CLAIMS

What is claimed is:

1. A system comprising:

a reagent cartridge, the reagent cartridge including:

a cartridge housing defining an interior plenum volume, the cartridge housing to be received by an analysis instrument;

a first set of reagent reservoirs positioned, at least in part, within the interior plenum volume of the cartridge housing, wherein:

each reagent reservoir of the first set of reagent reservoirs is defined, in part, by a sidewall and contains a corresponding reagent, and

a first reagent reservoir of the first set of reagent reservoirs is spaced apart from a second reagent reservoir of the first set of reagent reservoirs to form a fluid flow passage between corresponding sidewalls of the first reagent reservoir and the second reagent reservoir;

a fluid inlet that passes through the cartridge housing and is in fluidic communication with the interior plenum volume of the cartridge housing, the fluid inlet fluidically connecting a fluid supply port of a temperature control system of the analysis instrument with the interior plenum volume when the reagent cartridge is received by the analysis instrument; and

a fluid outlet that passes through the cartridge housing and is in fluidic communication with the interior plenum volume of the cartridge housing, the fluid outlet fluidically connecting a fluid return port of the temperature control system of the analysis instrument with the interior plenum volume when the reagent cartridge is received by the analysis instrument, wherein the fluid inlet of the cartridge is to receive a fluid from the temperature control system of the analysis instrument at a predetermined temperature such that the reagent in the first reagent reservoir is at a first temperature and the reagent in the second reagent reservoir is at a second temperature that is different from the first temperature;

wherein a shortest flow path within the cartridge housing from the fluid inlet to the first reagent reservoir of the first set of reagent reservoirs is shorter than a shortest flow path within the cartridge housing from the fluid inlet to the second reagent reservoir of the first set of reagent reservoirs such that the first reagent reservoir of the first set of reagent reservoirs experiences a first amount of heating or cooling and the second reagent reservoir

of the first set of reagent reservoirs experiences a second amount of heating or cooling when the temperature control fluid is flowed through the fluid inlet and into the interior plenum volume, wherein the second amount of heating or cooling is different than the first amount of heating or cooling.

2. The system of claim 1, wherein the first reagent reservoir contains one or more reagents selected from the group of: tris(hydroxypropyl)phosphine, ethanol amine, tris(hydroxymethyl)aminomethane, tris(hydroxymethyl)phosphine, and a mixture of tris(hydroxymethyl)aminomethane, acetic acid, and EDTA (ethylenediaminetetraacetic acid).

3. The system of claim 1, wherein the fluid inlet is located outside of a smallest enclosing perimeter of the first set of reagent reservoirs.

4. The system of claim 1, wherein the first set of reagent reservoirs are arranged along one or more concentric circles and the fluid inlet is located outside of the one or more concentric circles.

5. The system of claim 1, wherein:

the first set of reagent reservoirs are arranged in a cluster about a rotary valve located in the cartridge housing,

there are multiple fluid flow passages between the sidewalls of the reagent reservoirs in the first set of reagent reservoirs, and

the multiple fluid flow passages provide one or more fluidic flow paths around the rotary valve.

6. The system of claim 1, where in the reagent cartridge further includes:

an inlet passage that fluidically connects, and is fluidically interposed between, the fluid inlet and the interior plenum volume; and

an outlet passage that fluidically connects, and is fluidically interposed between, the fluid outlet and the interior plenum volume, wherein:

the inlet passage, the outlet passage, and the first reagent reservoir are all located at least partially within a common quadrant of a reference circle centered on an average center point of the reagent reservoirs in the first set of reagent reservoirs.

7. The system of claim 1, further comprising:

an inlet passage that fluidically connects, and is fluidically interposed between, the fluid inlet and the interior plenum volume; and

an outlet passage that fluidically connects, and is fluidically interposed between, the fluid outlet and the interior plenum volume, wherein:

the inlet passage is at least partially located within a first quadrant of a reference circle centered on an average center point of the reagent reservoirs in the first set of reagent reservoirs,

the outlet passage is at least partially located in a second quadrant of the reference circle, and

the first quadrant and the second quadrant are 180° out of phase with each other about the average center point.

8. The system of claim 1, further comprising a second set of reagent reservoirs, wherein:

each reagent reservoir of the second set of reagent reservoirs is defined, in part, by a corresponding sidewall,

each reagent reservoir of the second set of reagent reservoirs contains a corresponding reagent,

two of the reagent reservoirs in a first subset of the reagent reservoirs in the second set of reagent reservoirs are spaced apart from one another to form an inlet passage between the respective sidewalls thereof, and

the inlet passage fluidically connects, and is fluidically interposed between, the fluid inlet and the interior plenum volume.

