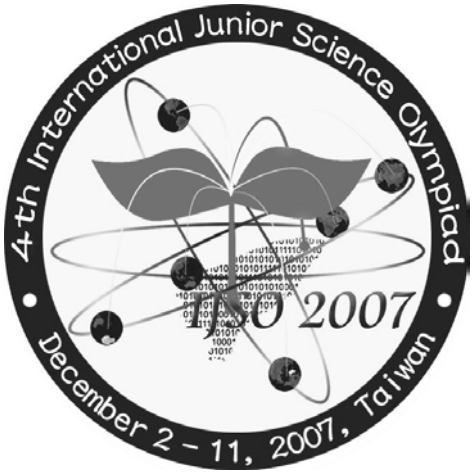


Practical Examination
December 08, 2007

Solution
and
Marking Scheme

Country		**Student Code:**	
Team Code			

Part I: Fruit Battery

	I-1-a	I-1-b	I-2-a	I-2-b	I-3-a	I-3-b	I-3-c	∑
Total Points	1	1.2	2	2	0.6	1.2	0.6	8.6
Received								

Part II: Starch Granules

	II-1	II-2-a	II-2-b	II-2-c	∑
Total Points	3	0.8	0.8	0.8	5.4
Received					

Part III: Conductivity of an Electrolyte Solution

	III-1-a	III-1-b	III-1-c	III-2-a	III-2-b	III-3-a	III-3-b	∑
Total Points	2	3	1	0.7	0.3	5	1	13
Received								

Part IV: Energy Transfer Associated with Incandescent Lamp

	IV-1	IV-2	IV-3	IV-4	IV-5	IV-6	IV-7	IV-8	∑
Total Points	0.5	1	2	1.4	1.6	1.5	2	3	13
Received									

Country		**Student Code:**	
Team Code			

Part I: Fruit Battery

	I-1-a	I-1-b	I-2-a	I-2-b	I-3-a	I-3-b	I-3-c	∑
Total Points	1	1.2	2	2	0.6	1.2	0.6	8.6
Received								

I-1: Determine how the electrodes affect the fruit battery

I-1-a. **D** . 1 point

I-1-b. **(i)** **A** . **(ii)** **C** . 0.6 point each

(A: Aluminum, B: Copper, C: Lead, D: Zinc)

I-2: Determine how different variables affect the fruit battery

Use "↑" to represent increase, "↓" to represent decrease, and "−" for no change (less than 20%) to answer Questions I-2-a and I-2-b.

I-2-a. Decrease in contact area: Voltage: - ; Current: ↓ . 1 point each

I-2-b. Increase the thickness of the lime slice. Voltage: - ; Current: ↓ . 1 point each

I-3: Characteristics of LED Device

Your LED device number: _____.

I-3-a. **3** 0.6 point

I-3-b. positive electrode: **B** ; negative electrode: **D** . 0.6 point each

I-3-c. The color of the LED luminescence _____. 0.6 point

(use abbreviation: red **(R)**, green **(G)**, blue **(B)**, white **(W)**).

Lab Assistant check on the final copy only. **Student signature**

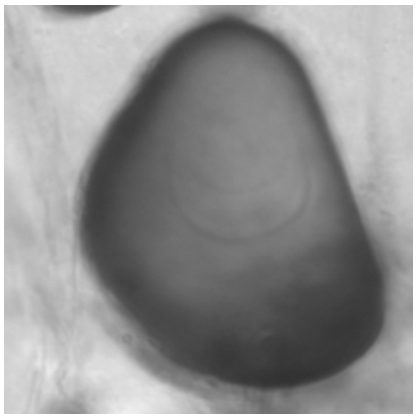
Country		**Student Code:**	
Team Code			

Part II: Starch Granules

	II-1	II-2-a	II-2-b	II-2-c	∑
Total Points	3	0.8	0.8	0.8	5.4
Received					

II-1: Observe the structure of a starch granule in potato

II-1. Draw the shape and detailed features of one starch granule under 400X magnification here.



It has an oval shape and a paracentric structure with hilum.
1.5 points to oval shape,
1.5 points to paracentric structure.

II-2: To determine reactions of reagents on starch granules

II-2-a. After adding the reagent A, potato starch granules were? **C** .

