skyla

# skyla VB1

## Veterinary Clinical Chemistry Analyzer
## Doctor’s Hand Book


- Biochemistry
- Electrolyte
- Endocrine

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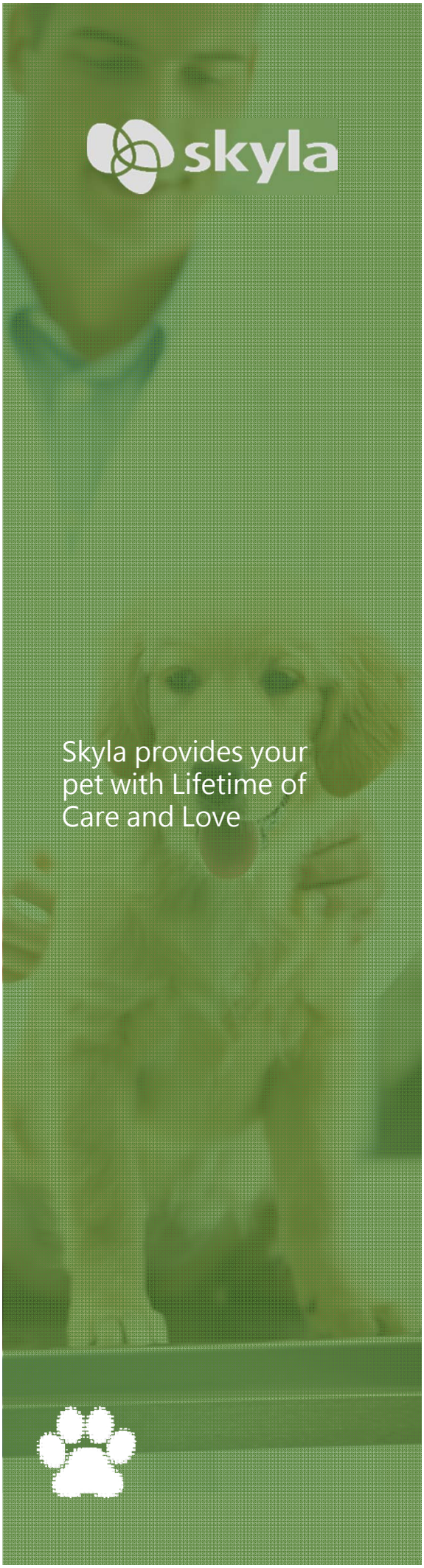


# Sample Treatment Know How

1. Take blood samples 12 hours after feeding to avoid lipemia and effects done to chemicals in blood
2. Exercise, stress, excitement, or long-term pressing causes fluctuation in blood concentration.
3. Hospitalization, surgery, injection, medication will change blood composition.
4. Age and sex of animals also causes great divergence in blood composition. Take blood sample at the same hour everyday as much as possible to avoid effects by circadian rhythm.
5. Take samples at the same time every day as much as possible to avoid variations in circadian rhythm
6. Take samples from the same body part as much as possible to avoid variations in concentration of blood combination.
7. **Use only Lithium Heparin** for anticoagulant, and the amount of the sample must be greater than one-half of the tube to avoid excessive anticoagulant interference.
8. For blood withdrawal 250~450uL, please use 500uL heparin lithium blood collection tube

**NOTE:** Misuse of the **EDTA** blood collection tube of the CBC will cause
decrease of **Ca, CPK, Cl, ALP, TP** values and cause
increase of **PHOS, K, Na, GGT, LDH** values.

## Ways and parts to take blood samples

Ways and parts for taking blood samples depend on classification, size of animals and required blood volume. Also, different test has different note. Listed below are some common ways for Skyla blood sampling.

1. Canine: blood can taken from a jugular vein, a cephalic vein, or a small saphenous vein on leg.
2. Feline: blood can taken by ear vein piercing and collected with a small bottle or a capillary.
3. Equine or other large economic animals: a jugular vein, or a caudal vein.
4. Avian: wing vein on the inner side of an elbow joint or a tibial vein on feet

# Sample Treatment Know How

Do not use a thin needle, preferably thicker than the 23G needle.
Also be slow when taking blood to avoid hemolysis

# Pipette operation precautions

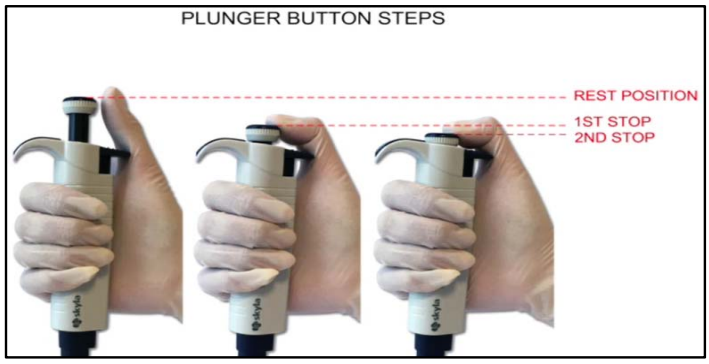
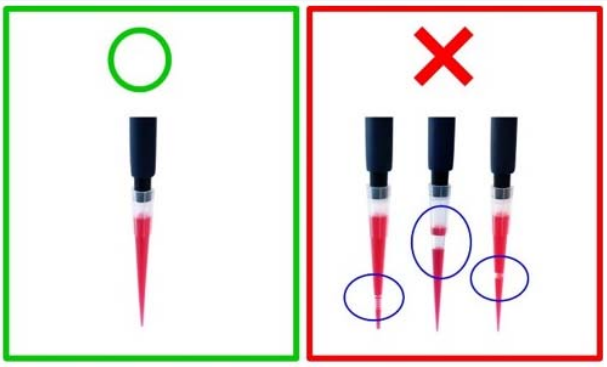
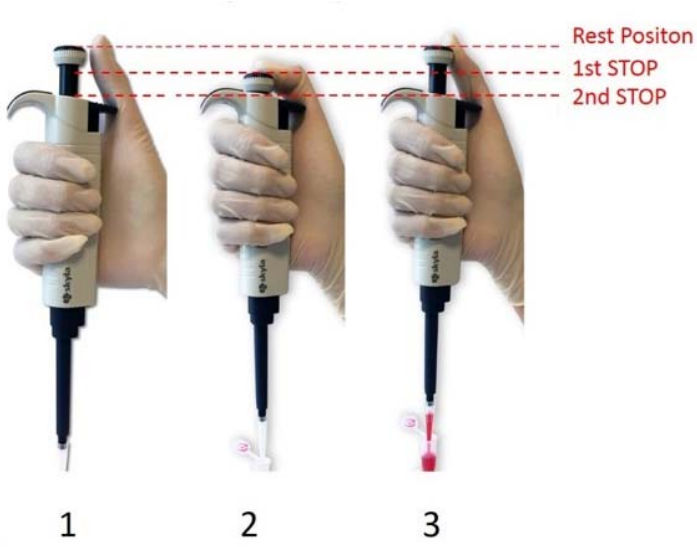
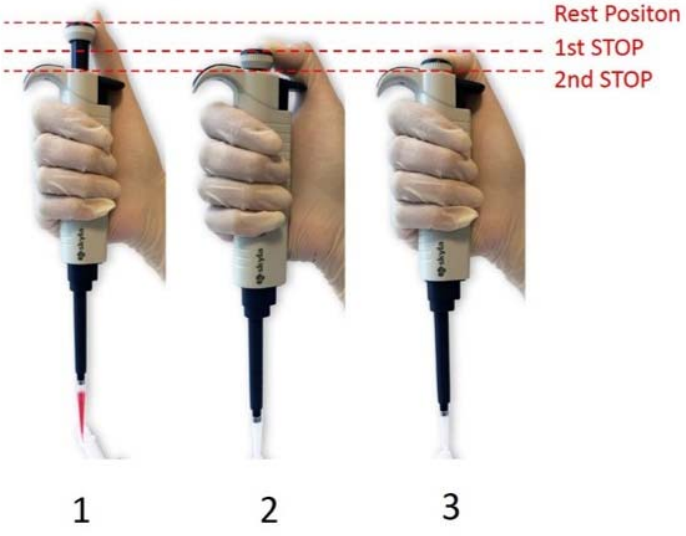
1. Please replace a tip every time and use the "skyla tip" to avoid disagreement with the pipette.

