Class 9 Academic Program-2020

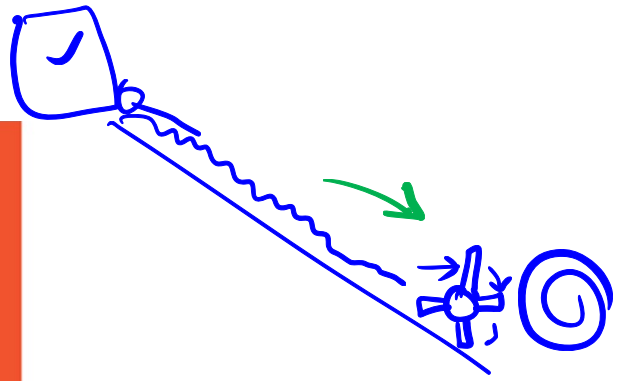
PHYSICS

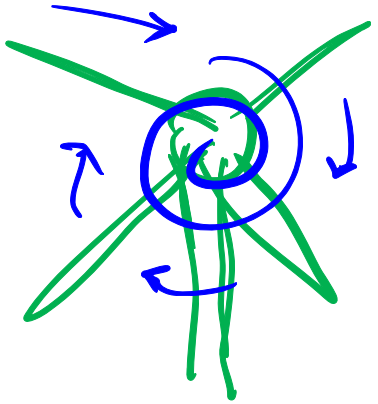
Lecture : P-10

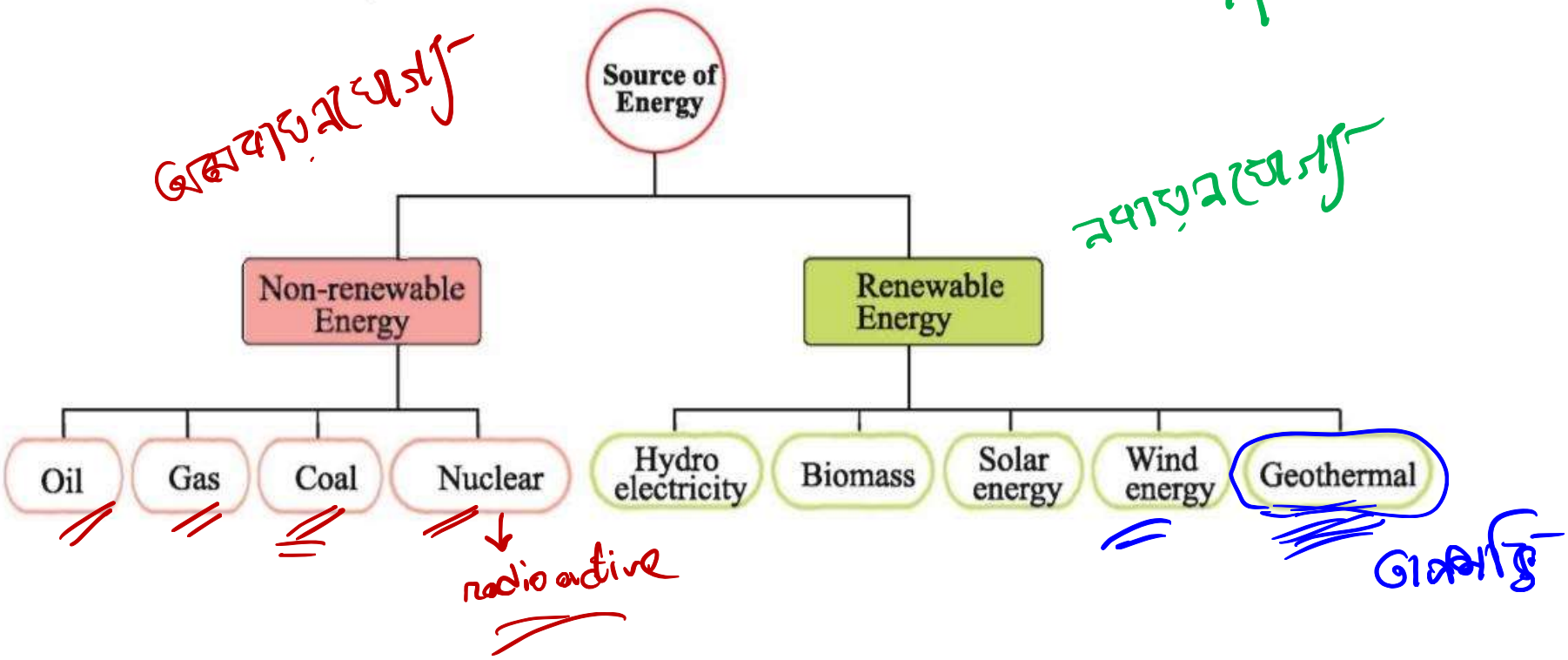
Chapter 04 : Work, Energy & Power

উদ্ভাস
একাডেমিক এন্ড এডমিশন কেয়ার

Sources of Energy:







Non-Renewable Energy:

(Fuel Energy) :

→ The fuel got from the remains of creatures that are being buried under the ground from million of years is called fossil fuel.

