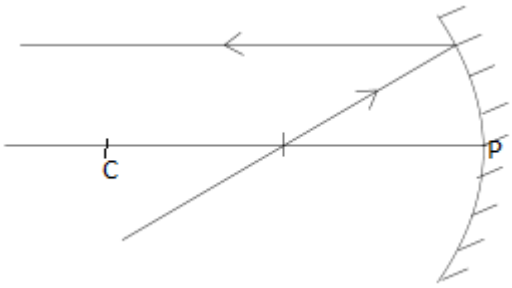


   b) For a convex mirror

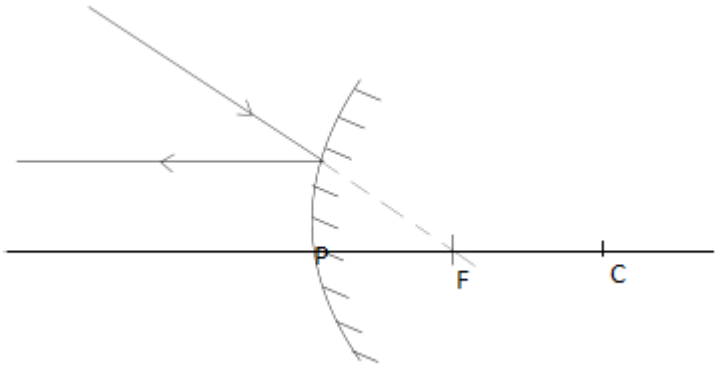


2. A ray through the principal focus is reflected parallel to the principal axis .

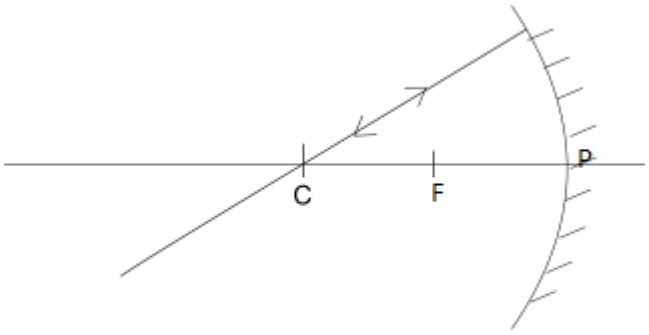
a) For a concave mirror



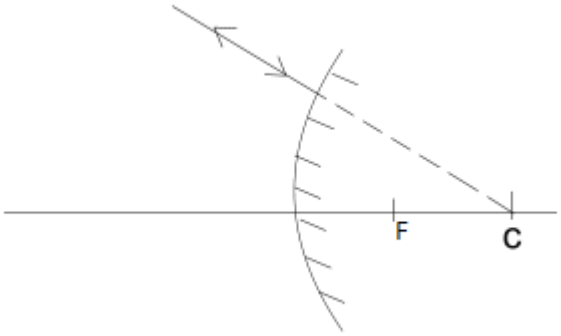
b) For a convex mirror



3. A ray through the center of curvature is reflected along the same path.
   a) For a concave mirror



   b) For a convex mirror



GEOMETRICAL RULES FOR THE CONSTRUCTION OF RAY DAIGRAMS

The following is a set of rules for easy location of the images formed by spherical mirrors

1. Rays parallel to the principal axis are reflected through the principal focus.
2. Rays through the principal focus are reflected parallel to the principal axis.
3. Rays passing through the centre of curvature are reflected back along their own paths.
4. Rays incident to the pole are reflected back, making the same angle with the principal axis.

NOTE:

(i) The normal due to reflection at the mirror surface at any point must pass through the centre of curvature.

(ii) The image position can be located by the intersection of two reflected rays initially coming from the object.