(A) unchanged (B) swollen only (C) swollen to lyse (D) shrinked

II-2-b. After adding the reagent B, potato starch granules were? **B** .

(A) unchanged (B) swollen only (C) swollen to lyse (D) shrinked

II-2-c. After adding the reagent C, potato granules were? **A** .

(A) unchanged (B) swollen only (C) swollen to lyse (D) shrinked 0.8 point each

Country		**Student Code:**	
Team Code			

Part III: Conductivity of an electrolyte solution

	III-1-a	III-1-b	III-1-c	III-2-a	III-2-b	III-3-a	III-3-b	∑
Total Points	2	3	1	0.7	0.3	5	1	13
Received								

III-1: The relationship between sodium hydroxide solution concentration and conductivity

III-1-a.

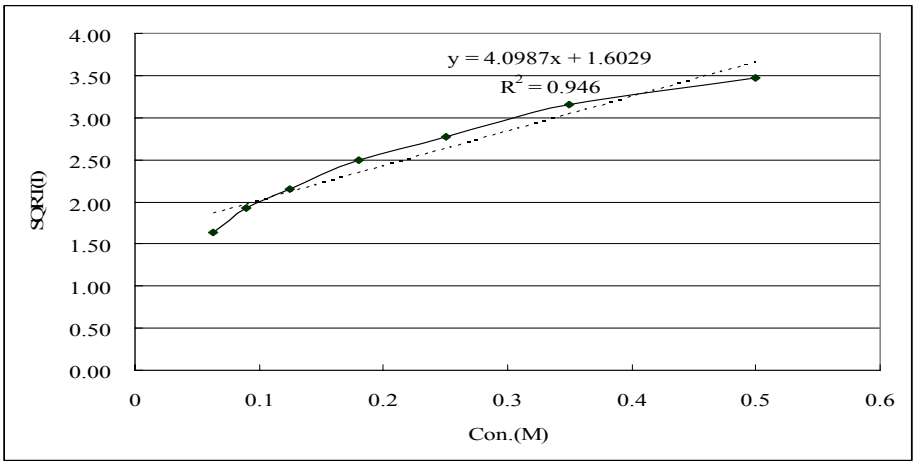
Solution preparation			Conductivity measurements		
$NaOH_{(aq)}$ solution, mol L^{-1}	Volume of 0.5 mol L^{-1} $NaOH_{(aq)}$ used to prepare 50 mL of desired solution, mL	$\sqrt{mol \cdot L^{-1}}$	Current I, mA	$\sqrt{I}$	I^2
0.06	6.0	0.245	2.70	1.64	7.29
0.12	12.0	0.346	4.61	2.15	21.25
0.25	25.0	0.500	7.70	2.78	59.29
0.35	35.0	0.592	9.95	3.15	99.00
0.50	50.0	0.707	12.04	3.47	144.96

0.2 points to each correct answer on the volume of NaOH used. 0.2 points to each filled current reading. No point will be given to the calculated values for $\sqrt{mol \cdot L^{-1}}$, $\sqrt{I}$, and I^2.

Country		Student Code:	
Team Code			

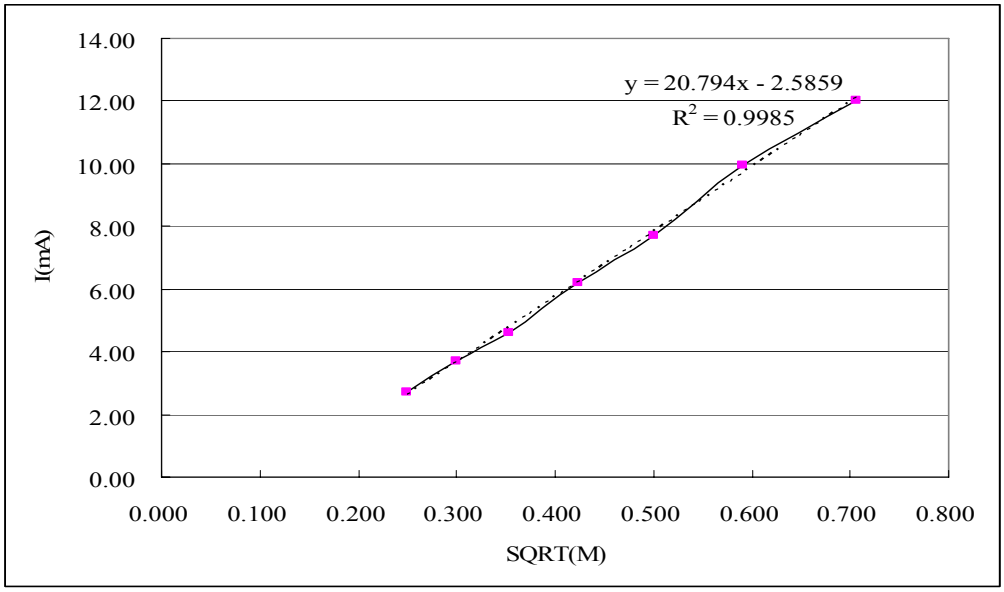
III-1-b. Plotted data: (1 point to each plot)

