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|----------------------|--------|----------|---------------|---------------|-----------------|
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| Solution | pH | H+ conc | concentration | | |
| | | | | | |
| water | | | | | |
| | | | | | |
| barium hydroxide | 12.301 | 5.00E-13 | 0.01 | | |
| calcium hydroxide | 12.301 | 5.00E-13 | 0.01 | | |
| sodium hydroxide | 12.000 | 1.00E-12 | 0.01 | | |
| ammonium hydroxide | 10.628 | 2.36E-11 | 0.01 | | |
| hydrochloric acid | 2.000 | 1.00E-02 | 0.01 | | |
| nitric acid | 2.000 | 1.00E-02 | 0.01 | | |
| acetic acid | 3.372 | 4.24E-04 | 0.01 | | |
| carbonic acid | 4.183 | 6.56E-05 | 0.01 | | |
| | | | | | |
| sodium chloride | 7.000 | 1.00E-07 | 0.01 | | |
| ammonium chloride | 5.628 | 2.36E-06 | 0.01 | | |
| sodium acetate | 8.372 | 4.24E-09 | 0.01 | | |
| sodium bicarbonate | 9.183 | 6.56E-10 | 0.01 | | |
| sodium carbonate | 11.126 | 7.48E-12 | 0.01 | | |
| sodium bisulfate | 1.960 | 1.10E-02 | 0.01 | | |
| | | | | | |
| | | | acid conc | base conc | |
| acetic acid buffer | 4.745 | | 0.1 | 0.1 | |
| ammonia buffer | 9.255 | | 0.1 | 0.1 | |
| phosphate buffer | 7.208 | | 0.1 | 0.1 | |
| bicarbonate buffer | 10.252 | | 0.1 | 0.1 | |
| carbonic acid buffer | 6.367 | | 0.1 | 0.1 | |
| | | | | | |
| solution volume | 10.000 | | | | |
| drop volume | 0.036 | | | | |
| | | | new acid conc | new base conc | .1 M HCl drops |
| acetic acid buffer | 4.745 | | 1.0000E-01 | 1.0000E-01 | 0 |
| ammonia buffer | 9.255 | | 1.0000E-01 | 1.0000E-01 | 0 |
| phosphate buffer | 7.208 | | 1.0000E-01 | 1.0000E-01 | 0 |
| bicarbonate buffer | 10.252 | | 1.0000E-01 | 1.0000E-01 | 0 |
| carbonic acid buffer | 6.367 | | 1.0000E-01 | 1.0000E-01 | 0 |
| | | | | | |
| | | | | | .01 HCl drops |
| acetic acid buffer | 4.745 | | 1.0000E-01 | 1.0000E-01 | 0 |
| ammonia buffer | 9.255 | | 1.0000E-01 | 1.0000E-01 | 0 |
| phosphate buffer | 7.208 | | 1.0000E-01 | 1.0000E-01 | 0 |
| bicarbonate buffer | 10.252 | | 1.0000E-01 | 1.0000E-01 | 0 |
| carbonic acid buffer | 6.367 | | 1.0000E-01 | 1.0000E-01 | 0 |
| | | | | | |
| | | | | | .1 M NaOH drops |
| acetic acid buffer | 4.745 | | 1.0000E-01 | 1.0000E-01 | 0 |
| ammonia buffer | 9.255 | | 1.0000E-01 | 1.0000E-01 | 0 |

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|--------------|--------|--------------------------|----------------------|-----------------|------------|--------------|
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| Ka or Kb | pKa | | | | | |
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| 1.00E-14 | | | | | | |
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| 1.80E-05 | | | | | | |
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| | | | | | | |
| 1.80E-05 | 4.745 | | | | | |
| 4.30E-07 | 6.367 | | | | | |
| | | | | | | |
| | | | | | | |
| 1.80E-05 | 9.255 | | | | | |
| 1.80E-05 | | | | | | |
| 4.30E-07 | | | | | | |
| 5.60E-11 | | | | | | |
| 1.20E-02 | | | | | | |
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| | | | | | | |
| | 4.745 | | | | | |
| | 9.255 | | | | | |
| | 7.208 | | | | | |
| | 10.252 | | | | | |
| | 6.367 | | | | | |
| | | | | | | |
| | | buffer capacity exceeded | | | | |
| | | | | | | |
| total volume | | | init base millimoles | millimoles HCl | excess H+ | new H+ conc |
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |
| | | | | | | |
| | | | | | | |
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |
| | | | | | | |
| | | | init acid millimoles | millimoles NaOH | excess OH- | new OH- conc |
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |

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| pH | |
| #NUM! | |
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| #NUM! | |
| #NUM! | |
| #NUM! | |
| #NUM! | |
| #NUM! | |
| | |
| new H+ conc | |
| -1.00E-13 | #NUM! |
| -1.00E-13 | #NUM! |

| | | | | | |
|----------------------|--------|-----------|------------|------------|------------------|
| phosphate buffer | 7.208 | | 1.0000E-01 | 1.0000E-01 | 0 |
| bicarbonate buffer | 10.252 | | 1.0000E-01 | 1.0000E-01 | 0 |
| carbonic acid buffer | 6.367 | | 1.0000E-01 | 1.0000E-01 | 0 |
| | | | | | |
| | | | | | .01 M NaOH drops |
| acetic acid buffer | 4.745 | | 1.0000E-01 | 1.0000E-01 | 0 |
| ammonia buffer | 9.255 | | 1.0000E-01 | 1.0000E-01 | 0 |
| phosphate buffer | 7.208 | | 1.0000E-01 | 1.0000E-01 | 0 |
| bicarbonate buffer | 10.252 | | 1.0000E-01 | 1.0000E-01 | 0 |
| carbonic acid buffer | 6.367 | | 1.0000E-01 | 1.0000E-01 | 0 |
| | | | | | |
| | | | | | .1 M HCl drops |
| water | 7.000 | 1.000E-07 | | | 0 |
| | | | | | |
| | | | | | .01 M HCl drops |
| water | 7.000 | 1.000E-07 | | | 0 |
| | | | | | |
| | | | | | .1 M NaOH |
| water | 7.000 | 1.000E-07 | | | 0 |
| | | | | | |
| | | | | | .01 M NaOH |
| water | 7.000 | 1.000E-07 | | | 0 |

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|------------|--|--|--------|---|---------|-------------|
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |
| | | | | | | |
| | | | | | | |
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |
| 1.0000E+01 | | | 1.0000 | 0 | -1.0000 | -1.0000E-01 |
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| 1.0000E+01 | | | | | | |
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| 1.0000E+01 | | | | | | |

[illegible]