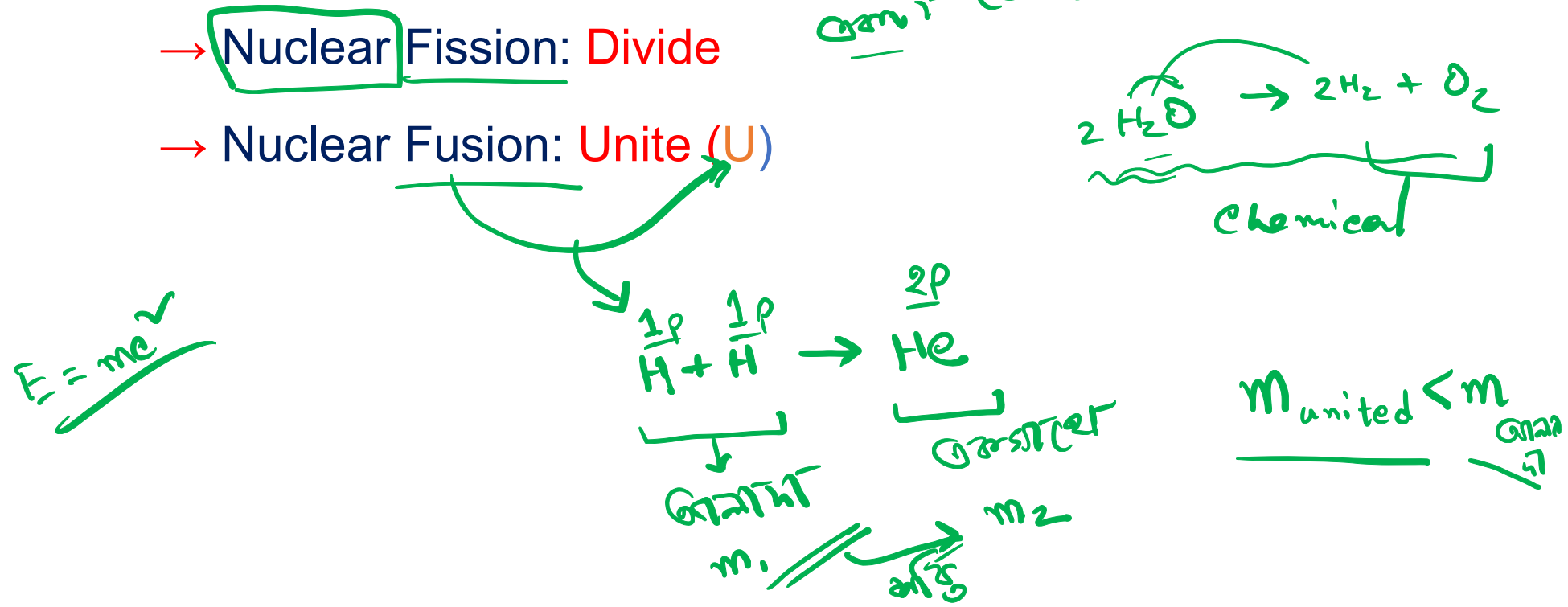
- **Oil**→ At first, it was called Crude Oil → Extracted from the ground
- **Gas**→ Mostly (Methane) → **CH_4**
- **Coal**

Nuclear Energy:

Two Types:

→ Nuclear Fission: Divide

→ Nuclear Fusion: Unite (U)



Renewable Energy:

1. Hydroelectricity :

→ Hydroelectricity is obtained from currents of water by rotating turbine with the help of generator….

2. Biomass :

→ Wood, Straw……..

