Chapter 5
Work and Energy

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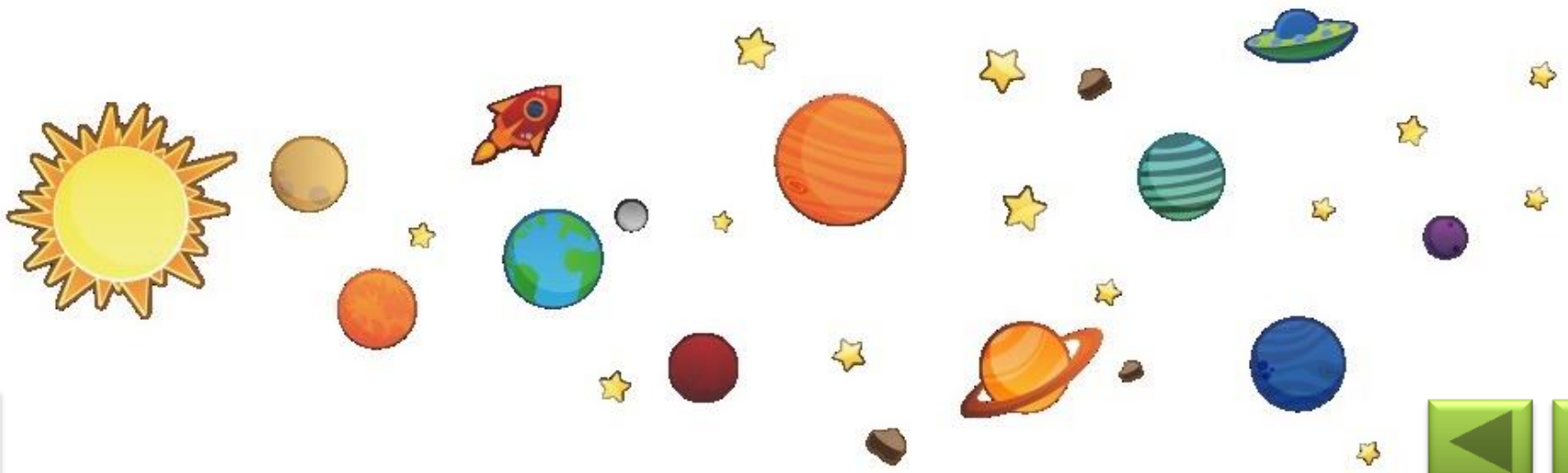
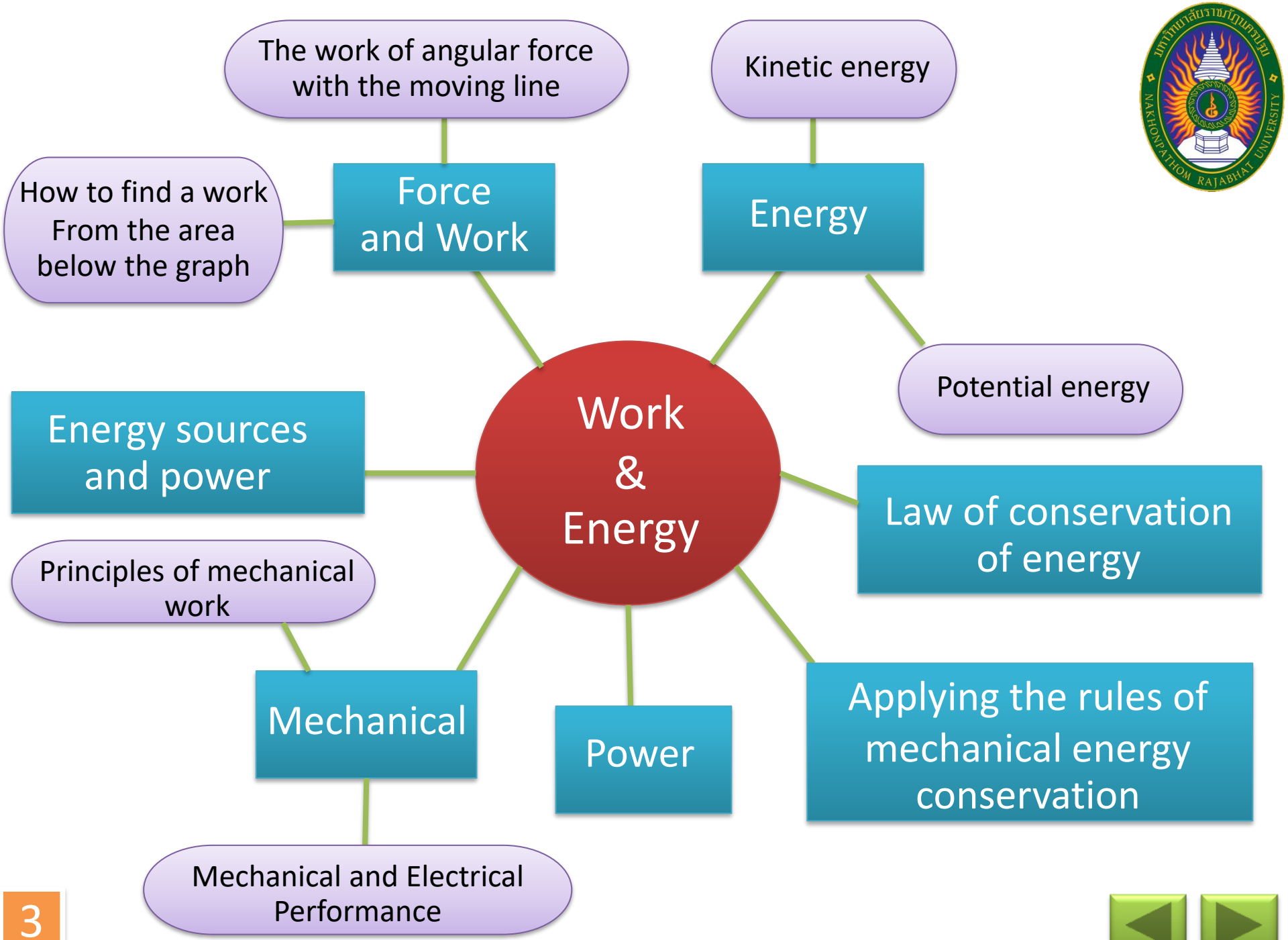
Contents 5 Energy

- Standard SC 5.1 Understand the relationship between energy and living. energy conversion Interactions between substances and energy the effect of energy on life and the environment is the process of inquiry. Communicate what is learned and Bring knowledge to use

- Indicators secondary education number 1 Describe the kinetic energy. Gravitational potential energy conservation rules and the relationship between these quantities. Include the knowledge to use.

