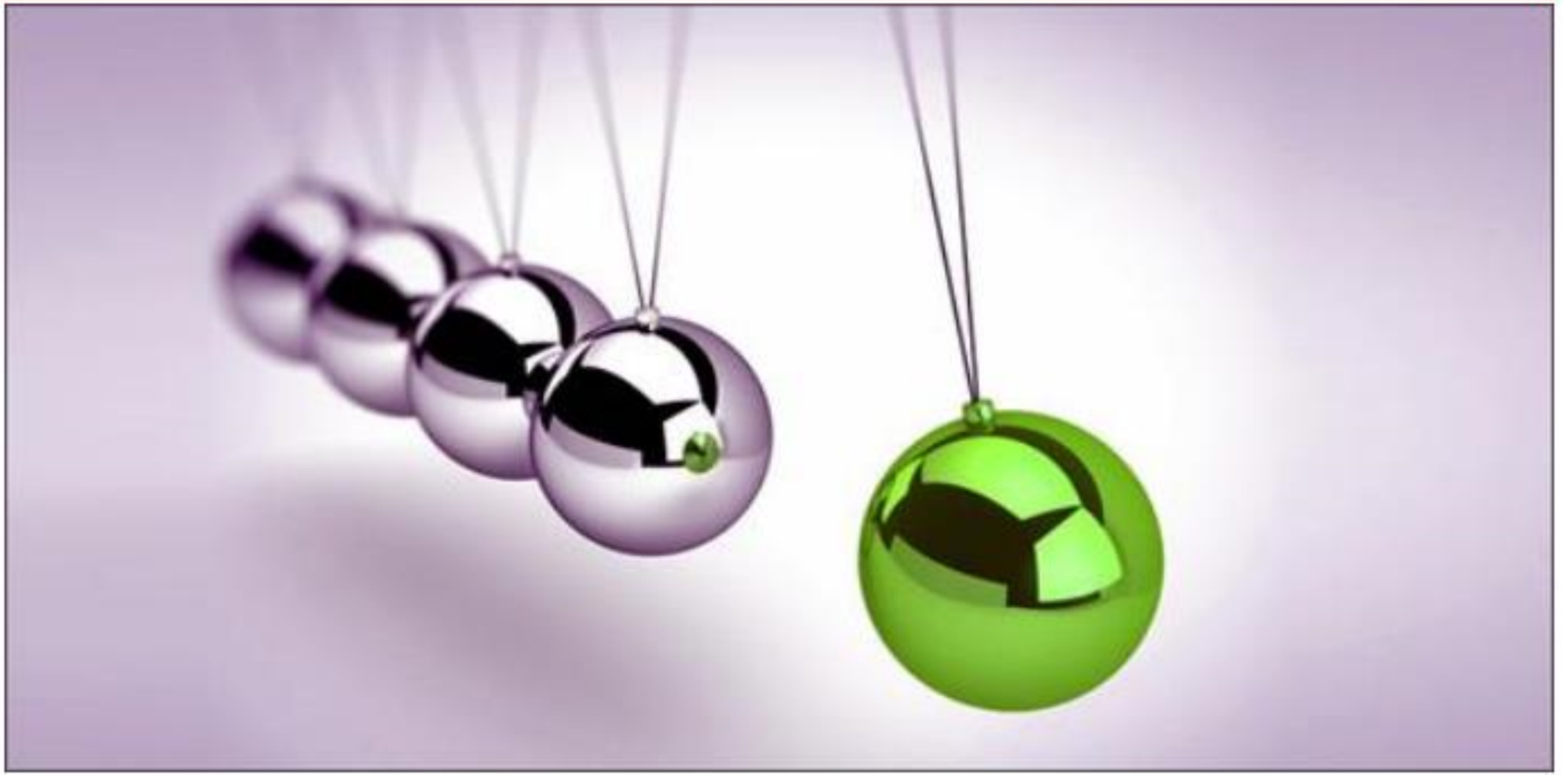
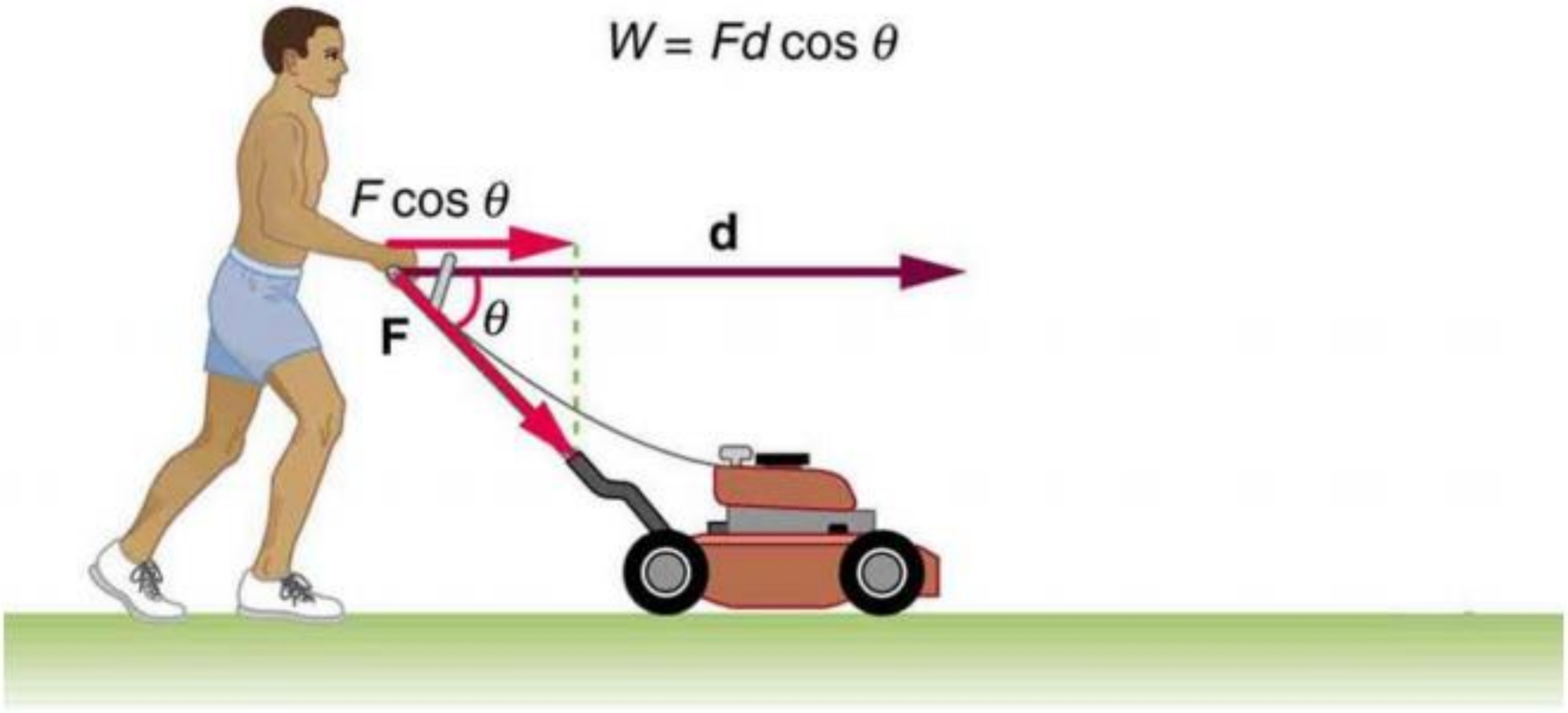
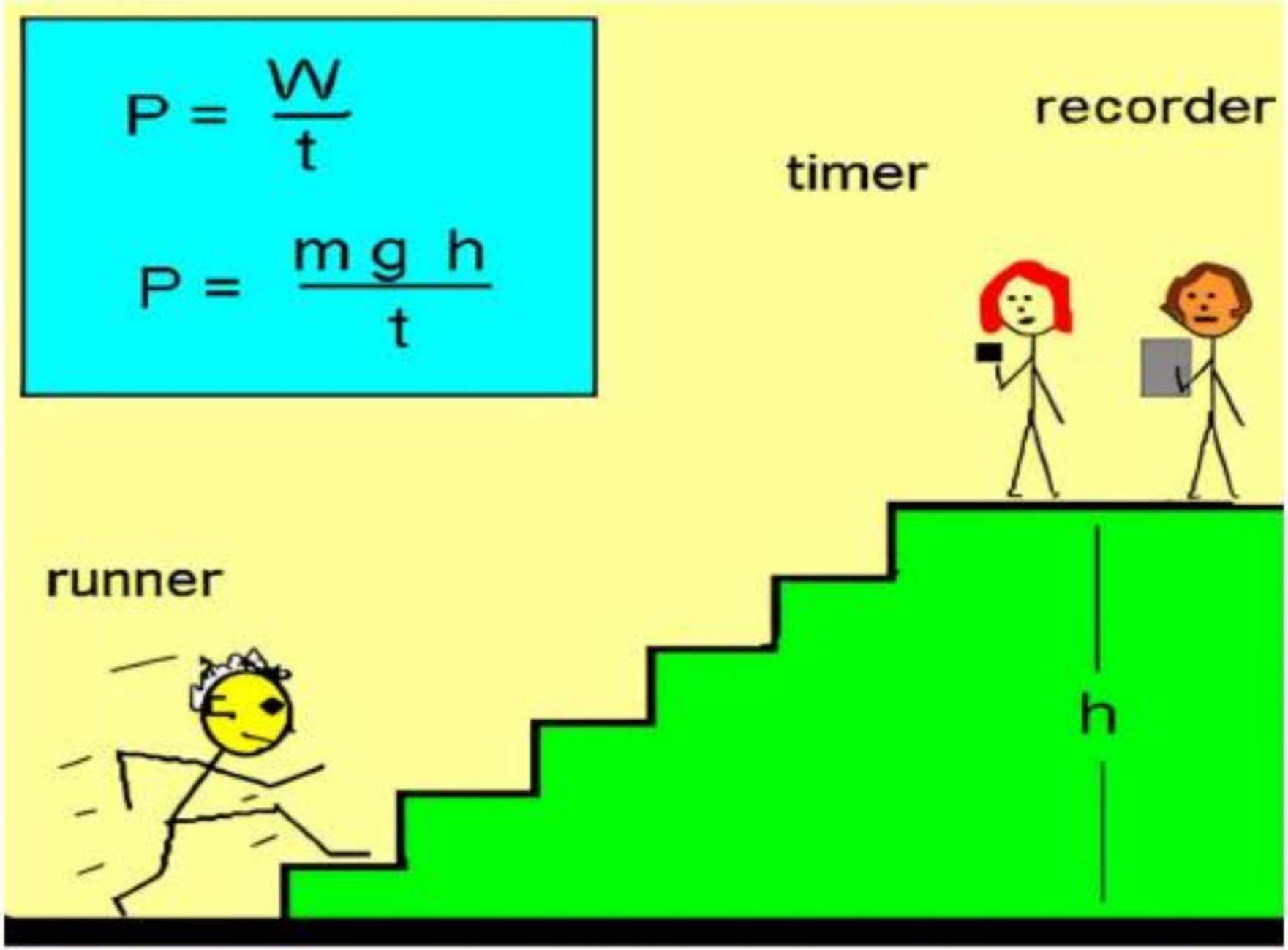
यांत्रिकी (Mechanics)