3. Solar Energy:

** Solar Panels…

4. Wind Energy:

** Wind Turbine…

5. Bio fuel:

** Alcohol

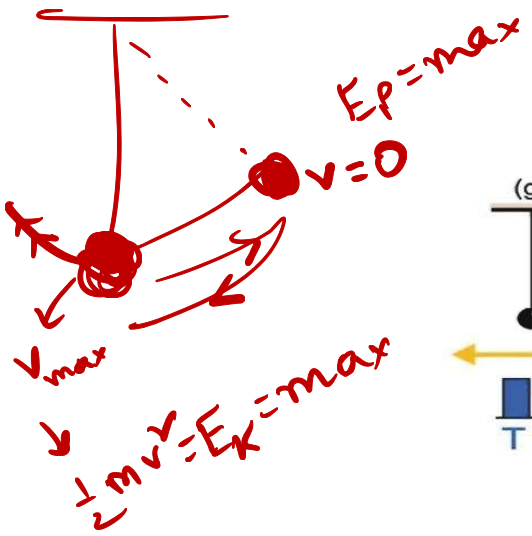
6. Geo Thermal Energy:

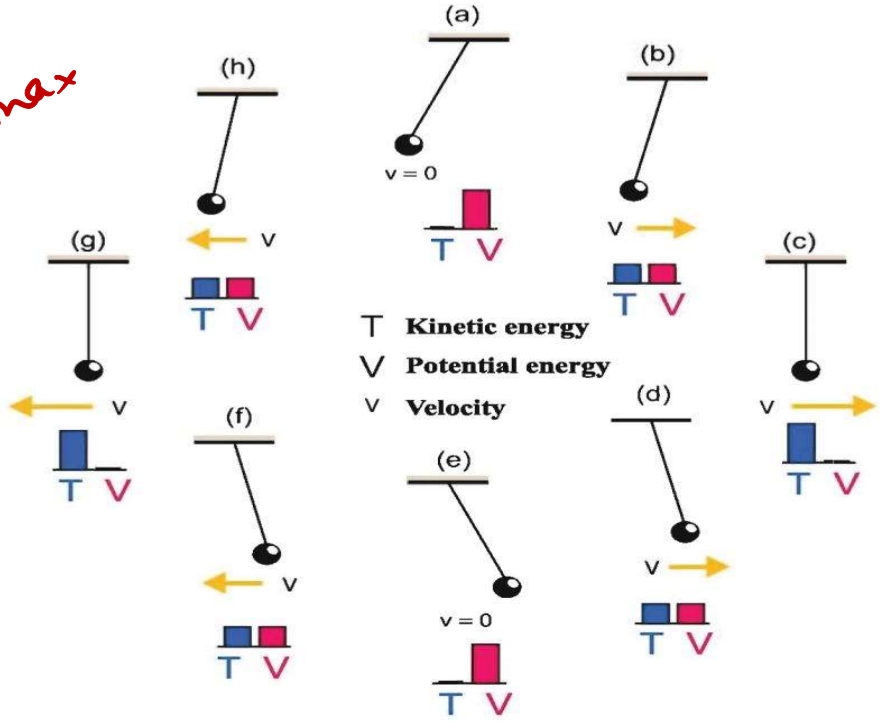
** **Magma**

→ It is extremely hot liquid and semi-liquid rock located under earth's surface…

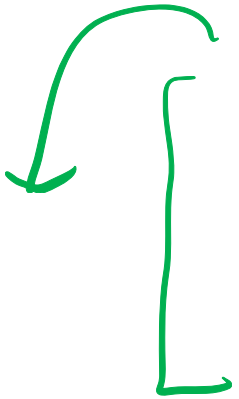
Conservation of Energy:

Energy is imperishable; it cannot be created or destroyed! Energy can just transfer from one form to another form. The amount of energy in the world is certain.





T = kinetic
V = Potential



Transformation of Energy:

1. **Electrical Energy:**

2. **Chemical Energy:**

3. **Heat Energy:** Thermocouple.