REAL AND VIRTUAL IMAGES

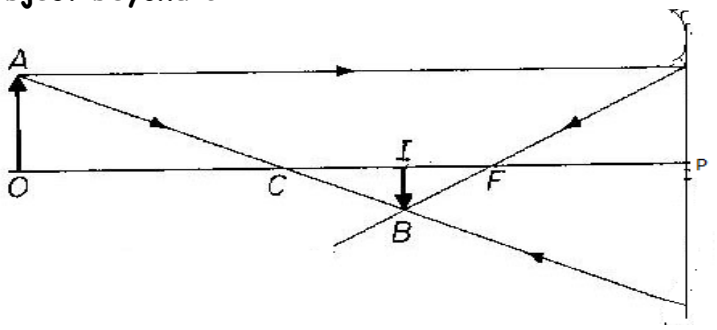
A REAL IMAGE: This is the image formed by the actual intersection of light rays from an object and can be received on the screen.

A VIRTUAL IMAGE: This is the image formed by the apparent intersection of light rays and can not be received on the screen

IMAGES FORMED BY A CONCAVE MIRROR

The nature of the image formed by a concave mirror is either real or virtual depending on the object distance from the mirror as shown below;

i) **Object beyond C**

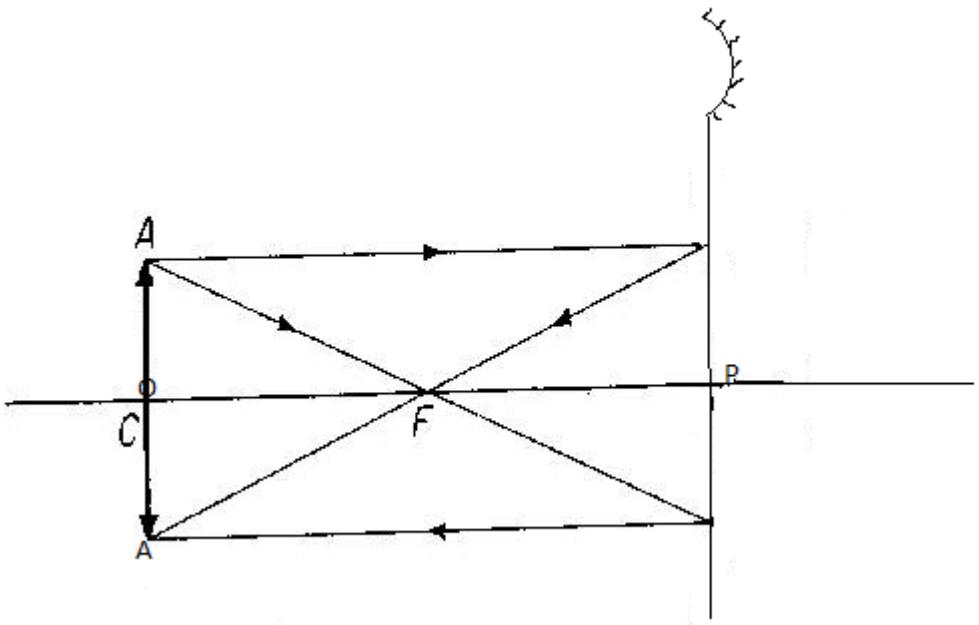


Properties of the image

The image is;

- Real
- Inverted
- Diminished

ii) Object at C

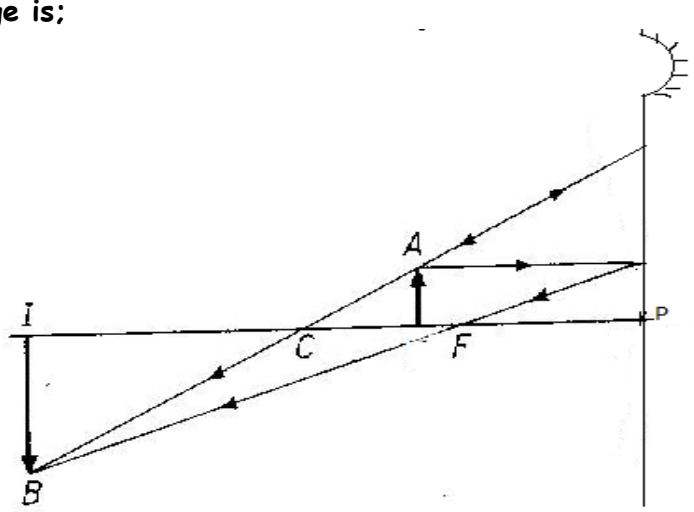


The image is;