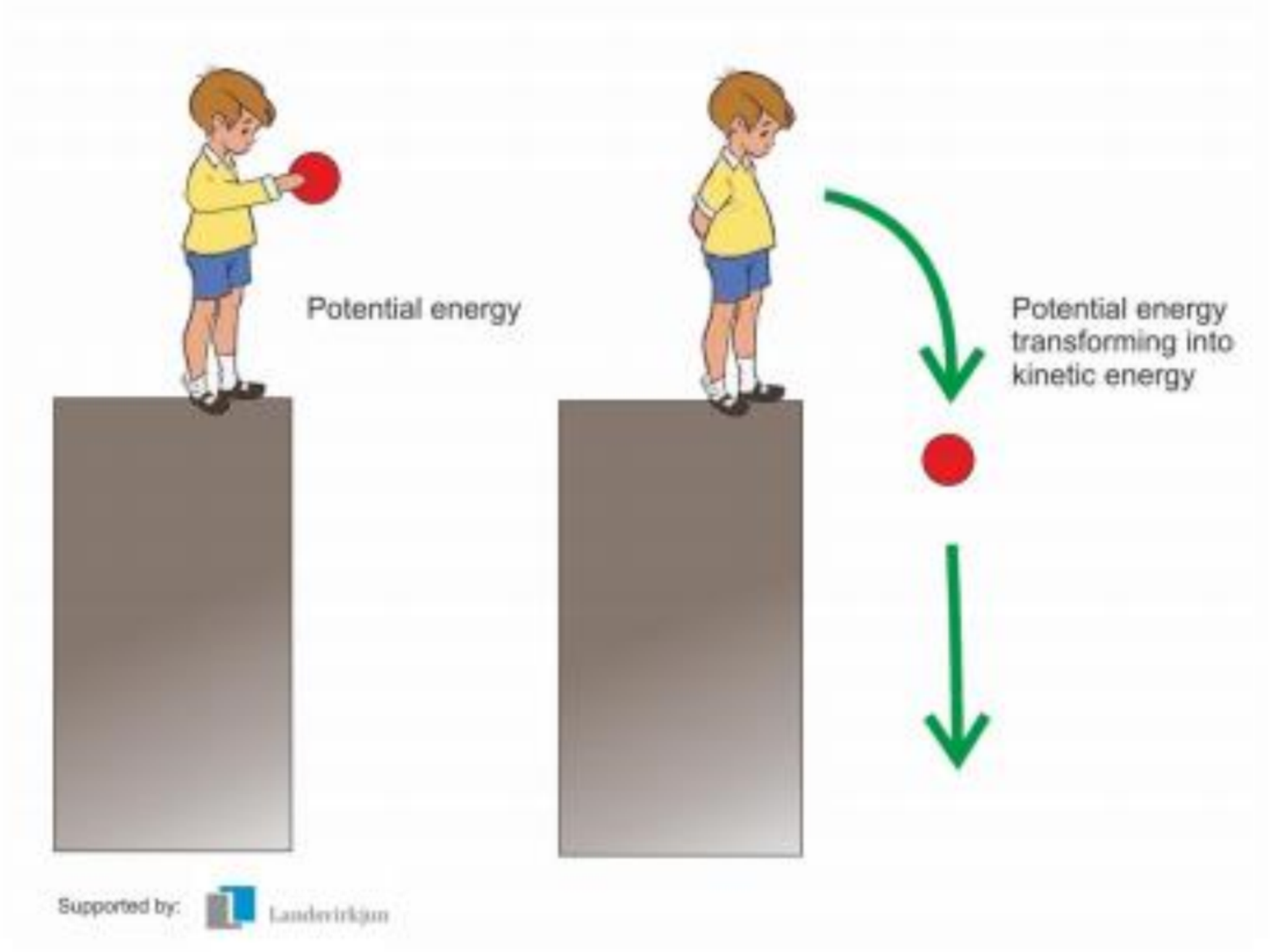


Trend of Questions on Mechanics

Work Force and Energy




$P = \frac{W}{t}$
$P = \frac{m\,g\,h}{t}$
recorder
timer
runner
h

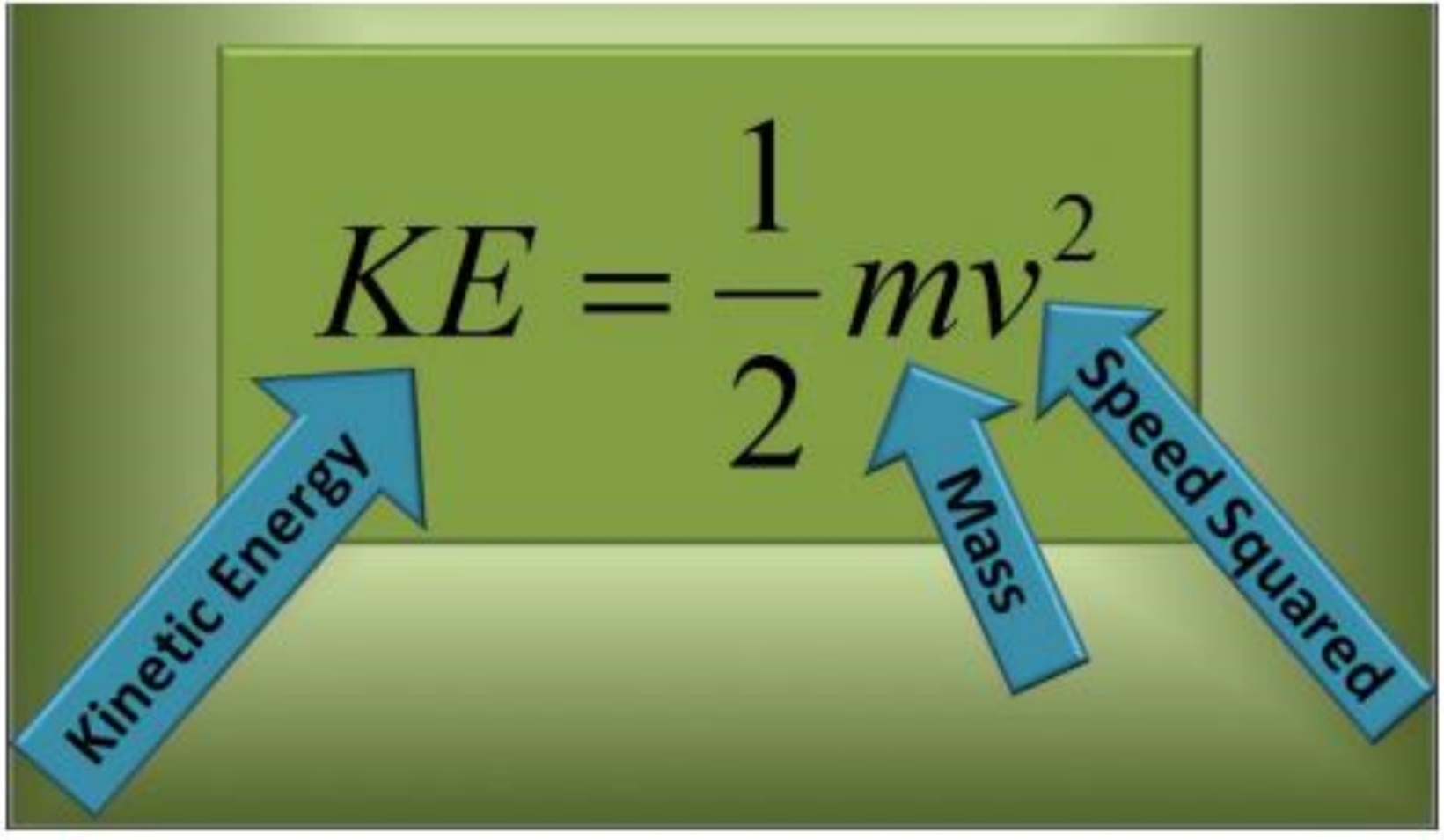

Potential energy
Potential energy transforming into kinetic energy
Supported by:
Landsverkjun

