November 4, 2015

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PLEASE NOTE: If ANY of the above information is UNCLEAR or not provided, your grade will NOT be recorded!!

Lab Day (circle): *Tues* *Wed* *Thurs* *Fri*

Time slot (circle): *morning* *afternoon* *night*

Lab Week (circle): *1* *2*

Laboratory Report Cover Page

Experiment 3.

Chemical Kinetics

Checklist:

- **Raw Data Sheet copy attached**
- **9 curves [3 for A vs t; 3 for log A vs t; 3 for log Rate vs log A] attached**
- **Completed formal report typed and attached**

Student's Initials _EY__

November 4, 2015

Experiment 3: Chemical Kinetics

Introduction:

In this experiment, we explore the speeds of chemical reactions. One of the factors in calculating the rate of reaction involves the concentration of the reactants. The experiment is designed to investigate the way in which the rate of a chemical reaction depends on the concentration of the reactants.

The rate of a chemical reaction is proportional to the product of the concentrations of the reacting species, raised to a power. This rate of reaction can also be determined graphically. If the concentration is graphed as a function of time, then an instantaneous rate can be determined by the slope of a tangent at any point in time. The downside of using this method is that it is more approximate. Eventually we are asked to calculate the amount of unreacted Cr(III) at any time using the equation:

$$A_{Cr(III)} = A_{\infty} - A_t \text{ [1]}$$

Procedure: As described in the lab manual (Chemical Kinematics, Dr. Rashmi Venkateswaran, 2000, Exp 3, p. 43).

Observations/Data/Results:

Observations:

pH 4: transitioned into a dark shade of purple; reacts slowest when not heated up.

pH 4.5: transitioned into a dark shade of purple; reacts faster than pH 4 when not heated up.

pH 5: transitioned into darkest shade of purple, almost black colour; reacts fastest when not heated up.

Table 1. Data and Results for pH 4

	Time (Min)	Trans @ 584.10 nm (%)	A	A Cr	A Cr(III)	Time (f)	Log A Cr (III)	Rate
a	0	84.3213467576	0.0740624656429	1.84183753436	1.84650291514	2	0.26634999762 4	0.00020842760805 6
a	2	85.232046256	0.069397084864	1.84650291514	1.846531	4	0.26	0.00

			7		00615		635660453	056065905881
a	4	85.23755941	0.0693689938469	1.84653100615	1.84532379203	6	0.26607258120	0.00111628760475
a	6	85.0009524401	0.0705762079662	1.84532379203	1.84228407149	8	0.26535659717	0.00176844586208
a	8	84.4080896886	0.0736159285076	1.84228407149	1.83791626871	10	0.26432572031	0.00231155341153
a	10	83.5634320587	0.0779837312869	1.83791626871	1.83284428488	12	0.26312556965	0.00273963230583
a	12	82.5931984958	0.0830557151174	1.83284428488	1.82690268676	14	0.26171541449	0.00310429844153
a	14	81.4709324192	0.0889973132438	1.82690268676	1.82032055582	16	0.26014787335	0.00338856458222
a	16	80.2454756813	0.0955794441821	1.82032055582	1.81308305057	18	0.25841769796	0.00353868889639
a	18	78.9192683968	0.10281694943	1.81308305057	1.80598779966	20	0.25671481211	0.00358384830625
a	20	77.6404063406	0.109912200344	1.80598779966	1.79888580016	22	0.25500359362	0.00365057370042

a	22	76.3810809343	0.117014199845	1.79888580016	1.79110414958	24	0.25312084009	0.00359810279208
a	24	75.024679631	0.124795850415	1.79110414958	1.78429008112	26	0.25146546124	0.00346840746139
a	26	73.8567309737	0.131609918882	1.78429008112	1.77781100846	28	0.24988559108 6	0.00356950561222
a	28	72.7630690022	0.138088991541	1.77781100846	1.769114945	30	0.24795154974 5	0.00362871377611
a	30	71.4515236949	0.145988505498	1.7699114945	1.7628236495	32	0.24620886823 8	0.00349647753222
a	32	70.294872816	0.153076350498	1.7628236495	1.7561301759	34	0.24455670552 2	0.00343158749 75
a	34	69.2197738241	0.159769824099	1.7561301759	1.749202704	36	0.24284014002 6	0.00340732367 5
a	36	68.1244021515	0.166697295995	1.749202704	1.74240047958	38	0.24114798194 7	0.00335605141389
a	38	67.0657027293	0.173499520419	1.74240047958	1.7358582629	40	0.23951426107 5	0.00331069962278
a	40	66.0629956294	0.180041737096	1.7358582629			0.26634999762 4	0.00020842760805