9. The system of claim 8, wherein:

two reagent reservoirs in a second subset of the reagent reservoirs in the second set of reagent reservoirs are spaced apart from one another to form an outlet passage between the respective sidewalls thereof,

the outlet passage fluidically connects, and is fluidically interposed between, the fluid outlet and the interior plenum volume, and

the first subset and the second subset are not identical.

10. The system of claim 9, wherein:

the reagent reservoirs in the second set of reagent reservoirs are arranged around an outer perimeter of the interior plenum volume, and

portions of the sidewalls of at least some of the reagent reservoirs in the second set of reagent reservoirs define, at least in part, the outer perimeter of the interior plenum volume.

11. The system of claim 1, further comprising the analysis instrument, wherein:

the analysis instrument includes the temperature control system, and

the temperature control system includes:

a recirculation plenum with a plenum inlet and a plenum outlet,

a first fluid pump fluidically interposed between the plenum inlet of the recirculation plenum and the plenum outlet of the recirculation plenum and configured to urge fluid within the recirculation plenum from the plenum inlet of the recirculation plenum towards the plenum outlet of the recirculation plenum when activated, and

one or more thermoelectric heat pumps, each thermoelectric heat pump in thermally conductive contact with a corresponding first radiator structure positioned within the recirculation plenum, wherein:

the plenum inlet of the recirculation plenum is fluidically connected with the fluid return port, and

the plenum outlet of the recirculation plenum is fluidically connected with the fluid supply port.

12. The system of claim 11, wherein the temperature control system further includes:

an ambient plenum with a plenum inlet and a plenum outlet; and

a second fluid pump fluidically interposed between the plenum inlet of the ambient plenum and the plenum outlet of the ambient plenum and configured to urge fluid within the ambient plenum from the plenum inlet of the ambient plenum towards the plenum outlet of the ambient

plenum when activated, wherein each thermoelectric heat pump is also in thermally conductive contact with a corresponding second radiator structure positioned within the ambient plenum.

13. The system of claim 12, wherein a cross-section of the recirculation plenum for at least a portion of the recirculation plenum is nested within a corresponding cross-section of the ambient plenum for at least a corresponding portion of the ambient plenum.

14. An analysis instrument comprising:

a cartridge receptacle, the cartridge receptacle configured to receive a reagent cartridge containing a plurality of liquid reagents; and

a temperature control system having:

a recirculation plenum with a plenum inlet and a plenum outlet,

an ambient plenum with a plenum inlet and a plenum outlet,

a first fluid pump fluidically interposed between the plenum inlet of the recirculation plenum and the plenum outlet of the recirculation plenum and configured to urge fluid within the recirculation plenum from the plenum inlet of the recirculation plenum towards the plenum outlet of the recirculation plenum when activated,

a second fluid pump fluidically interposed between the plenum inlet of the ambient plenum and the plenum outlet of the ambient plenum and configured to urge fluid within the ambient plenum from the plenum inlet of the ambient plenum towards the plenum outlet of the ambient plenum when activated,

one or more thermoelectric heat pumps, each thermoelectric heat pump in thermally conductive contact with a corresponding first radiator structure positioned within the recirculation plenum,

a fluid supply port, and

a fluid return port, wherein:

the plenum inlet of the recirculation plenum is fluidically connected with the fluid return port, and

the plenum outlet of the recirculation plenum is fluidically connected with the fluid supply port;

wherein the temperature control system controls a temperature of the liquid reagents,

wherein the ambient plenum has a U-shaped cross-section or an O-shaped cross-section,

wherein the recirculation plenum is nested within the ambient plenum having the U-shaped cross-section or the O-shaped cross-section, and

wherein the thermoelectric heat pumps are sandwiched in between the ambient plenum and the recirculation plenum.

15. The analysis instrument of claim 14, wherein a cross-section of the recirculation plenum for at least a portion of the recirculation plenum is nested within a corresponding cross-section of the ambient plenum for at least a corresponding portion of the ambient plenum.