ऊर्जा के प्रकार

Kinetic Energy

Potential Energy

Kinetic Energy



Kinetic Energy Examples

Airplane flying

Woman cycling

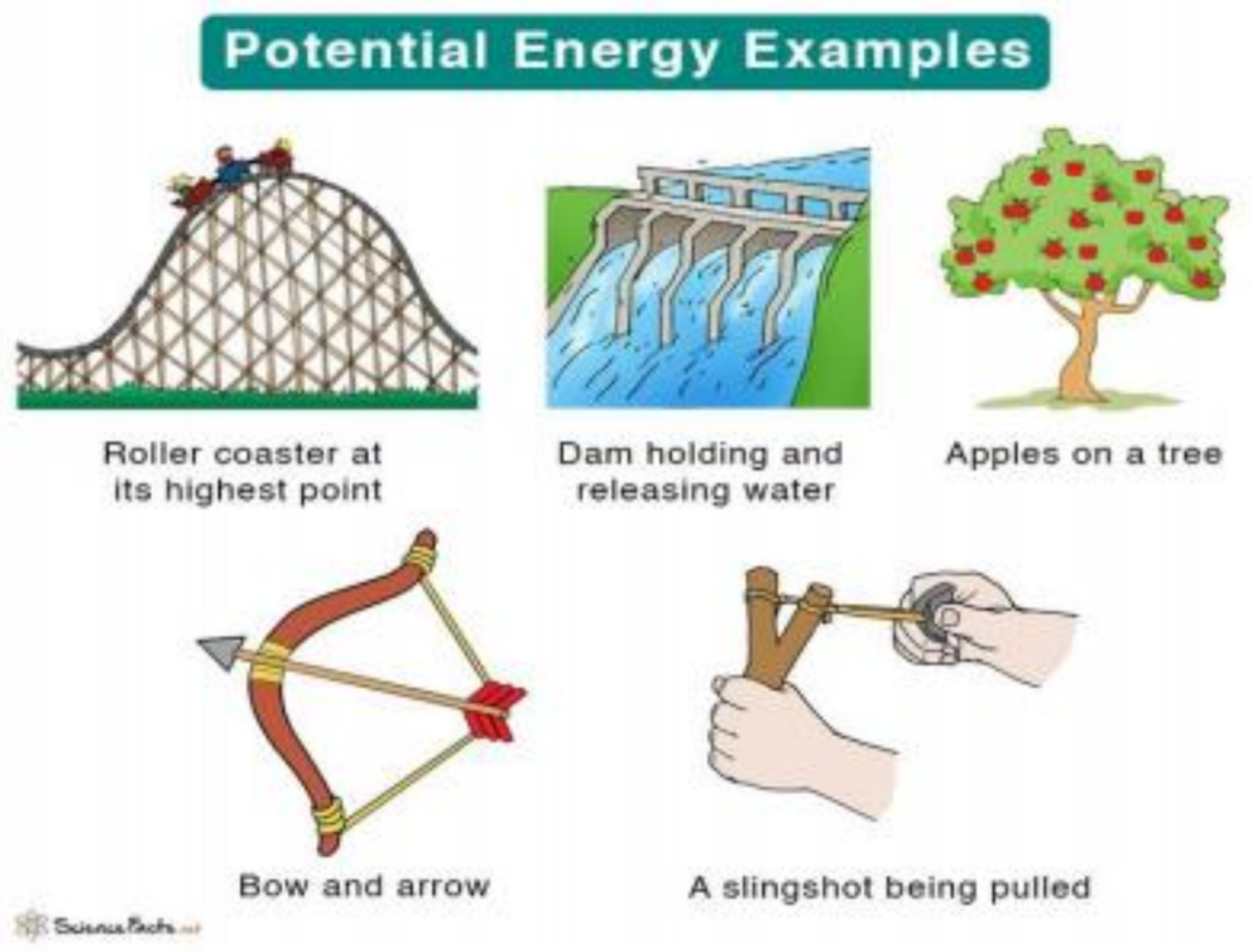
Car moving

Windmill rotating

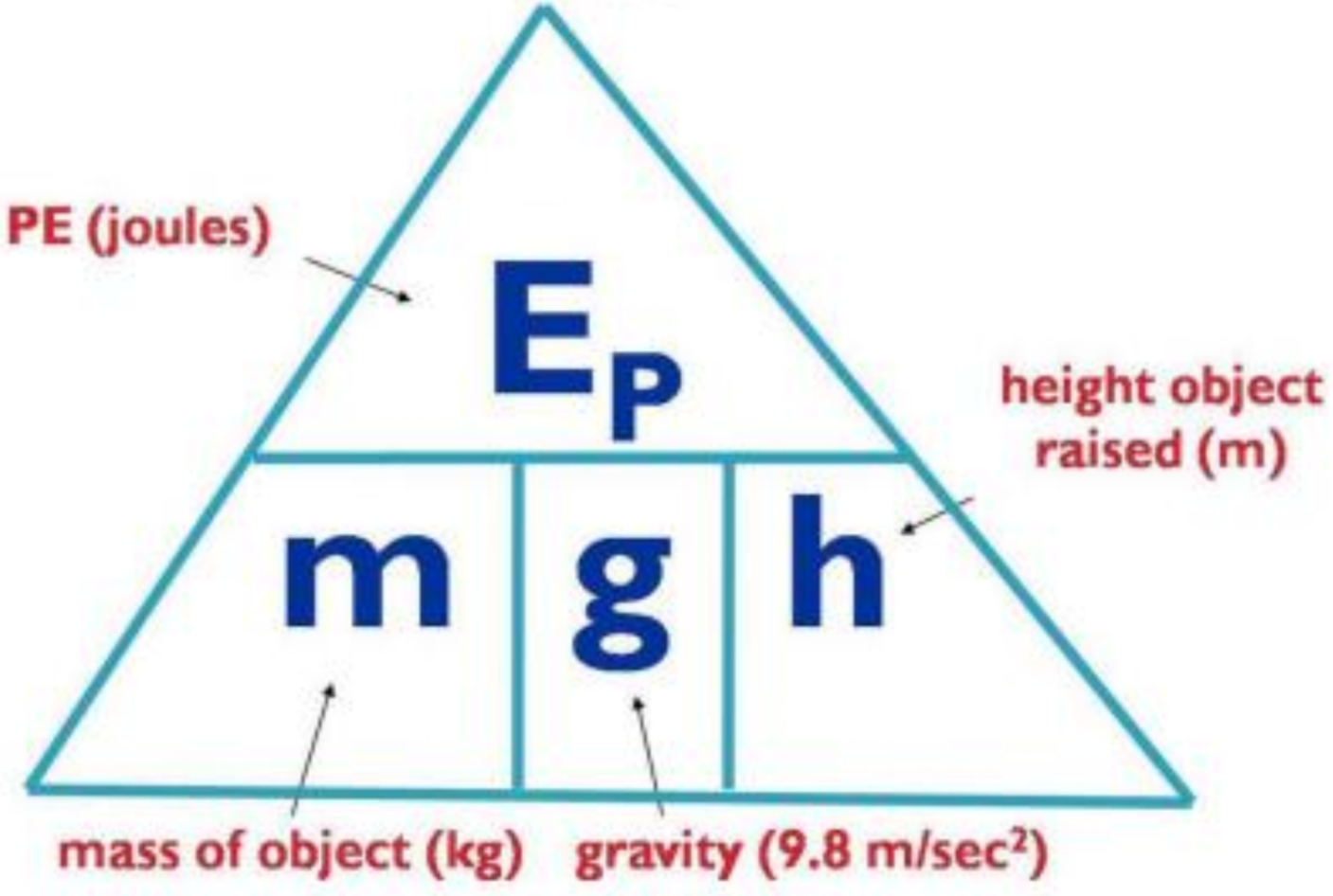
Boy skateboarding

Boy kicking a ball

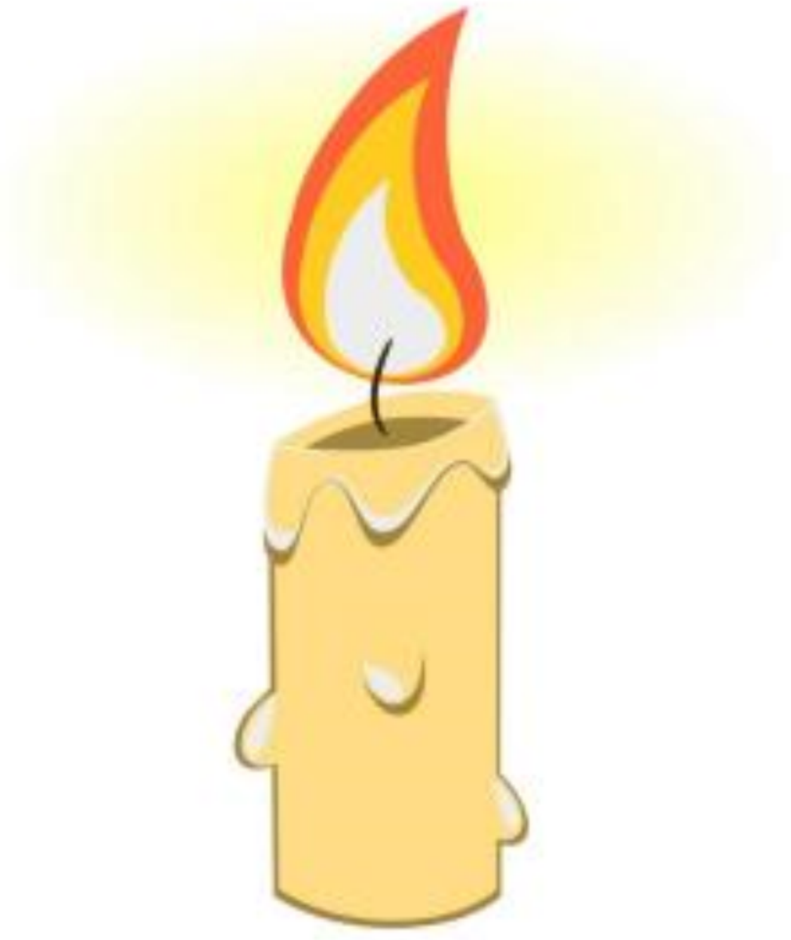
Potential Energy



Potential Energy

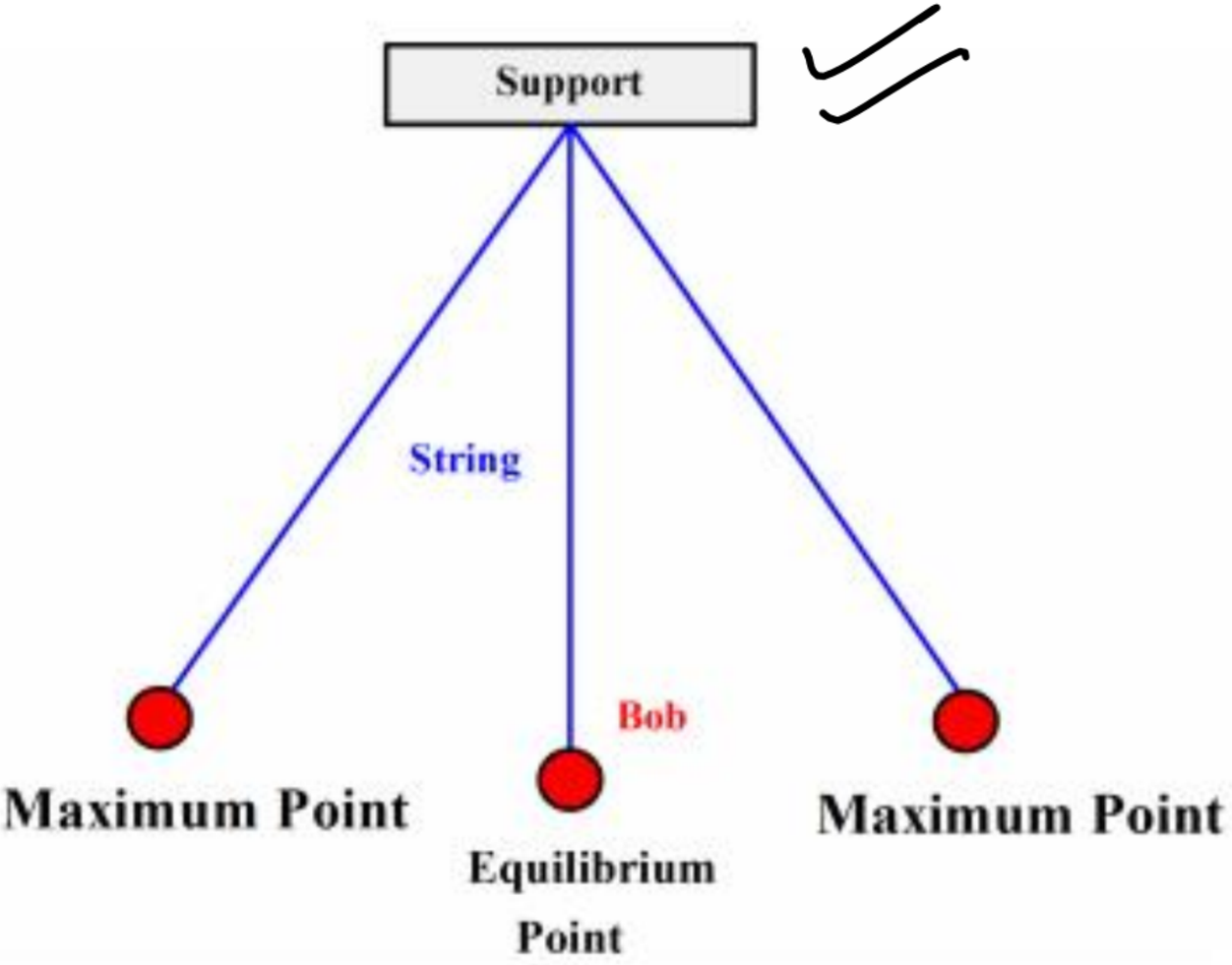


ऊर्जा संरक्षण नियम के आधार पर ऊर्जा का परिवर्तन

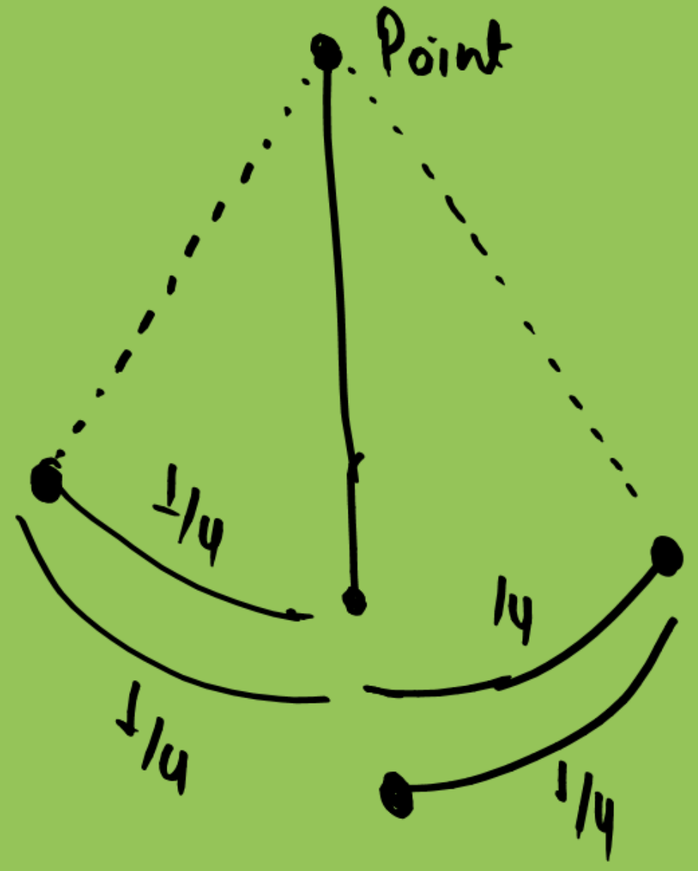



AXA

सरल आवर्त गति


Support
String
Bob
Maximum Point
Equilibrium Point
Maximum Point

आवर्त गति → किसी पथ पर जब कोई पिण्ड निश्चित समयान्तराल में अपने गति को दोहराता → **सरल आवर्त गति**



$\Rightarrow \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = 1$ **एक कम्पन**