2. **200uL (220uL)** Skyla pipette is a **two-stop pipette**:
   - Used to test the reagent panels
   - Refer to the right page
   - Press the pipette to **1st stop to draw** a sample from the blood collection tube, slowly release it, and do not draw the bubbles of the sample or discontinuities.
   - Insert the tip into the blood injection hole of the reagent panel. Do not press the pipette too hard or too quick. Slowly press it for 3 seconds until it reaches the 1st stop to inject blood, and then press it to the **2nd stop to inject** all the remaining sample in the tip.
   - Release the pipette after pulling out the tip from the injection hold to avoid drawing back the sample that is already in the panel

3. **50uL** small pipette is a **one-stop pipette**:
   - Used to test the single/dual tests
   - Since the pipette has only one-stop, when injecting the sample, please lean the tip against the inner wall of the blood collection tube (avoid contact with the liquid in the tube),
     utilize the liquid tension to completely draw the remaining sample in the tip.

4. Push or Release the plunger of pipette Slowly at anytime.

# 220uL Pipette Operation

| 2-stop Pipette Operation | Sample Volume<br>Correct v.s Incorrect |
|---|---|
|  |  |
| Draw sample : Press to 1st stop | Inject sample : Press to 2st stop |
|  |  |

**NOTE:**

1. **Please SLOWLY draw or inject the sample. Slowly press it for 3 seconds until it reaches the 1st stop to inject blood.**
2. **Please inject the sample with a VERTICAL way.**
3. **Samples can be sticky and viscous. Please make sure all sample is injected slowly into the panel.**

# Precautions after Taking Samples

1. After the blood sample is collected, please test it as soon as possible, especially when testing **GLU, tCO2, PHOS, K, Mg, TBIL, and $NH_3$**.
2. Fresh plasma can be stored at 1-4 ° C for 24 hours before the formation of precipitate. After the precipitate is formed, it can be centrifuged again. The serum can be stored at 1-4 ° C for 30 days.

**Note: Freezing whole blood or shaking vigorously can cause hemolysis and interfere with test results.**

# Sample Treatment Know How

## Choice of serum or plasma sample

Skyla reagent panels can be tested with whole blood, plasma and serum. Skyla single cartridges can only be tested with plasma or serum. If sample amount is small and can only test the whole blood in a reagent panel, use plasma or serum can avoid lipemia and partial hemolysis interference.

When sample amount is sufficient, the plasma or serum after centrifugation can be used to reduce the endogenous interference of the sample. Serum may be a better choice over plasma because of lack of anticoagulant. However, preparation of serum sample must be carefully handled. It is essential that blood comes to a complete coagulation. Separate serum too early or too late from blood sample will both cause interference to test results. After serum separation, storage is also critical to avoid enzyme activation change and decomposition of the testing parameter.

# Sample Endogenous Interference Know How

1. Hemolysis is the rupture of red blood cells. Most vascular cell damage occurs during phlebotomy due to wet syringe and needle, high pressure to push blood out through needle, unclean container, interference by substances released from red blood cells and separating blood clot from container's wall mechanically.
   - When blood is drawn, if hemolysis is detected, the sample should be centrifuged immediately, and take only the uppermost liquid for the test.
   - When hemolysis is very serious and you must have a reference measurement, use the residual sample and centrifuge it to take the upper serum/plasma. Dilute it 2 to 3 times to get a rough value (Note: Some items have a large error)
2. Lipemia: Lipemic blood has large lipid particles. These samples have increased sample turbidity and may result in the prolongation of coagulation results.
   - If lipemia is detected with naked eyes, please test with serum/plasma after centrifugation.
   - After the lipemia sample is centrifuged, the lipemia will float to the top, and please avoid it when taking the serum/plasma sample.
   - If lipemia is really serious, please test the patient again after 12 hours of empty stomach.
3. Icterus: Icteric blood contains high levels of bilirubin which can interfere with test enzymes.
   - When icterus is very serious and you must have a reference measurement, use the residual sample and centrifuge it to take the upper serum/plasma. Dilute it 2 to 3 times to get a rough value (Note: Some items have a large error)
4. Hematocrit (hematocrit) PCV (HCT) too high: Skyla Biochemistry Analyzer allows a sample specification of <60%. Otherwise there will be too much red blood cells in the Skyla reagent panel, they will rupture during auto-dilution, cause severe hemolysis (HEM: 999) and fail.
   - After centrifugation, take the upper serum/plasma. If the serum/plasma is less than 200uL, you can make up some blood cells.

Skyla Biochemistry Analyzer can use multi-wavelength LEDs to detect the interference of the above HEM/LIP/ICT interference and compensate to reduce errors. If the interference is too serious, the sample quality control will alert, and the test result will be marked with % to indicate possible deviations.

# VB1 Panel Test Quick Manual

* For detailed information, please refer to Operator's Manual of VB1 analyzer.

## ■ Start Analyzer


## ■ Sample Preparation

**Whole blood**

* Use lithium heparin blood collection tubes (Green cap).
* DO NOT use sodium heparin blood collection tubes.
* DO NOT use EDTA blood collection tubes.
* Once the whole-blood sample is extracted, it must undergo testing within 2 hours (room temperature).

**Plasma**

* The blood sample must be at least half the volume of the blood collection tube.

**Serum**

* Use serum Clotting Activator blood collection tube (Gold cap).

## ■ Sample Analysis

### Step 1: Reagent Disc Preparation

1. Tear the aluminum foil packaging from the edge.

2. Grip with finger and thumb along with tissue paper to remove the reagent disc.

3. After removal, use the other hand to hold the reagent disc by the edge.

4. Tear and discard the tissue paper.

5. Remove the aluminum foil strip covering the sample injection port.

### Note

* Reagent discs retrieved from 2-8°C storage can be directly used without warming-up.
*Do not leave unopened reagent discs at 25°C(77°F) for more than 48 hours.

## Step 2: Dispensing the Sample

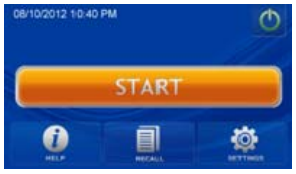
1. Use the provided pipette and tip to draw up 200 µL of the sample.

2. Keep the pipette **perpendicular** to the surface of the reagent disc. Gently push down the plunger to the lowest to dispense all the sample.

## Note

* When using the pipette, avoid drawing up air in the pipette tip.
* The pipette tip only needs to make slight contact with the bottom of the sample chamber; do not push down hard in order to avoid deforming the pipette tip.
* After the sample has been completely dispensed into the reagent disc, keep the pipette plunger down and remove the pipette from the sample injection port before releasing the plunger to avoid re-extracting the sample from the reagent disc.
* Do not repeatedly push down the pipette plunger which might cause sample volume quantification error.
* Perform the test within 10 minutes of dispensing the sample into the reagent disc.

## Step 3: Performing a Test




1.Press the **START** button on the touchscreen to open the disc drawer.

2. Hold a reagent disc by its edge. Gently place the disc into the drawer.


3. Input the patient ID and press **OK**.


4. Select the species.
*If you enable the Report Heading Option, the system will prompt you to enter Gender and/or Weight. Press **OK** when you have finished.


