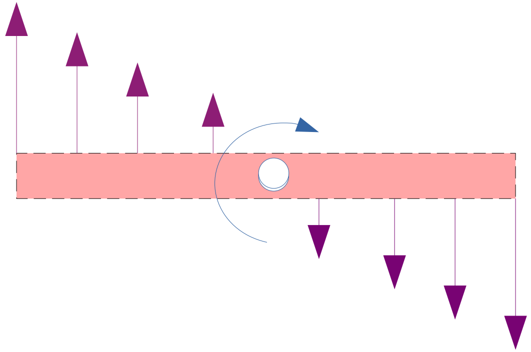
INELASTIC COLLISION

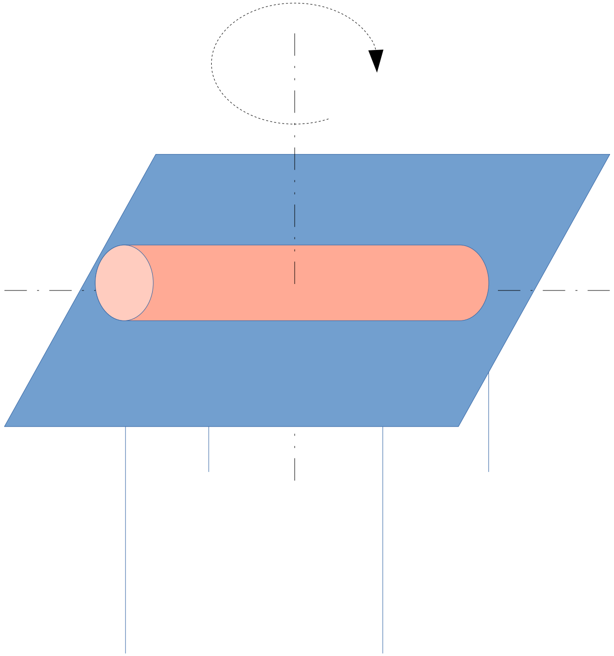
A ROD OF MASS ‘M_1’ AND LENGTH ‘L’ IS **ROTATING** ON A **FRICTIONLESS** HORIZONTAL SURFACE AT **ANGULAR SPEED ω** ABOUT ITS MID POINT.

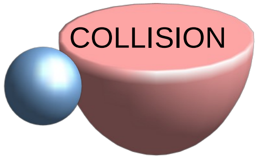
A POINT MASS ‘M_2’ MOVING AT SPEED ‘V’ COLLIDES AT RADIUS ‘R’ IN A TANGENTIAL DIRECTION (perpendicular to the rod) OPPOSITE TO ROTATION OF THE ROD AND STICKS TO IT.

FOR WHAT VALUE OF ‘R’ THE ROTATING ROD WILL **STOP ROTATING** INSTANTANEOUSLY **AFTER COLLISION**?

COMPLETELY INELASTIC COLLISION – ROTATING ROD AND POINT MASS

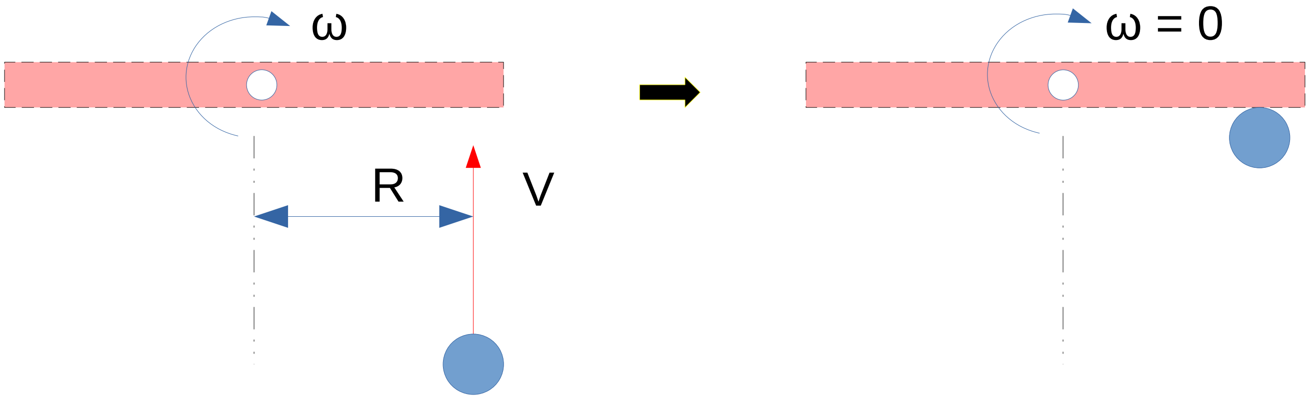




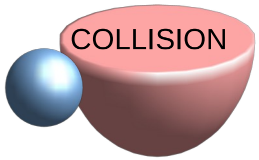


PHYSICS

COMPLETELY INELASTIC COLLISION – ROTATING ROD AND POINT MASS



R = ?



