Math Studies IB

Period 3

Burn Time and type of Paper.

There are many layers of a tree that make up paper. Just inside the bark the Cambium layer who cells bark the inter wood. The next layer the sapwood carries the sap to nourish the tree. The last layer heartwood, the inner most part of the tree, provides the tree with strength and structure. All of these layers make up tinny fibers that make up the paper we know and use. Paper has been used for thousands of years starting with the Egyptians who took the tapa batch and hit it with a wooden hammer to flatten it. Then paper makers would dip it in pulp to make a "floating mold" (www.paperonline.org), and it spread evenly. Next it was dried and the paper makers would pull the paper into thin sheets, which were used for documentation.

I am going to be taking each piece of paper and burning different sizes of the paper to determine if there is a constant rate of burn. I will be taking 2in by 2in, 4in by 4in and 8in by 8in, and weighing each piece before I burn it. Then I will light one of the corners of the paper and start the time on a stop watch. I will then record each time in seconds. After burning I will place the burnt paper on the scale and weigh how much the paper weights after it is burned. The Types of paper to be tested are: CVS Brand Lined Paper, CVS Construction Paper, Georgia Pacific Computer Paper, Jet Print Photo Paper, and News Press Newspaper.

Math Studies IB

Period 3

Paper Weight in Grams

	2X2			4X4			8X8		
Paper	Weight Before	Weight After	Amount burned	Weight Before	Weight After	Amount Burned	Weight Before	Weight After	Amount burned
CVS Brand Lined Paper	.4g	.2g	.2g	.7g	.2g	.5g	2.4g	.4g*	2.0g
CVS Construction Paper	.3g	.1g	.2g	.9g	.3g	.6g	2.9g	.5g*	2.4g
Georgia Pacific Computer Paper	.3g	.1g	.2g	.8g	.2g	.6g	3.4g	.6g*	2.8
Jet Print Photo Paper	.6g	.2g	.4g	1.7g	.3g	1.4g	6.5g	1.4g*	5.1g
News Press Newspaper	.2g	.1g	.1g	.6g	.2g	.4g	2g	.1g*	1.9g

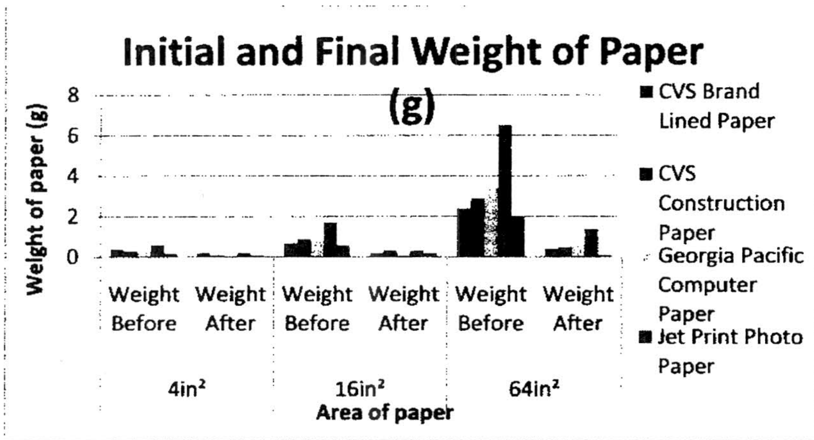
*Since these were bigger pieces of paper I had to switch from a glass dish to a plastic plate.