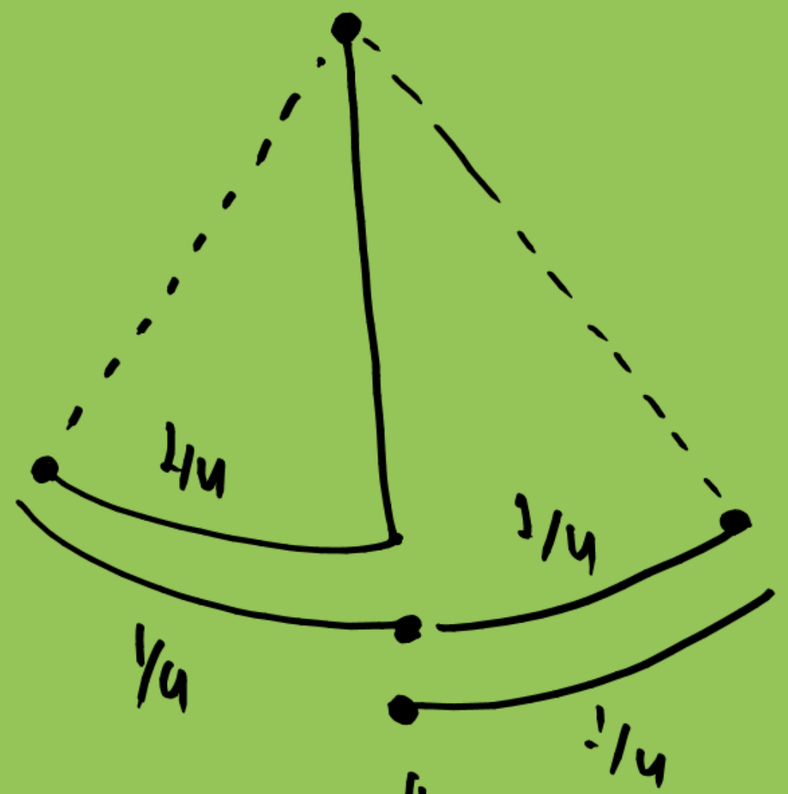
आवर्त गति → दोलन → Oscillation

Note: यदि किसी निश्चित बिंदु के परितः

$$T = 2\pi\sqrt{\frac{l}{g}}$$

$$T \propto l$$

$$T \propto \frac{1}{g}$$



(एक दोलन सम्पन्न)

(एक कम्पन्न)

Note: एक दोलन / कम्पन्न पूरा होने में जो समय लगता है

(T) आवर्तकाल कहा जाता

Time period

$T = 2\pi\sqrt{\frac{l}{g}}$ = $T \propto l$ = l (लम्बाई) ↑ T (आवर्तकाल) ↑

$T \propto \frac{1}{g}$ = g (गुरुत्वीयत्वरण) ↑ आवर्तकाल ↓

✓ T ↑ l ↑ g ↓ T ↓ l ↓ g ↑

आवर्तगति व आवर्तकाल : प्रमुख बिंदु

Ques: झूला झूलते समय यदि कोई व्यक्ति खड़ा हो जाए तो झूले क्या प्रभाव पड़ेगा?

बड़े → $l \downarrow$ घट जाती

$T \downarrow$ आवर्तकाल

आवृत्ति अधिक - झूला तेज़ झूलेगा

Note: झूले पर व्यक्ति की संख्या बढ़ाने पर उसकी गति पर कोई प्रभाव नहीं।

आवृत्ति (n) ↑ बढ़ जाती

⊙ पेंडुलम घड़ी ⟶ ध्रुवों पर लाई जाए तो गति पर क्या प्रभाव पड़ेगा –

पेंडुलम की गति बढ़ जायेगी ↑

R↓ (त्रिज्या कम)

g↑ (गुरुत्वीय त्वरण अधिक)

T↓ कम

पेंडुलम धीमा

आवृत्ति (n) ↑

speed ↑

पेंडुलम घड़ी

ठण्डा → सिकुड़न → $l \downarrow$ कमी

$T \downarrow$ आवर्तकाल कमी

$n \uparrow$ आवृत्ति अधिक

"Speed अधिक"