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Force and Work

Energy

Law of conservation of energy

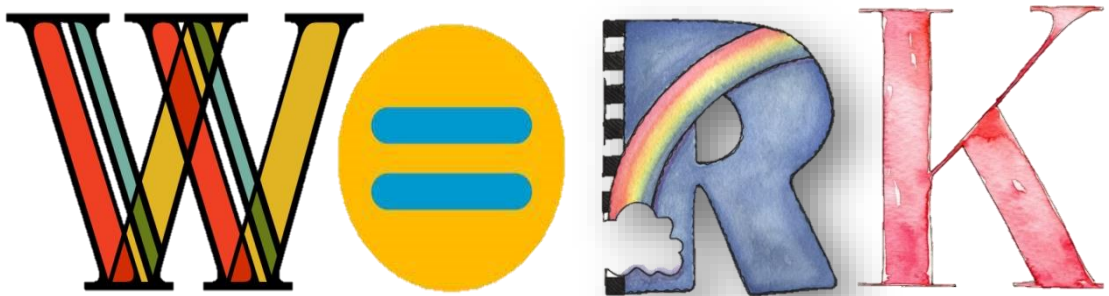
Applying the rules of mechanical energy conservation

Power

Mechanical

Energy sources and usage power

The work of angular force with the moving line

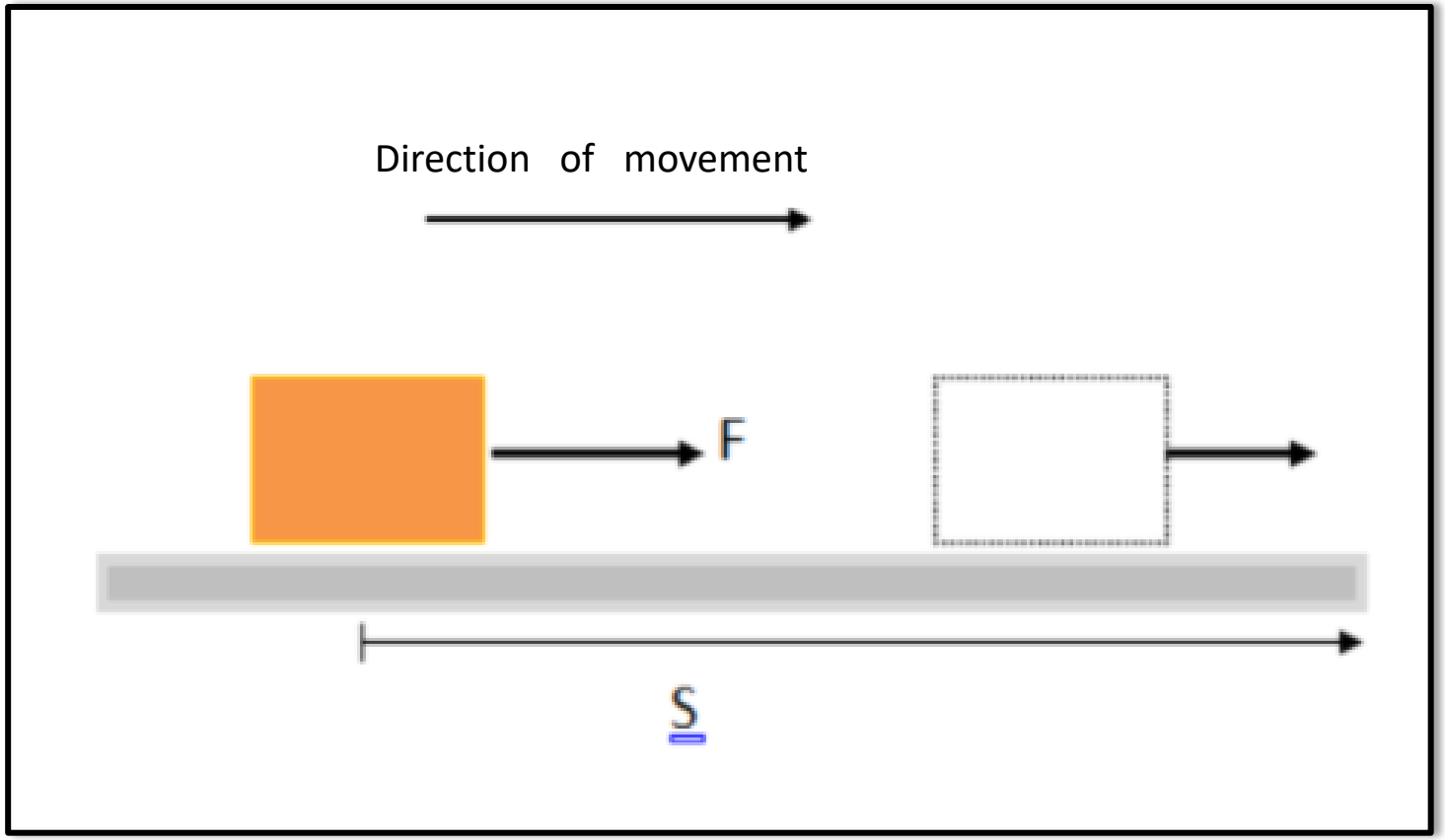


The force of act on objects and move the object along the line

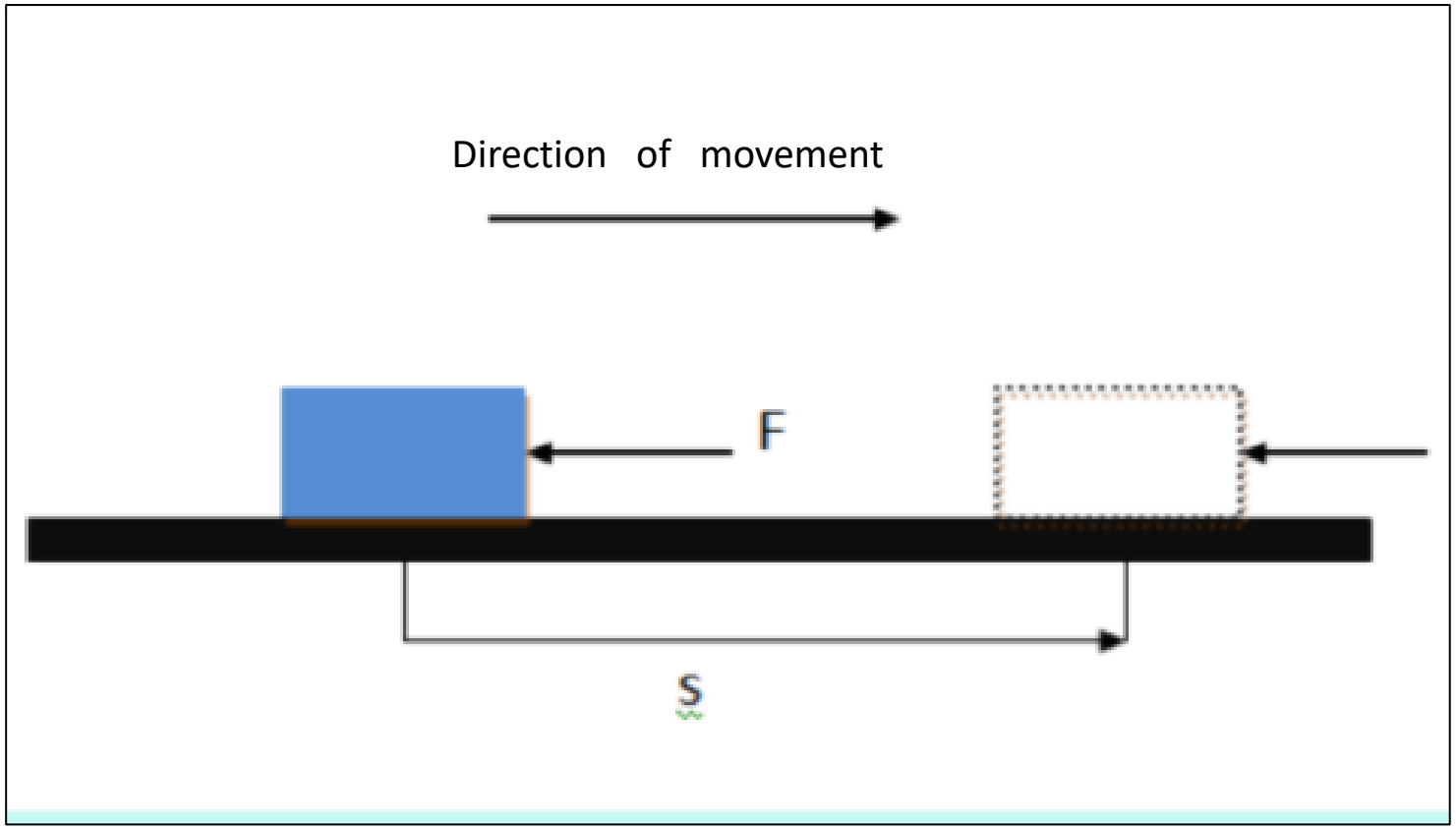
$W = F \cdot s$

W = Work (J)
F = Force of act on objects (N)
s = The displacement of the object in line with the force (m)

$$W = F \cdot s$$



$$W = -F \cdot s$$



Exert force 10 N drag a box to movement with steady speed on the floors in horizontal line with friction find

A. work of force drag a box

B. Work of friction if displacement is 3 m

F = 10 N

s = 3 m

W = ?