								6
a	42	1.21375449753	1.91586914782	3.08521839025			0.26635660453	0.00056065905881

Table 2: Data and Results for pH4.5

	Time (Min)	Trans @ 584.10 nm (%)	A	A Cr	A Cr(III)	Time (f)	Log A Cr (III)	Rate
a	0	83.8336801054	0.0765814688957	1.0686185311	1.08033832045	2	0.03355978113 1	0.00516406246028
a	2	86.1268017721	0.0648616795517	1.08033832045	1.06981436836	4	0.02930842647 88	0.00524198882389
a	4	84.0648356722	0.0753856316355	1.06981436836	1.06086205783	6	0.02565891696 64	0.00578475289125
a	6	82.349706912	0.084337942174	1.06086205783	1.04757642855	8	0.02018571783 09	0.00669821979403
a	8	79.8686656004	0.0976235714486	1.04757642855	1.03294547769	10	0.01407739861 23	0.00716825245917
a	10	77.2227881142	0.112254522309	1.03294547769	1.01851980245	12	0.00796947713 703	0.00739590272126
a	12	74.699862506	0.126680197553	1.01851980245	1.003199	14	0.00	0.00

		3			41427		138726991868	744068736349
a	14	72.1106506636	0.142000585727	1.00319941427	0.98819775688	16	-0.00515613625488	0.00720476034856
a	16	69.6622916061	0.15700224312	0.98819775688	0.974207647689	18	-0.01134846546 83	0.00686281645724
a	18	67.4539905874	0.170992352311	0.97420764768 9	0.960958838512	20	-0.01729521440 22	0.00660166660032
a	20	65.4272758883	0.184241161488	0.96095883851 2	0.947811523637	22	-0.02327801538 6	0.00636181163592
a	22	63.4762882506	0.197388476363	0.94781152363 7	0.93571095474	24	-0.02885828603 53	0.00621593297919
a	24	61.732086313	0.20948904526	0.93571095474	0.922904941935	26	-0.03484302846 39	0.00604205818553
a	26	59.938371881	0.222295058065	0.92290494193 5	0.911286390304	28	-0.04034511569 16	0.00576162977596
a	28	58.3561175317	0.233913609696	0.91128639030 4	0.899837053129	30	-0.04583612	0.00545468097

							759 84	814
a	30	56.8377729911	0.245362946871	0.899837053129	0.889675 140602	32	- 0.05 076 854 436 51	0.00 522 205 203 326
a	32	55.5232834194	0.255524859398	0.889675140602	0.878692 621436	34	- 0.05 616 302 044 42	0.00 496 054 605 1
a	34	54.1368050085	0.266507378564	0.878692621436	0.870112 133129	36	- 0.06 042 477 535 72	0.00 487 450 946 407
a	36	53.0777046052	0.275087866871	0.870112133129	0.860739 852302	38	- 0.06 512 808 871 07	0.00 544 095 974 226
a	38	51.9445337347	0.284460147698	0.860739852302	0.847485 74437	40	- 0.07 186 759 836 8	0.00 606 591 707 586
a	40	50.3831996386	0.29771425563	0.84748574437				
a	42	7.15890766339	1.14515323914	4.67608619161				