5. The system will begin the analysis. "**Analyzing...**" will be displayed on the screen.

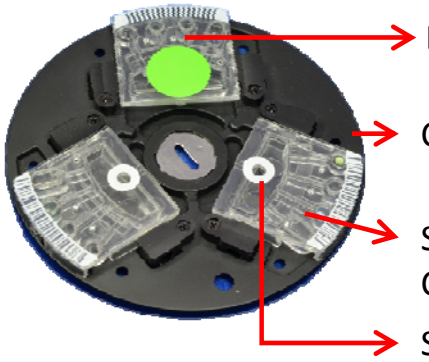
## Step 4: Test Results

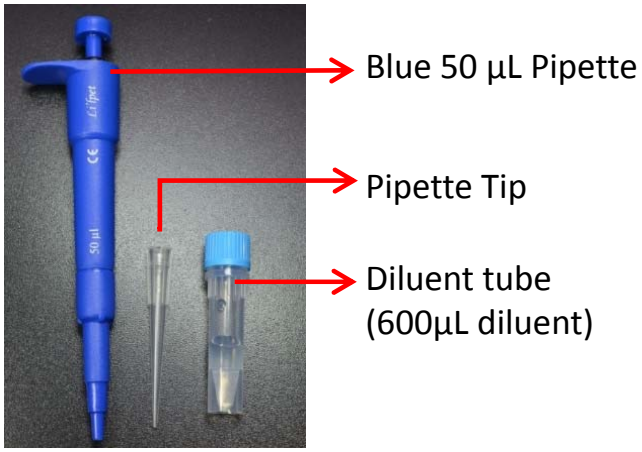
1.The system will automatically display the test report, which can be printed out.


2. Press **HOME** to open the drawer and remove the reagent disc. An analysis is now completed.

# VB1 Single Assay Analysis Quick Manual

## ■ Single Assay Analysis extension




## ■ Sample Analysis

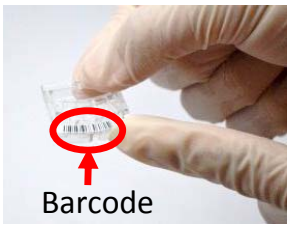
**Step 1: Centrifugation of whole blood sample to get enough plasma or serum sample**

Please follow user instructions of the specific centrifuge, and set enough centrifugation time to ensure proper sample separation. (For UPC test, prepare urine sample in a clean tube.)

**Step 2: Single Assay Cartridge (SAC) Preparation**

1. Tear the cartridge foil pouch open from the notch on the edge.

2. When retrieving the SAC from the pouch, use powder-free gloves and avoid contacting the reagent reaction cuvettes.





3. Place the barcode end of the SAC toward the outer edge of the carrier, and align the groove below the barcode to the raised bump on the outer edge.

4. When aligned, press the SAC in place on the carrier.

5. There must be 3 SACs on 1 carrier. If only 1 or 2 SACs are tested, place the balancer into other unused slots.

**Never use a used SAC as a balancer.*

## Step 3: Sample Preparation and Analysis Process


6. The dilution tube contains 600 µL of diluent. Before using, **please spin it for several seconds** to avoid liquid loss on the cap. (The blue ink is only for showing the liquid level.)

7. Use the blue 50 µL pipette to extract 50 µL of specimen **(plasma, serum, or urine)** and lean pipette tip against inner tube wall. Inject the sample **very slowly** (allow 3 seconds before it reaches to a stop) into the diluent tube along the upper side wall of the tube.

8. After injecting the specimen, close the cap tightly and **invert it 10 times** to thoroughly mix the solution.

9. **Change for a new pipette tip,** and use the blue 50 µL pipette to **inject 100µL** of the diluted specimen into the injection port **by 2 loads**.

10. Hold the carrier level. Place the carrier into the disc drawer of skyla VB1 analyzer.

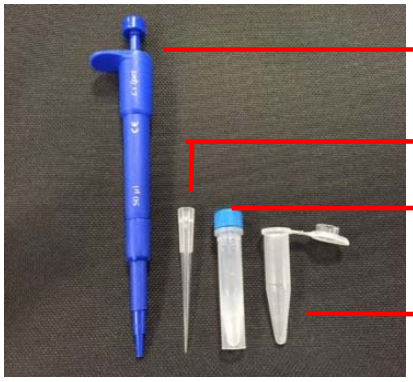
*****_Please ensure the SACs on the same carrier must contain specimens taken from the same pet, at the same time._

# Sample 2X Dilute Procedure

■ **Please dilute the sample 2X times if the measured item(Assay) gets high concentration or interference seriously.**

## Tools and Sample Collection

■ **Tools**



**50 µL fixed pipette**

**Tip**

**Diluent tube with diluent**

**Eppendorf tube**

■ **Sample Collection**

**Centrifuge whole blood sample to obtain enough plasma or serum sample.**

Put sample into **lithium heparin blood collection tube** (Green cap) **or serum clotting activator blood collection tube**( Gold cap) , then slightly shake up and down several times and put in centrifuge to obtain enough serum or plasma.

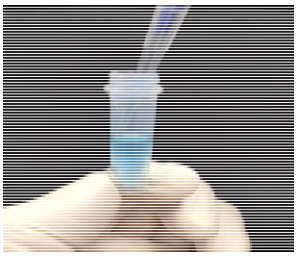
- **Whole blood can not be diluted directly.**
- Please refer to centrifuge instruction to set appropriate time

## Method to dilute sample

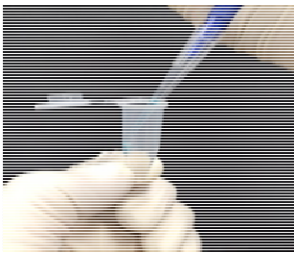
2 times dilution

- 150µLplasma/ serum+ 150µL diluent and centrifuge for few seconds after mix together ➡
  Take 200 µL of diluted sample for test
- 200µLplasma/ serum+ 200µL diluent and centrifuge for few seconds after mix together ➡
  Take 200 µL of diluted sample for test

## Procedure to dilute sample



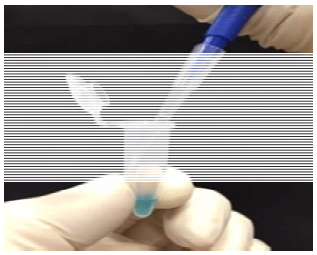
1. Use 50 µL fixed pipette to draw up diluent from diluent tube.



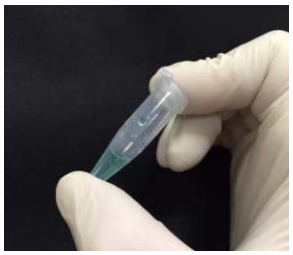
2. Lean pipette tip against upper Eppendorf tube wall, and press plunger to dispense diluent.

3. Use 50 µL fixed pipette with new pipette tip to draw up plasma or serum.

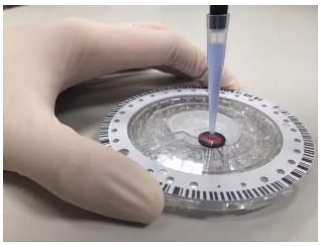
## Procedure to dilute sample



4. Lean pipette tip against upper Eppendorf tube wall, and press plunger very slowly (allow 3 seconds before it reaches to a stop) to dispense plasma/ serum.



5. Close Eppendorf tube lid after dispensing plasma/serum, slightly shake 10 times to mix plasma/serum with diluent, and **centrifuge the sample**.



**6.** Use 200 µL fixed pipette to draw up 200 µL diluted sample, and dispense sample into the reagent disc .

## Test Result

The system will automatically display the test report, which can be printed out..

