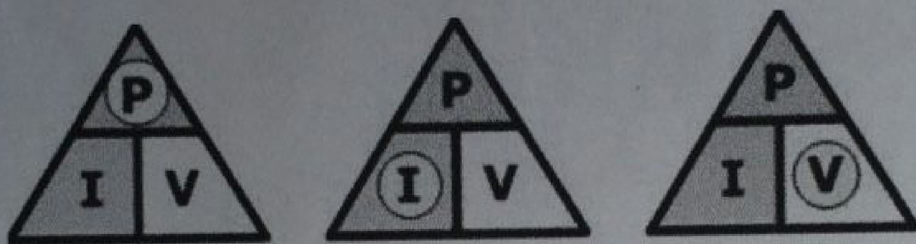
Answer Key

Booklet # 42



$P = I \times V$ $\quad I = \frac{P}{V}$ $\quad V = \frac{P}{I}$

Trimester 2 || Main Topic: Energy || Unit: Work

Date: Dec 09, 2015 || Name --Answer Key--

1 Do-now:

I. Please read and sign on the "Welcome to Trimester # 2" Letter. (Please rip it out from the booklet and return it to me).

N/A

II. How can you describe the motion of an object such as Mr. Bari's Bike?

Using the 4 properties of kinematis: position, time, velocity, acceleration.

III. How can you Explain the motion of an object such as Mr. Bari's Bike?

Using the properties of Dynamics such as Newton's 3 laws of motion.

IV. Is there anyway we can describe and explain the motion of Mr. Bari's bike by not using Kinematics and Dynamics?

Yes, by work & energy – especially kinetic energy

$Fd = W = \boxed{KE = \frac{1}{2} mv^2}$

2

2a. In order to understand this work-energy approach to the analysis of motion, it is important to first have a solid understanding of a few basic terms:

I. **Mechanical energy**: sum of kinetic & potential energy

II. **Potential energy**: energy object has due to its position

III. **Kinetic energy**: energy of object due to its motion

IV. **Power**: power is the rate of done work. SI unit is watt

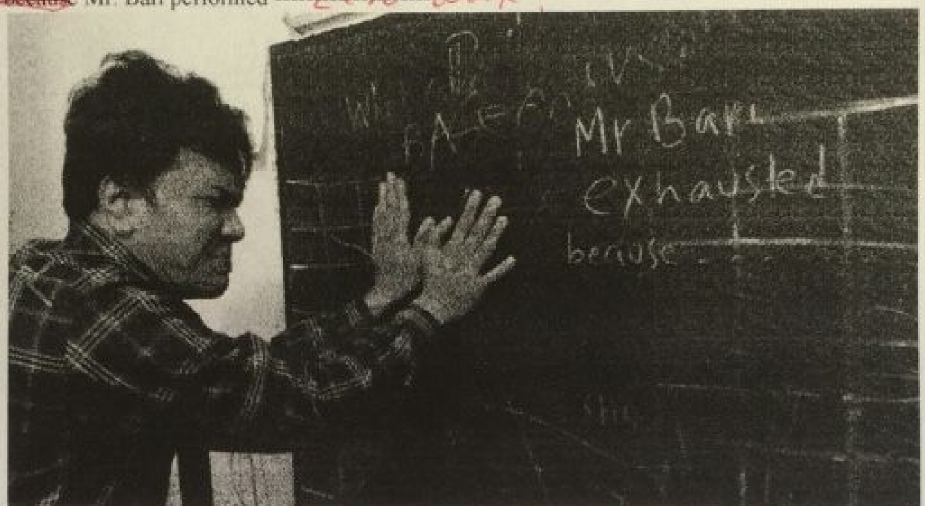
2b. Write three main properties of work.

When a force acts upon Jevon Bike it cause a ------$\vec{d}$------------------of his bike, it is said that ~~work~~---- was done upon the Bike. There are three key *ingredients* to work -

(a) force,
(b) displacement,
(c) and cause (force must cause the displacement)

In order for a ---$\vec{F}$---------- to qualify as having done ------Work---------on a Bike, there must be a ----------$\vec{d}$-----of Jevon Bike and the force must cause-----the displacement. There are several good examples of work that can be observed in everyday life: Jevon is moving faster and faster!

3	Example # 1
	Mr. Bari applies a force to a wall and becomes ----exhausted but ~~because~~ Mr. Bari performed ----zero----work!



This is not an example of work because Mr. Bari's wall is not displaced. A $\vec{F}$ must cause $\vec{d}$ in order for W to be done.

5	Example # 3
	Sam's bike accelerates through space and time!! Sam has performed ---work

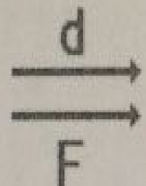
Yes, this is an example of work. There is a $\vec{F}$ which cause ~~the~~ Sam's bike to be displaced through space-time.

7 Mathematics of Work

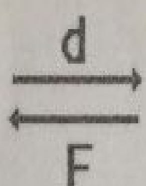
Mathematically, work can be expressed by the following equation:

$$W = Fd \cos\theta.$$

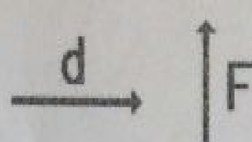
Perhaps the most difficult aspect of the above equation is the angle "theta." The angle measure is defined as the angle between the force and the displacement. To get an idea of it's meaning, consider the following three scenarios.



