Date of Lab 10/10 Date of Submission 10/17.

Laboratory Report

Title Force Table

Homeroom	Section	Name	
110			Fumino Tsuchiya.

Lab Partners Fukutaro | Nakashiro.

Summary

The purpose of this experiment is to check the net force is equal to zero when equilibrium. Firstly, we put different amount of weights in three hangers, and make a ring is in center. Secondly, we put different amount of weights in four hangers, and also tried to make equilibrium. Finaly, we tried to make a condition which is slightly off the balance. We made so many errors so all the result of these experiments didn't say the net forces are equal to zero by using math method and graph method.

• Meet a deadline • Write logically • Write clearly • Write with your own words

Teacher's Comments

Drawings are all clear and beautiful. Exp 2 and 3 show good agreement between the math method and the head-to-tail method. Some wrong expressions about angles

1	2	3	4	5	6	7	8	9
Due	Summary	Intro.	Method.	Results	Table/Fig.	Discussion	Clearness	General

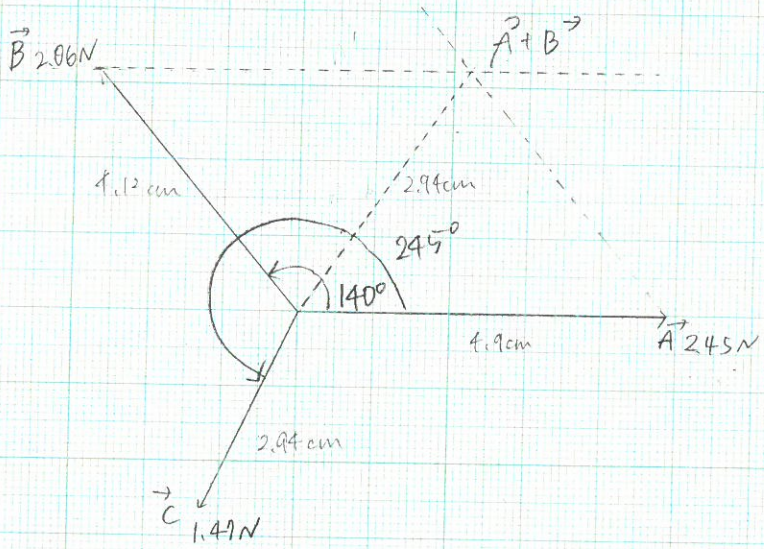
* Use this form as a cover sheet.
* Submit your reports by the seventh day after your lab.

〈Exp.1 3hungers in equilibrium〉.

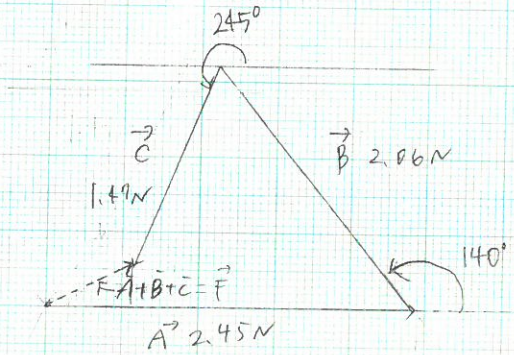
1N = 2cm

	Force (N)	Arrow (cm)	Angle (°)
A)	2.45N	4.90cm	0°
B)	2.06N	4.12cm	140°
C)	1.47N	2.94cm	245°

〈Parallelogram method〉



〈Head-to-tail method〉



$\vec{A}+\vec{B}+\vec{C}=1.2$

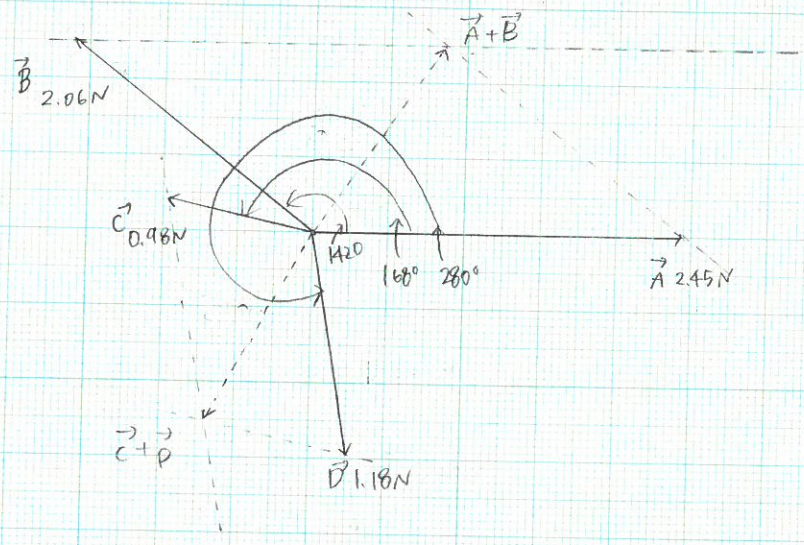
$1.2 \div 2 = 0.6$ 0.6N

< Exp. 2 4 hungers in equilibrium >.