**※Notice:**

- **Diluent sample 2 times => Test result should x2 times to get actual results.**
- **For T4/Thyroid Panel test , the sample can not be diluted !**

# Reference Ranges Common Unit

| Main Species I | | | | | | | |
|---|---|---|---|---|---|---|---|
| Item | Reference Range | | | | | | Common Unit |
| |  Canine Geriatric |  Canine Adults |  Canine Puppies |  Feline Geriatric |  Feline Adults |  Feline Kittens | |
| ALB | 2.5 - 4.5 | 2.6 - 4.6 | 2.4 - 4.1 | 2.6 - 4.5 | 2.5 - 4.6 | 2.5 - 4.5 | g/dL |
| TP | 5.2 - 8.2 | 5.2 - 8.2 | 4.8 - 7.2 | 5.7 - 8.9 | 5.7 - 8.9 | 5.2 - 8.2 | g/dL |
| GLU | 66 - 139 | 60 - 110 | 73 - 146 | 67 - 155 | 53 - 150 | 73 - 149 | mg/dL |
| ALP | 0 - 212 | 0 - 212 | 46 - 337 | 0 - 111 | 0 - 111 | 0 - 192 | U/L |
| ALT | 0 - 88 | 0 - 88 | 0 - 66 | 0 - 116 | 0 - 116 | 0 - 102 | U/L |
| AST | 0 - 50 | 0 - 50 | 0 - 50 | 0 - 48 | 0 - 48 | 0 - 32 | U/L |
| GGT | 0 - 10 | 0 - 10 | 0 - 10 | 0 - 10 | 0 - 10 | 0 - 10 | U/L |
| TBIL | 0 - 0.9 | 0 - 0.9 | 0 - 0.8 | 0 - 0.9 | 0 - 0.9 | 0 - 0.9 | mg/dL |
| BA | N/A | 0 - 25 | N/A | N/A | 0 - 25 | N/A | mmol/L |
| AMY | 500 - 1500 | 400 - 1500 | 300 - 1300 | 500 - 1500 | 500 - 1600 | 500 - 1400 | U/L |
| BUN | 6 - 26 | 6 - 26 | 6 - 28 | 13 - 37 | 13 - 37 | 13 - 34 | mg/dL |
| CREA | 0.3 - 1.6 | 0.4 - 1.6 | 0.1 - 1 | 0.6 - 2.2 | 0.7 - 2.0 | 0.4 - 1.4 | mg/dL |
| Ca | 7.9 - 12.0 | 7.9 - 12.0 | 7.8 - 12.6 | 8.0 - 12.0 | 8.0 - 12.0 | 8.1 - 12.0 | mg/dL |
| PHOS | 2.5 - 6.8 | 2.5 - 6.8 | 5.1 - 10.4 | 3.1 - 7.5 | 3.1 - 7.5 | 4.5 - 10.4 | mg/dL |
| Na | 138 - 160 | 138 - 160 | 138 - 159 | 142 - 164 | 142 - 164 | 142 - 164 | mmol/L |
| K | 3.5 - 5.8 | 3.5 - 5.8 | 3.5 - 5.5 | 3.5 - 5.8 | 3.5 - 5.8 | 3.7 - 5.9 | mmol/L |
| Cl | 110 - 122 | 106 – 120 | 107 - 120 | 113 - 129 | 112 – 126 | 116 - 126 | mmol/L |
| CPK | 0 - 200 | 0 - 200 | 99 - 436 | 0 - 314 | 0 - 314 | 0 - 394 | U/L |
| T4 | N/A | 1.0 - 4.0 | N/A | N/A | 0.8 - 4.7 | N/A | mg/dL |
| CHOL | 120 - 305 | 110 - 320 | 112 - 375 | 81 - 222 | 54 - 220 | 78 - 192 | mg/dL |
| TRIG | 0 - 100 | 0 - 100 | 0 - 33 | 0 - 100 | 0 - 100 | 8 - 54 | mg/dL |
| Mg | N/A | N/A | N/A | N/A | N/A | N/A | mg/dL |
| UA | N/A | N/A | N/A | N/A | N/A | N/A | mg/dL |
| tCO2 | N/A | 12 - 27 | N/A | N/A | 15 - 24 | N/A | mmol/L |
| UREA | N/A | 12.8 - 55.6 | N/A | N/A | 27.8 - 79.2 | N/A | mmol/L |
| LIPA | 0 - 125 | 0 - 125 | 0 - 100 | 0 - 35 | 0 - 35 | 0 - 25 | U/L |
| LAC | 1.0 - 2.9 | 1.0 - 2.9 | 1.0 - 2.9 | 1.1 - 2.9 | 1.1 - 2.9 | 1.1 - 2.9 | mmol/L |

# Reference Ranges Common Unit

| Main Species II | | | | | |
|---|---|---|---|---|---|
| Item | Reference Range | | | | Common Unit |
| |  Equine Yearlings |  Equine Foal |  Equine Adult |  Equine Mares at Stud | |
| ALB | 4.4 - 5.4 | 3.4 - 4.6 | 2.1 - 4.3 | 4.6 - 5.7 | g/dL |
| TP | 5.2 - 8.5 | 4.7 - 7.2 | 5.6 - 7.9 | 5.0 - 9.0 | g/dL |
| GLU | 54 - 163 | 105 - 264 | 63 - 136 | 41 - 133 | mg/dL |
| ALP | 0 - 469 | 505 - 4667 | 0 - 326 | 0 - 565 | U/L |
| ALT | 0 - 25 | 0 - 11 | 0 - 43 | 0 - 16 | U/L |
| AST | 0 - 317 | 0 - 228 | 92 - 610 | 0 - 333 | U/L |
| GGT | 0 - 24 | 0 - 34 | 0 - 42 | 0 - 33 | U/L |
| TBIL | 0 - 2.5 | 0 - 4.1 | 0 - 3.5 | 0 - 2.1 | mg/dL |
| BA | N/A | N/A | N/A | N/A | mmol/L |
| AMY | N/A | N/A | N/A | N/A | U/L |
| BUN | 12 - 26 | 6 - 32 | 10 - 30 | 12 - 34 | mg/dL |
| CREA | 0.2 - 1.6 | 0.7 - 1.5 | 0.7 - 2.0 | 0.4 - 1.5 | mg/dL |
| Ca | 11 - 13.7 | 10.4 - 13.1 | 11.5 - 14.2 | 11.1 - 13.9 | mg/dL |
| PHOS | N/A | N/A | N/A | N/A | mg/dL |
| Na | 126 - 144 | 126 - 144 | 126 - 146 | 126 - 144 | mmol/L |
| K | 1.8 - 4.5 | 1.8 - 4.5 | 2.5 - 5.2 | 1.8 - 4.5 | mmol/L |
| Cl | N/A | N/A | N/A | N/A | mmol/L |
| CPK | 0 - 354 | 0 - 473 | 0 - 350 | 0 - 504 | U/L |
| T4 | N/A | N/A | 1.0 - 3.8 | N/A | mg/dL |
| CHOL | N/A | N/A | N/A | N/A | mg/dL |
| TRIG | 19 - 52 | 4 - 166 | 0 - 68 | 6 - 80 | mg/dL |
| Mg | N/A | N/A | N/A | N/A | mg/dL |
| UA | N/A | N/A | N/A | N/A | mg/dL |
| tCO2 | N/A | N/A | 20 - 33 | N/A | mmol/L |
| UREA | | | 21.4 - 64.2 | | mmol/L |
| LIPA | N/A | N/A | N/A | N/A | U/L |
| LAC | N/A | N/A | N/A | N/A | mmol/L |