(a) (a) Plot concentration (in $mol{\cdot}L^{-1}$) as x-axis and square root of current (in $\sqrt{mA}$) as y-axis. 0.2 point to each proper filled data



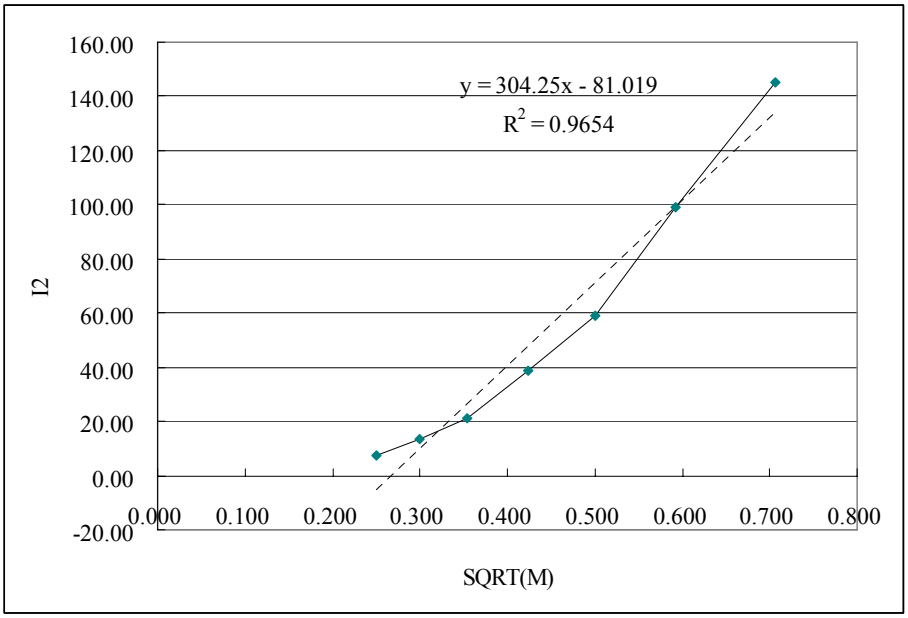
(b) Plot square root of concentration (in $\sqrt{mol \cdot L^{-1}}$) as x-axis and current (in mA) as y-axis.

0.2 point to each proper filled data



Country		Student Code:	
Team Code			

(c) Plot square root of concentration (in $\sqrt{mol \cdot L^{-1}}$) as x-axis and current square (in $(mA)^2$) as y-axis. 0.2 point to each proper filled data



III-1-c. Which of the plots in **III-1-b** is the best approximation of a straight line?

Line (b) $\sqrt{mol \cdot L^{-1}}$ v.s. I. 1 point

Country		**Student Code:**	
Team Code			

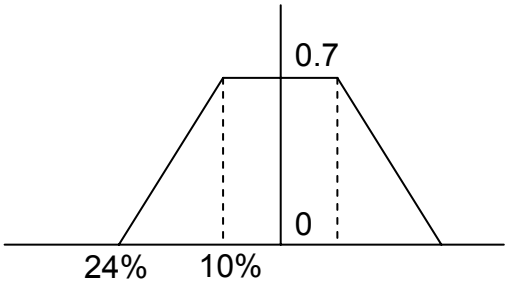
III-2: Determine the concentration of a $NaOH_{(aq)}$ solution by using conductivity measurement

III-2-a Record the current reading of the unknown concentration of $NaOH_{(aq)}$ solution

I = _____mA.