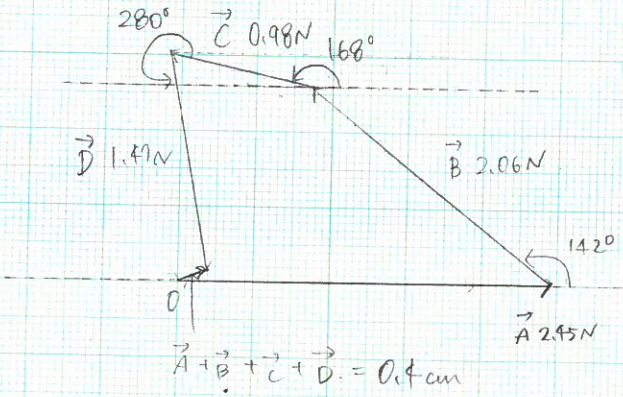
1 N = 2 cm

	Force(N)	Arrow (cm)	Angle (°)
A)	2.45N	4.90cm	0°
B)	2.06N	4.12cm	142°
C)	0.98N	1.96cm	168°
D)	1.49N	2.94cm	280°

< Parallelogram method >



< Head - to - tail method >.



$\vec{A}+\vec{B}+\vec{C}+\vec{D}=0.4$cm

$0.4 \div 2 = 0.2$ 0.2N

28

0.98×2

1.96

1.47

2

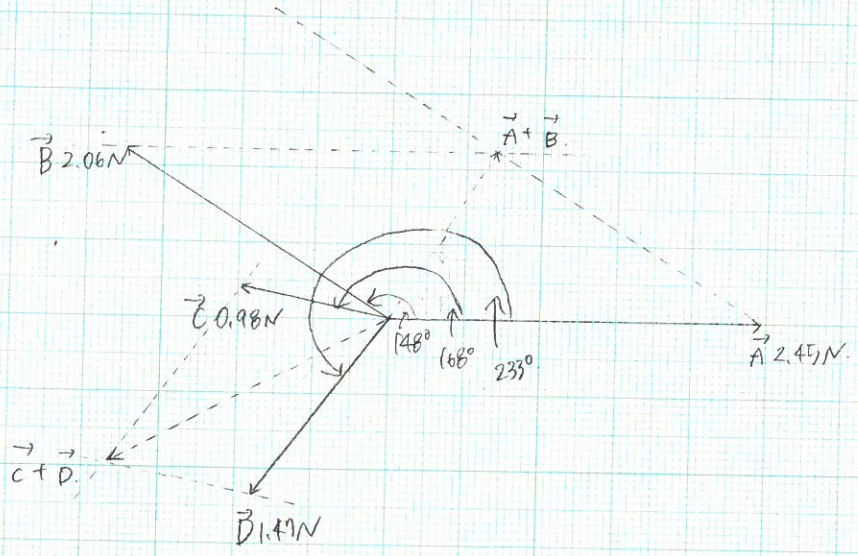
2.94

〈Exp.3 4 hungers in slightly off balance〉

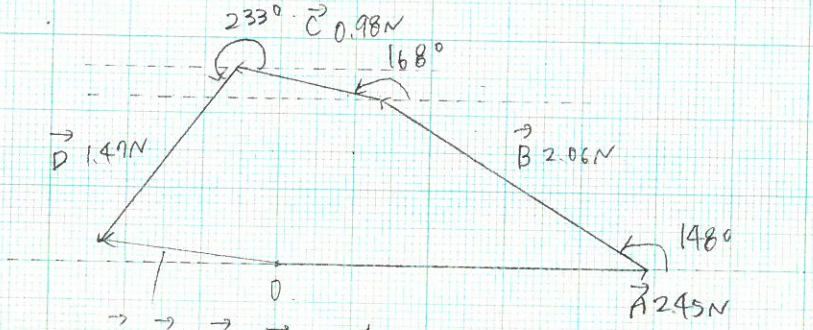
1N = 2cm

	Force (N)	Arrow (cm)	Angle (°)
A)	2.45N	4.90cm	0°
B)	2.06N	4.12cm	148°
C)	0.98N	1.96cm	168°
D)	1.47N	2.94cm	233°

〈Parallelogram method〉



〈Head-to-tail method〉



$\vec{A}+\vec{B}+\vec{C}+\vec{D}=2.4\text{cm}$

$2.4 \div 2 = 1.2$ 1.2 N

3. Tables (length of an arrow 1N=2cm)

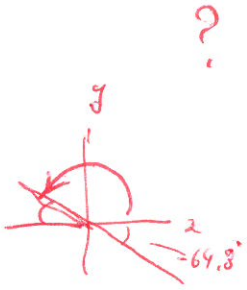
The Net Force for Four Forces $F=F_1+F_2+F_3+F_4$