16. The analysis instrument of claim 14, further comprising the reagent cartridge, wherein the reagent cartridge includes:

a cartridge housing defining an interior plenum volume, the cartridge housing to be received by the cartridge receptacle of the analysis instrument;

a first set of reagent reservoirs positioned, at least in part, within the interior plenum volume of the cartridge housing, wherein:

each reagent reservoir of the first set of reagent reservoirs is defined, in part, by a sidewall and contains a corresponding reagent, and

a first reagent reservoir of the first set of reagent reservoirs is spaced apart from a second reagent reservoir of the first set of reagent reservoirs to form a fluid flow passage between corresponding sidewalls of the first reagent reservoir and the second reagent reservoir;

a fluid inlet that passes through the cartridge housing and is in fluidic communication with the interior plenum volume of the cartridge housing, the fluid inlet fluidically connecting the fluid supply port with the interior plenum volume; and

a fluid outlet that passes through the cartridge housing and is in fluidic communication with the interior plenum volume of the cartridge housing, the fluid outlet fluidically connecting the fluid return port with the interior plenum volume,

wherein the fluid inlet of the cartridge is to receive a fluid from the temperature control system of the analysis instrument at a predetermined temperature such that the reagent in the first reagent reservoir is at a first temperature and the reagent in the second

reagent reservoir is at a second temperature that is different from the first temperature; wherein a shortest flow path within the cartridge housing from the fluid inlet to the first reagent reservoir of the first set of reagent reservoirs is shorter than a shortest flow path within the cartridge housing from the fluid inlet to the second reagent reservoir of the first set of reagent reservoirs such that the first reagent reservoir of the first set of reagent reservoirs experiences a first amount of heating or cooling and the second reagent reservoir of the first set of reagent reservoirs experiences a second amount of heating or cooling when a temperature control fluid at a particular temperature is flowed through the fluid inlet and into the interior plenum volume, wherein the second amount of heating or cooling is different than the first amount of heating or cooling.

17. A method comprising:

(a) providing a reagent cartridge having:

a cartridge housing defining an interior plenum volume,

a fluid inlet that passes through the cartridge housing,

a fluid outlet that passes through the cartridge housing, and

a first set of reagent reservoirs positioned, at least in part, within the interior plenum volume of the cartridge housing, wherein:

each reagent reservoir of the first set of reagent reservoirs is defined, in part, by a sidewall and contains a corresponding reagent, and

a first reagent reservoir of the first set of reagent reservoirs is spaced apart from a second reagent reservoir of the first set of reagent reservoirs to form a fluid flow passage between corresponding sidewalls of the first reagent reservoir and the second reagent reservoir,

wherein a shortest flow path within the cartridge housing from the fluid inlet to the first reagent reservoir of the first set of reagent reservoirs is shorter than a shortest flow path within the cartridge housing from the fluid inlet to the second reagent reservoir of the first set of reagent reservoirs;

(b) inserting the reagent cartridge into an analysis instrument;

(c) connecting a fluid supply port of a temperature control system of the analysis instrument to the fluid inlet of the cartridge housing;

(d) connecting a fluid return port of the temperature control system of the analysis instrument to the fluid outlet of the cartridge housing; and

(e) activating the temperature control system to cause fluid at a first predetermined temperature to flow from the fluid supply port to the fluid inlet, from the fluid inlet to the interior plenum volume within the cartridge, from the interior plenum volume to the fluid outlet, and from the fluid outlet to the fluid return port to cause the reagent in the first reagent reservoir to be at a first temperature and the reagent in the second reagent reservoir to be at a second temperature that is different from the first temperature.

18. The method of claim 17, wherein:

a shortest flow path within the cartridge housing from the fluid inlet to the first reagent reservoir of the first set of two or more reagent reservoirs is shorter than a shortest flow path within the cartridge housing from the fluid inlet to the second reagent reservoir of the first set of two or more reagent reservoirs, and

the performance of (e) causes the fluid to flow from the fluid inlet to both the first reagent reservoir and the second reagent reservoir along the respective shortest flow paths to the first reagent reservoir and the second reagent reservoir, respectively.

19. The method of claim 17, wherein:

the first predetermined temperature is within about 0°C to about 20°C, and

the reagent contained in the first reagent reservoir comprises one or more selected from the group of: tris(hydroxypropyl)phosphine, ethanol amine, tris(hydroxymethyl)aminomethane, tris(hydroxymethyl)phosphine, and a mixture of tris(hydroxymethyl)aminomethane, acetic acid, and EDTA (ethylenediaminetetraacetic acid).