

## **World Water Monitoring Day Kit ( 世界水监测日实验成套安排 )**

By Jennifer LaPoma, Montclair State University

(蒙特克利尔州立大学 Jennifer LaPoma 编写)

### **Instruction for the Teacher ( 对教师的说明 )**

Ideally 2, 40 minute class periods(最适合的课时安排是 2 次 , 每次 40 分).

### **Goals ( 目的 ) :**

- Understand how and why water quality directly affects the aquatic ecosystem ( 了解水质直接影响水中生态状况的原因 )
- Perform experiment, compile results, analyze results and compare results to broader data – Just like scientists do ( 完成实验 , 编辑和分析结果并与各方数据作比较——就像科学家所用方法一样 ) .

### **Objectives ( 目标 ) :**

- Analyze water samples of student's town ( 分析学生所在地域的水样 )
- Understand how dissolved oxygen, pH, turbidity, temperature, and % saturation affects the health of an aquatic ecosystem( 了解溶解氧 ,pH 值 , 浑浊度和饱和度的百分比如何影响水中生态状况 )
- Compare any town's water quality results to New Jersey and , to world-wide averages( 将任一地区的水质结果与新泽西及世界范围的平均值作对比 )

### **Materials ( 材料 ) :**

- World Water Monitoring Day Kit (WWMD) ( 世界水监测日成套用具 )
- One container to hold water sample (盛放水样的容器)

- 2 tubes for DO/pH analysis test (each team will need 2 containers)( 两个试管分别用于溶解氧 DO 和 pH 的分析测试 ( 每组需两个试管 ) )
- One bucket for each team, to place all materials in, and for students to pour water over ( 教师需为每组准备一个桶用于放置所有材料 , 也可用于盛泼溅出的水 )
- Index cards to attach DO, pH, and turbidity charts ( 用于粘贴溶解氧 DO, pH 值和浑浊度图表的索引卡 )
- Sticker paper (glossy/coated) for paste the icon of turbidity ( 标志浑浊度的小样板粘性纸 )

( 注 : 以上所述是盒中所配作样品的 , 如果学生多 , 盒中所配不够用 , 教师可以仿照盒中器具 , 按相应学生数目准备。标志浑浊度的小样板 , 也可将本文最后一页打印得到 )

**Prior Knowledge( 预备知识 ):** pH scale, basic chemistry, hydrological cycle( pH 测量 , 基础化学 , 水分循环 )

**Pre- Procedure ( 预先程序 ) :**

1. Place the icon of turbidity sticker on bottom inside portion of the water sample containers ( 将标志浑浊度的小样板粘在水样容器内侧的底部 )
2. Collect water samples from a local freshwater location. (I took enough samples in order for every team of students to have a sample.) ( 从当地水域收集水样 , 注意应采足够水样以保证各组每个学生都有 )
  - Label sample location, and temperature of water on the lid( 在盖上标注水样采集位置和水温 ) .
  - Sample should be taken approximately 10 centimeters below the water surface ( 水样应采自水面下约 10 厘米处 ) .

- Temperature needs to be taken at the time of sampling, not later in the classroom ( 水温应在采水样的同时记录，而非课后记录 ) .
3. Prepare each bucket with materials from WWMD kit: two DO tablets, one pH tablet. Also a worksheet, water quality parameters index card, instructions, two labeled tubes/containers with 10 mL mark (for pH) and another for DO ( 从成套用具包中取出需用物品放入桶中：两片溶解氧 DO，一片 pH，工作记录表，水质参数索引卡，说明书，两个带标度的试管分别用于 pH 和 DO，以及带 10 mL 以上标记的容器 ) .
- Match water levels with those of the containers from the one in the WWMD kit.

### Procedure(步骤) :

1. Pass out buckets with materials to each team of students ( 用桶将各组所用物品传递到同学手中 ) .
2. Review how the experiment will be conducted ( 复习实验操作方法 )
  - **Part One ( 第一步 )** : Following the water sampling instruction worksheet, the students will take approximately 15 minutes to test the water quality parameters ( 按照水样说明书，学生约需用 15 分测试水质参数 ) .
  - **Part Two ( 第二步 )** : Students will answer questions 1-6 using the “Here’s What You’ll Test For...” guide. Students will need calculators to complete question one ( 学生将用“这是你要测试的”指南回答问题 1-6，问题 1 需学生用计算器完成 ) .
  - **Part Three( 第三步 )** : After gathering and analyzing their own results, students will compare the averages of New Jersey and 6 other continents. This information was obtained from World Water Monitoring Day’s 2007 Annual Report ( 收集和分析各自结果后，学

生需与新泽西及其他六个大陆的平均值作比较。该信息由每年世界水监测日报告结果获得 )

3. Guide class discussion on results. Ask students why they believe their water sample might be considered more or less healthy than others ( 指导结果的讨论。问学生他们认为所在地区水样好或差于其他地区的理由是什么 ) .