A. $W = F \cdot s$

$= (10)(3)$

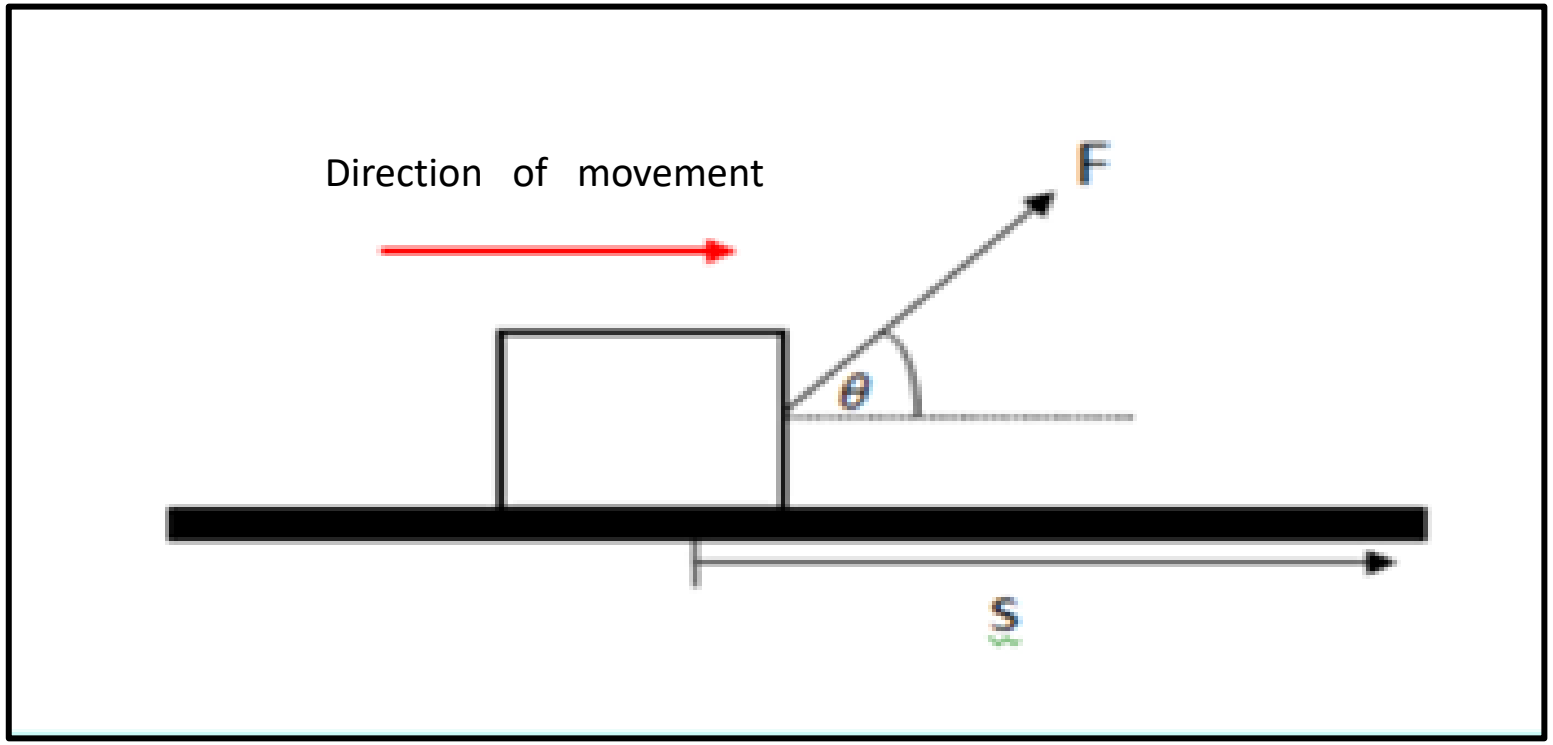
$= 30$ J

B. $W = -F \cdot s$

$= -(10)(3)$

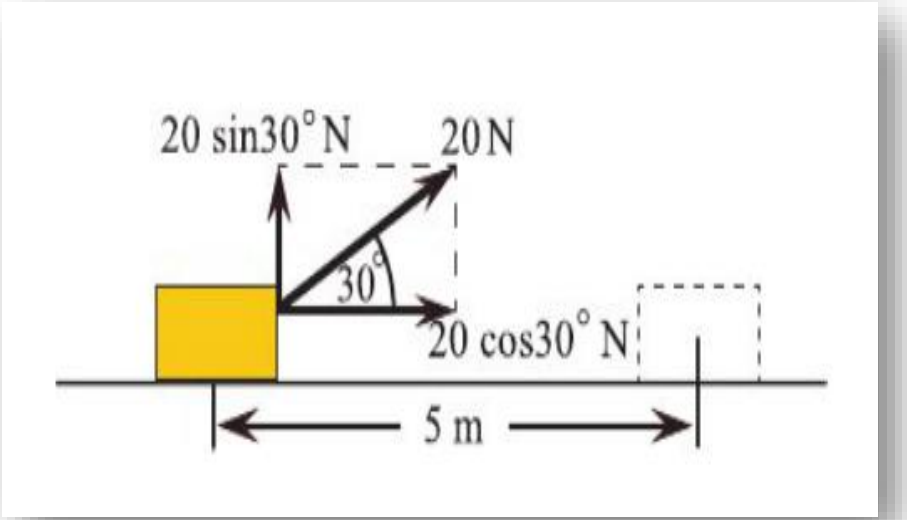
$= -30$ J

$$W = F \cdot s \cos\theta$$



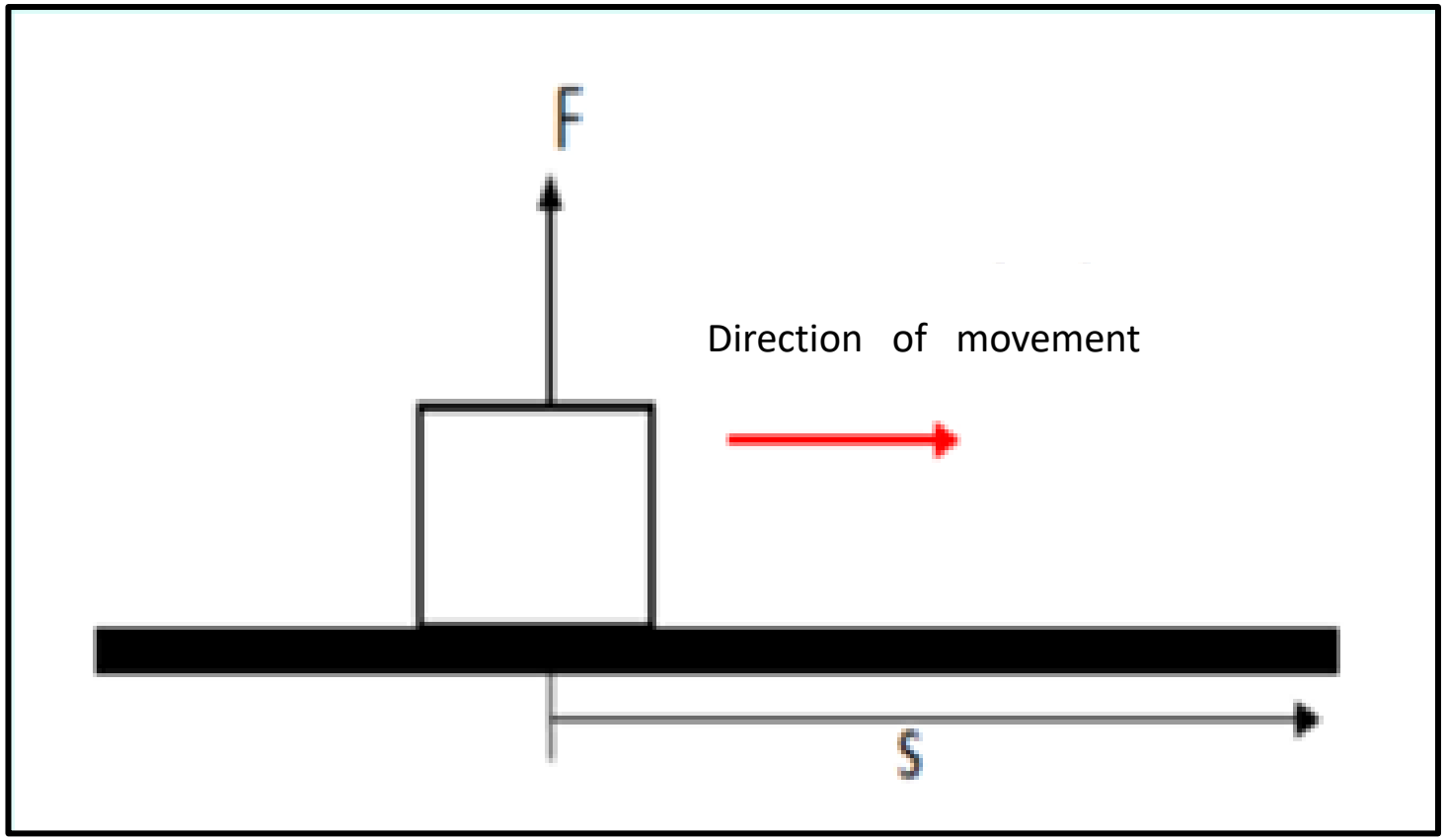
Exert 20 N drag a box to movement on the floors in horizontal line displacement is 5 m if exert corner 30 ◦ with horizontal line. What is the work of force drag a box.

$F = 20\ N\ ,\ s = 5\ m\ ,\ W = ?$



$$W = F \cdot s \cos\theta$$
$$= (20)(5)\cos 30^\circ$$
$$= (20)(5)(0.866)$$
$$= 86.6\ J$$

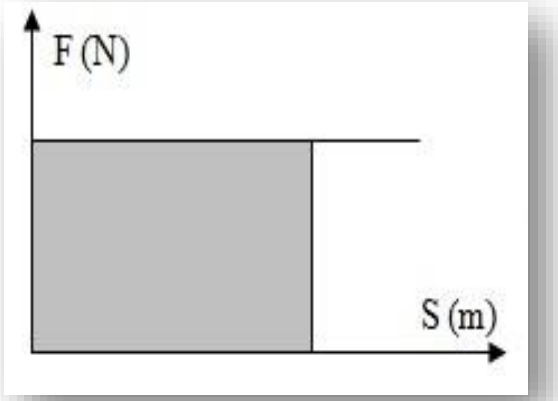
W = 0



How to find a work from the area under the graph ?

Graph show the relationship between force and displacement let know work From the area below the graph ass follows.

1



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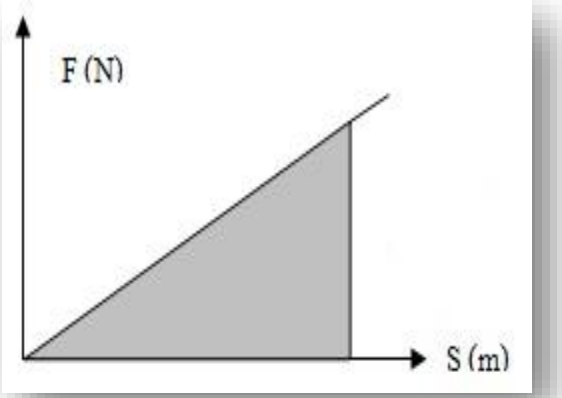