पेंडुलम तेज

Space → No work

गर्मी → प्रसार → $l \uparrow$ = वृद्धि

$T \uparrow$ वृद्धि

अर्थात् आवृत्ति $\downarrow$ (n) → Speed $\downarrow$

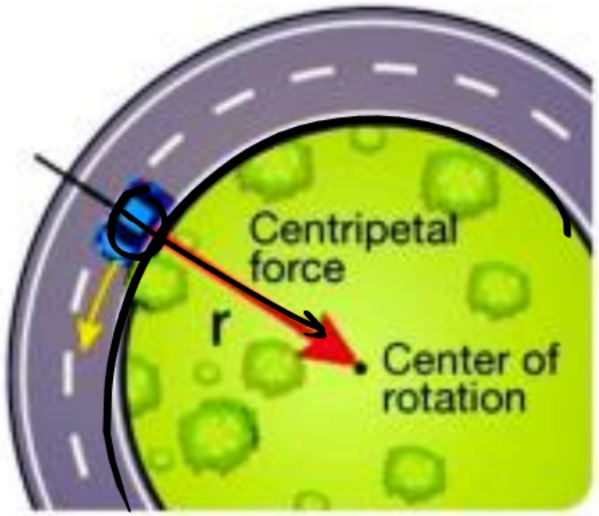
पेंडुलम धीमा

Centripetal Force

Circular Path

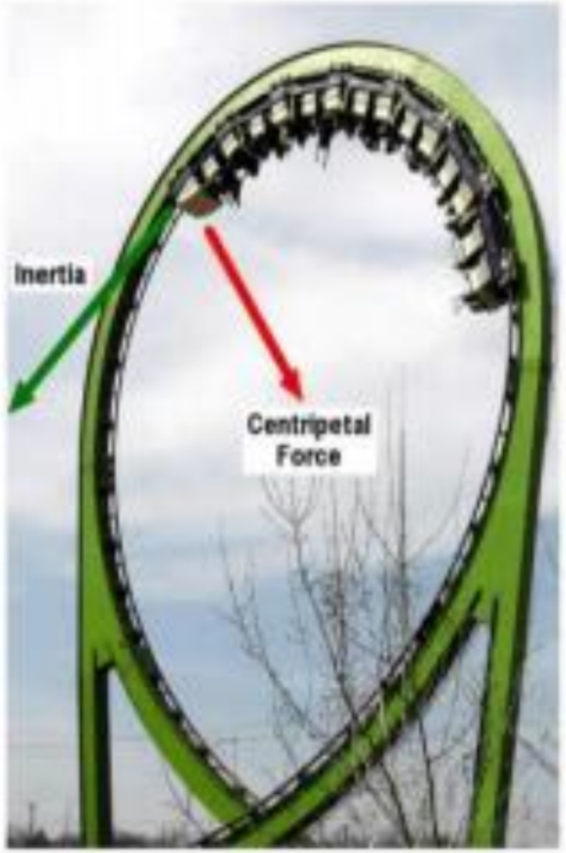
अभिकेंद्री बल

(a) Spinning a ball on a string or twirling a lasso



(b) Turning a car

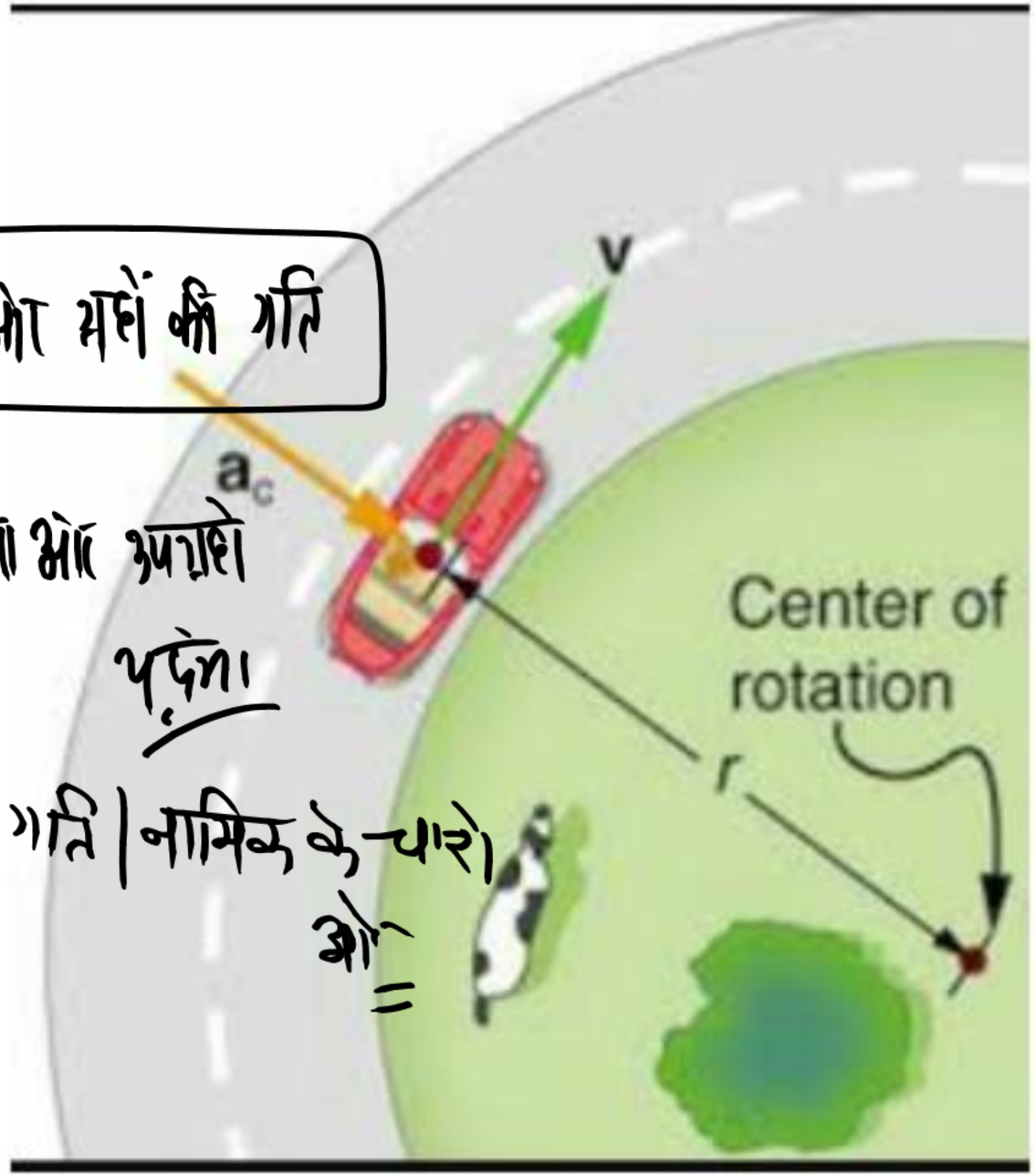
Centripetal Force



सूर्य के चारों ओर ग्रहों की गति

पृथ्वी के चारों ओर उपग्रहों पड़ना।

इले० की गति | नाभिक के चारों ओर




Tangent
lig

Centrifugal Force

वृत्तीय पथ

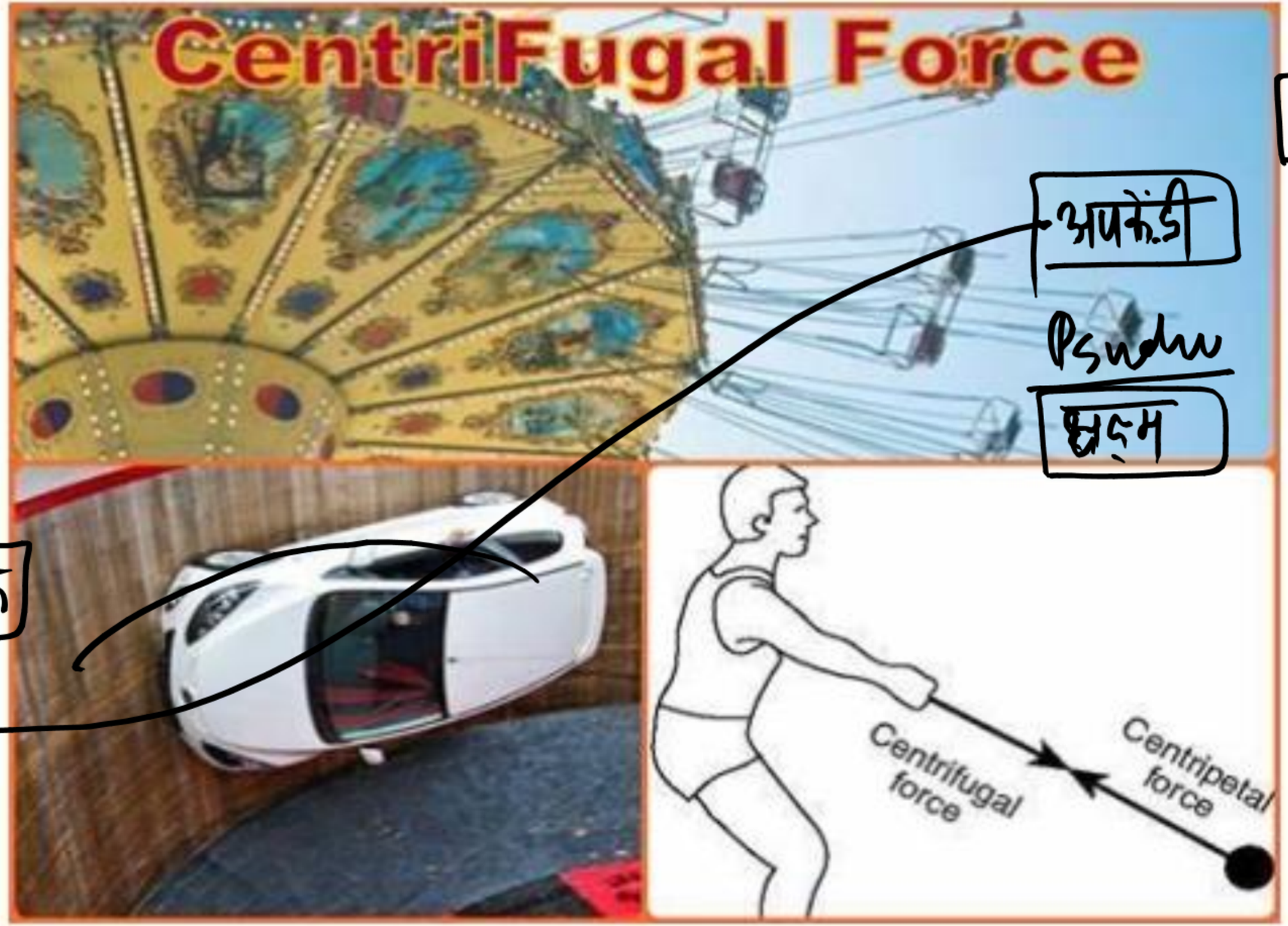
↓

गति

↓

बाहर की तरफ

बल



उदाहरण

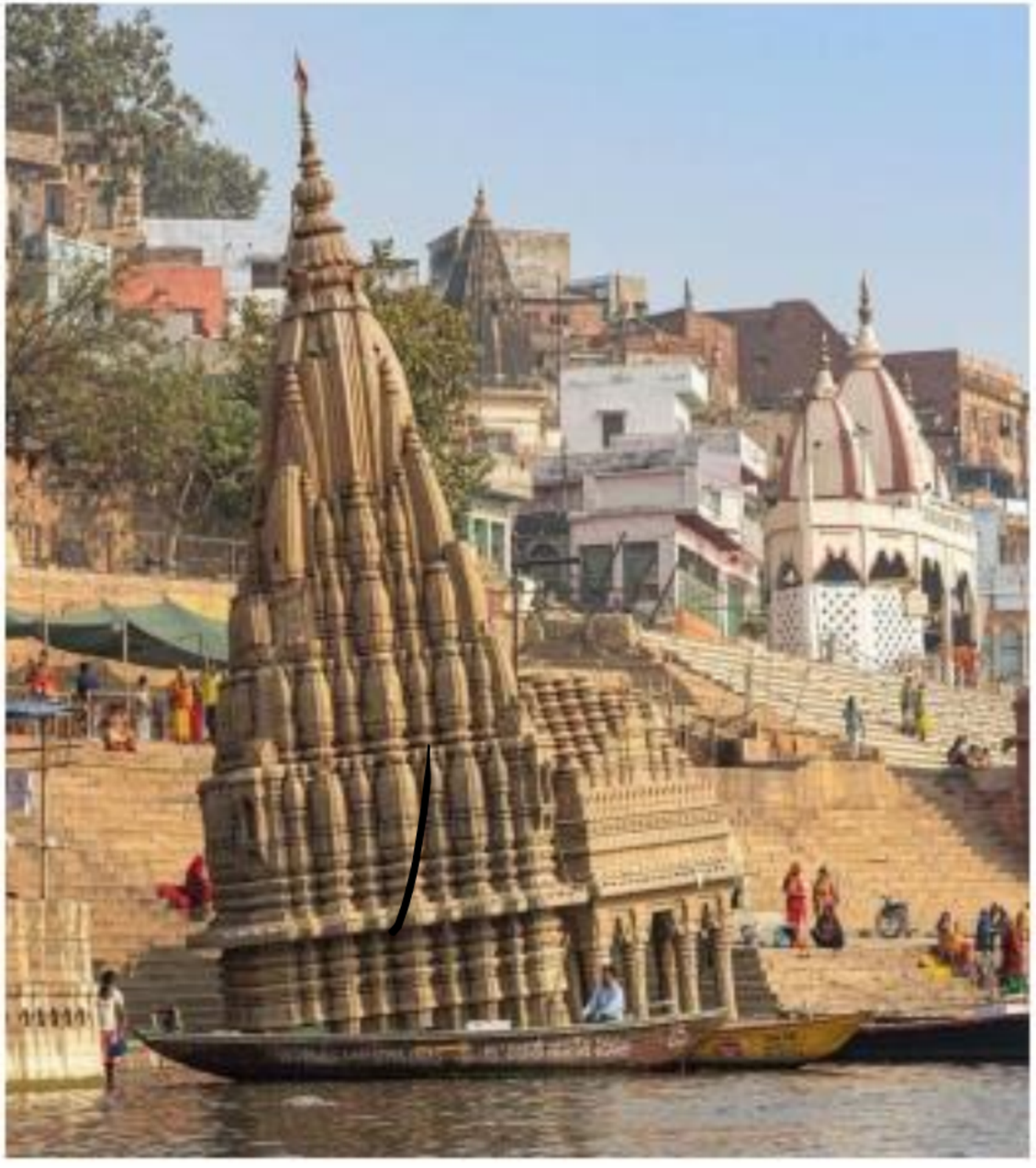
अपकेंद्री

Pseudo

बल

Centre of Mass

द्रव्यमान के इस केंद्र है जहाँ जिस बिंदु पर
उसका पूरा द्रव्यमान प्रभावी रूप से
निहित रहे।

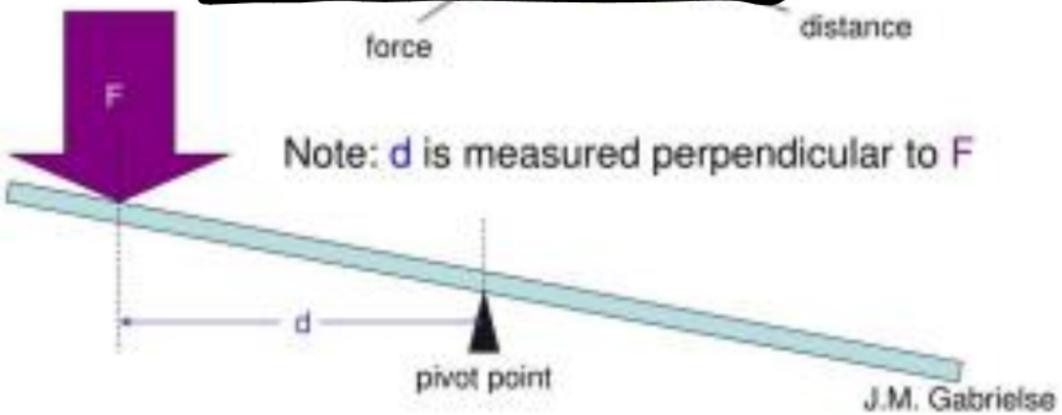


Torque

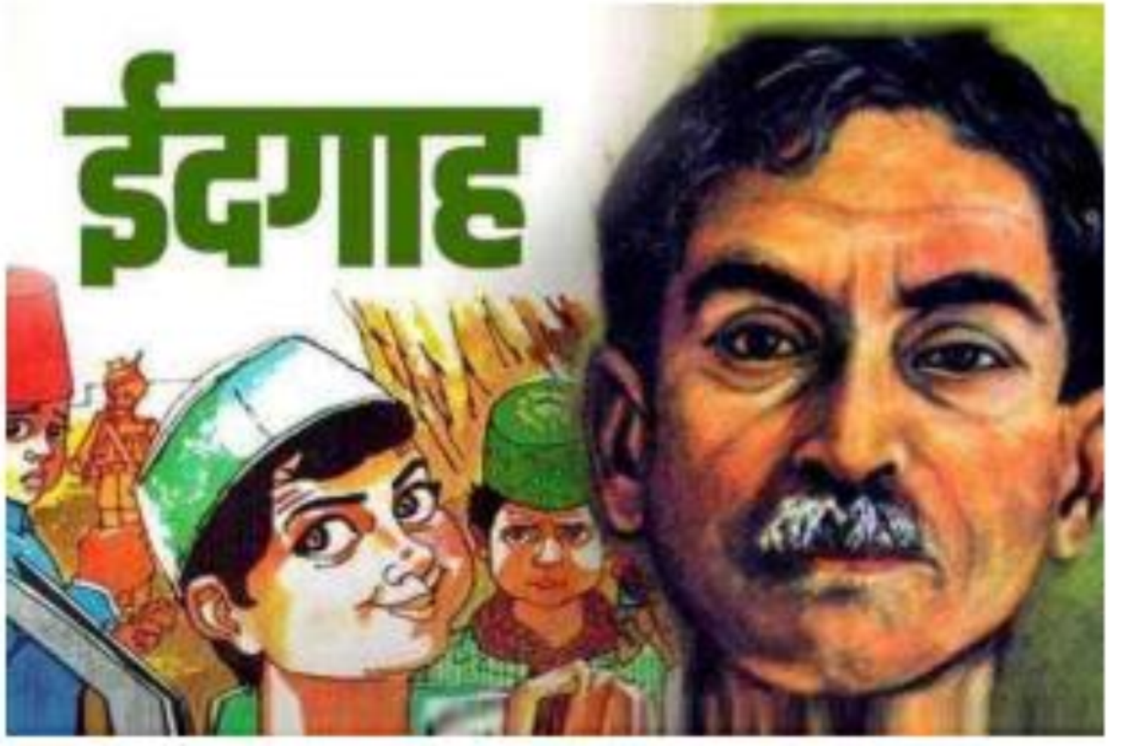
Calculate Torque (T)