# Reference Ranges Common Unit

| Small Mammal | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Item | Reference Range | | | | | | | Common Unit |
| |  Rabbit |  Rat |  Mouse |  marmot |  Sugarglider |  Ferret |  Monkey | |
| ALB | 2.7 - 4.6 | 3.8 - 4.8 | 2.5 - 4.8 | 2.4 - 3.9 | 3.1 - 4.5 | 2.6 - 3.8 | 2.8 - 4.4 | g/dL |
| TP | 5.5 - 7.2 | 5.3 - 6.9 | 3.6 - 6.6 | 5.8 - 8.1 | 5.4 - 6.6 | 5.2 - 7.3 | 5.9 - 7.6 | g/dL |
| GLU | 75 - 145 | 50 - 135 | 90 - 192 | 120 - 209 | 60 - 210 | 94 - 207 | 50 - 100 | mg/dL |
| ALP | 70 - 145 | 16 - 302 | 62 - 209 | 25 - 64 | 30 - 72 | 9 - 84 | 73 - 210 | U/L |
| ALT | 23 - 44 | 13 - 52 | 20 - 120 | 18 - 80 | 21 - 94 | 72 - 269 | 13 - 108 | U/L |
| AST | 42 - 98 | 39 - 111 | 59 - 247 | 16 - 53 | 5 - 135 | 28 - 120 | 23 - 94 | U/L |
| GGT | N/A | 1 - 6 | N/A | N/A | N/A | N/A | 40 - 78 | U/L |
| TBIL | 0.3 - 0.8 | 0.1 - 0.7 | 0.1 - 0.9 | 0.1 - 0.3 | 0.1 - 0.5 | 0.1 - 1 | 0.1 - 0.6 | mg/dL |
| BA | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| AMY | N/A | 326 - 2246 | 1691 - 3615 | N/A | N/A | N/A | 149 - 500 | U/L |
| BUN | 8 - 24 | 7 - 20 | 17 - 29 | 20 - 46 | 5 - 30 | 8 - 48 | 4 - 25 | mg/dL |
| CREA | 0.8 - 1.8 | 0.1 - 0.7 | 0.2 - 0.8 | 0.8 - 2.3 | 0.4 - 1.0 | 0.4 - 0.9 | 0.4 - 1.2 | mg/dL |
| Ca | 5.1 - 12.7 | 4.8 - 12.2 | 5.5 - 9.6 | 8.3 - 11.3 | 3.8 - 10.7 | 8 - 12.5 | 8.3 - 10.5 | mg/dL |
| PHOS | 0.6 - 4.8 | 5.9 - 12 | 6.2 - 10.7 | 3.4 - 10.6 | 4.6 - 8.8 | 4.7 - 9.4 | 2 - 6.6 | mg/dL |
| Na | 131 - 143 | 128 - 140 | 115 - 172 | 138 - 174 | 131 - 140 | 136 - 152 | N/A | mmol/L |
| K | 3.8 - 7.5 | 4.5 - 6.4 | 5.1 - 6.3 | 4.5 - 6.2 | 3 - 4.5 | 4.7 - 8.3 | N/A | mmol/L |
| Cl | 95 - 113 | 98 - 108 | 95 - 121 | N/A | 104 - 109 | 113 - 124 | N/A | mmol/L |
| CPK | N/A | 48 - 340 | 68 - 1070 | N/A | 162 - 1116 | N/A | 63 - 460 | U/L |
| T4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mg/dL |
| CHOL | 55 - 70 | 41 - 105 | 55 - 108 | N/A | 120 - 207 | 80 - 284 | 88 - 181 | mg/dL |
| TRIG | 124 - 156 | 0 - 108 | 55 - 144 | N/A | N/A | 0 - 35 | 0 - 153 | mg/dL |
| Mg | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mg/dL |
| UA | N/A | 1.2 - 4.8 | 2.1 - 5.9 | N/A | N/A | N/A | N/A | mg/dL |
| tCO2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| UREA | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| LIPA | N/A | 0 - 25 | N/A | N/A | N/A | N/A | N/A | U/L |
| LAC | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |

# Reference Ranges Common Unit

| Large Mammal | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Item | Reference Range | | | | | | | Common Unit |
| |  Pig |  Dairy Cow |  Beef Cattle |  Llama |  Goat |  Sheep |  Panda | |
| ALB | 1.8 - 3.3 | 2.5 - 3.5 | 2.5 - 3.6 | 1.7 - 3.7 | 2.8 - 3.8 | 2.4 - 3.7 | 2.3 - 4.1 | g/dL |
| TP | 6 - 8 | 6.2 - 8 | 5.8 - 8 | 3.9 - 7.5 | 6.4 - 7.8 | 5.6 - 7.8 | 3.8 - 5.6 | g/dL |
| GLU | 85 - 160 | 56 - 88 | 46 - 93 | 85 - 236 | 54 - 93 | 50 - 80 | 109 - 193 | mg/dL |
| ALP | 92 - 294 | 28 - 233 | 10 - 149 | 30 - 95 | 75 - 228 | 50 - 228 | 6 - 72 | U/L |
| ALT | 2 - 35 | N/A | N/A | 3 - 21 | 16 - 36 | 0 - 10 | 3 - 27 | U/L |
| AST | 16 - 65 | 50 - 150 | 0 - 91 | 81 - 559 | 122 - 321 | 40 - 96 | 10 - 96 | U/L |
| GGT | 16 - 30 | 0 - 87 | 0 - 80 | 9 - 70 | 60 - 101 | 33 - 55 | N/A | U/L |
| TBIL | 0.1 - 0.3 | 0 - 0.7 | 0 - 0.7 | 0.1 - 0.2 | 0.1 - 0.4 | 0.1 - 0.4 | 0.6 - 1.3 | mg/dL |
| BA | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| AMY | 271 - 1198 | 0 - 34 | 0 - 28 | 175 - 1242 | 1 - 30 | 1 - 30 | N/A | U/L |
| BUN | 5 - 30 | 8 - 25 | 5 - 16 | 0 - 37 | 8 - 20 | 4 - 19 | 16 - 48 | mg/dL |
| CREA | 0.5 - 2.1 | 0.5 - 1.6 | 0 - 2.0 | 0.8 - 1.9 | 0.6 - 1.4 | 0.6 - 1.5 | 0.4 - 1.3 | mg/dL |
| Ca | 6.2 - 12 | 8 - 12.7 | 7.7 - 10.9 | 6.8 - 11.5 | 8.2 - 10.1 | 9.3 - 11.3 | 5.1 - 12.8 | mg/dL |
| PHOS | 3.4 - 8 | 3.8 - 7.5 | 4 - 6.9 | 1.3 - 9.4 | 3.9 - 6.7 | 3.8 - 7.7 | 3.8 - 7 | mg/dL |
| Na | 135 - 144 | 131 - 151 | 124 - 147 | 141 - 155 | N/A | 135 - 146 | 136 - 163 | mmol/L |
| K | 2.5 - 7.7 | 4.4 - 7 | 4.4 - 6.3 | 4.8 - 5.8 | N/A | 4.6 - 6.3 | 3.8 - 6.2 | mmol/L |
| Cl | 102 - 110 | 98 - 117 | 99 - 112 | 113 - 120 | N/A | 102 - 114 | 109 - 129 | mmol/L |
| CPK | N/A | 50 - 350 | 0 - 110 | 11 - 153 | 28 - 130 | 8 - 100 | N/A | U/L |
| T4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mg/dL |
| CHOL | 40 - 93 | 63 - 200 | 91 - 223 | 30 - 101 | 79 - 119 | 62 - 96 | 68 - 289 | mg/dL |
| TRIG | 41 - 83 | 0 - 35 | 0 - 35 | N/A | 0 - 35 | 0 - 35 | N/A | mg/dL |
| Mg | N/A | 1.8 - 3.0 | 1.3 - 2.4 | 1.4 - 2.9 | N/A | 2.3 - 3.0 | N/A | mg/dL |
| UA | 0.5 - 0.7 | N/A | N/A | N/A | N/A | N/A | N/A | mg/dL |
| tCO2 | N/A | N/A | N/A | N/A | N/A | 19 - 34 | N/A | mmol/L |
| UREA | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| LIPA | N/A | 0 - 25 | 0 - 25 | N/A | N/A | 0 - 25 | N/A | U/L |
| LAC | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |

# Reference Ranges Common Unit

| Avian I | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Item | Reference Range | | | | | | | Common Unit |
| |  Parrots Amazon Blue |  Parrots Amazon Yellow |  Parrots Eclectus |  Parrots African Grey |  Cockatoos Grey Cheek |  Cockatoos Moluccan |  Cockatoos Umbrella | |
| ALB | 0.7 - 1.7 | 0.7 - 1.3 | 0.6 - 1.3 | 0.8 - 4.9 | 0.8 - 4.9 | 1 - 2.9 | 0.9 - 2.7 | g/dL |
| TP | 3.7 - 5 | 3.4 - 4.6 | 3.5 - 5 | 2.6 - 4.9 | 2.5 - 4.5 | 3.6 - 5.5 | 3.8 - 5.5 | g/dL |
| GLU | 232 - 296 | 220 - 295 | 233 - 392 | 224 - 308 | 200 - 350 | 189 - 261 | 193 - 277 | mg/dL |
| ALP | 15 - 109 | 31 - 198 | 97 - 668 | 24 - 94 | 0 - 3000 | 40 - 160 | 30 - 204 | U/L |
| ALT | 0 - 12 | N/A | 0 - 10 | 0 - 14 | 0 - 631 | 0 - 1 | 0 - 7 | U/L |
| AST | 73 - 160 | 67 - 151 | 19 - 159 | 28 - 200 | 150 - 400 | 53 - 140 | 84 - 143 | U/L |
| GGT | 1 - 12 | 2 - 19 | 0 - 1 | 0 - 900 | 0 - 900 | 0 - 1 | 0 - 3 | U/L |
| TBIL | N/A | 0 - 0.1 | 0 - 0.1 | 0 - 26.8 | 0 - 26.8 | 0 - 0.2 | 0 - 0.3 | mg/dL |
| BA | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| AMY | 402 - 882 | 264 - 798 | 425 - 981 | 211 - 519 | 0 - 2500 | 414 - 972 | 424 - 759 | U/L |
| BUN | N/A | N/A | N/A | 3 - 117 | 3 - 117 | N/A | N/A | mg/dL |
| CREA | 0 - 0.1 | 0 - 0.1 | 0.1 - 0.2 | 0.1 - 0.4 | 0.1 - 0.4 | 0.1 - 0.6 | 0.1 - 0.2 | mg/dL |
| Ca | 8.1 - 11.9 | 7.7 - 11 | 7.9 - 12.6 | 6.8 - 9.7 | 1.9 - 16.4 | 7.3 - 12.9 | 8.4 - 11.6 | mg/dL |
| PHOS | 2.2 - 3.8 | 1.4 - 3.2 | 2.4 - 4.8 | 1.3 - 4.7 | 0.9 - 11.7 | 1.9 - 4.6 | 1 - 4.8 | mg/dL |
| Na | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| K | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| Cl | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| CPK | 97 - 450 | 98 - 646 | 144 - 418 | 71 - 408 | 100 - 300 | 60 - 606 | 112 - 559 | U/L |
| T4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mg/dL |
| CHOL | 208 - 438 | 147 - 302 | 185 - 322 | 215 - 314 | 28 - 450 | 139 - 321 | 123 - 349 | mg/dL |
| TRIG | 102 - 264 | 91 - 215 | 70 - 304 | 51 - 140 | 0 - 375 | 105 - 294 | 191 - 375 | mg/dL |
| Mg | 3.2 - 3.8 | 2.3 - 3.7 | 1.8 - 3.1 | 0 - 3.8 | 0 - 3.8 | 1.7 - 3.5 | 1.8 - 3.1 | mg/dL |
| UA | 1.7 - 6.2 | 1 - 6.6 | 2.8 - 9.3 | 3.5 - 7.5 | 4.4 - 12.6 | 3 - 13.4 | 3.8 - 12.3 | mg/dL |
| tCO2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| UREA | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| LIPA | 0 - 25 | 0 - 25 | 0 - 25 | 0 - 35 | 0 - 35 | 0 - 25 | 0 - 25 | U/L |
| LAC | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |

# Reference Ranges Common Unit

| Avian II | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Item | Reference Range | | | | | | | Common Unit |
| |  Budgerigar |  Cockatiel |  Canary |  Conure |  Macaw Blue and Gold |  Macaw Blue Hyacinth |  Macaw Scarlet | |
| ALB | 0.8 - 4.9 | 0.8 - 4.9 | 0.8 - 4.9 | 0.8 - 4.9 | 0.4 - 1.9 | 1.4 - 2 | 0.6 - 2.1 | g/dL |
| TP | 2 - 3 | 3 - 5 | 3 - 5 | 2.5 - 4.5 | 3.7 - 5.2 | 3.9 - 4.6 | 3.8 - 5.1 | g/dL |
| GLU | 254 - 399 | 200 - 450 | 200 - 450 | 200 - 350 | 227 - 310 | 215 - 275 | 206 - 292 | mg/dL |
| ALP | 54 - 326 | 0 - 3000 | 0 - 3000 | 0 - 3000 | 27 - 205 | 3 - 84 | 9 - 74 | U/L |
| ALT | 0 - 13 | 0 - 631 | 0 - 631 | 0 - 631 | 0 - 4 | 0 - 1 | N/A | U/L |
| AST | 55 - 154 | 100 - 350 | 150 - 350 | 125 - 350 | 17 - 126 | 68 - 122 | 32 - 95 | U/L |
| GGT | 0 - 900 | 0 - 900 | 0 - 900 | 0 - 900 | 0 - 1 | 0 - 1 | 0 - 1 | U/L |
| TBIL | 0 - 26.8 | 0 - 26.8 | 0 - 26.8 | 0 - 26.8 | 0 - 1 | 0 - 0.2 | 0 - 0.3 | mg/dL |
| BA | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| AMY | 187 - 582 | 0 - 2500 | 0 - 2500 | 0 - 2500 | 295 - 506 | 283 - 595 | 217 - 710 | U/L |
| BUN | 3 - 117 | 3 - 117 | 3 - 117 | 3 - 117 | 0 - 3 | 0 - 4 | 0 - 7 | mg/dL |
| CREA | 0.1 - 0.4 | 0.1 - 0.4 | 0.1 - 0.4 | 0.1 - 0.5 | 0.1 - 0.2 | 0.1 - 0.3 | 0.1 - 0.13 | mg/dL |
| Ca | 6.1 - 11.8 | 8.6 - 13.9 | 1.9 - 16.4 | 8 - 16.3 | 7 - 13.4 | 7.4 - 10.5 | 8 - 11.2 | mg/dL |
| PHOS | 1.3 - 2.1 | 0.9 - 11.7 | 0.9 - 11.7 | 0.9 - 11.7 | 1.8 - 6.1 | 1.8 - 4.5 | 1.8 - 4.8 | mg/dL |
| Na | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| K | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| Cl | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| CPK | 54 - 252 | 100 - 300 | 0 - 2015 | 100 - 300 | 62 - 393 | 284 - 871 | 76 - 406 | U/L |
| T4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mg/dL |
| CHOL | 175 - 275 | 28 - 450 | 28 - 450 | 28 - 450 | 96 - 193 | 85 - 163 | 118 - 304 | mg/dL |
| TRIG | 109 - 271 | 0 - 375 | 0 - 375 | 0 - 375 | 86 - 288 | 84 - 201 | 83 - 266 | mg/dL |
| Mg | 0 - 3.8 | 0 - 3.84 | 0 - 3.8 | 0 - 3.8 | 2.0 - 3.8 | 1.3 - 2.8 | 1.5 - 3.2 | mg/dL |
| UA | 3.4 - 9.1 | 3.9 - 11.6 | 4.4 - 12.6 | 2.5 - 3.6 | 1.1 - 14.4 | 3.9 - 20.7 | 2.1 - 8.5 | mg/dL |
| tCO2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| UREA | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| LIPA | 0 - 35 | 0 - 35 | 0 - 35 | 0 - 35 | 0 - 30 | 0 - 30 | 0 - 30 | U/L |
| LAC | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |

# Reference Ranges Common Unit

| Reptile | | | | | |
|---|---|---|---|---|---|
| Item | Reference Range | | | | Common Unit |
| |  Snake |  Tortoise |  Sea Turtle |  Lizard | |
| ALB | N/A | 1.3 - 3 | 1 - 2.5 | N/A | g/dL |
| TP | 2.9 - 8 | 3 - 7 | 3.6 - 6.8 | 3 - 8.1 | g/dL |
| GLU | 10 - 108 | N/A | 72 - 125 | 54 - 198 | mg/dL |
| ALP | 80 - 145 | 36 - 156 | 24 - 48 | 60 - 99 | U/L |
| ALT | 3 - 242 | N/A | N/A | N/A | U/L |
| AST | 5 - 35 | 14 - 18 | 66 - 315 | 5 - 103 | U/L |
| GGT | 1.0 - 1.5 | N/A | N/A | 1 - 10 | U/L |
| TBIL | N/A | 0.1 - 0.6 | N/A | N/A | mg/dL |
| BA | N/A | N/A | N/A | N/A | mmol/L |
| AMY | N/A | N/A | N/A | N/A | U/L |
| BUN | 0 - 9 | 18 - 34 | 35 - 104 | 0 - 10 | mg/dL |
| CREA | 0.1 - 0.5 | 0.1 - 0.4 | 0.1 - 0.3 | 0.1 - 0.2 | mg/dL |
| Ca | 10.3 - 24.6 | 10.3 - 15.7 | 4.4 - 15.1 | 7.5 - 10.3 | mg/dL |
| PHOS | 2.8 - 5.1 | 2.4 - 9.8 | 5 - 8.2 | 2.1 - 4.7 | mg/dL |
| Na | N/A | N/A | N/A | N/A | mmol/L |
| K | N/A | N/A | N/A | N/A | mmol/L |
| Cl | N/A | N/A | N/A | N/A | mmol/L |
| CPK | N/A | N/A | N/A | N/A | U/L |
| T4 | N/A | N/A | N/A | N/A | mg/dL |
| CHOL | 68 - 146 | N/A | 156 - 415 | 64 - 147 | mg/dL |
| TRIG | 53 - 177 | N/A | 0 - 260 | 53 - 106 | mg/dL |
| Mg | N/A | N/A | 6.7 - 9.4 | N/A | mg/dL |
| UA | 1.4 - 10.6 | 1.6 - 3.2 | 0.7 - 2.2 | 3.1 - 8.5 | mg/dL |
| tCO2 | N/A | N/A | N/A | N/A | mmol/L |
| UREA | N/A | N/A | N/A | N/A | mmol/L |
| LIPA | N/A | N/A | N/A | N/A | U/L |
| LAC | N/A | N/A | N/A | N/A | mmol/L |

# Add Note

# Reference Ranges SI Unit

| Main Species I | | | | | | | |
|---|---|---|---|---|---|---|---|
| Item | Reference Range | | | | | | SI Unit |
| |  Canine Geriatric |  Canine Adults |  Canine Puppies |  Feline Geriatric |  Feline Adults |  Feline Kittens | |
| ALB | 25 - 45 | 26 - 46 | 24 - 41 | 26 - 45 | 25 - 46 | 25 - 45 | g/L |
| TP | 52 - 82 | 52 - 82 | 48 - 72 | 57 - 89 | 57 - 89 | 52 - 82 | g/L |
| GLU | 3.7 - 7.7 | 3.33 - 6.11 | 4.1 - 8.1 | 3.7 - 8.6 | 2.94 - 8.33 | 4.1 - 8.3 | mmol/L |
| ALP | 0 - 212 | 0 - 212 | 46 - 337 | 0 - 111 | 0 - 111 | 0 - 192 | U/L |
| ALT | 0 - 88 | 0 - 88 | 0 - 66 | 0 - 116 | 0 - 116 | 0 - 102 | U/L |
| AST | 0 - 50 | 0 - 50 | 0 - 50 | 0 - 48 | 0 - 48 | 0 - 32 | U/L |
| GGT | 0 - 10 | 0 - 10 | 0 - 10 | 0 - 10 | 0 - 10 | 0 - 10 | U/L |
| TBIL | 0 - 15.4 | 0 - 15.4 | 0 - 13.7 | 0 - 15.4 | 0 - 15.4 | 0 - 15.4 | µmol/L |
| BA | N/A | 0 - 25 | N/A | N/A | 0 - 25 | N/A | µmol/L |
| AMY | 500 - 1500 | 400 - 1500 | 300 - 1300 | 500 - 1500 | 500 - 1600 | 500 - 1400 | U/L |
| BUN | 2.1 - 9.3 | 2.1 - 9.3 | 2.1 - 10.0 | 4.6 - 13.2 | 4.6 - 13.2 | 4.6 - 12.1 | mmol/L |
| CREA | 27 - 141 | 35 - 141 | 9 - 88 | 53 - 194 | 62 - 177 | 35 - 124 | µmol/L |
| Ca | 1.98 - 3.00 | 1.98 - 3.00 | 1.95 - 3.15 | 2.00 - 3.00 | 2.00 - 3.00 | 2.03 - 3.00 | mmol/L |
| PHOS | 2.5 - 6.8 | 0.8 - 2.2 | 5.1 - 10.4 | 3.1 - 7.5 | 1.0 - 2.42 | 4.5 - 10.4 | mmol/L |
| Na | 138 - 160 | 138 - 160 | 138 - 159 | 142 - 164 | 142 - 164 | 142 - 164 | mmol/L |
| K | 3.5 - 5.8 | 3.5 - 5.8 | 3.5 - 5.5 | 3.5 - 5.8 | 3.5 - 5.8 | 3.7 - 5.9 | mmol/L |
| Cl | 110 - 122 | 106 – 120 | 107 - 120 | 113 - 129 | 112 – 126 | 116 - 126 | mmol/L |
| CPK | 0 - 200 | 0 - 200 | 99 - 436 | 0 - 314 | 0 - 314 | 0 - 394 | U/L |
| T4 | N/A | 12.9 - 51.5 | N/A | N/A | 10.3 - 60.5 | N/A | nmol/L |
| CHOL | 3.1 - 7.9 | 2.8 - 8.3 | 2.9 - 9.7 | 2.1 - 5.7 | 1.4 - 5.7 | 2 - 5 | mmol/L |
| TRIG | 0 - 1.1 | 0 - 1.1 | 0 - 0.4 | 0 - 1.1 | 0 - 1.1 | 0.1 - 0.6 | mmol/L |
| Mg | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| UA | N/A | N/A | N/A | N/A | N/A | N/A | µmol/L |
| tCO2 | N/A | 12 - 27 | N/A | N/A | 15 - 24 | N/A | mmol/L |
| UREA | N/A | 2.1 - 9.3 | N/A | N/A | 4.6 - 13.2 | N/A | mmol/L |
| LIPA | 0 - 125 | 0 - 125 | 0 - 100 | 0 - 35 | 0 - 35 | 0 - 25 | U/L |
| LAC | 1.0 - 2.9 | 1.0 - 2.9 | 1.0 - 2.9 | 1.1 - 2.9 | 1.1 - 2.9 | 1.1 - 2.9 | mmol/L |

# Reference Ranges SI Unit

| Main Species II | | | | | |
|---|---|---|---|---|---|
| Item | Reference Range | | | | SI Unit |
| |  Equine Yearlings |  Equine Foal |  Equine Adult |  Equine Mares at Stud | |
| ALB | 44 - 54 | 34 - 46 | 21 - 43 | 46 - 57 | g/L |
| TP | 52 - 85 | 47 - 72 | 56 - 79 | 50 - 90 | g/L |
| GLU | 3 - 9 | 5.8 - 14.7 | 3.50 - 7.55 | 2.3 - 7.4 | mmol/L |
| ALP | 0 - 469 | 505 - 4667 | 0 - 326 | 0 - 565 | U/L |
| ALT | 0 - 25 | 0 - 11 | 0 - 43 | 0 - 16 | U/L |
| AST | 0 - 317 | 0 - 228 | 92 - 610 | 0 - 333 | U/L |
| GGT | 0 - 24 | 0 - 34 | 0 - 42 | 0 - 33 | U/L |
| TBIL | 0 - 42.8 | 0 - 70.1 | 0 - 59.9 | 0 - 35.9 | µmol/L |
| BA | N/A | N/A | N/A | N/A | µmol/L |
| AMY | N/A | N/A | N/A | N/A | U/L |
| BUN | 4.3 - 9.3 | 2.1 - 11.4 | 3.6 - 10.7 | 4.3 - 12.1 | mmol/L |
| CREA | 18 - 141 | 62 - 133 | 62 - 177 | 35 - 133 | µmol/L |
| Ca | 2.75 - 3.43 | 2.6 - 3.28 | 2.88 - 3.55 | 2.78 - 3.48 | mmol/L |
| PHOS | N/A | N/A | N/A | N/A | mmol/L |
| Na | 126 - 144 | 126 - 144 | 126 - 146 | 126 - 144 | mmol/L |
| K | 1.8 - 4.5 | 1.8 - 4.5 | 2.5 - 5.2 | 1.8 - 4.5 | mmol/L |
| Cl | N/A | N/A | N/A | N/A | mmol/L |
| CPK | 0 - 354 | 0 - 473 | 0 - 350 | 0 - 504 | U/L |
| T4 | N/A | N/A | 12.9 - 48.9 | N/A | nmol/L |
| CHOL | N/A | N/A | N/A | N/A | mmol/L |
| TRIG | 0.2 - 0.6 | 0 - 1.9 | 0 - 0.8 | 0.1 - 0.9 | mmol/L |
| Mg | N/A | N/A | N/A | N/A | mmol/L |
| UA | N/A | N/A | N/A | N/A | µmol/L |
| tCO2 | N/A | N/A | 20 - 33 | N/A | mmol/L |
| UREA | | | 3.6 - 10.7 | | mmol/L |
| LIPA | N/A | N/A | N/A | N/A | U/L |
| LAC | N/A | N/A | N/A | N/A | mmol/L |