- Real
- Inverted
- Same size as the object

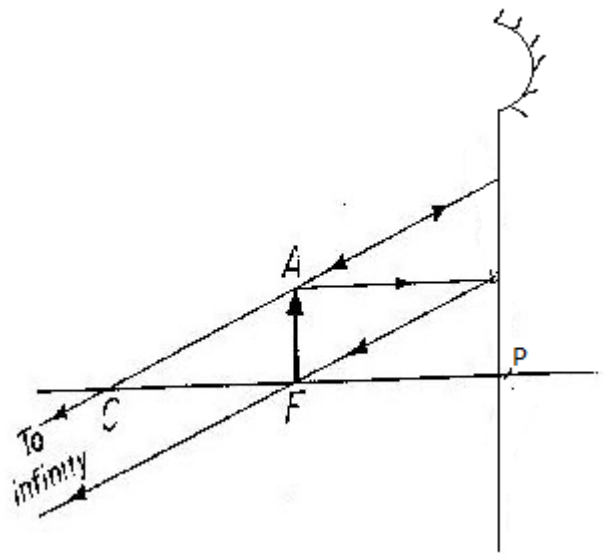
iii) **Object between F and C**

The image is;



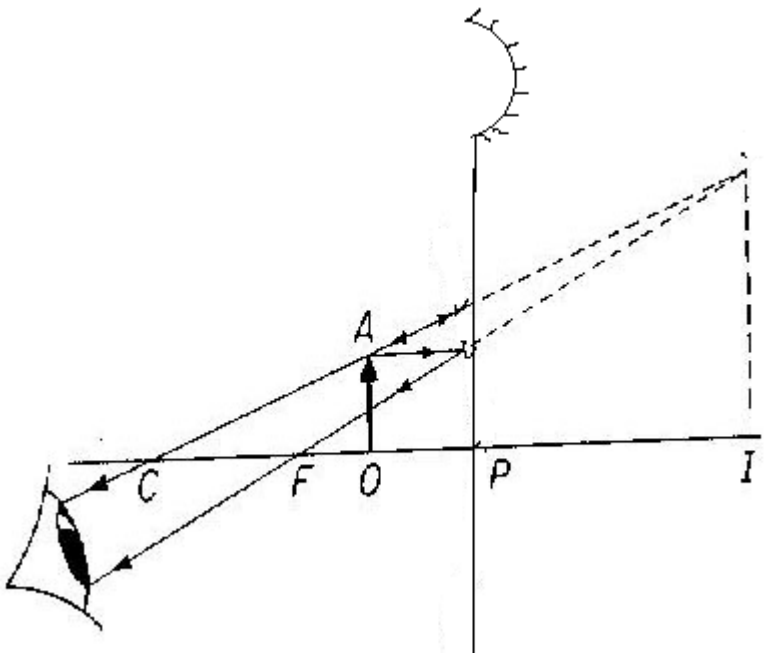
- Real
- Inverted
- Magnified

iv) **Object at F**



The final image is formed at infinity

v) **Object between F and P**



The image is;

- Virtual
- Erect
- Magnified

In this position of the object, a concave mirror can be used as;

- Shaving mirror
- Dentist mirror

This is because a concave mirror forms upright and magnified image

NOTE;

The image of an object in a concave mirror is **virtual only when the object is nearer to the mirror than its focus.**

CONSTRUCTION OF SCALE DIAGRAMS

STEPS TAKEN;

i) On graph paper draw a central horizontal line (which acts as the principal axis) with a perpendicular line to act as the curved mirror.