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**Instruction for the students ( 对学生的说明 )**

**Name ( 姓名 ) :**

**Team ( 小组 ) :**

**Local Area Water Sampling ( 当地的水样 )**

**Water sample taken at location ( 水样采集地域 ) :** \_\_\_\_\_

**Part One ( 第一部分 ) :** Please report your results in the space below ( 请将结果填入以下空格 )

<b>Water Quality Parameter( 水质 参量 )</b>	<b>Tested Result ( 测 试结果 )</b>
DO	

pH	
Turbidity ( 混浊度 )	
Temperature( 温度 ) (C)	

**Part Two ( 第二部分 ) : Answer the following questions ( 回答如下问题 )**

1.a. What does **dissolved oxygen (DO)** measure in the water ( 水中测得的**溶解氧 (DO)**怎样 ) ?

b. Based upon your DO result what can be said about the health of the aquatic ecosystem ( 基于你测得的水的溶解氧 DO 之结果 , 对于水中生态状况能说出些什么 ) ?

2. a. What is the **pH** range of healthy water ( 什么是有益于生物的正常水的 **pH** 范围 ) ?

b. Would you consider your water sample to be healthy based on pH ( 基于 **pH** 值 , 你认为你测的水样品是有益于生物的最佳状态吗 ) ?

Is it more acidic or basic than natural water ( 它比自然水更酸或更碱性 ) ?

3. a. What does **turbidity** measure in the water(水中测量到的浑浊度怎样)?

b. Based upon your turbidity result, what can be said about the health of the aquatic ecosystem ( 基于你测到的浑浊度的结果 , 对于水中生态状况能说出些什么 ) ?

4. a. Using the chart below determine the **% saturation** of your water sample ( 试用如下表格确定所测水样**饱和度**的百分比 ) .

First, locate the temperature (degrees Celsius) on the left side of the chart

Next, locate the DO of the water sample on the top of the chart.

The % saturation is where the temperature row and DO column intersect. ( 先将温度标在表格左列 , 然后将水样的溶解氧 DO 标在表格顶行 , 最后将饱和度的百分比放在与相应的温度行和溶解氧 DO 列之交叉的位置上 ) .

#### Dissolved Oxygen ( 溶解氧 )

b. Why is % saturation of concern to your water quality ( 为何饱和度的百分比与水质相关 ) ?

Temp C°	0 ppm	4 ppm	8 ppm
2	0	29	58
4	0	31	61
6	0	32	64
8	0	34	68
10	0	35	71
12	0	37	74
14	0	39	78
16	0	41	81
18	0	42	84
20	0	44	88
22	0	46	92
24	0	48	95
26	0	49	99
28	0	51	102
30	0	53	106

5. How might temperature affect water quality ( 温度会怎样对水质产生影响 ) ?

**Part Three ( 第三部分 ) :**

State	Total Sites	Total Participants	Average DO (PPM)	Average pH	Average Temperature (°C)	Average Turbidity (JTU)
New Jersey	50	315	5.87	7.59	16.91	3.34

New Jersey's 2007 World Water Monitoring Day Results ( 水监测日结果 )

How does your water sample compare to New Jersey's 2007 averages ( 你测到的水样与新泽西 2007 年的平均值作比较 , 结果如何 ) ?

Continent	DO	pH	Temperature	Turbidity
Africa	4.75	7.88	23.35	28.78
Asia	4.67	7.15	23.04	39.83
Australia	4.41	7.00	17.50	21.82
Europe	5.07	7.35	10.44	6.07
North America	5.31	7.68	18.99	7.44
South America	6.19	7.53	20.01	22.71

Worldwide Water Monitoring Day 2007 Results( 2007 年世界范围的水监测日结果 )