Table 3. Data and Results for pH 5

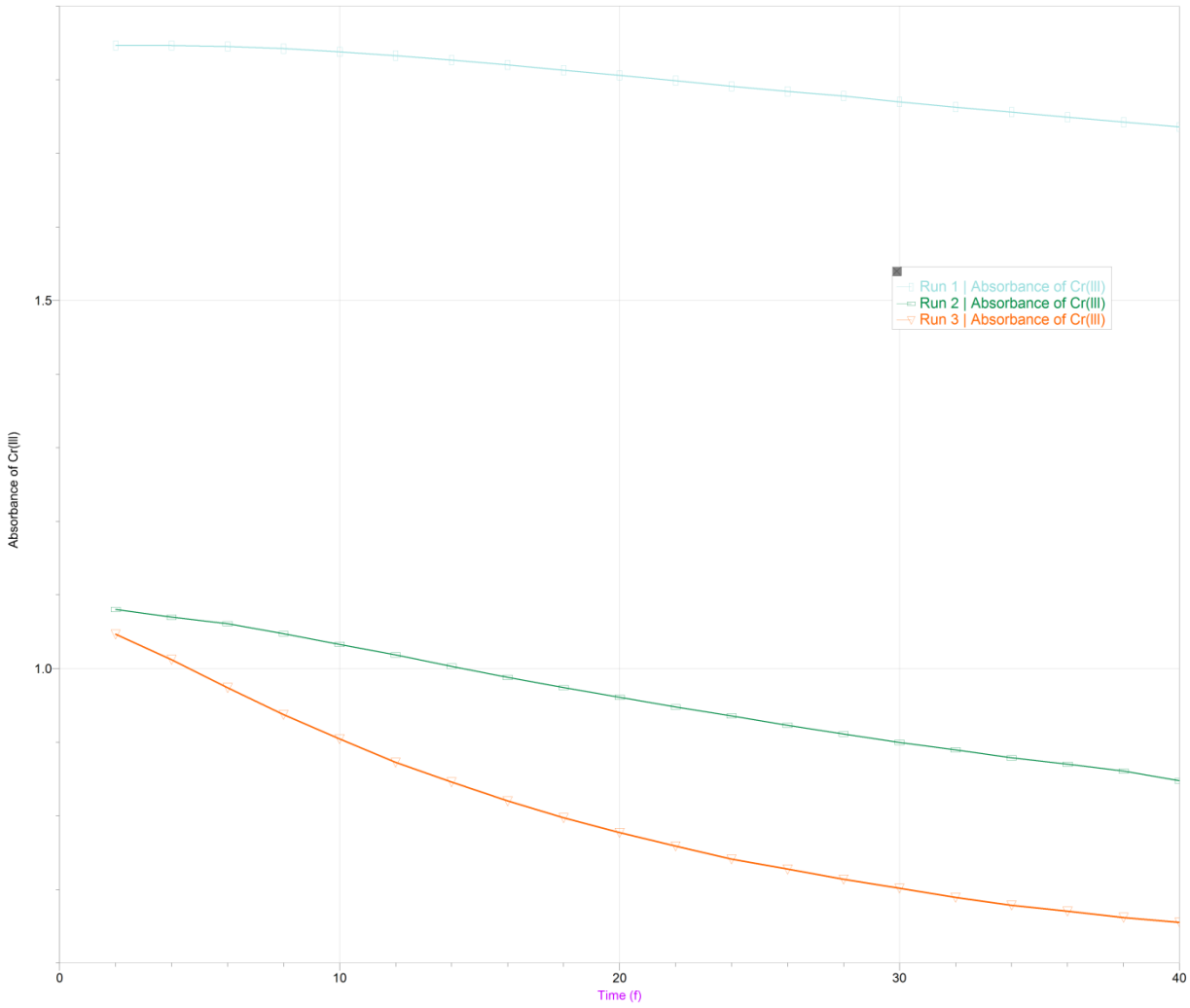
Time (Min)	Trans @ 584.10 nm (%)	A	A Cr	A Cr(III)	Time (f)	Log A Cr (III)	Rate	Log of Rate
0	83.4944794968	0.0783422383288	1.04945776167	1.04671182907	2	0.01 982 713 223 2	0.01 772 257 413 27	- 1.7514731983 4
2	82.968230742	0.081088170929	1.04671182907	1.012180	4	0.00	0.01	-