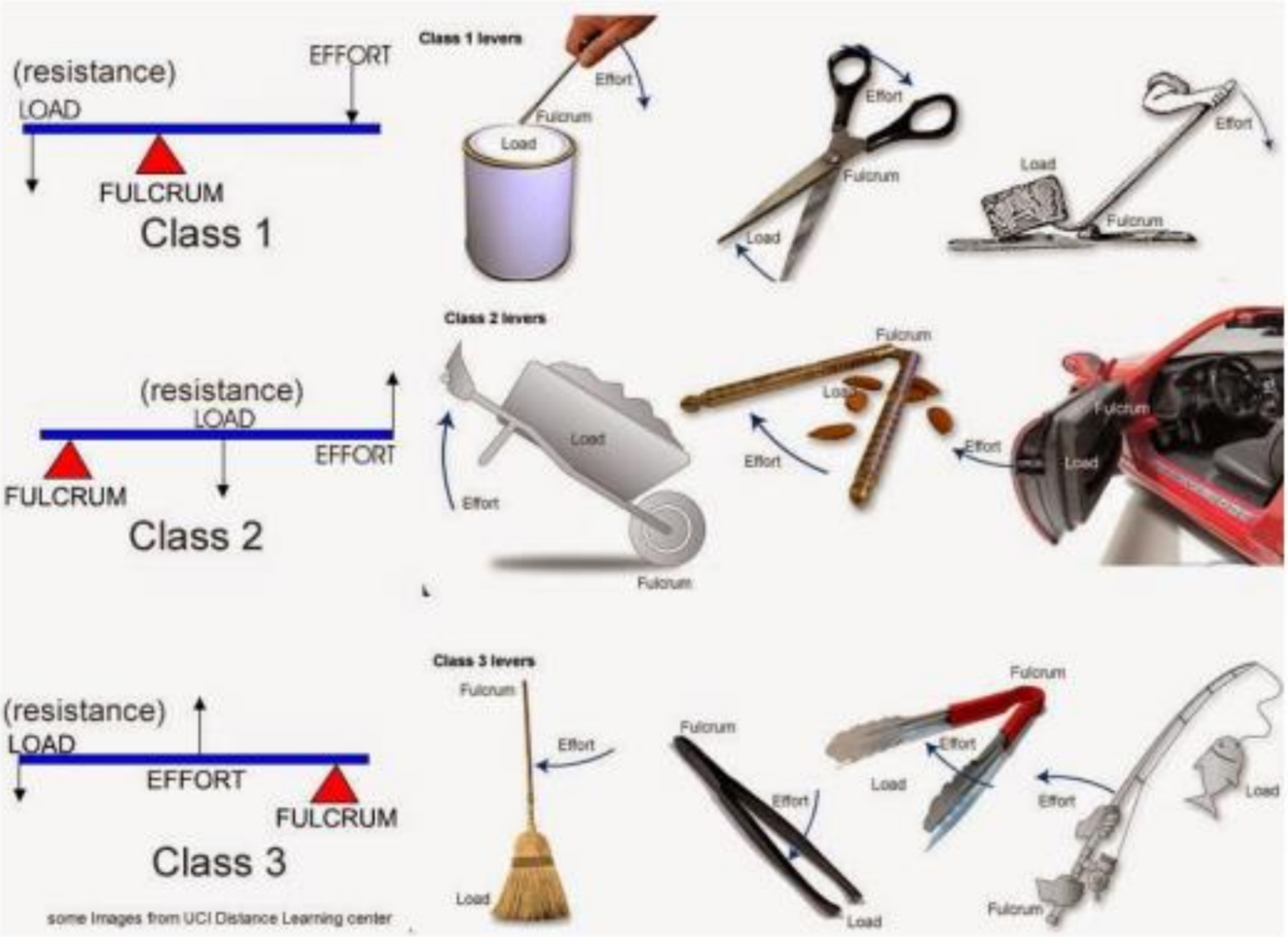
$$T = F \times d$$

force distance

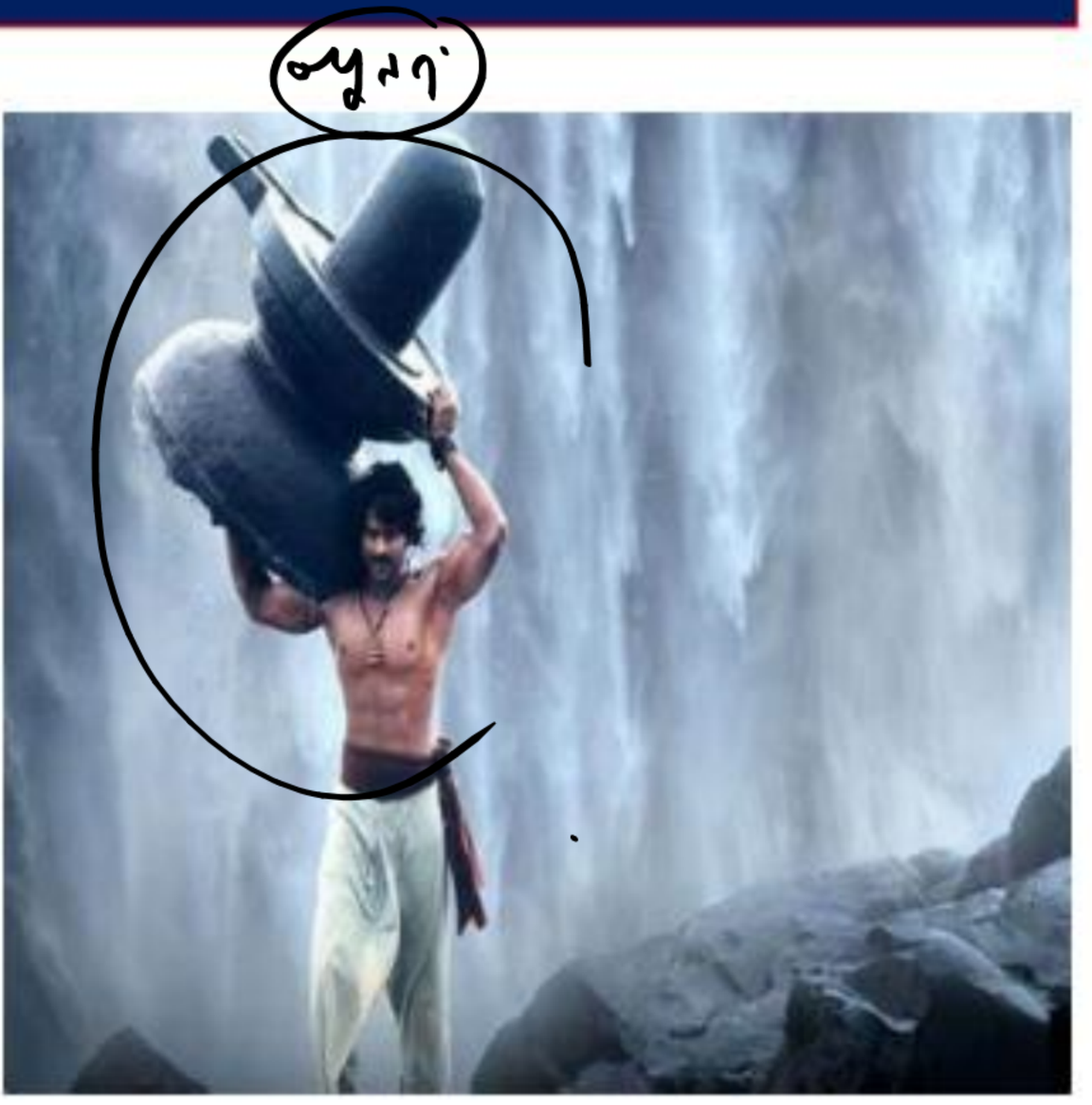


Lever




(resistance)
LOAD
EFFORT
FULCRUM
Class 1
Class 1 levers
Effort
Fulcrum
Load
Effort
Fulcrum
Load
Load
Effort
Fulcrum
(resistance)
LOAD
EFFORT
FULCRUM
Class 2
Class 2 levers
Load
Effort
Fulcrum
Fulcrum
Load
Effort
Effort
Load
(resistance)
LOAD
EFFORT
FULCRUM
Class 3
Class 3 levers
Fulcrum
Effort
Load
Fulcrum
Effort
Load
Fulcrum
Effort
Load
Effort
Load
Fulcrum
some Images from UCI Distance Learning center

Force



1 फर्मी = 10^{-15} m

बल के प्रकार

1-2 फर्मी

सूक्ष्म प्रभाव (micro)