ii) Where distances are given, choose a scale for object size and position

iii) Measure the focal length "f" and radius of curvature "r" from the pole of the mirror

iv) Mark **C** and **F** as Centre of curvature and principal focus respectively.

v) Position the object perpendicular to the principal of the mirror axis

vi) Draw two of the principal rays to obtain the position of the image.

vii) Measure the position (distance) and the size (height) of the image and multiply by the corresponding scale

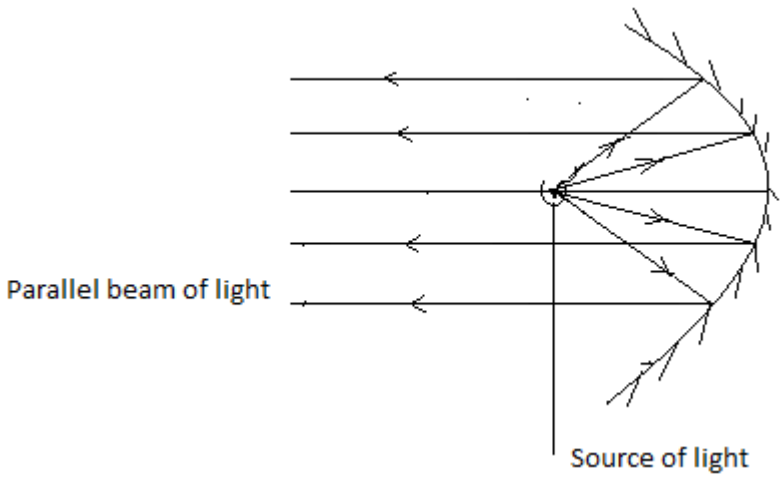
Example

1. An object 4cm high is placed 30cm from a concave mirror of focal length 10cm. by construction of a scale diagram, find the;
   i) position
   ii) nature and
   iii) size of the image
2. An object 3cm high is placed at right angles to principal axis a concave mirror with focal length 7.5cm. If the object is 30cm from the pole, construct a ray diagram to obtain the;
   i) position
   ii) size and
   iii) nature of image **(use a scale 1cm : 3cm)**
3. An object 4cm high is placed 2.4cm from convex mirror of focal length 8cm. Draw a ray diagram to find the position, size, Magnification and nature of image (Scale 1cm = 2cm)
4. An object of height 10cm is placed at a distance 60cm from a convex mirror of focal length 20cm. By scale find the image position, height, nature and magnification (scale 1cm : 5cm)
5. An object of height 6cm is 10cm in front of a convex mirror of focal length 12cm. Find by graphical method, the size, position and nature of the image.

USES OF CONCAVE MIRRORS

- Used as shaving mirrors.
- Used by dentists for teeth examination.
- Used as solar concentrators in solar panels.
- They are used in projectors (a device for showing slides on a screen)
- Used in reflecting telescopes, (a device for viewing distant objects)

The mirrors used in car head lamps are called parabolic mirrors



- ✓ A source of light is placed at the focal point of a parabolic mirror
- ✓ Light rays incident from the source are reflected parallel to the principal axis of the mirror
- ✓ A parallel beam of light is produced by the mirror

IMAGES FORMED BY A CONVEX MIRROR

The image of an object in a convex mirror is;

- erect,
- virtual, and
- diminished in size no matter where the object is situated as shown below