4. **Mechanical Energy:**

5. **Light Energy:**

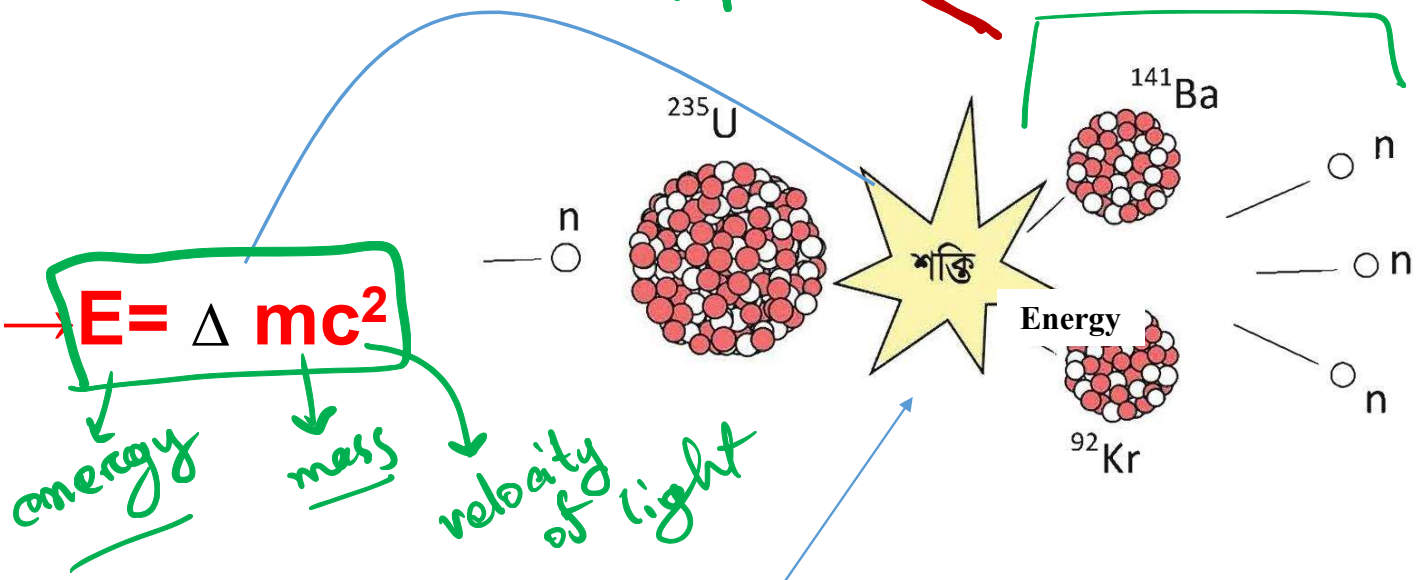
6. **Mass:** $E = mc^2$

Relation between Mass & Energy

$\Delta m = m_2 - m_1$

mass defect

$m_1 < m_2$



$E = \Delta mc^2$

energy, mass, velocity of light

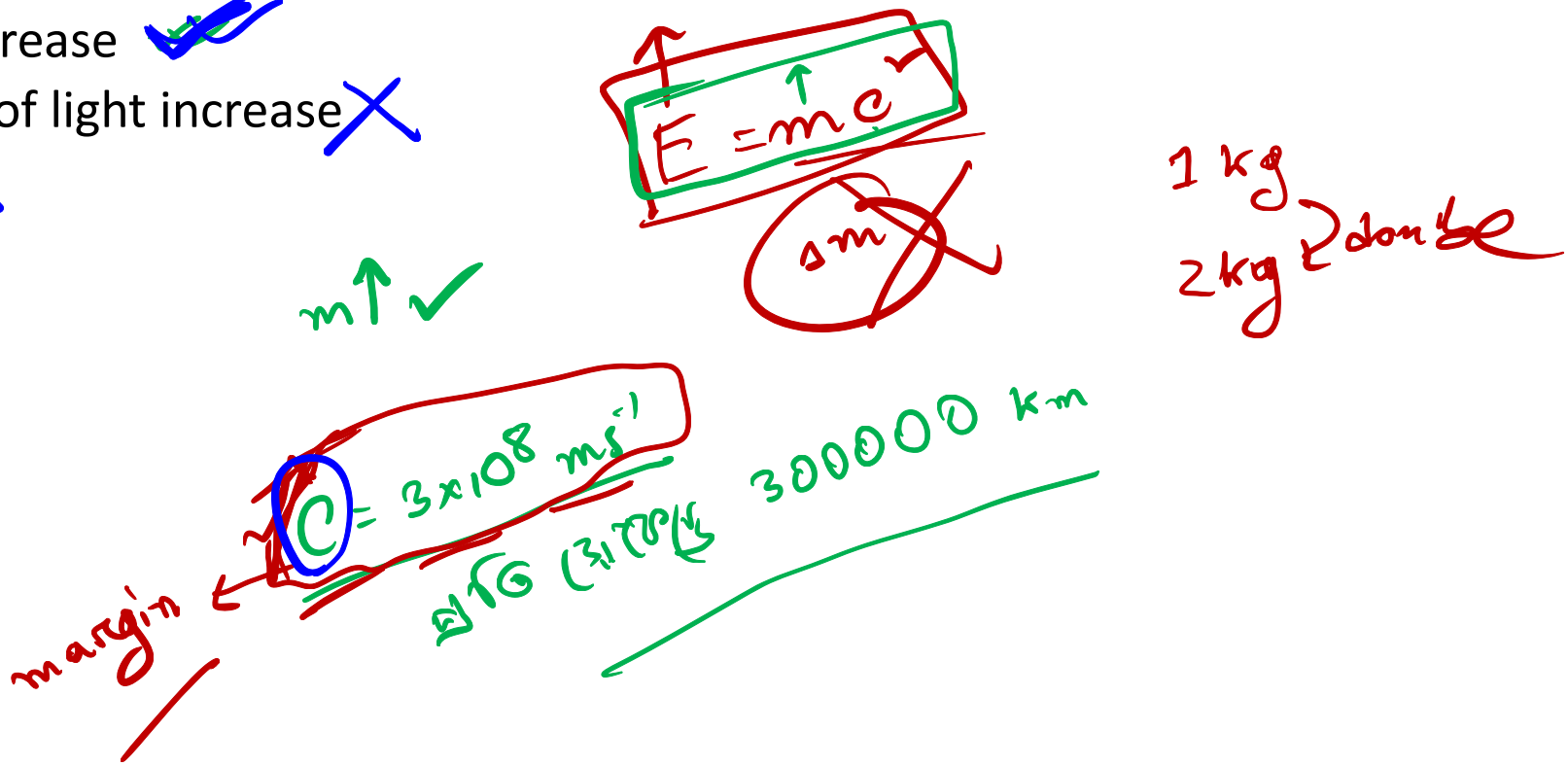
$$^{1}_{0}n + {}^{235}_{92}U \rightarrow {}^{92}_{36}Kr + {}^{141}_{56}Ba + 3{}^{1}_{0}n$$