6. Please list the worldwide range for each water quality parameter below( 请将世界范围各区域水质的参量列在下表中 ) :

<b>DO ( 溶解氧 ) :</b>
<b>pH:</b>
<b>Turbidity ( 浑浊度 ) :</b>

**Temperature (degrees Celsius) ( 摄氏温度 ) :**

7. Please report the worldwide mean for each water quality parameter below( 请将世界范围各水质参量的平均数报告在下表中 ) :


**DO ( 溶解氧 ) :**

**pH:**

**Turbidity ( 浑浊度 ) :**

**Temperature (degrees Celsius) ( 摄氏温度 ) :**

### **Water Sampling Instructions ( 水取样方法说明 ) :**

1. First and foremost SAFETY!!! Be careful handling the glass ( 最为重要的是安全!!! 小心操作玻璃制品 ) .
2. Record your sample number and temperature on your worksheet ( 记着在实验记录表中记下你的样品编号和温度 ) .
3. Remove the sample's lid and measure the **turbidity** of the water by matching the icon of turbidity  at the bottom of your water sample which is 10cm deep to the turbidity chart provided. Report your findings in JTU (Jackson Turbidity Units) ( 去掉样品的盖并将你在水面下 10cm 处取的水样与底部粘贴的标志浑浊度的小样板对比 , 找出相配的水的浑浊度将其用杰克逊浑浊度单位报到在浑浊度表格中 )
4. Carefully over your bucket, pour some of your water sample into the tube labeled "**DO**" ( 小心抓好桶 , 将一些水样倒在标有"**DO**"的试管中 )
  - Match the water level to the black line ( 水位与黑线相齐 ) .

- Drop **two DO** tablets into the tube ( 将两个 **DO** 片投入管中 )
  - Tightly screw on the cap of the tube afterwards ( 之后旋紧管盖 ) .
  - Turn the tube upside down until the tablets have disintegrated. This should take no more than 4 minutes ( 上下翻转试管约 4 分钟 , 直到 **DO** 片都溶解 )
  - Place aside, and let sit for approximately 5 minutes in order for the color to develop ( 放在一边 , 约等 5 分钟而待颜色逐步显现出来 )
  - After 5 minutes, compare the color to the DO chart and record result as the ppm DO ( 5 分之后 , 比较颜色将溶解氧的结果以百万分率记录在 DO 表格中 )
5. Carefully over your bucket, pour some more of your water sample into the second tube labeled “**pH**” to the 10 mL line ( 小心抓好桶 , 将更多的水样倒在标有“**pH**”的另一试管中使水位达 10 mL 线 ) .
- Add **one pH tablet** to the tube ( 将一个 **pH** 片投入管中 ) .
  - Tightly cap the tube and mix by turning upside down until tablet has disintegrated. Bits of material may remain in the sample ( 旋紧管盖上下翻转试管直到 **pH** 片都溶解。或许会有少量留存在样品上 ) .
  - Compare the color of the sample to the pH color chart provided(将样品颜色与提供的颜色图样作比较).
  - Record your result on your worksheet ( 在实验记录表中记录下你的结果 ) .
6. Clean up your experiment with the provided paper towels. Ask our teacher to dispose of your water sample ( 用提供的纸巾清理干净实验器具。请老师处理你的水样 ) .

7. Begin working on your worksheet ( 开始完成你的实验报告 ).

说明：此试验测试的包括：

1. 溶解氧 **DO** ----- 用来测量水中有多少氧分子。由于氧对鱼和其它水中生物像对人一样重要。高 **DO** 读数对水中生物的存活和多样有益，而低的 **DO** 读数能减少甚至使鱼和其它水中生物死亡。
2. pH 酸碱度----- 用来测量某一液体的酸碱度如何，测量级别为 0-14. 其中 0 为最酸，14 为碱性最大，7 是中性。中性的水对生物最有益。一般水的 pH 值应介于 6.5 至 8.5.
3. 浑浊度----- 用来测量水的纯净程度。残渣、沙子和淤泥等会使水浑浊。浑浊度能通过影响光合作用而对水中生物的呼吸和繁殖产生影响。
4. 温度----- 用来测量水的冷热程度。这个指标很重要，因为它影响到氧的分解、光合作用和食物的供应。水温过热或过冷都会对鱼和其它水中生物产生严重影响。

**Here's What You'll Test For...**

**Dissolved Oxygen (DO)**

Measures how many molecules of oxygen are in the water. Since oxygen is important to fish and other aquatic life (just as it is for people!), higher DO readings support more diverse species and a healthier ecosystem. Low levels of DO can weaken or kill fish and other aquatic life.

**pH (Acidity)**

Measures how acidic or basic a liquid is. It is measured on a scale from 0-14, where 0 is most acidic, 14 is most basic, and 7 is neutral. Natural waters with conditions favorable for supporting life usually have a pH between 6.5 and 8.5.

**Turbidity (Clarity)**

Measures the water's clarity. Debris, sand, silt, and other materials can make the water less clear (more turbid). Turbidity can impact the aquatic ecosystem by affecting photosynthesis, respiration, and reproduction of aquatic life.

**Temperature**

Measures the warmth or coldness of the water. This indicator is important because it affects dissolved oxygen, photosynthesis, and the food supply. Waters that are too hot or too cold can have severe effects on fish and other aquatic life.

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