प्रबल बल

गुरुत्वीय बल Gravity

दुर्बल बल → ✓

ब्रह्माण्ड प्रभाव

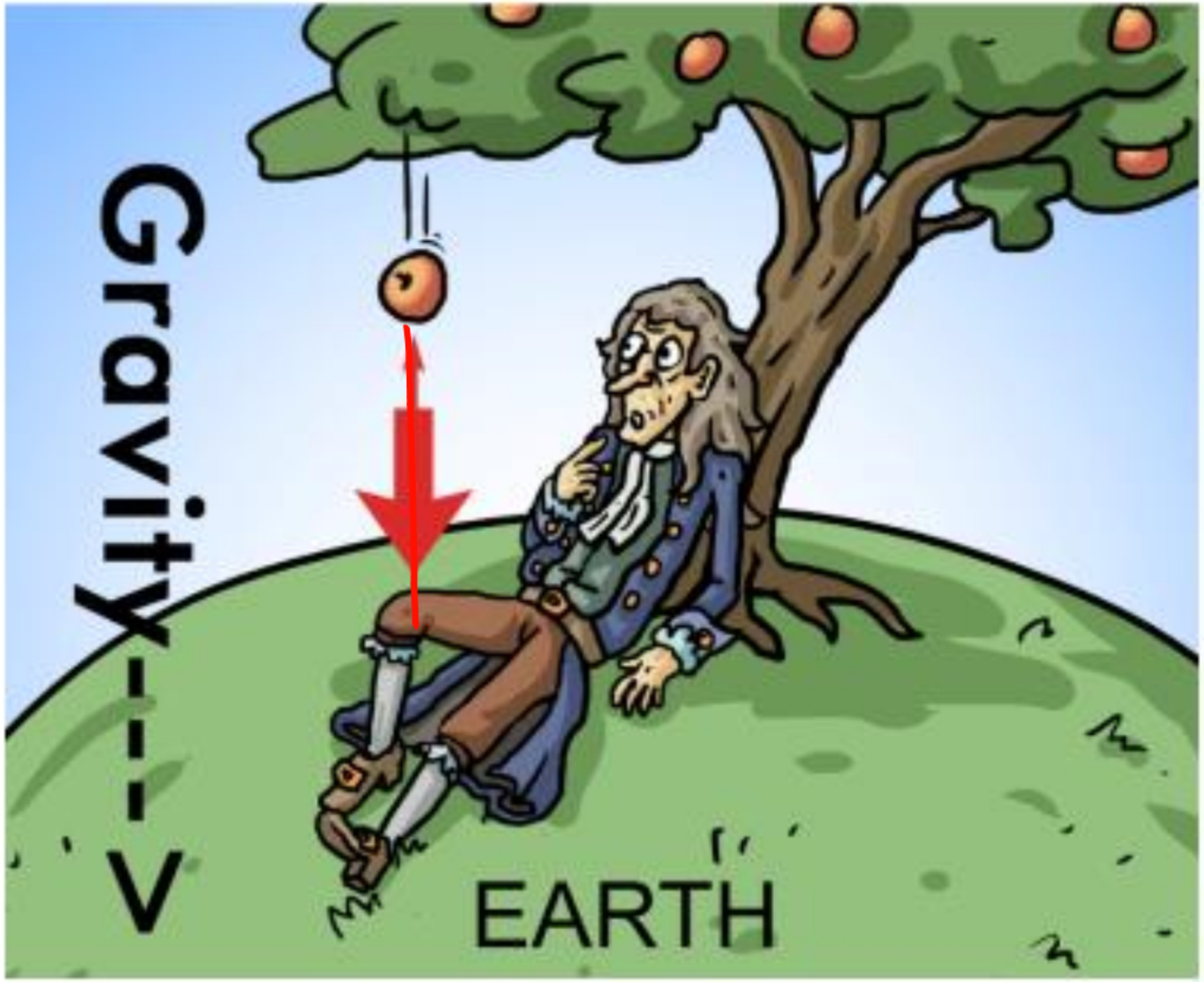
Universal Gravity

दुर्बल नाभिकीय बल Weak Nuclear Force

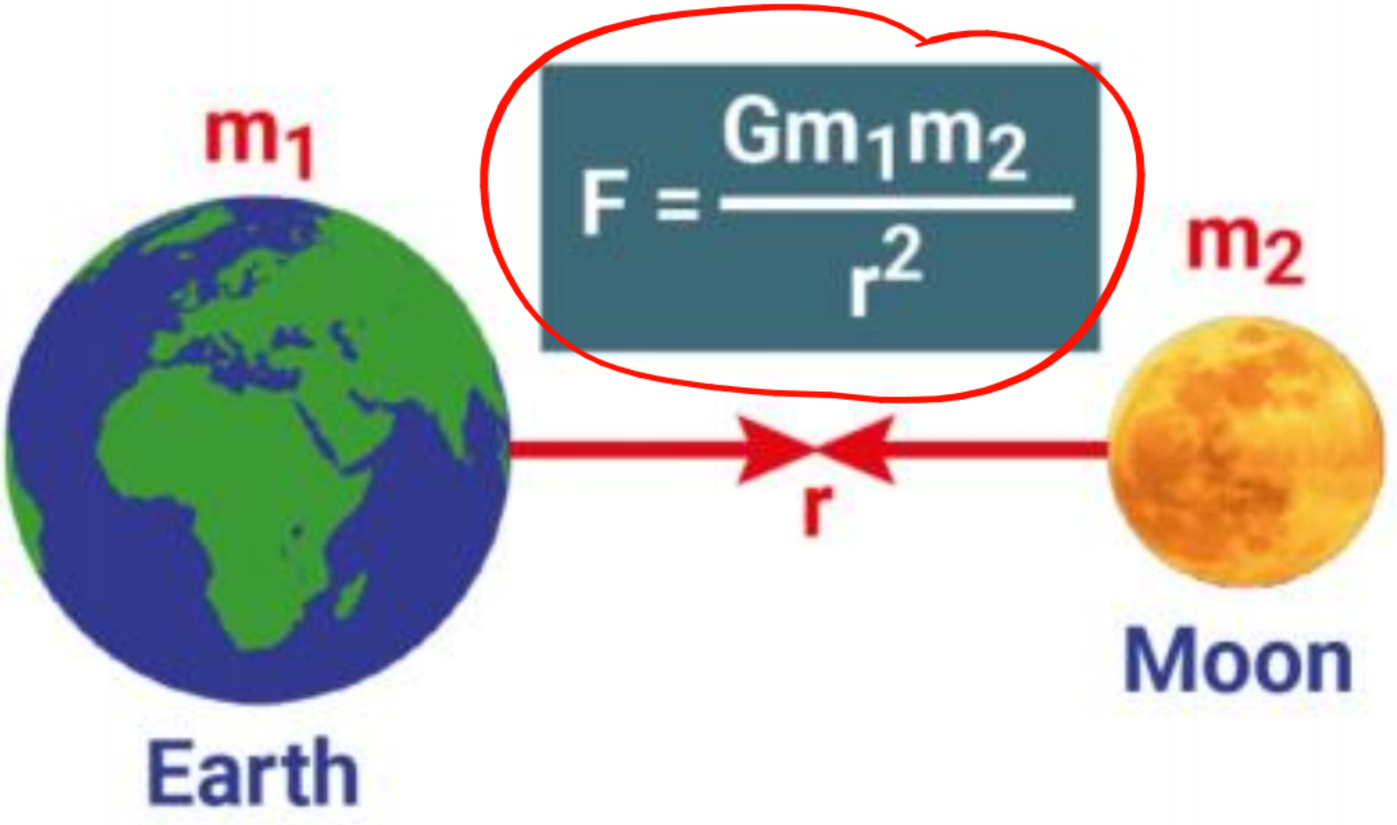
प्रबल नाभिकीय बल Strong Nuclear Force

विद्युत चुम्बकीय बल Electromagnetic Force

Gravitational Force



Universal law of Gravity

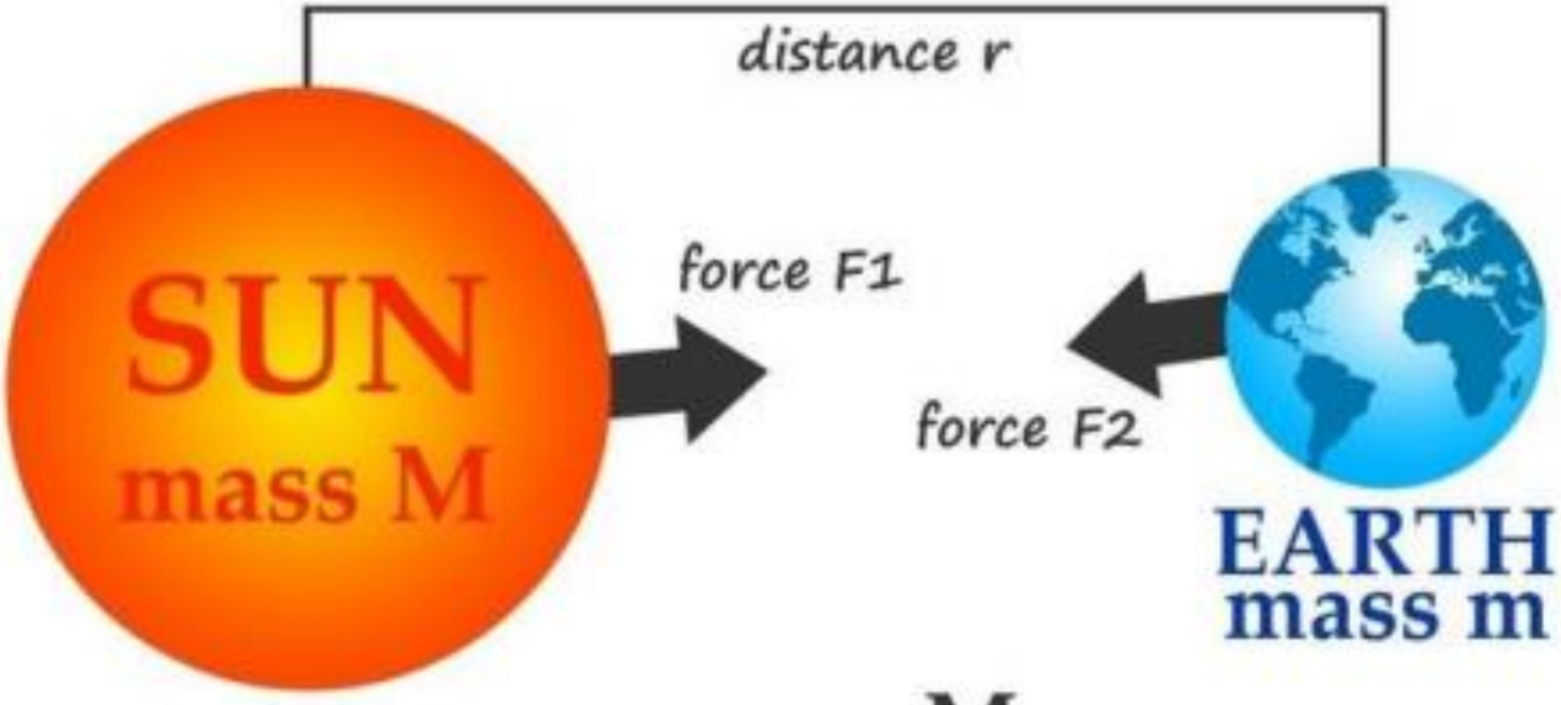


$$F = \frac{G m_1 m_2}{r^2}$$

G (गुरुत्वाकर्षण नियतांक)