+Binding Energy

This type of reaction is called Chain Reaction.

Poll-01

- **According to Mass-Energy relation, the energy will increase if:**
  - A) Mass increase
  - B) Velocity of light increase
  - C) a + b
  - D) None



Power:

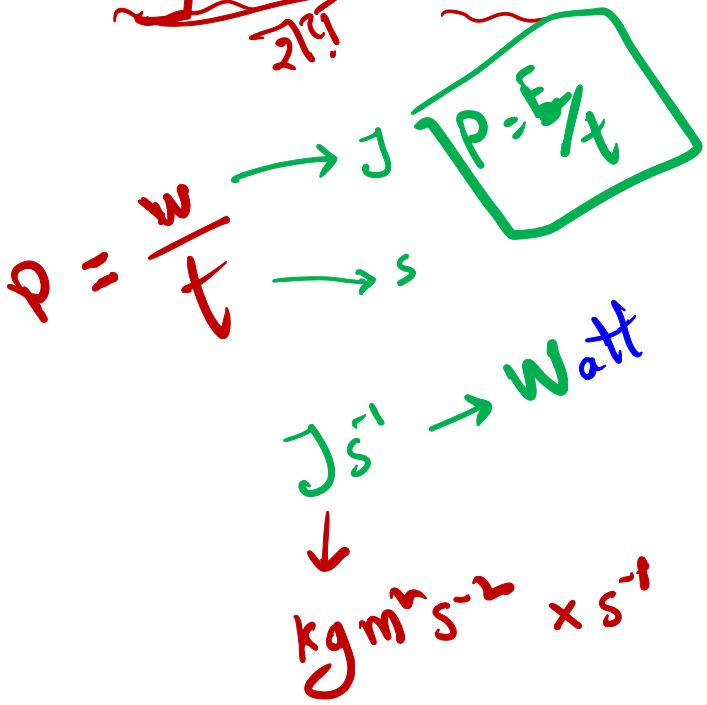
The rate of work done or energy transformation is known as Power.

We know,

$P = W/t$

Unit: W or Watt.

Dimension: $[P] = [ML^2T^{-3}]$.



$P = E/t$

$W = Pt = Fs = mgh$

Energy = Work

$E_p \rightarrow mgh$

$E_k \rightarrow \frac{1}{2}mv^2$

$W = mgh = \frac{1}{2}mv^2$

What is the meaning of 100W sticker on a Bulb?)

Power

→ The light is spending 100 J energy / creating heat & light energy in each second .