	7	2		20892		525784132995	81153861011	1.74195240522
4	76.6267152188	0.115619791081	1.01218020892	0.97404180973	6	-0.01142240108 31	0.01816515250 6	-1.74076095165
6	70.1845968698	0.15375819027	0.97404180973	0.937493799661	8	-0.02803159590 1	0.01730396401 55	-1.76185439671
8	64.5199169451	0.190306200339	0.937493799661	0.904441490682	10	-0.04361952288 47	0.01611581389 73	-1.79274775641
10	59.7917811196	0.223358509318	0.904441490682	0.87262659412	12	-0.05917155561 28	0.01466619450 87	-1.83368255952
12	55.5682339128	0.25517340588	0.87262659412	0.845890135787	14	-0.07268603946 67	0.01325782439 32	-1.87752773774
14	52.2504621135	0.281909864213	0.845890135787	0.820101480011	16	-0.08613240434 56	0.01207709742 1	-1.91803743041
16	49.2381219931	0.307698519989	0.820101480011	0.797214958109	18	-0.09842456124 69	0.01079715057 61	-1.96669084195
18	46.7105475401	0.330585041891	0.797214958109	0.777336068054	20	-0.10939118	0.00972617258	-2.01205802829

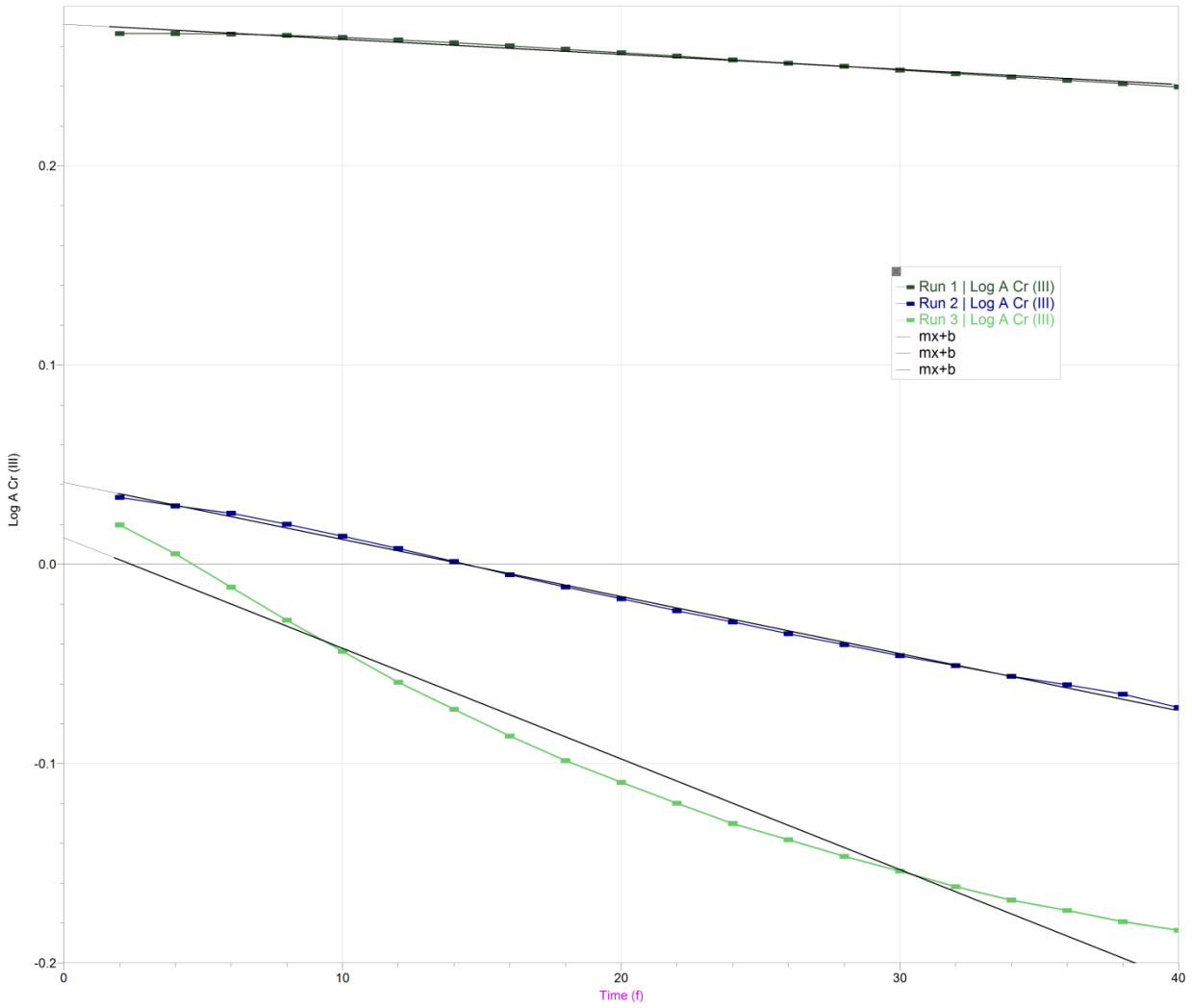
						0753	775	
20	44.6206680401	0.350463931946	0.777336068054	0.758838653668	22	-0.11985055515 9	0.00889000206861	-2.05109813797
22	42.7600942378	0.368961346332	0.758838653668	0.741274906614	24	-0.13002070121 9	0.00789577917146	-2.10260500648
24	41.0652911805	0.386525093386	0.741274906614	0.727472169629	26	-0.13818361651 1	0.00704258479908	-2.15226791501
26	39.7806769834	0.400327830371	0.727472169629	0.713800149471	28	-0.14642336543 8	0.00651686475379	-2.18596129194
28	38.5478490336	0.413999850529	0.713800149471	0.701624969864	30	-0.15389496342 6	0.00610027877111	-2.21465031811
30	37.4821910407	0.426175030136	0.701624969864	0.689183828219	32	-0.16166492187 6	0.00560518711793	-2.25140988478
32	36.4236805362	0.438616171781	0.689183828219	0.678522424465	34	-0.16843579478 3	0.00481102322979	-2.31776254612
34	35.5404092532	0.449277575535	0.678522424465	0.670450961854	36	-0.17363298183 2	0.00426733477214	-2.36984328543