Θ=0 degrees, $\cos 0^\circ = 1$



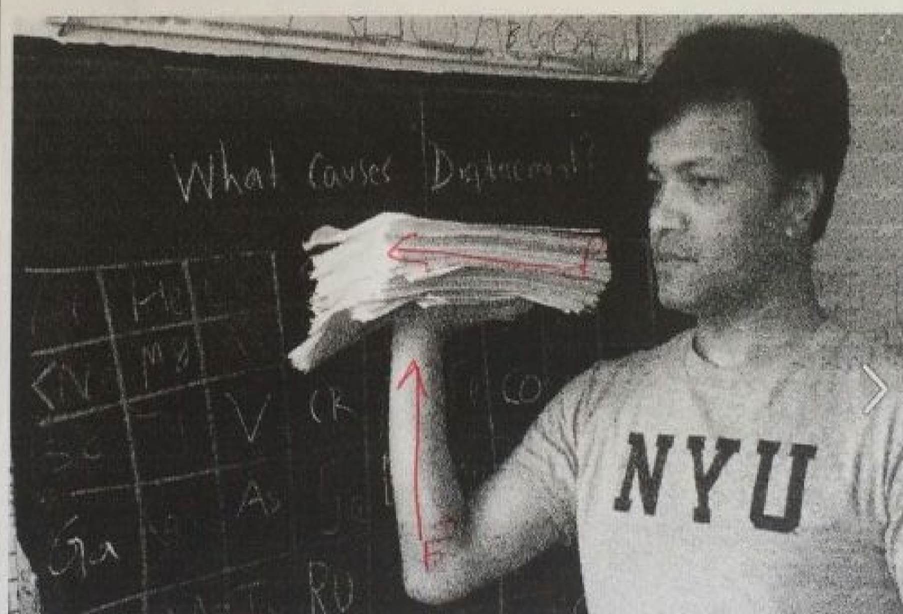
Θ=180 degrees, $\cos 180^\circ = -1$



Θ=90 degrees, $\cos 90^\circ = 0$

7	Describe Scenario A , B and C
	Scenario A: $\vec{F}$ & $\vec{d}$ acts same direction so, the angle b/w them is 0°, $\cos 0^\circ = 1$ Scenario B: $\vec{F}$ & $\vec{d}$ acts different direction — so, angle b/w them is 180° $\cos 180^\circ = (-1)$ Scenario # C: $\vec{F}$ & $\vec{d}$ are acts perpendicular to each other, making angle 90°

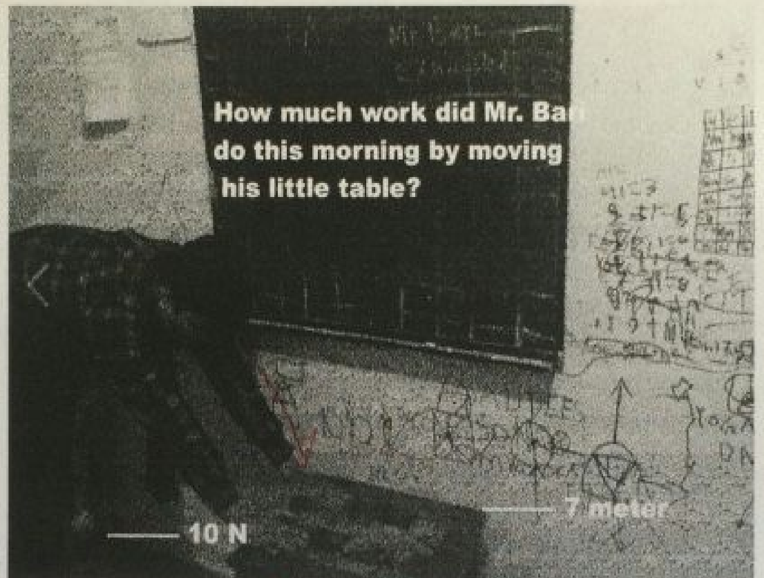
$\cos 90^\circ = 0$

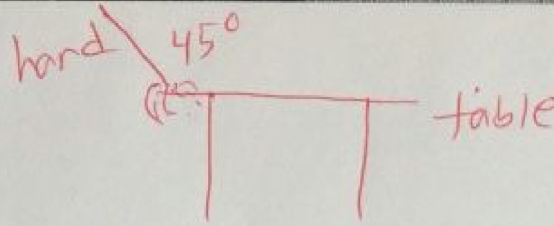
10	**What *Causes* Displacements? Let's explore Scenario C again!**
	
	$\vec{F} \perp \vec{d}$, so, $\cos 90^\circ$, which is (0)

11	To Do Work, Forces Must *Cause* Displacements!
	let's consider Box #10 in more detail: scenario C involves a situation similar to ~~the~~ Mr Bari carried a book above his head by one arm straight accross the room at constant speed.

12	Assessment
	1.What is work? → Force is said to do work if, when acting on a body, there is displacement in the direction of force. **2. What is force?** → is an interaction, when unopposed, will change the motion of an object. **3. What is energy?** → ability to do work.

13	Let's do math!





$W = Fd \cos\theta$

$= (10N)(7m) \cos 45°$

$= 70j (.70)$

$= 49.49j$

14	Homework (This is the challenge of Trimester # 2)
	This morning, Mr. Bari ran out of gas - and started pushing his car. He appli 10 Newtons for a distance of 10 meters. Find the velocity.  Note: Don't solve it. Just think about it. How can we use the biggest equation of Tri # 1(F= ma) and mix it with the biggest equation of Tri # 2 (W= FD) in order to find the Kinetic Energy Equation.

Tri #1

$F = ma$

$a = \frac{F}{m}$

$V_f^2 = V_i^2 + 2ad$ ($V_i^2 \to 0$)

Tri #2

$W = Fd$

$V_f^2 = 2\left(\frac{F}{m}\right)d$

$V_f^2 = 2\frac{1}{m}Fd$

$(m)\left(\frac{1}{2}\right)v^2 = 2\frac{1}{m}W$ — $\frac{1}{2}(m)$

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

This by definition call Kinetic energy.