$100 = P = \frac{W}{t}$ → 100, 1

200 50 500

2 ½ 5

500 tk

80% ✗

400 tk

100 tk

Current → heat + light

100J

20J 80J

লাভ T-shirt

$\frac{80}{100} \times 100\% = 80\%$

Efficiency: * Symbol→ η (Eta)

300 taka
60 taka
$\eta = ?$
$\frac{240}{300} \times 100\% = 80\%$

The ratio of effective power & supplied power or the ratio of effective work done & supplied work done is known as Efficiency.

$$\text{Efficiency} = \frac{amount\ of\ work}{energy\ given} \times 100\% = \frac{amount\ of\ work - energy\ wasted}{energy} \times 100\%$$

400
(100 tk)
500
$\eta = \frac{400}{500} \times 100\% = 80\%$

400 taka টি-শার্ট
200 taka দিয়ে T-shirt কিনলো
$\frac{200}{400} \times 100\% = 50\%$

$g = 9.80665\ ms^{-2}$ $= 9.8$

Mathematical Problems

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

❖ If an object of mass 10kg is lifted 10m in 15s using a motor of 1000 W, then what is the amount of energy wasted? Efficiency = ?

$m = 10kg$

$h = 10m$

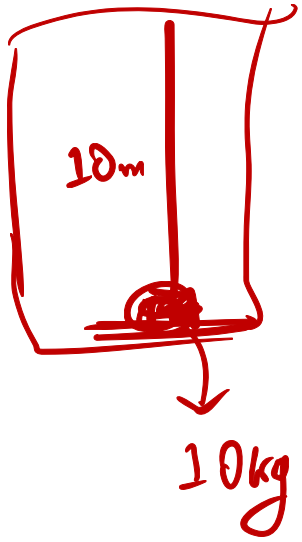
$t = 15s$

$P = 1000\ W$

Workdone $= mgh$

$= 10 \times 9.8 \times 10$

$= 980$ Joule



expected, Workdone $= Pt$

$= 1000 \times 15$

$= 15000J$

Energy wasted $= (15000 - 980)$

$= 14020$ Joule

$\left\{\frac{\text{T-shirt মাহর}}{\text{given money}} \times 100\% = \frac{980}{15000} \times 100\%\right.$

$= 6.533\%$

Poll-02:

❖ **If 20% energy is wasted in every step, what will be the efficiency in 6 steps?**