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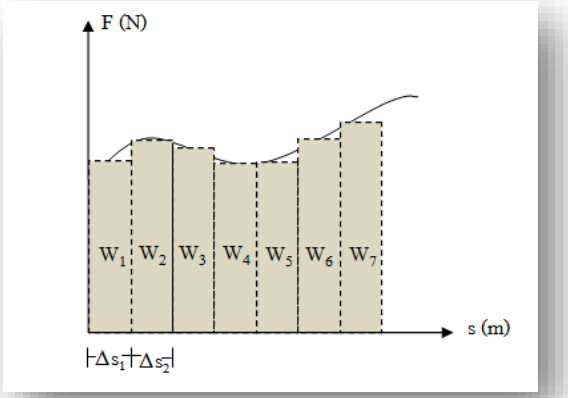
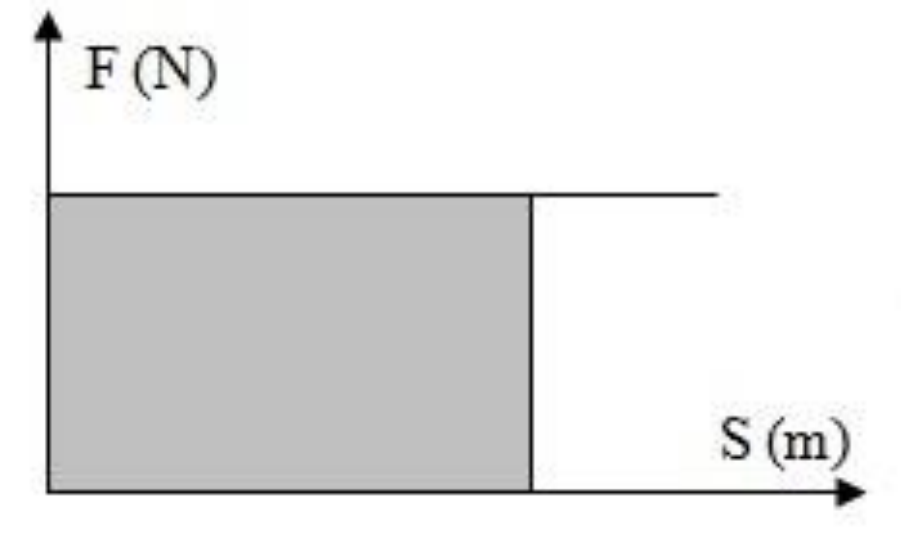


1 Force is constant

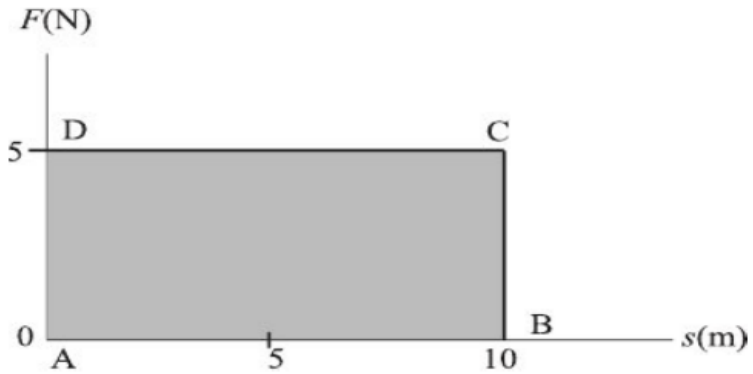
When there is constant force on the object, the object moves. By force acting in the same direction as displacement.



Area under the graph = wide × long

$$W = F \cdot s$$

Find the work of the 5 N constant force that moves the object 10 m distance.



F = 5 N
S = 10 m
W = ?

Area under the graph = wide×long

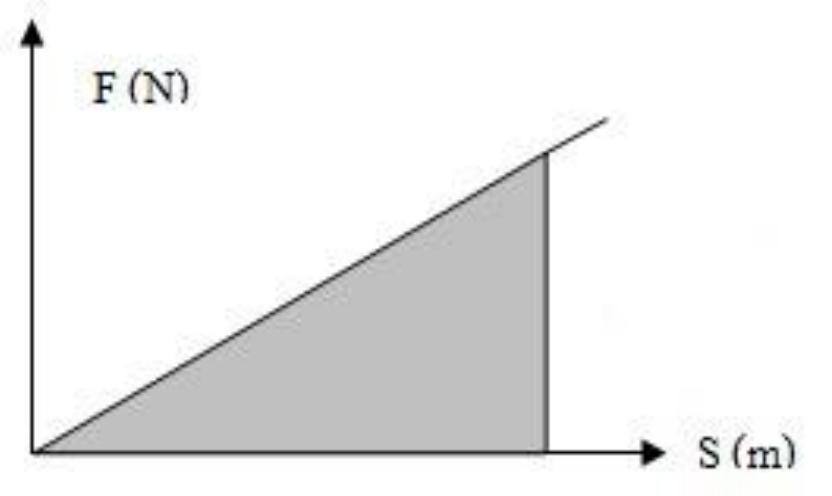
$W = F \cdot s$

$= (5)(10)$

$= 50$ J

2 Force action increases or decreases regularly.

The force acting on the object is not constant. The graph is as follows.



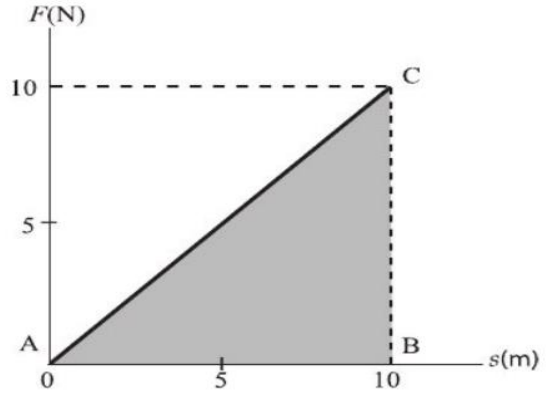
Work = Average force × displacement

or

Area under the graph = $\frac{1}{2}$ × high × base

$W = \frac{1}{2} \times F \times s$

Increased force from 0-10 N makes the object moving. There is a 10 m displacement find a work.



Average force = 0-10 N

s = 10 m

W = ?

Method 1 W = Average force × s

$= \left(\frac{0+10}{2}\right)(10)$

$= (5)(10) = 50$ J

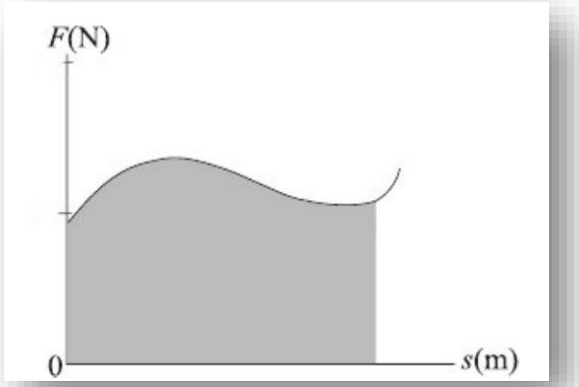
Method 2 consider area under the graph have a triangle ABC