PHYSICS

COMPLETELY INELASTIC COLLISION – ROTATING ROD AND POINT MASS

KNOWN:

ANGULAR MOMENTUM OF ROD = Q1

ANGULAR MOMENTUM OF MASS = Q2

DIRECTION OF IMPACT

ANGULAR SPEED AFTER COLLISION

TO BE CALCULATED:

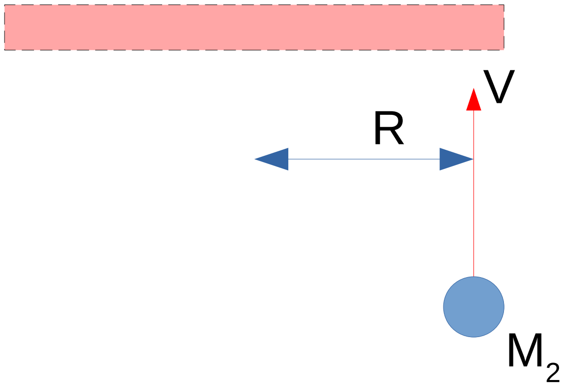
LOCATION OF COLLISION

GOVERNING EQUATION:

NO EXTENAL TORQUE: CONSERVATION OF ANGULAR MOMENTUM

PHYSICS

COMPLETELY INELASTIC COLLISION – ROTATING ROD AND POINT MASS



$Q_1 = M_1 \cdot L^2 \cdot \omega / 12$

CLOCKWISE ASSUMED POSITIVE

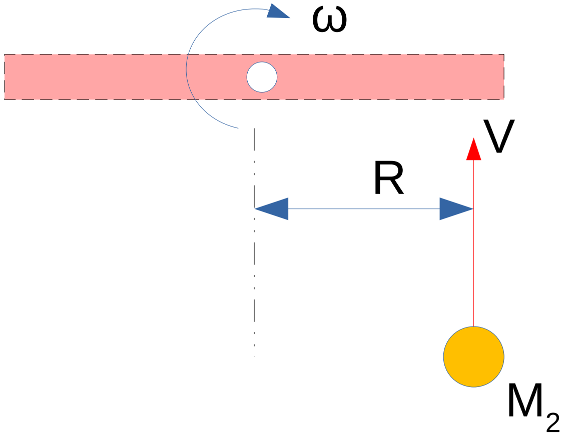
$Q_2 = -[M_2 \cdot V] \cdot R$

NEGATIVE AS COUNTERCLOCKWISE

ANGULAR MOMENTUM = MOMENT OF MOMENTUM

PHYSICS

COMPLETELY INELASTIC COLLISION – ROTATING ROD AND POINT MASS



$$Q_1 = M_1 . L^2 . \omega/12$$

BEFORE COLLISION

AFTER COLLISION

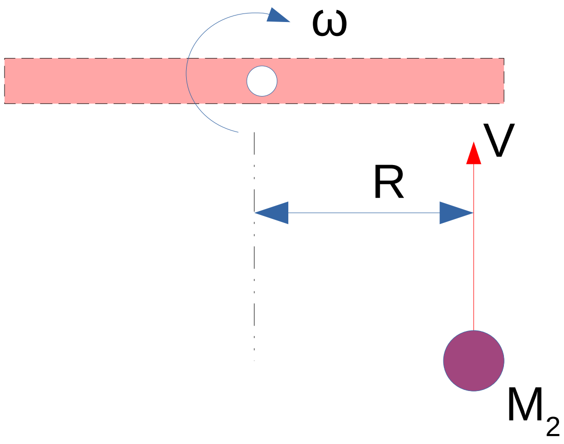
$$Q_1 + Q_2 = 0$$

$$Q_2 = -[M_2 . V] . R$$

PHYSICS

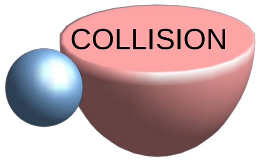
COLLISION

COMPLETELY INELASTIC COLLISION – ROTATING ROD AND POINT MASS

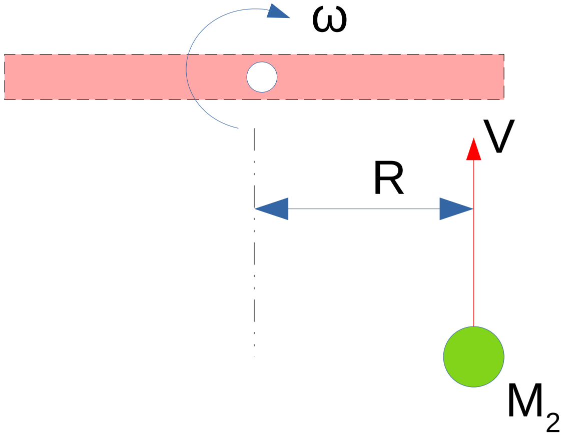


BEFORE COLLISION			AFTER COLLISION
$Q_1 + Q_2$		=	0
$M_1 \cdot L^2 \cdot \omega/12 - [M_2 \cdot V] \cdot R$		=	0

PHYSICS



COMPLETELY INELASTIC COLLISION – ROTATING ROD AND POINT MASS



BEFORE COLLISION | AFTER COLLISION

$$Q_1 + Q_2 = 0$$

$$M_1 \,.\, L^2 \,.\, \omega/12 - [M_2 \,.\, V] \,.\, R = 0$$

$$R = \frac{M_1 \,.\, L^2 \,.\, \omega/12}{[M_2 \,.\, V] \,.\, R}$$

(ANSWER)

PHYSICS