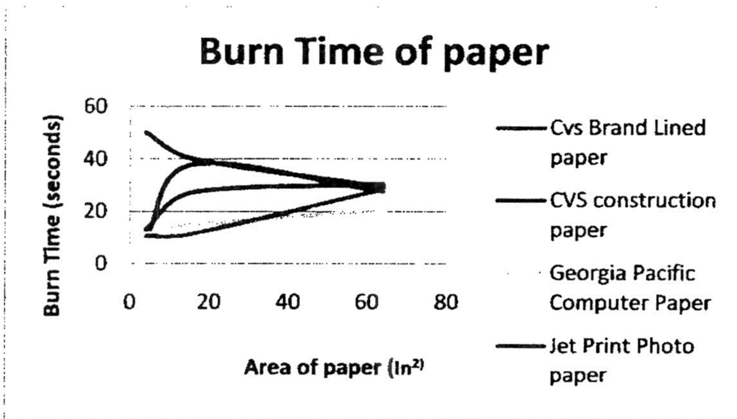
Paper Burn Time in Seconds

Paper	2X2	4X4	8X8
CVS Brand Lined Paper	13.2 Seconds	27.25 Seconds	30.5 Seconds
CVS Construction Paper	10.57 Seconds	37.91 Seconds	27.78 Seconds
Georgia Pacific Computer Paper	11.44 Seconds	15.03 Seconds	20.32 Seconds
Jet Print Photo Paper	50.16 Seconds	40.12 Seconds	29.44 Seconds
News Press Newspaper	10.5 Seconds	11.5 Seconds	28.46 Seconds (did not burn fully)

Math Studies IB

Period 3

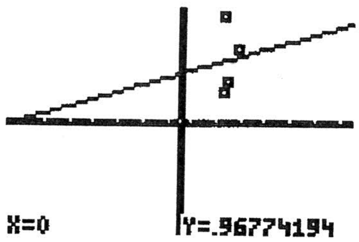




Math Studies IB

Period 3

Linear Regression



LinReg
y=ax+b
a=.4466718774
b=17.79751342
r^2=.3573505265
r=.5977880281

Linear Regression Equation: $y=.447X+17.8$

2-Var Stats
$\bar{x}$=19.174
Σx=95.87
Σx^2=3043.1141
Sx=17.35585434
σx=15.52354805
↓n=5

2-Var Stats
↑$\bar{y}$=26.362
Σy=131.81
Σy^2=4147.4959
Sy=12.96842974
σy=11.59931619
↓Σxy=3065.5211

Math Studies IB

Period 3

Pearson's Correlation Coefficient

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{\sqrt{\sum x^2 - n\bar{x}^2}\sqrt{\sum y^2 - n\bar{y}^2}} = \frac{3065.5211-5(19.174)(26.362)}{\sqrt{3043.1141-5(367.642276)}\sqrt{4145.4959-5(694.955044}} = \frac{538.19616}{898.9733989} = .599 \text{ (3sf)}$$

$r^2 = .359$

$0.25 \leq r^2 < 0.50 = 0.25 \leq 0.359 < 0.50$ = Weak Correlation

Slope - Points:(5, 20.035) (10, 22.27)

$$m = \frac{\Delta y}{\Delta x} = \frac{22.27-20.037}{10-5} = \frac{2.233}{5} = .447 \text{ (3sf)}$$

$y - y_1 = m(x-x) = y-20.035=.447(x-5) = y-20.035=.447x-2.235 = y=.447x+17.8$

+20.035 +20.035

Slope Equation = y=.447x+17.8

During this experiment I found that the burn time does depend on the type of paper used. When I burned the CVS brand lined paper that the biggest jump in how long it took to burn compared to size of paper was between 4in² and 16in². But when the area went up from 16in² to 64in² the burn time did not drastically increase like it had before. The lined paper took a flame almost immediately, burning until the paper turned to ash. Next, the CVS construction paper, just like the CVS brand lined paper seemed to drastically increase from 4in² to 16in². But unlike the CVS brand lined paper the burn time

time, from the $4in^2$ to the $16in^2$ and the $16in^2$ to the $64in^2$. Just like the lined paper, the computer paper burned until the paper had turned to ash. The Jet Photo Paper has a continuous decline rate from each area and burn time. The line appears almost exact as it declines. The photo paper burned extremely slow but as the size grew the burn time decreased. The News Press newspaper burn time grew only slightly between $4in^2$ to the $16in^2$. But from $16in^2$ to the $64in^2$, there was a significant grow rate. The newspaper took a flame immediately and burned almost all the way, except for the $64in^2$ area which had a tinny part in the middle that did not burn.

I also looked at weight before and after burning the paper and as you can see from the chart the all of the paper decrease significantly. The weight before and after did not seem to depend on the brand, it seemed to depend on the initial weight of the paper.

Math Studies IB

Period 3

Works Cited

America, Colored Pencil Society of. The Making of Paper. 25 March 2008 <http://www.cpsa.org/PRODUCT_RESEARCH/PaperMaking.html>.

Industries., Confederation of European Paper. Paper Online. 25 March 2008 <http://www.paperonline.org/history/history_frame.html>.

Tappi. How is Paper Made? 25 March 2008 <http://www.tappi.org/paperu/all_about_paper/paperMade.htm>.