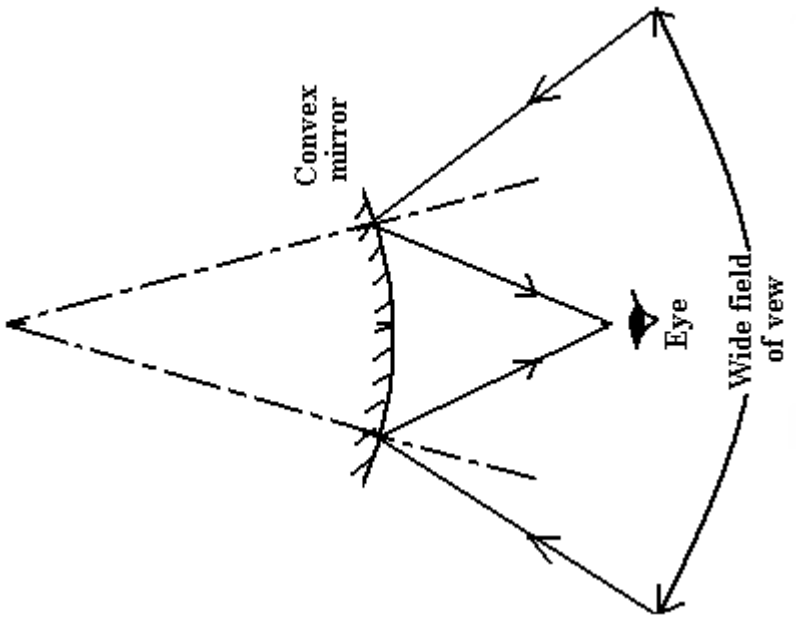
In addition to providing an erect image, convex mirrors have got a wide field of view as illustrated below.

USES OF CONVEX MIRRORS

- Used in reflecting telescopes
- Used in security checks
- Used as car driving mirror

This is because;

- ✓ They convex mirrors form upright images
- ✓ And have a wide field of view

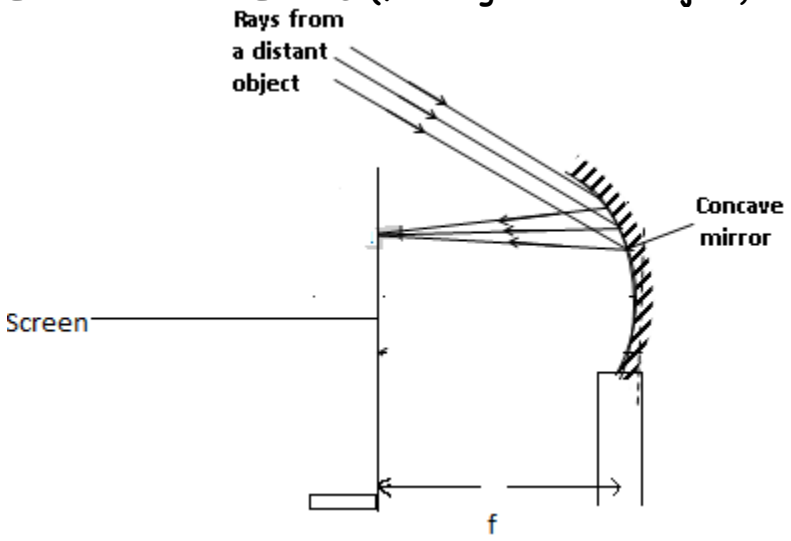


DISADVANTAGE OF CONVEX MIRROR

- ✓ Forms diminished images.
- ✓ Gives a false impression of the distance of an object
  The above makes it difficult for the driver to judge the distance when reversing the vehicle.

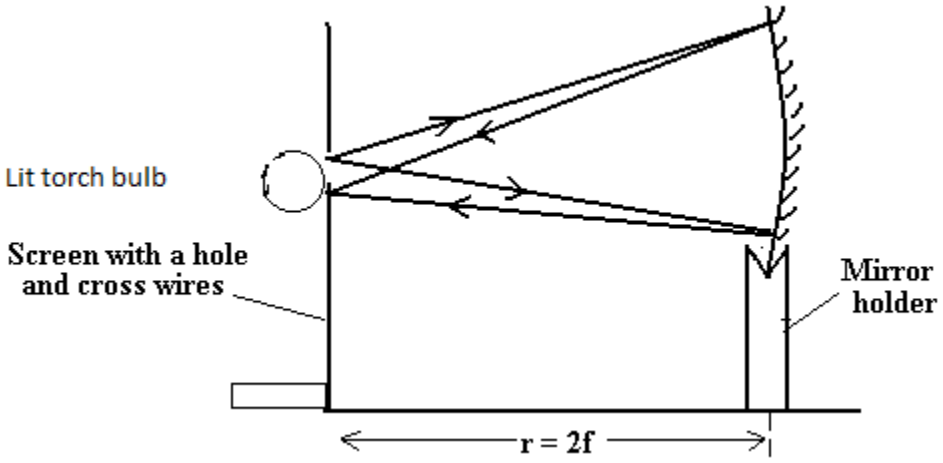
DETERMINING THE FOCAL LENGTH OF CONCAVE MIRROr