$F_X=F_{1X}+F_{2X}+F_{3X}+F_{4X}$ $F_Y=F_{1Y}+F_{2Y}+F_{3Y}+F_{4Y}$ $F=\sqrt{F_X^2+F_Y^2}$ $\theta=\tan^{-1}(F_Y/F_X)$

1) 3 hangers in equilibrium

Exp.1	Weight[kg]	Force[N]	Arrow[cm]	Angle[°]
A	0.25	2.45	4.90	0
B	0.21	2.06	4.12	140
C	0.15	1.47	2.94	245

Exp.1	F[N]	θ [°]	Fx=Fcos θ [N]	Fy=Fsin θ [N]
A	2.45	0	2.45	0.00
B	2.60	140	-1.99	1.67
C	1.47	245	-0.62	-1.33
	ΣF_X ($F_X=F_{AX}+F_{BX}+F_{CX}+F_{DX}$) ΣF_Y ($F_Y=F_{AY}+F_{BY}+F_{CY}+F_{DY}$)		-0.16	0.34



F $=\sqrt{(-0.16)^2+(0.34)^2}=$**0.38N** $\theta=\tan^{-1}(0.34/-0.16)=$**-64.80°**

180° − 64.8° = 115.2°

2) 4 hangers in equilibrium

Exp.2	Weight[kg]	Force[N]	Arrow[cm]	Angle[°]
A	0.25	2.45	4.90	0
B	0.21	2.06	4.12	142
C	0.10	0.98	1.96	168
D	0.15	1.47	2.94	280

Exp.2	F[N]	θ [°]	Fx=Fcos θ [N]	Fy=Fsin θ [N]
A	2.45	0	2.45	0.00
B	2.06	142	-1.62	1.27
C	0.98	168	-0.96	0.20
D	1.47	280	0.26	-1.45
	ΣF_X ($F_X=F_{AX}+F_{BX}+F_{CX}+F_{DX}$) ΣF_Y ($F_Y=F_{AY}+F_{BY}+F_{CY}+F_{DY}$)		0.13	0.02

F$=\sqrt{(0.13)^2+(0.02)^2}=$**0.13N** $\theta=\tan^{-1}(0.02/0.13)=$**8.75°**

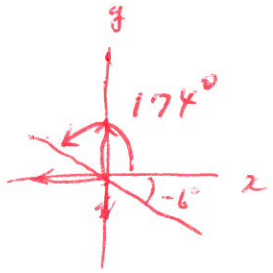
OK

3) 4 hungers in slightly off balance

Exp.3	Weight[kg]	Force[N]	Arrow[cm]	Angle[°]
A	0.25	2.45	4.90	0
B	0.21	2.06	4.12	148
C	0.10	0.98	1.96	168
D	0.15	1.47	2.94	233

Exp.3	F[N]	θ [°]	Fx=Fcos θ [N]	Fy=Fsin θ [N]
A	2.45	0	2.45	0
B	2.06	148	-1.75	1.09
C	0.98	168	-0.96	0.20
D	1.47	233	-0.88	-1.17
	ΣF_X ($F_X=F_{AX}+F_{BX}+F_{CX}+F_{DX}$) ΣF_Y ($F_Y=F_{AY}+F_{BY}+F_{CY}+F_{DY}$)		-1.14	0.12

F=$\sqrt{(-1.14)^2+(0.12)^2}$=**1.15N** $\theta=\tan^{-1}(0.12/-1.14)$=**-6.00°**



180° - 6° = 174°

OK

4.Discussion and opinions

・Discussion

I compared the differences between the net force solved by calculation and solved by the graph.

Exp.1) calculation: 0.38N　Graph: 0.6N　0.6-0.38=0.22N

$$\frac{|(0.6)-(0.38)|}{(0.38)} \times 100\% = 57.9\%$$

Exp.2) calculation: 0.13N　Graph: 0.2N　0.2-0.13=0.07N

$$\frac{|(0.2)-(0.13)|}{0.13} \times 100\% = 53.8\%$$

Exp.3) calculation: 1.15N　Graph: 1.2N　1.2-1.15=0.05N

$$\frac{|(1.2)-(1.15)|}{1.15} \times 100\% = 4.35\%$$

⇨The net force solved by calculation and solved by the graph are different.

In this experiment, I didn't get the result which is the net force is equal to zero when I tried to the force is equilibrium. Therefore, I think there are many sources of error. I can think 3 errors. **First error** is caused when I read the angle. There is the possibility that I didn't read exact angle in each experiment. **Second error** is caused by round off. When we calculated, we did round off. I think it can be one of the reasons of errors. **Third error** is caused when we tried to make equilibrium. I think there is the possibility that the ring was not in the center, and the not force is not zero. Through this, I think that to make the condition of equilibrium by ourselves is really hard.

・Opinion

We had so many errors, but this experiment makes me easy to understand the net force is equal to zero. I can see the condition of equilibrium (actually not) by using force table, so I could understand why net force is equal to zero. In addition, through this experiment, I get used to drawing the head-to-tail method and parallelogram method. Therefore, although we made so many errors, I think this experiment became a chance to understand about forces.