$W = \frac{1}{2} \times F \times s$

$= \frac{1}{2}(10)(10)$

$= (5)(10) = 50$ J

3 Unstable force

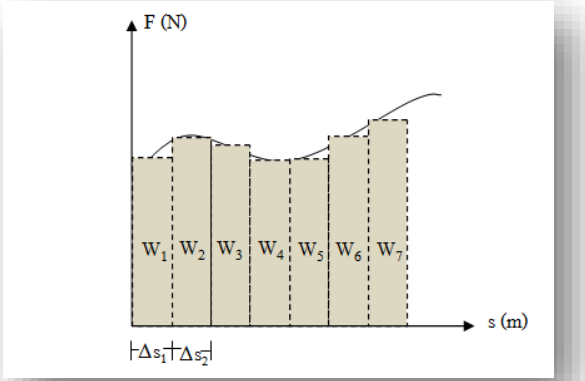


$$W = F_1\Delta s_1 + F_2\Delta s_2 + F_3\Delta s_3 + \ldots + F_n\Delta s_n \; ; \Delta s = \frac{s}{n}$$

$$W = (F_1 + F_2 + F_3 + \ldots + F_n)\Delta s$$

$$= (F_1 + F_2 + F_3 + \ldots + F_n)\frac{s}{n}$$

$$= \frac{(F_1 + F_2 + F_3 + \ldots + F_n)}{n} s$$

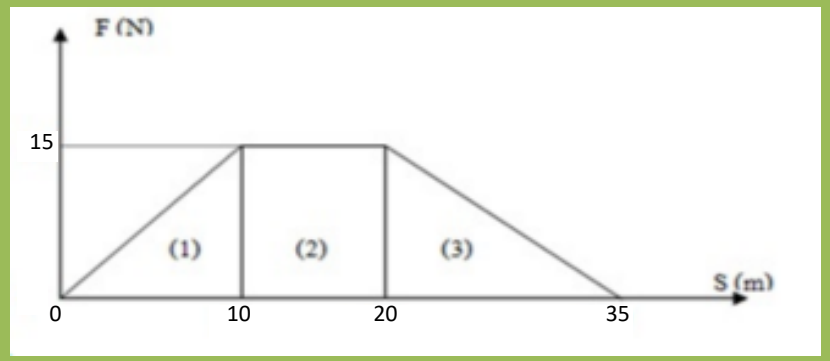


Work = Average force × displacement

or

Work = Sum sub-work

Find the work from the graph below.



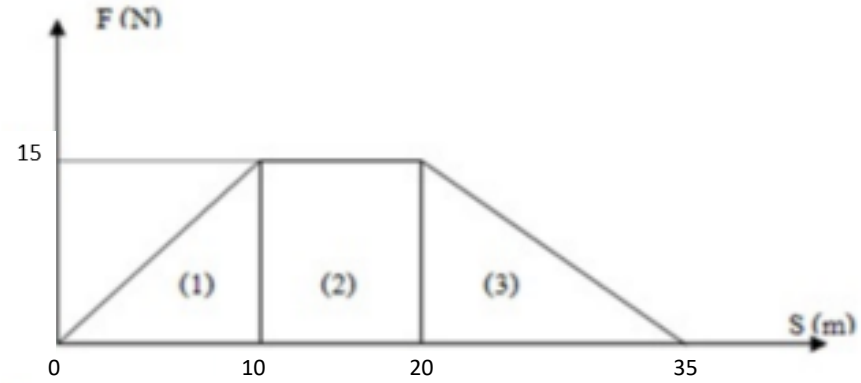
Method 1 Work = Area under the graph

$W = Area(1)+Area(2)+Area(3)$

$W = (\frac{1}{2} \times 15 \times 10)+(15 \times 10)+ (\frac{1}{2} \times 15 \times 15)$

$W = 75 + 150 + 112.5$

$W = 337.5\ J$



Method 2 Work = Area under the graph

W = Area of a Trapezoid

$W = \frac{1}{2} \times$ Sum of parallel $\times$ high

$W = \frac{1}{2} \times (10+35) \times 15$

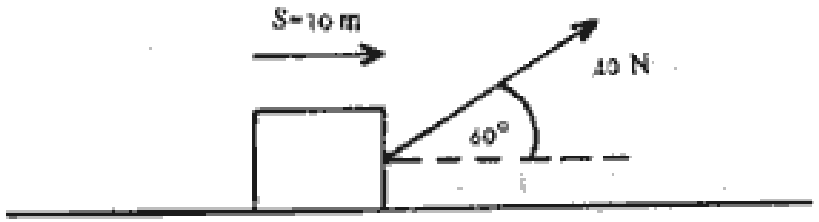
$W = 337.5$ J

Exercise s

1. Exert 40 N pulls the object flat on a flat surface in a 60 ° angle to the horizontal. When the object moves flat, it is 10 m away. Find a work does the object pull ?

Answer

$F = 40\ N,\ s = 10\ m,\ \theta = 60^{\circ}$



จาก $W = F s \cos\theta \quad (\theta = 60^{\circ})$

$= 40 \times 10 \times \frac{1}{2}$

$\therefore W = 200\ J.$

AMAZING ENERGY FACTS

Ability to work and The unit is Joule (J)

it's scalar quantity

divide into
- Kinetic energy
- Potential energy

Kinetic energy

Potential energy

What is kinetic energy?

- Kinetic energy is the energy an object has because of motion.

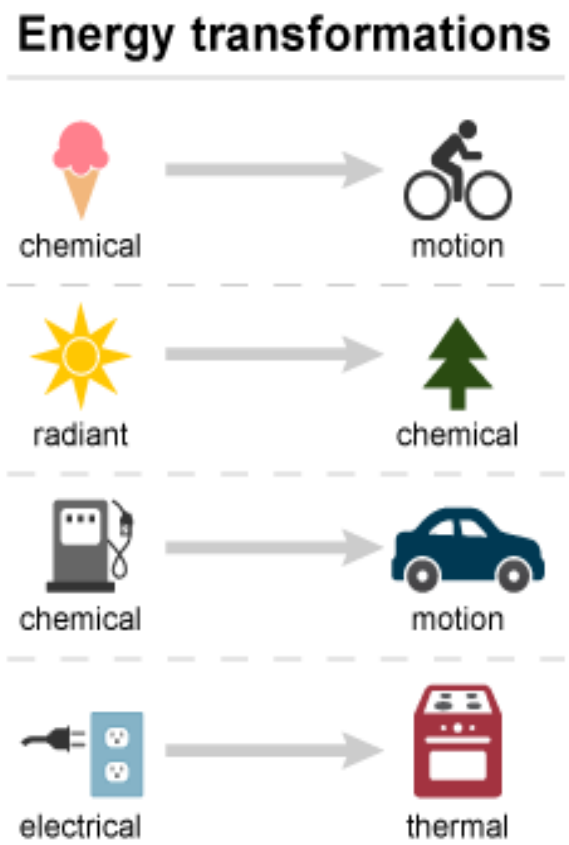
What is potential energy ?

- The energy of the object is related to the position.