9% a) 262.1%

31% b) 26.2%

25% c) 0.0064%

35% d) 12%

100 এর 80% → 80 এর 80% → 64

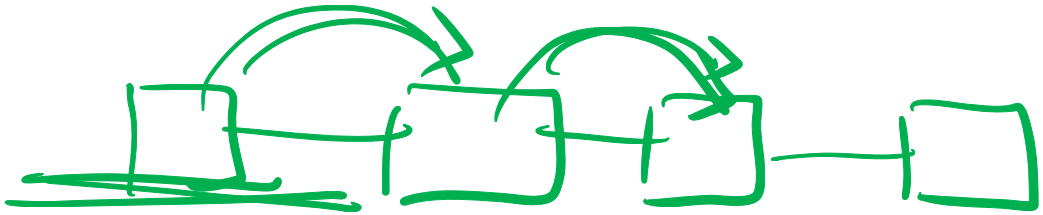
100 × 0·8

80 × 0·8

⇒ 100 × 0·8 × 0·8 × 0·8 × 0·8 × 0·8 × 0·8

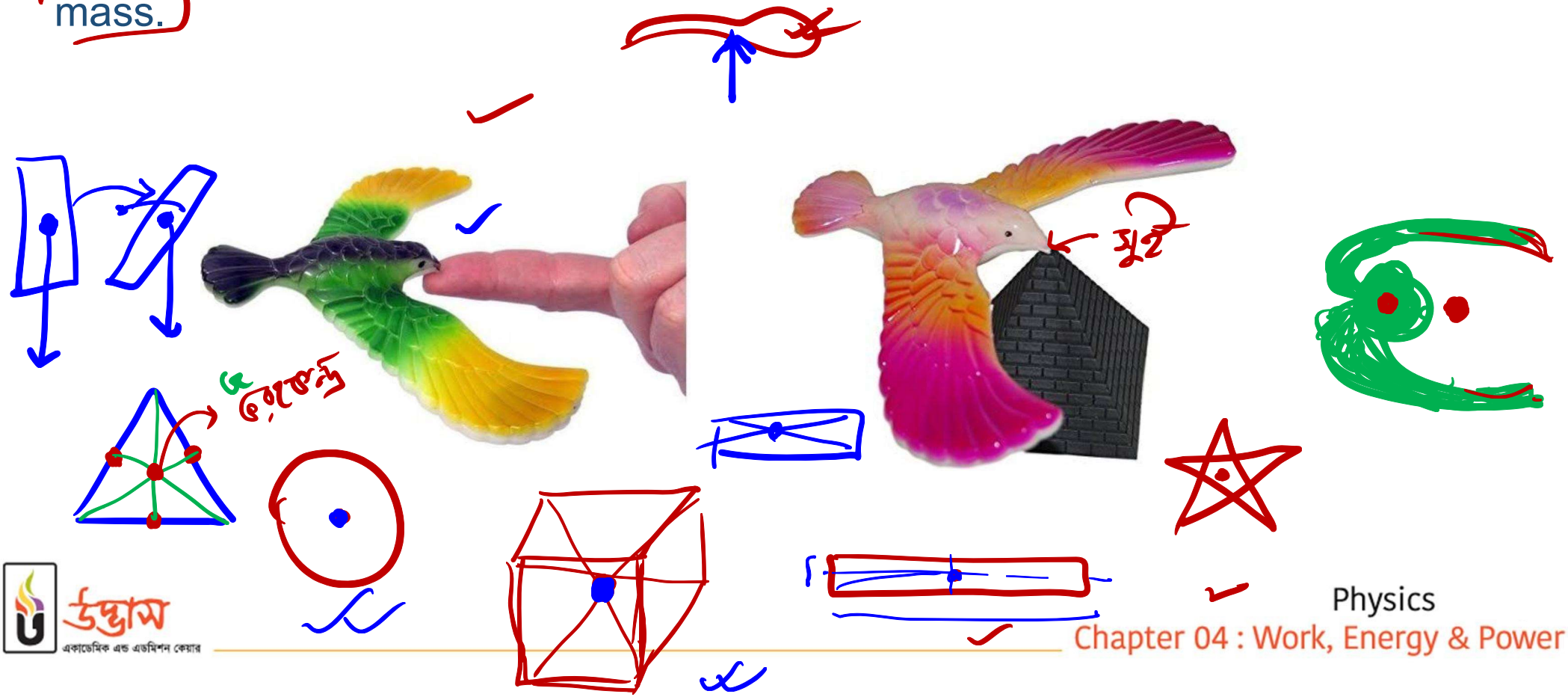
3rd 4th 5th 6th

⇒ 26·2



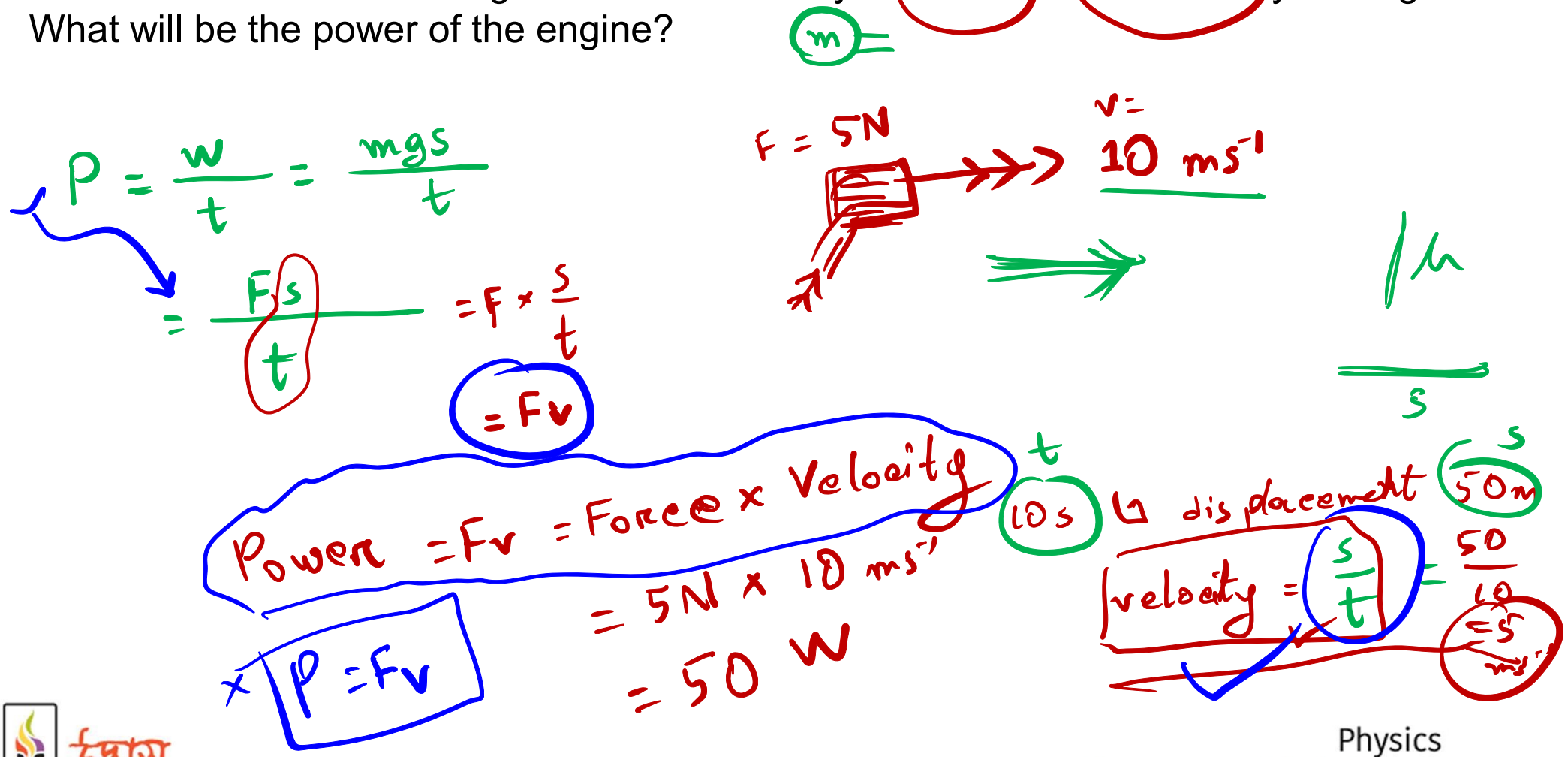
Centre of Mass:

** The point of an object where the whole mass is centralized is called centre of mass.



Mathematical Problem

❖ The water of a well is being thrown at a velocity of 10 m/s & Force 5 N by an engine. What will be the power of the engine?



1 HP = 746 W

8.167 W → ?? HP

746 W = 1 HP

1 W = 1/746 HP

∴ 8.1677 W = 1 × 8.167 / 746 HP = 0.0109473 HP

Mathematical Problem

❖ The water of a well is being lifted by an engine for 2 min. Depth of the well is 10m & total mass of water is 5kg. Efficiency is 50%, What will be the supplied horse power of the engine?