Student's data of $\sqrt{mol \cdot L^{-1}}$ v.s. *mA* will be replotted then assign points.

Points are allocated according to the following scheme (max 0.7 point):



III-2-b. Use the graph you decided to be the best approximation of a straight line **in III-1-c** to find out the concentration of the $NaOH_{(aq)}$ solution by using interpolation. 0.3 point

Make a big mark (x) on the graph and write down the concentration here.

[NaOH] = _____mol L^{-1}

III-3 Determine the concentration of a $NaOH_{(aq)}$ solution by using acid-base titration

III-3-a. Titration data

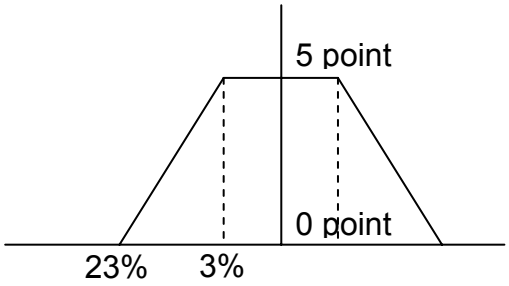
Titration	Burette reading before titration, mL	Burette reading after titration, mL	Volume of HCl solution used, mL
1			
2			
Average volume of HCl solution used, mL			

Country		**Student Code:**	
Team Code			

III-3-b Calculate the concentration of the given $NaOH_{(aq)}$ solution?

You must show all works.

Points for titration are allocated according to the following scheme (max 5 points):



1 point total is given to the correct calculation; 0.6 point for the correct equation, 0.4 point for the correct answer

$N_{HCl} \times V_{HCl} = N_{NaOH} \times V_{NaOH}$

$0.25 \times V_{HCl} = N_{NaOH} \times 20.0$

[NaOH] = _____ mol L^{-1}

Country		**Student Code:**	
Team Code			

Part IV: Energy Transfer Associated with Incandescent Lamp

	IV-1	IV-2	IV-3	IV-4	IV-5	IV-6	IV-7	IV-8	∑
Total Points	0.5	1	2	1.4	1.6	1.5	2	3	13
Received									

IV-1: Record the current room temperature (0.5 point for correct K)

15 °C = 288 K = T_o

IV-2: The resistance of the light bulb at room temperature:

$R(T_o)$ = **1.1 – 1.3** Ω

Points give by range

Points : 0.3 0.7 1 0.7 0.3

Range : 0.7——0.9——1.1——1.3———1.5———2 Ω

Country		Student Code:	
Team Code			

Data table for IV-3: Record the measured V and I. (0.2 point to each correct unit)
Reasonable data values; V: 0~6 V (0.3point); I: 0.1~0.5 A (0.3point)
10 data sets of *V-I*, 0.1 points for each set

IV-4: Calculated R and P. Correct unit for R and P. (0.2 point to each correct unit)
10 data calculated, 0.1 points for each set of (R,P)

IV-5: Calculated T. 0.2 point to correct unit.
0.4 point to reasonable data values; T: 400~2000 K
0.1 points for each temperature calculated,

IV-6: Calculated Log(T): 0.5 point to reasonable data values; Log(T): 2.5 ~ 3.5
0.1 points for each temperature calculated