MENU

Law of conservation of energy

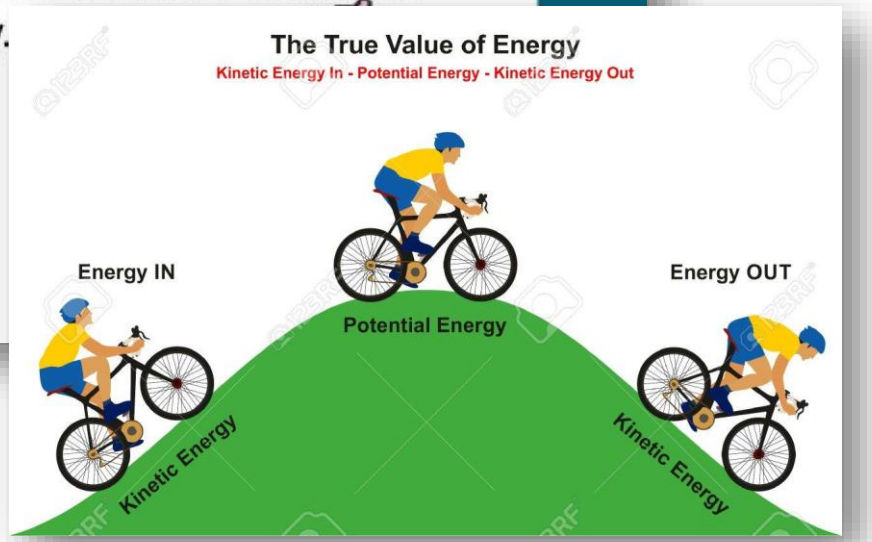
"Energy cannot be created or destroyed it only can be transformed from one form into another"



MENU

Law of Conservation of Energy

- It states that the total amount of energy in an isolated system remains constant over time (is said to be conserved over time).
- A consequence of this law is that energy can neither be created or destroyed: it can only be transformed from one state to another.
- The only thing that can happen to energy in a closed system is that it can change form: for instance chemical energy can become kinetic energy.
- As stated by Sir Isaac Newton



Applying the rules of mechanical energy conservation

- Movement of the circle vertically.
- Simple harmonic motion.
- Movement under the gravitational field.

MENU

POWER

Quantities that indicate the ability to work per unit time.