6.67×10^{-11}

LAW OF GRAVITY



$$F1 = F2 = G\frac{M \times m}{r^2}$$

Gravitational Acceleration

The Acceleration due to Gravity

$$F = mg$$

Newton's Law of Motion

$$F = \frac{Gm_1m_2}{r^2}$$

Newton's Law of Gravitation

$$g = \frac{G \quad m_2}{r^2}$$

$$g = \frac{GM_E}{R_E^{\ 2}}$$

For reference mass and a spherical earth:
$g = 10\ m/s^2$

$g \uparrow \quad R \downarrow$

$g = \frac{m}{R^2}$

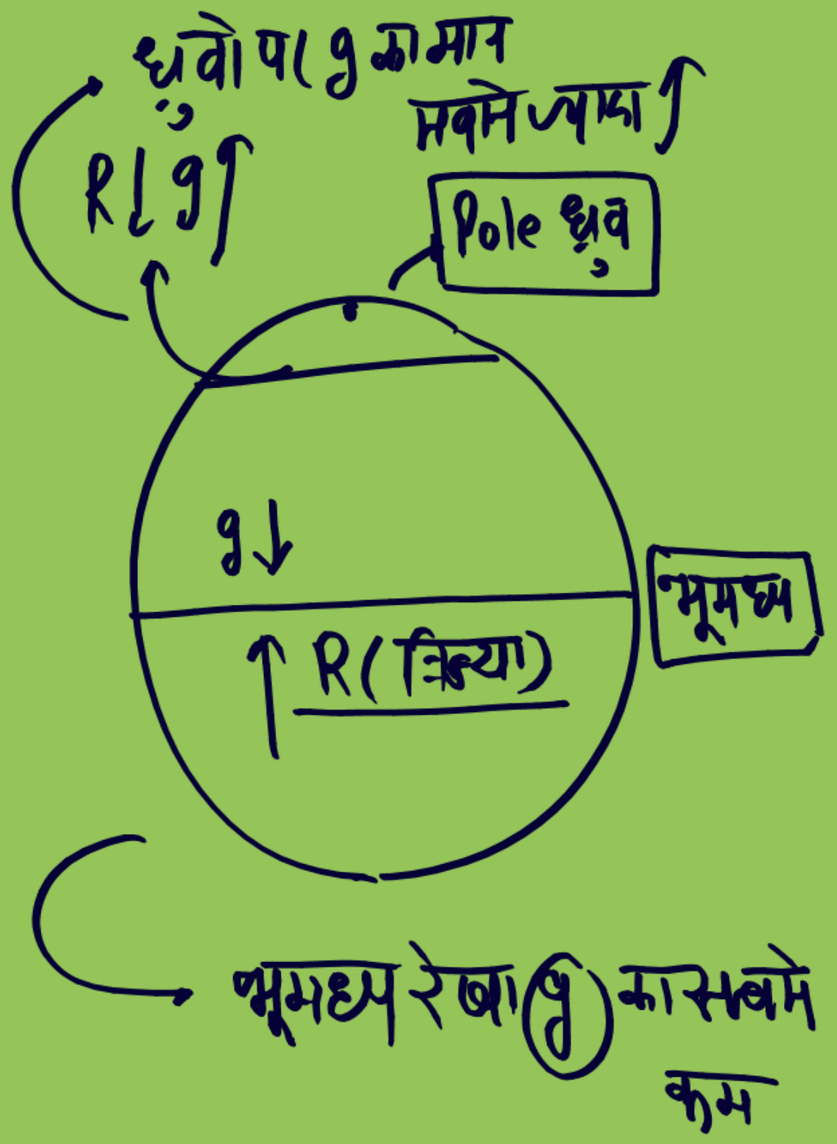
$g = m$

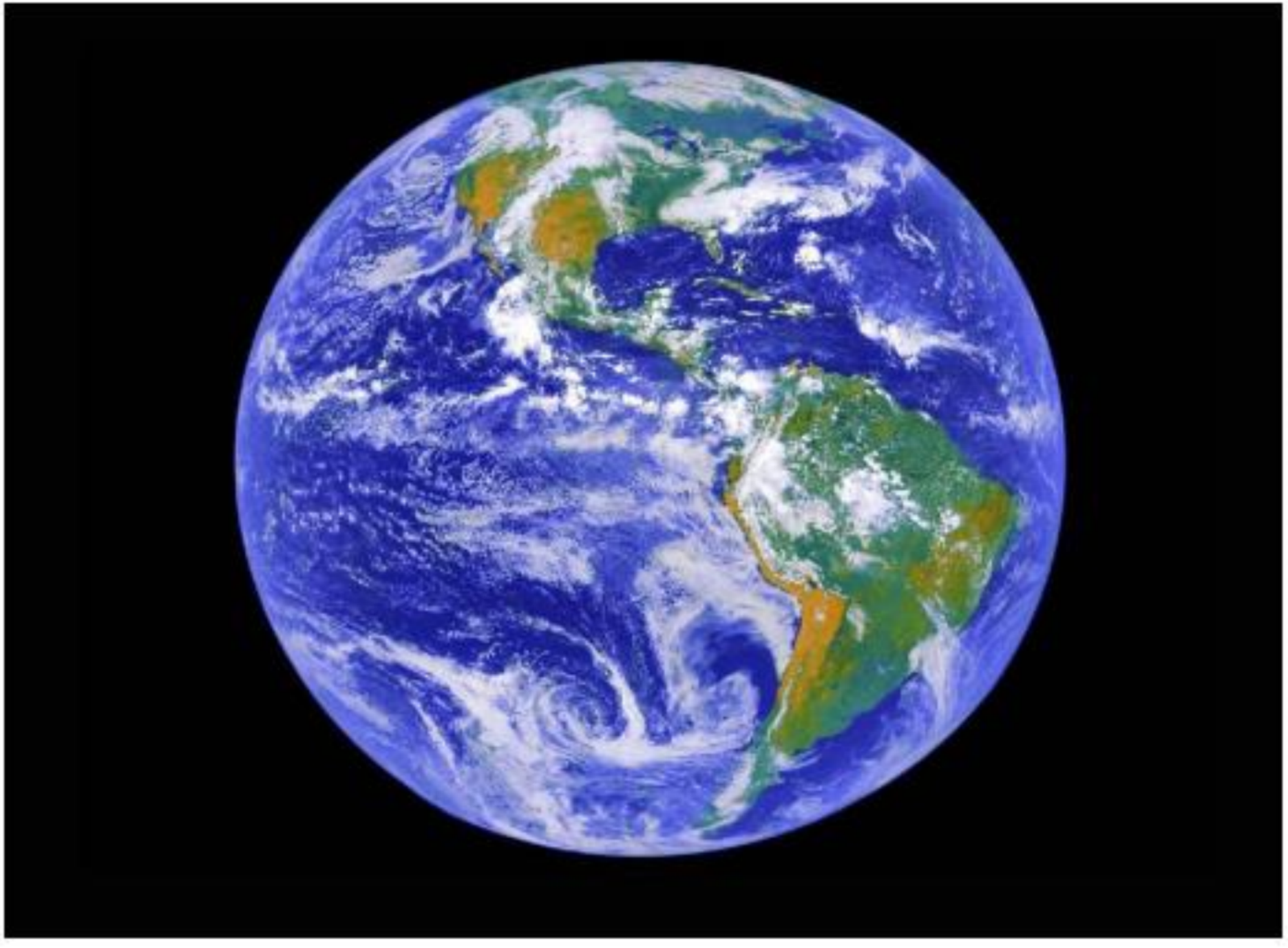
$g \uparrow \quad m \uparrow$

$$g = \frac{M_e}{R^2}$$

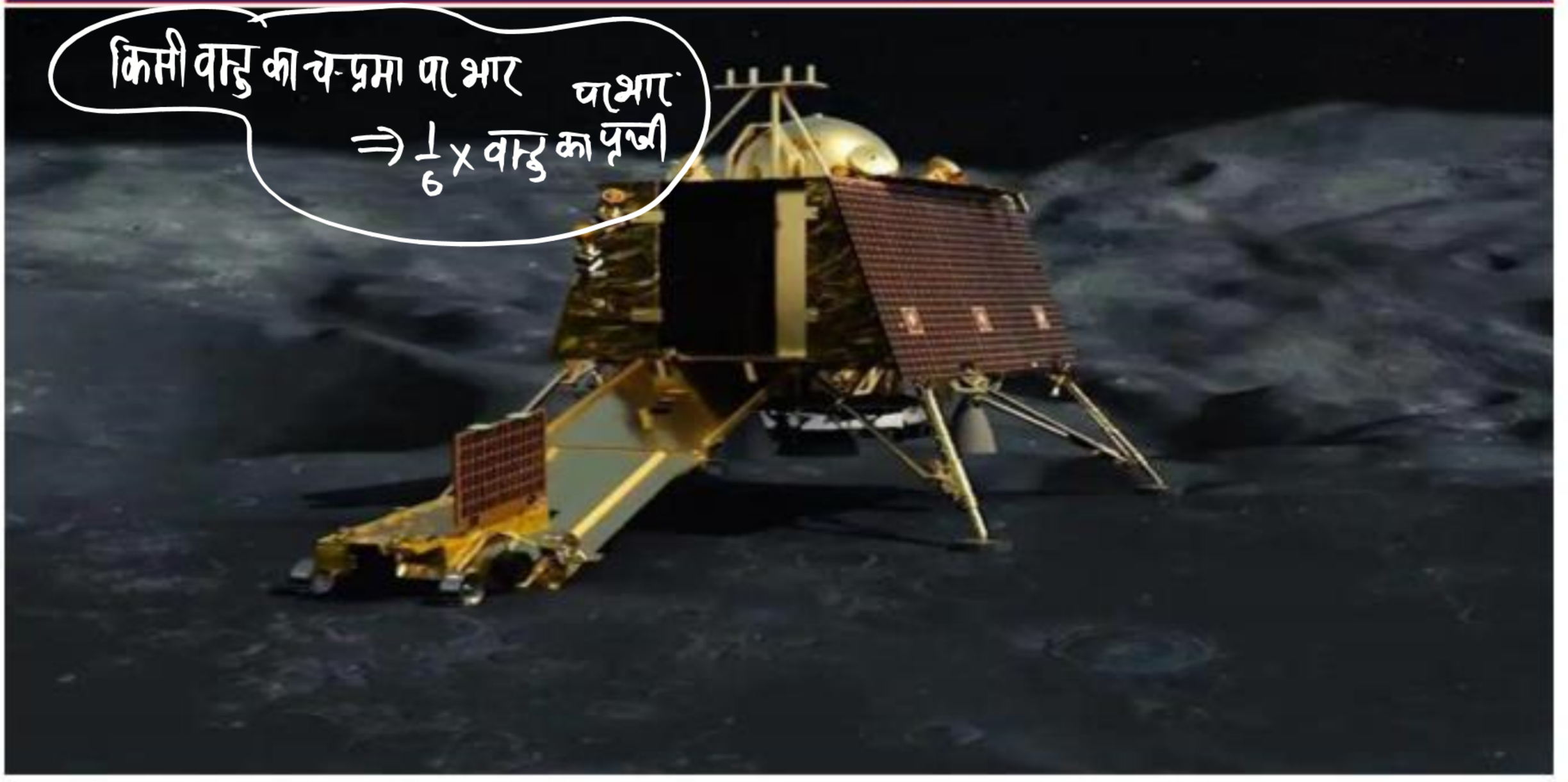
$\Rightarrow$ $g\uparrow$ $m\uparrow$

$\Rightarrow$ $g\uparrow$ $R\downarrow$



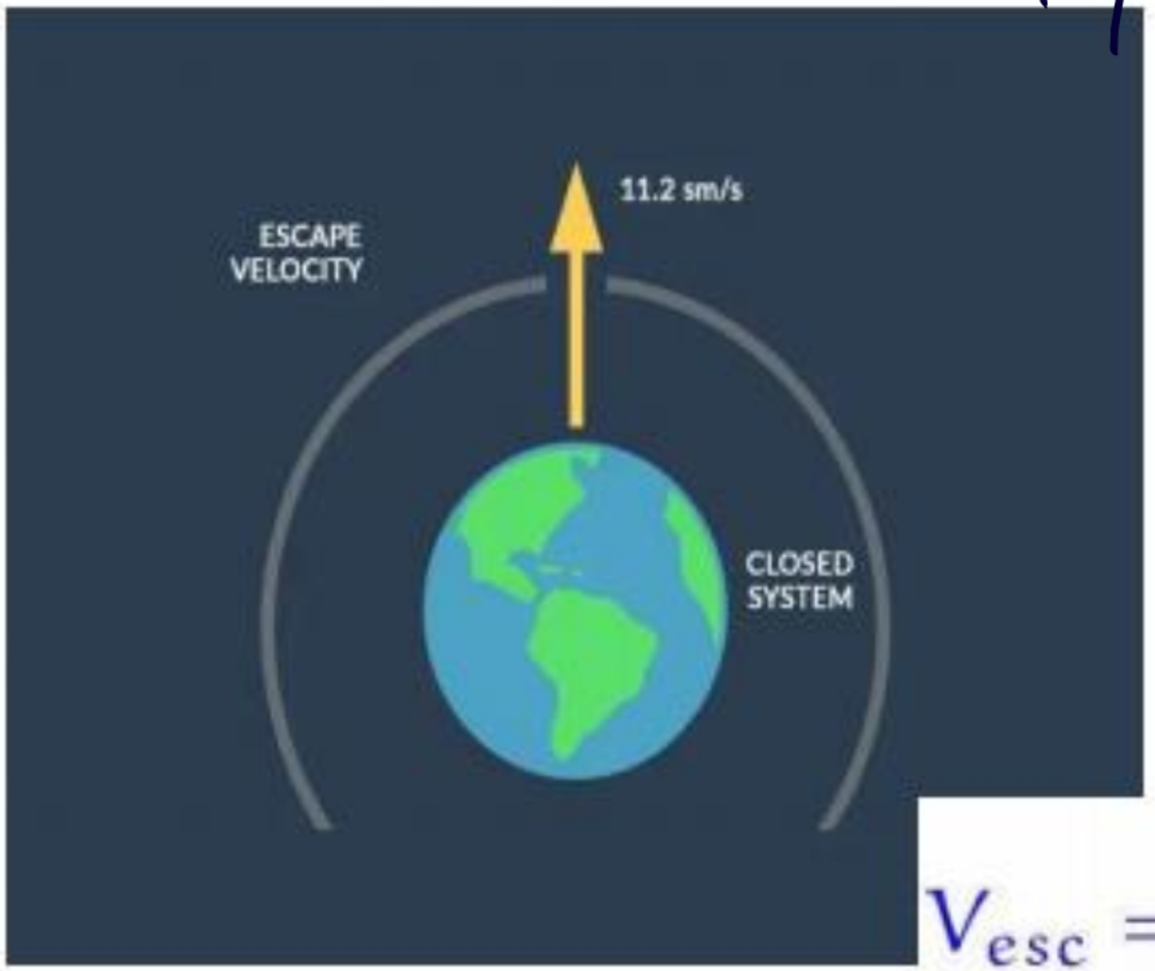


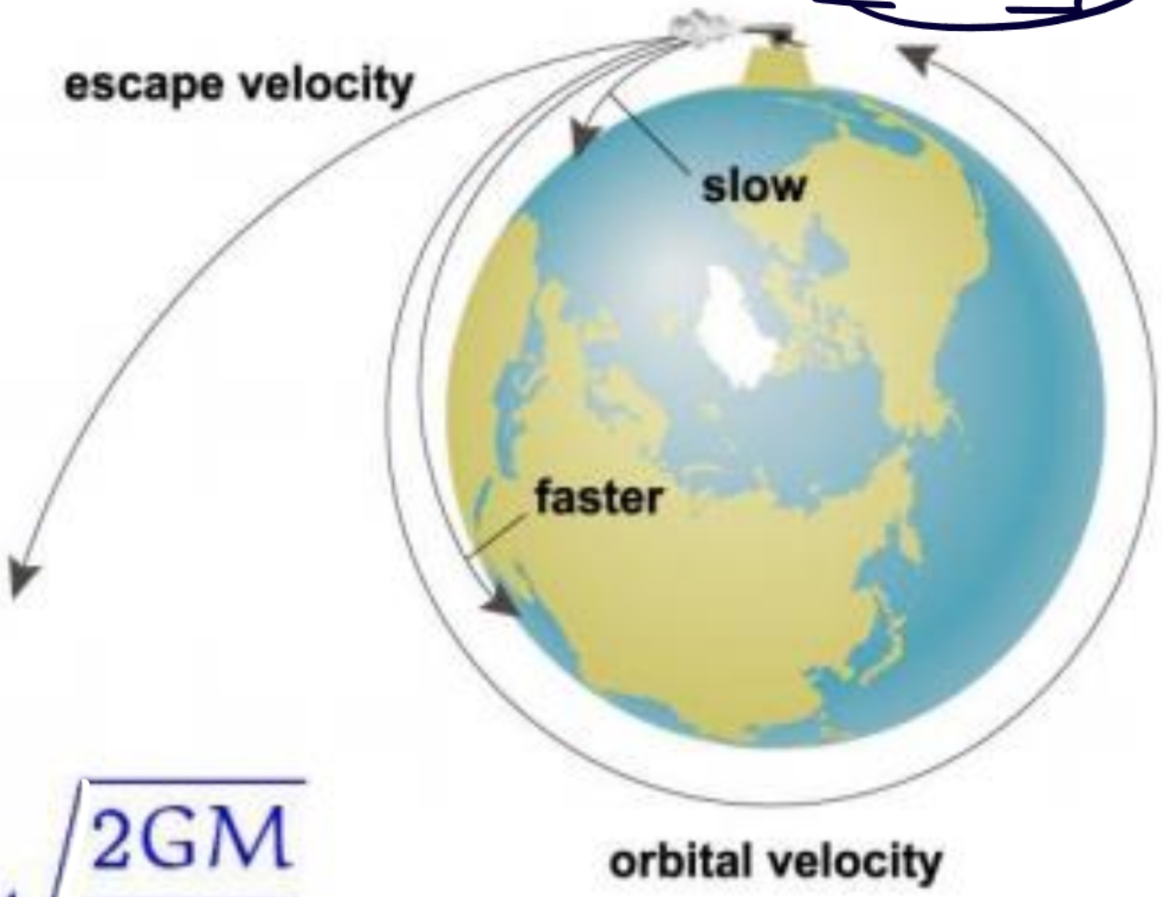
चंद्रमा पर किसी वस्तु का भार



पलायन वेग (Escape Velocity)

Earth = 11.2 km/s / Moon → 2.5 km/s, Mar (Mom) = 5 km/s





$$V_{esc} = \sqrt{\frac{2GM}{R}}$$