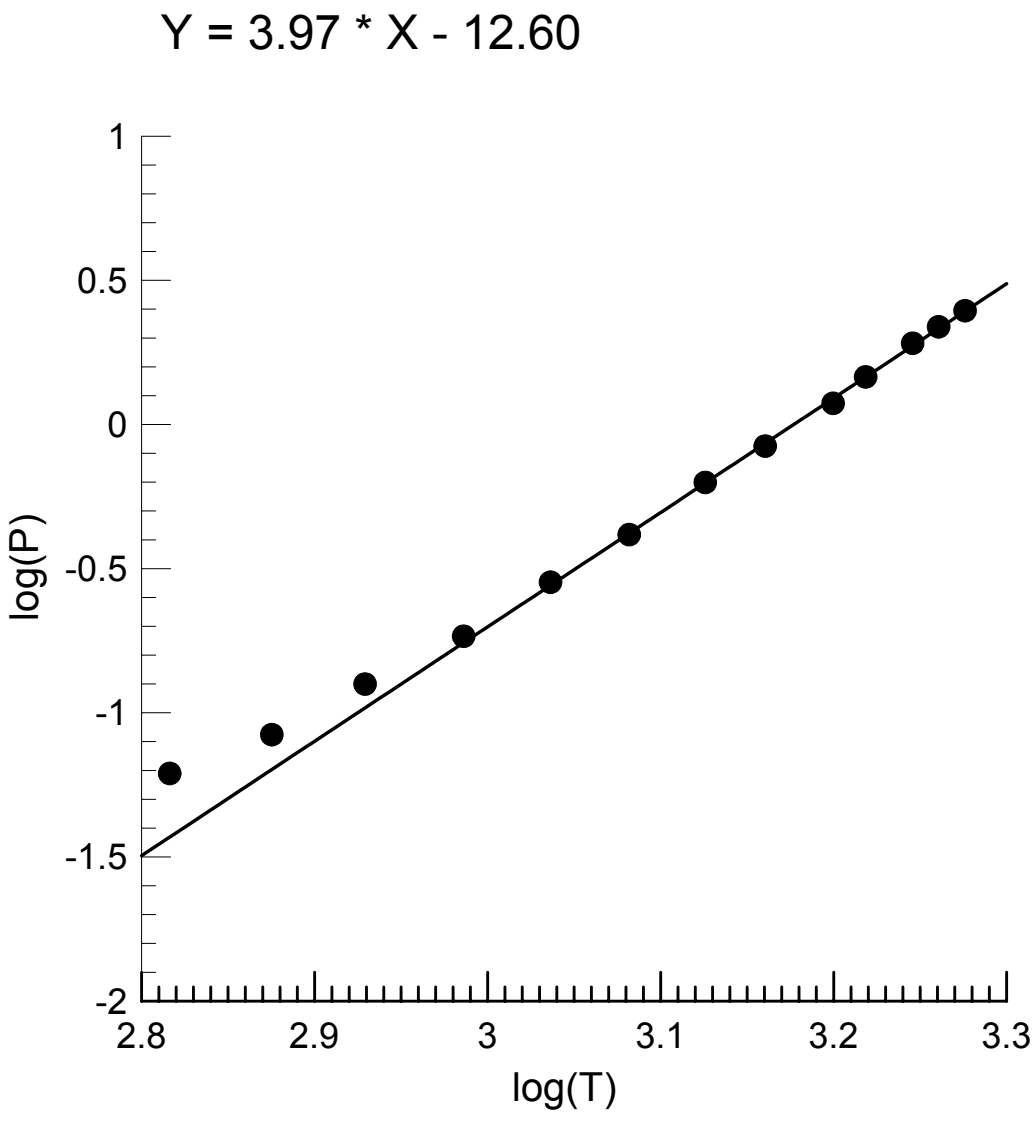
	I	V	R	P	T	log(P)	log (T)
Unit	**A**	**V**	**Ω**	**Js^{-1}(watt)**	**K**	-	-
1	0.47	5.28	11.23	1887.67	2.48	3.28	0.39
2	0.45	4.85	10.77	1822.39	2.18	3.26	0.34
3	0.43	4.45	10.34	1760.56	1.91	3.25	0.28
4	0.39	3.75	9.61	1653.80	1.46	3.22	0.17
5	0.36	3.29	9.14	1583.74	1.18	3.20	0.07
6	0.32	2.63	8.22	1446.89	0.84	3.16	-0.07
7	0.29	2.17	7.48	1335.95	0.63	3.13	-0.20
8	0.25	1.66	6.64	1207.30	0.42	3.08	-0.38
9	0.22	1.29	5.86	1087.27	0.28	3.04	-0.55
10	0.19	0.97	5.11	968.60	0.18	2.99	-0.73

Country		Student Code:	
Team Code			

IV-7: Plot $\log(P)$ versus $\log(T)$.

Two axes properly marked and labeled (0.5 point each axis).

Data correctly plotted (0.1 point each)



Country		**Student Code:**	
Team Code			

IV-8.

On the log(P)-log(T) plot:

A straight line (0.5 point) in the T > ~1000 K region (+0.5 point)

Use the slope to find β (1 point);

correct value of β = **3.7 – 4.0**

Points : 0.3 0.7 1 0.7 0.3

Range : 3.2——3.5——3.70——4.00————4.2——4.5