36	34.8859827615	0.457349038146	0.670450961854	0.661869 16858	38	-0.17922784889 7	0.00389602451335	-2.4093783192 5
38	34.2033912734	0.46593083142	0.66186916858	0.655269 678063	40	-0.18357992811 4	0.00356088923411	-2.4484415353 9
40	33.687569465	0.472530321937	0.655269678063					
42	7.45115273294	1.12777653439	2.34656111431 E-005					

Graph 1: $A_{Cr(III)}$ VS Time



Graph 2: log $A_{Cr(III)}$ vs Time



Graph 3: log Rate vs log $A_{Cr(III)}$

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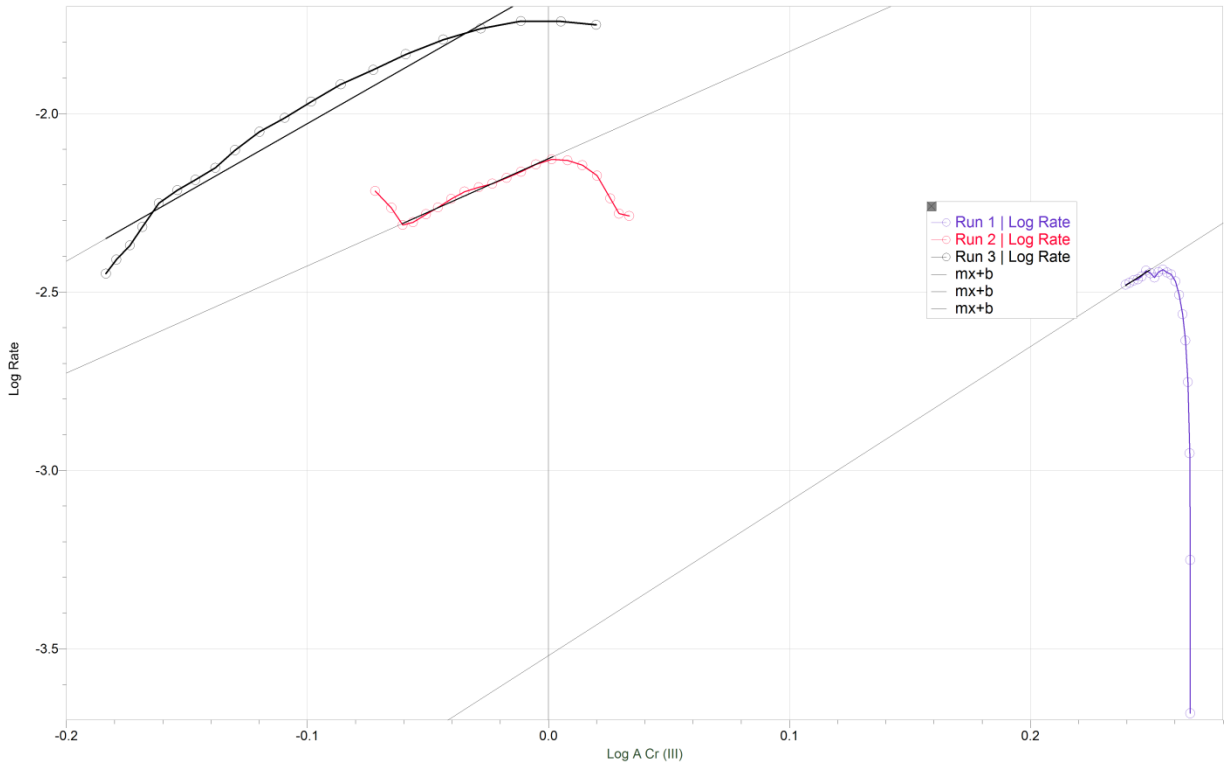

Calculations:

a) $A_{Cr(III)} = A_{\infty} - A_t$

$A_{Cr(III)} = 1.9159 – 0.069397 = 1.847$

Discussion:

There are many possible sources of error in this experiment. Some are experimental while others are inherent in the method.

In this experiment, we mixed the Cr (III) solution with the EDTA solution, while doing this, we were told to stir it. It is possible that we had not stirred the solution properly or enough so that it is possible that it may not have dissolved properly. This affects the rate of reaction because the concentration of the solution may not have reached the most optimal amount.

Another possible source of error inherent in the method was the cooling down of the test tube to room temperature. Since the test tube is put in the room temperature water, reusing the same water means it could have increased in temperature as we used it for subsequent trials. Therefore, there exists the possibility that the test tube was not always cooled to room temperature.

Conclusion:

The final rate of reaction for pH 4, pH 4.5, and pH 5 was 0.003, 0.006, and 0.004 respectively.

Experiment 3 Oct 20, 2015

Wavelength of Minimum = 0.749 @ 584.10

Trial 1:
~~pH~~ Buffer Sol'n = ~~pH~~ 4.5
Volume of Sol'n = 10 mL
Drops of ~~8~~ Cr(III) = 3

Observations
-> goes dark shade of purple
-> reacts slowest when not heated up

Trial 2: (4.5 ~~pH~~ pH)

Volume of EDTA = 10 mL
Concentration = 0.1 M
2 drops of Cr(III)

- goes dark shade of purple
- reacts ~~neutral~~ medium

Trial 3 (5 pH)
Volume = 10.0 mL
Concentration = 0.1 M
Drops = 2

- goes darkest fastest
- dark purple colour.

figs.

November 4, 2015

Rashmi Venkateswaran 10:27 AM (1 hour ago)
to Yixin, me

Hello Eric,
LATE PASS: Your lab report is now due on November 4, 2015 by **5:00 pm** without any penalty....after this date/time, your report will receive a grade of zero. Please upload the report, any graphs, your RAW DATA and a copy of this email to Blackboard directly in PDF format ONLY and as a SINGLE FILE.
NO paper copy is required and no copy needs to be emailed to your TA!
You have now used your late pass. Thanks!

Take care.....Rashmi
****

Dr. Rashmi Venkateswaran
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From: Eric Yong Heng Yeung [mailto:eyeun010@uottawa.ca]
Sent: November-03-15 1:15 PM
To: Rashmi Venkateswaran
Subject: Request for Approval of Late Pass