i) ESTIMATION METHOD (focusing a distant object)



- ✓ The mirror is used to focus light from a distant object through the window of the lab
- ✓ The screen is adjusted until a clear image of the object is formed on the on it
- ✓ The distance between the screen and the mirror is measured and recorded.
- ✓ This is the focal length **f** of the mirror.

ii) Using an illuminated object at C



- ✓ A concave mirror in its holder is placed in front of an illuminated screen with cross wire
- ✓ The mirror ids moved to and fro until a sharp image of the crosswire is formed alongside the object
- ✓ The distance **r** from the screen to the concave mirror is measured and recorded
- ✓ The focal length f of the concave mirror is obtained from $f=\frac{r}{2}$

REVISION QUESTIONS

1. a) The figure below shows an object, O placed in front of a mirror.

If F is the principle focus of the mirror. Complete the diagram to show the formation of the image.

b) State two applications of convex mirrors.

2. a) An object 10cm high is placed at a distance of 25cm from a convex mirror of focal length 10cm.

i) Draw a ray diagram to locate the position of the image.

ii) Calculate the magnification.

b) State the reasons for use of convex mirrors as driving mirrors.

2.a) With the aid of a diagram, explain why a parabolic mirror is most suitable for use in car head lights.

b) List **three** uses of concave mirrors

c) Describe an experiment to determine the focal length of a concave mirror using an illuminated screen with cross wire.

TOPIC TWO

LINEAR MOTION

Terms used

a) **Distance**:

This is the space between two points.

The SI-unit is **metre (m)**

It is a scalar quantity

b) Displacement

This is the distance moved in a specified direction.

The S.I Unit of displacement is **metre (m)**

It is a vector quantity.

c) Speed

This is the rate of change of distance with time.

Speed= $\frac{Distance}{Time}$

The SI-Unit of speed is **ms^{-1}**

It is a scalar quantity

d) **Velocity**

This is the rate of change of displacement with time.

Velocity= $\frac{Displacement}{time}$

The S.I-Unit of velocity is **ms^{-1}**.

It is a vector quantity

Task

Differentiate between speed and velocity

Types of velocities

Initial velocity U

This is the velocity with which a body starts motion in a given time interval.

Note;

i) For a body starting from rest the initial velocity "U' must be zero that is U = 0 ms^{-1}

ii) For a body traveling with a certain velocity, *x*, the initial velocity for such a body will be x so, u = *x* ms^{-1}

Final velocity, V

This is the velocity with which a body ends motion for a given time.

Average velocity:

Average Velocity= $\frac{Initialvelocity + Finalvelocity}{2}$

Average Velocity= $\frac{(U+V)}{2}$

Uniform velocity

This is the constant rate of change of displacement with time.

A body is said to move with a uniform velocity if it covers equal displacements in equal time intervals.

When a body moves with uniform velocity, initial velocity U must be equal to final velocity

The acceleration of the body is thus zero

e) **Acceleration (a)**

This is the rate of change in velocity with time.

Acceleration, a= $\frac{Changeinvelocity}{time}$

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

Its S.I unit is **ms^{-2}**.

Uniform acceleration

Uniform acceleration is the constant rate of change in velocity with time.

A body is said to move with uniform acceleration if it moves with equal velocity in equal time intervals.

When a body moves with uniform acceleration, the final velocity is not equal to initial velocity.

TO BE CONTINUED

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