$$P = \frac{W}{t}$$

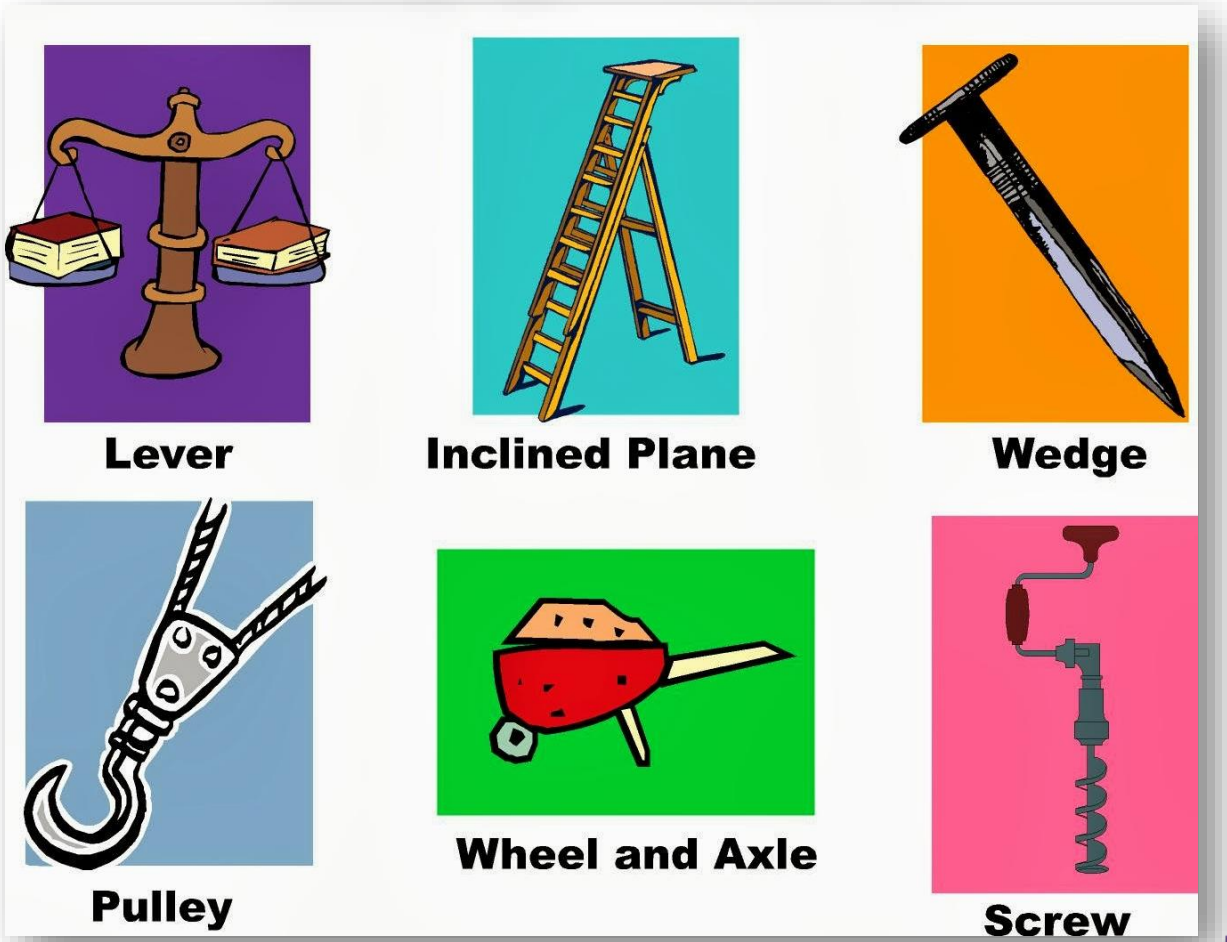
P = Power

W = Work done

t = Time taken

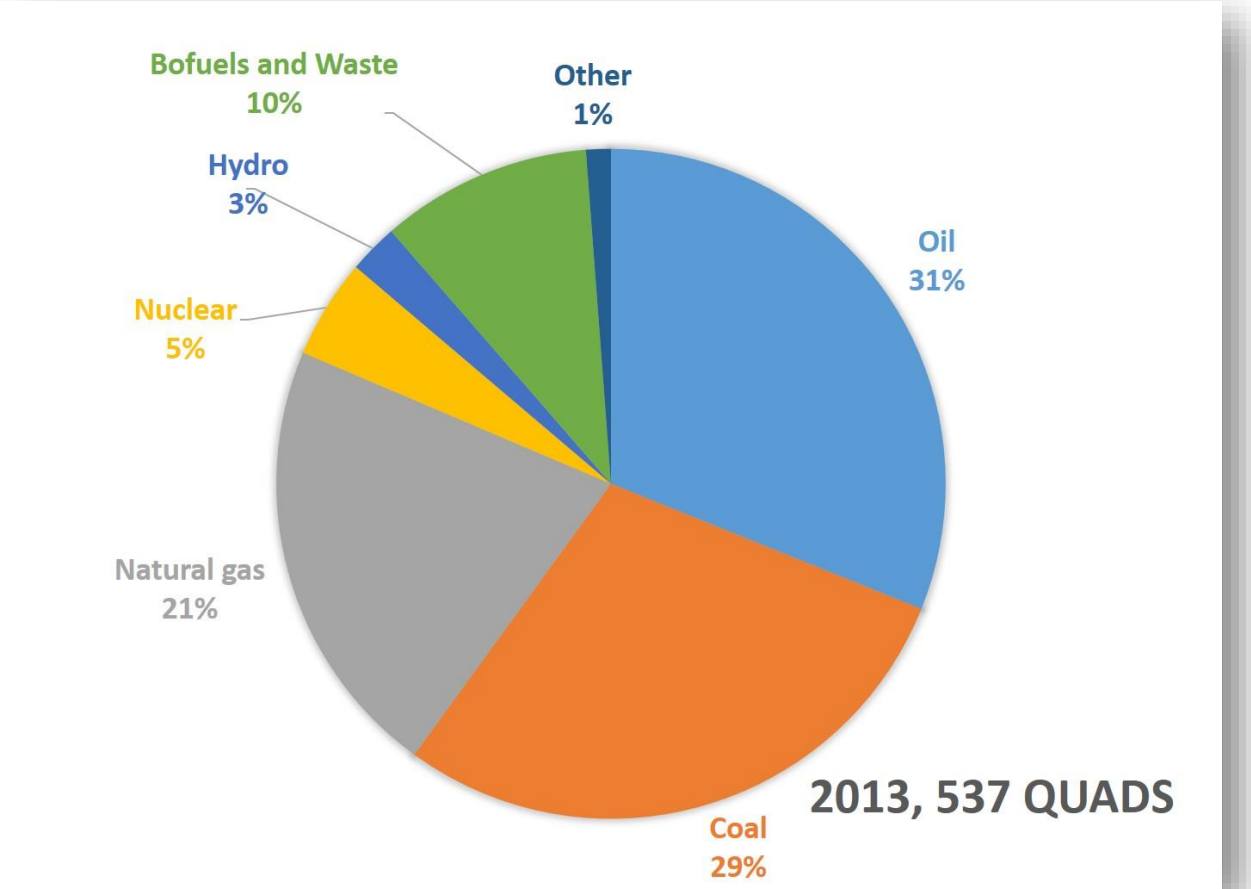
MENU

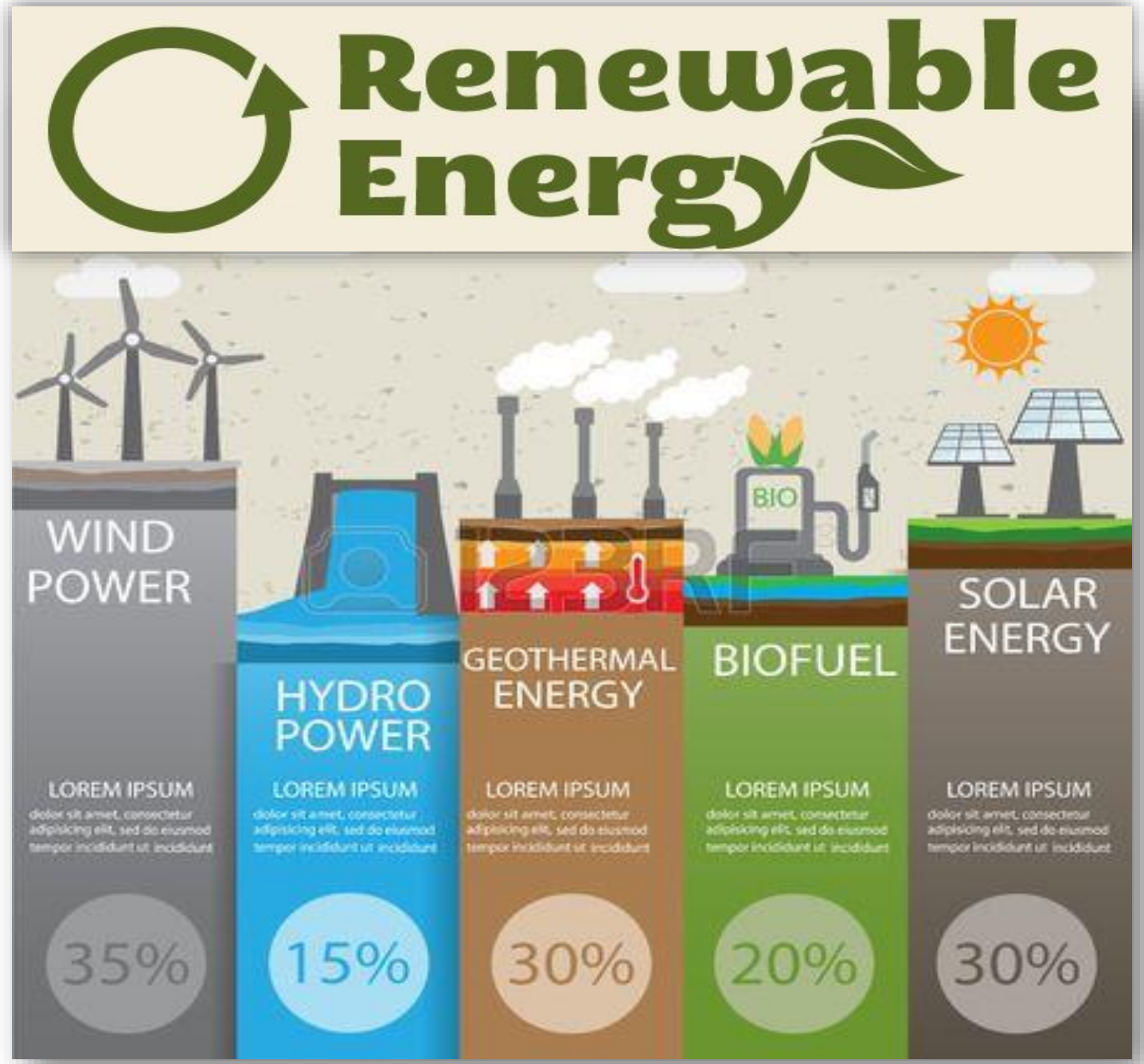
SIMPLE MACHINES



MENU

Energy sources and usage power




Renewable Energy
WIND POWER
LOREM IPSUM
dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut incididunt
35%
HYDRO POWER
LOREM IPSUM
dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut incididunt
15%
GEOTHERMAL ENERGY
LOREM IPSUM
dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut incididunt
30%
BIO
BIOFUEL
LOREM IPSUM
dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut incididunt
20%
SOLAR ENERGY
LOREM IPSUM
dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut incididunt
30%

MENU

The End !!