$t = 2\text{min} = 120\text{ s}$

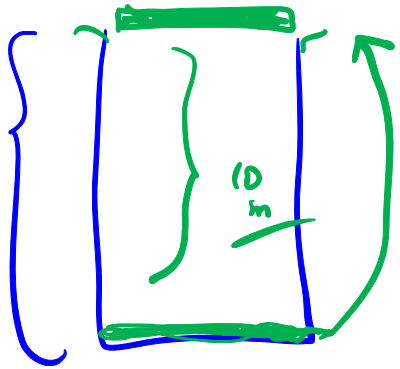
$h = 10\text{ m}$

$m = 5\text{ kg}$

$\eta = 50\%$

gained, $P = \frac{mgh}{t} \left(= \frac{W}{t}\right) = \frac{5 \times 9.8 \times 10}{120}$

$= 4.0833\text{ W}$



$\eta = \frac{\text{tshirt পাওয়ার}}{\text{given money}} \times 100\%$

$50\% = \frac{4.0833}{\text{given mney}} \times 100\% \Rightarrow 1 = \frac{4.083}{\text{given m}} \times 2$

given money = 8.1667 W

tshirt পাওয়ার = 4.0833 W

Supplied power = 8.167 W

1 ft →

① Horse Power is a unit of Power.

unit → W

1 H.P = 746 Watt

Special Problem:

Q. What will be the work done to lift a 2kg mass brick (10m x 8m x 2m) from its horizontal position to vertical position?

Work = mgh → displacement of the center of mass

$= 2 \times 9.8 \times (h_2 - h_1)$

$= 2 \times 9.8 \times (5 - 1)$

$= 78.4\,J$

না বুঝে মুখস্থ করার অভ্যাস প্রতিভাকে ধ্বংস করে।