# Appendix A: Misconceptions about Acid and Base Indicators – What Does This Data Infer?

## LITMUS PAPER

**THYMOL BLUE**

**UNIVERSAL INDICATOR**

**BROMO-­‐ THYMOL BLUE**

**PHENOL-­‐ PHTHALEIN**

**PHENOL RED**

**THYMOL-­‐ PHTHALEIN**

**BASE** R→B B→B BLUE SEE CHART BLUE FUCHSIA PINK BLUE

**ACID** R→R B→R YELLOW SEE CHART YELLOW COLORLESS YELLOW COLORLESS

**NEUTRAL** R→R B→B YELLOW SEE CHART BLUE COLORLESS RED COLORLESS

|  |  |  |  |
| --- | --- | --- | --- |
| **Appendix B: Indicators** | **Low pH Color** | **pH Range** | **High pH Color** |
| Gentian violet (Methyl violet) | yellow | 0.0–2.0 | blue-­‐violet |
|  |  |  |  |
| Leucomalachite green (first transition) | yellow | 0.0–2.0 | green |
|  |  |  |  |
| Leucomalachite green (second transition) | green | 11.6–14 | colorless |
|  |  |  |  |
| Thymol blue (first transition) | red | 1.2–2.8 | yellow |
|  |  |  |  |
| Thymol blue (second transition) | yellow | 8.0–9.6 | blue |
|  |  |  |  |
| Methyl yellow | red | 2.9–4.0 | yellow |
|  |  |  |  |
| Bromophenol blue | yellow | 3.0–4.6 | purple |
|  |  |  |  |
| Congo red | blue-­‐violet | 3.0–5.0 | red |
|  |  |  |  |
| Methyl orange | red | 3.1–4.4 | orange |
|  |  |  |  |
| Bromocresol green | yellow | 3.8–5.4 | blue-­‐green |
|  |  |  |  |
| Methyl red | red | 4.4–6.2 | yellow |

|  |  |  |  |
| --- | --- | --- | --- |
| **Indicator** | **Low pH Color** | **pH Range** | **High pH Color** |
|  |  |  |
| Methyl red / Bromocresol green | red | 4.5–5.2 | green |
|  |  |  |  |
| Azolitmin | red | 4.5–8.3 | blue |
|  |  |  |  |
| Bromocresol purple | yellow | 5.2–6.8 | purple |
|  |  |  |  |
| Bromothymol blue | yellow | 6.0–7.6 | blue |
|  |  |  |  |
| Phenol red | yellow | 6.8–8.4 | red |
|  |  |  |  |
| Neutral red | red | 6.8–8.0 | yellow |
|  |  |  |  |
| Naphtholphthalein | colorless to reddish | 7.3–8.7 | greenish to blue |
|  |  |  |  |
| Cresol Red | yellow | 7.2–8.8 | reddish-purple |
|  |  |  |  |
| Phenolphthalein | colorless | 8.3–10.0 | fuchsia |
|  |  |  |  |
| Thymolphthalein | colorless | 9.3–10.5 | blue |
|  | yellow |  | red |
| Alizarine Yellow R | 10.2–12.0 |

# Appendix C: Suggestions for Lab Materials

* ammonia
* bottles, water
* bromothymol blue
* copies of chemistry task for students
* cups, graduated
* cups, medicine, graduated
* eyedroppers
* fume hoods
* goggles, safety
* graduated cylinders
* litmus paper, red
* litmus paper, blue
* paper towels
* paper, chart
* paper, copy
* pencils, grease to label cups, test tubes, etc.
* pH paper
* phenol red
* phenolphthalein
* scissors
* solutions, unknowns and Relieve It (directions for solutions attached below)
* stirring rod or sticks (e.g., craft sticks, toothpicks, etc.)
* test tube holders
* test tubes
* thymol blue
* thymolphthalein
* titration equipment
* trays, plastic for supplies
* trays, SEPUP
* universal indicator
* vinegar, white, distilled
* water, distilled
* water, tap

# Appendix D: Sample Blank Lab Table To Give To Students or Have Them Create Their Own

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| RELIEVE IT | LITMUS PAPER | THYMBOL BLUE | UNIVERSAL INDICATOR  | BROMOTHYMOL BLUE | PHENOL PHTHALEIN | PHENOL RED | THYMOL PHTHALEIN |
| I |  |  |  |  |  |  |  |
| II |  |  |  |  |  |  |  |
| III |  |  |  |  |  |  |  |
| IV |  |  |  |  |  |  |  |

# Appendix E: Sample Lab Results

## USE TO NEUTRALIZE?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **PAPER** |  | **INDICATOR** | **THYMOL BLUE** | **PHTHALEIN** |  |
| R→B B→B | BLUE | PURPLE ≈10 | BLUE | FUCHSIA | PINK | BLUE |
| R→B B→B | BLUE | PURPLE ≈10 | BLUE | FUCHSIA | PINK | BLUE |
| R→R B→R | YELLOW | ORANGE ≈5-­‐6 | YELLOW | COLORLESS | YELLOW | COLORLESS |
| R→R B→R | YELLOW | ORANGE ≈5-­‐6 | YELLOW | COLORLESS | YELLOW | COLORLESS |
| R→R B→B | YELLOW | GREEN ≈6-­‐7 | BLUE | COLORLESS | RED | COLORLESS |

**RELIEVE IT (BASE)**

1. **(BASE-­‐WON’T HELP)**
2. **(ACID-­‐ POTENTIAL)**
3. **(ACID-­‐ POTENTIAL)**
4. **(ALMOST NEUTRAL)**

**LITMUS**

**THYMOL BLUE UNIVERSAL**

**BROMO-­‐**

**PHENOL**

**PHENOL RED THYMOL PHTHALEIN**

**Appendix F: Directions for Making Relieve IT and Other Unknown Solutions**

**RELIEVE IT! (BASE)** 30 mL of Ammonia in 970 mL of Distilled Water

1. **(BASE)** 700 mL of Ammonia in 300 mL of Distilled Water
2. **(ACID)** 10 mL of White Distilled Vinegar in 990 mL of Distilled Water
3. **(ACID)** 400 mL of White Distilled Vinegar in 600 mL of Distilled Water
4. **(ALMOST NEUTRAL)** 1000 mL of Distilled Water