# Reference Ranges SI Unit

| Small Mammal | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Item | Reference Range | | | | | | | SI Unit |
| |  Rabbit |  Rat |  Mouse |  marmot |  Sugarglider |  Ferret |  Monkey | |
| ALB | 27 - 46 | 38 - 48 | 25 - 48 | 24 - 39 | 31 - 45 | 26 - 38 | 28 - 44 | g/L |
| TP | 55 - 72 | 53 - 69 | 36 - 66 | 58 - 81 | 54 - 66 | 52 - 73 | 59 - 76 | g/L |
| GLU | 4.2 - 8 | 2.8 - 7.5 | 5 - 10.7 | 6.7 - 11.6 | 3.3 - 11.7 | 5.2 - 11.5 | 2.8 - 5.6 | mmol/L |
| ALP | 70 - 145 | 16 - 302 | 62 - 209 | 25 - 64 | 30 - 72 | 9 - 84 | 73 - 210 | U/L |
| ALT | 23 - 44 | 13 - 52 | 20 - 120 | 18 - 80 | 21 - 94 | 72 - 269 | 13 - 108 | U/L |
| AST | 42 - 98 | 39 - 111 | 59 - 247 | 16 - 53 | 5 - 135 | 28 - 120 | 23 - 94 | U/L |
| GGT | N/A | 1 - 6 | N/A | N/A | N/A | N/A | 40 - 78 | U/L |
| TBIL | 5.1 - 13.7 | 1.7 - 12 | 1.7 - 15.4 | 1.7 - 5.1 | 1.7 - 8.6 | 1.7 - 17.1 | 1.7 - 10.3 | μmol/L |
| BA | N/A | N/A | N/A | N/A | N/A | N/A | N/A | μmol/L |
| AMY | N/A | 326 - 2246 | 1691 - 3615 | N/A | N/A | N/A | 149 - 500 | U/L |
| BUN | 2.9 - 8.6 | 2.5 - 7.1 | 6.1 - 10.4 | 7.1 - 16.4 | 1.8 - 10.7 | 2.9 - 17.1 | 1.4 - 8.9 | mmol/L |
| CREA | 71 - 159 | 9 - 62 | 18 - 71 | 71 - 203 | 35 - 88 | 35 - 80 | 35 - 106 | μmol/L |
| Ca | 1.28 - 3.18 | 1.2 - 3.05 | 1.38 - 2.4 | 2.08 - 2.83 | 0.95 - 2.68 | 2 - 3.13 | 2.08 - 2.63 | mmol/L |
| PHOS | 0.5 - 1.5 | 1.7 - 3.1 | 1.8 - 2.8 | 1.1 - 2.8 | 1.4 - 2.4 | 1.4 - 2.5 | 0.8 - 1.9 | mmol/L |
| Na | 131 - 143 | 128 - 140 | 115 - 172 | 138 - 174 | 131 - 140 | 136 - 152 | N/A | mmol/L |
| K | 3.8 - 7.5 | 4.5 - 6.4 | 5.1 - 6.3 | 4.5 - 6.2 | 3 - 4.5 | 4.7 - 8.3 | N/A | mmol/L |
| Cl | 95 - 113 | 98 - 108 | 95 - 121 | N/A | 104 - 109 | 113 - 124 | N/A | mmol/L |
| CPK | N/A | 48 - 340 | 68 - 1070 | N/A | 162 - 1116 | N/A | 63 - 460 | U/L |
| T4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | nmol/L |
| CHOL | 1.4 - 1.8 | 1.1 - 2.7 | 1.4 - 2.8 | N/A | 3.1 - 5.4 | 2.1 - 7.4 | 2.3 - 4.7 | mmol/L |
| TRIG | 1.4 - 1.8 | 0 - 1.2 | 0.6 - 1.6 | N/A | N/A | 0 - 0.4 | 0 - 1.7 | mmol/L |
| Mg | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| UA | N/A | 71 - 286 | 125 - 351 | N/A | N/A | N/A | N/A | μmol/L |
| tCO2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| UREA | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| LIPA | N/A | 0 - 25 | N/A | N/A | N/A | N/A | N/A | U/L |
| LAC | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |

# Reference Ranges SI Unit

| Large Mammal | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Item | Reference Range | | | | | | | SI Unit |
| |  Pig |  Dairy Cow |  Beef Cattle |  Llama |  Goat |  Sheep |  Panda | |
| ALB | 18 - 33 | 25 - 35 | 25 - 36 | 17 - 37 | 28 - 38 | 24 - 37 | 23 - 41 | g/L |
| TP | 60 - 80 | 62 - 80 | 58 - 80 | 39 - 75 | 64 - 78 | 56 - 78 | 38 - 56 | g/L |
| GLU | 4.7 - 8.9 | 3.1 - 4.9 | 2.6 - 5.2 | 4.7 - 13.1 | 3 - 5.2 | 2.8 - 4.4 | 6 - 10.7 | mmol/L |
| ALP | 92 - 294 | 28 - 233 | 10 - 149 | 30 - 95 | 75 - 228 | 50 - 228 | 6 - 72 | U/L |
| ALT | 2 - 35 | N/A | N/A | 3 - 21 | 16 - 36 | 0 - 10 | 3 - 27 | U/L |
| AST | 16 - 65 | 50 - 150 | 0 - 91 | 81 - 559 | 122 - 321 | 40 - 96 | 10 - 96 | U/L |
| GGT | 16 - 30 | 0 - 87 | 0 - 80 | 9 - 70 | 60 - 101 | 33 - 55 | N/A | U/L |
| TBIL | 1.7 - 5.1 | 0 - 12 | 0 - 12 | 1.7 - 3.4 | 1.7 - 6.8 | 1.7 - 6.8 | 10.3 - 22.2 | μmol/L |
| BA | N/A | N/A | N/A | N/A | N/A | N/A | N/A | μmol/L |
| AMY | 271 - 1198 | 0 - 34 | 0 - 28 | 175 - 1242 | 1 - 30 | 1 - 30 | N/A | U/L |
| BUN | 1.8 - 10.7 | 2.9 - 8.9 | 1.8 - 5.7 | 0 - 13.2 | 2.9 - 7.1 | 1.4 - 6.8 | 5.7 - 17.1 | mmol/L |
| CREA | 44 - 186 | 44 - 141 | 0 - 177 | 71 - 168 | 53 - 124 | 53 - 133 | 35 - 115 | μmol/L |
| Ca | 1.55 - 3 | 2 - 3.18 | 1.93 - 2.73 | 1.7 - 2.88 | 2.05 - 2.53 | 2.33 - 2.83 | 1.28 - 3.2 | mmol/L |
| PHOS | 1.1 - 2.6 | 1.2 - 2.4 | 1.3 - 2.2 | 0.4 - 3 | 1.3 - 2.2 | 1.2 - 2.5 | 1.2 - 2.3 | mmol/L |
| Na | 135 - 144 | 131 - 151 | 124 - 147 | 141 - 155 | N/A | 135 - 146 | 136 - 163 | mmol/L |
| K | 2.5 - 7.7 | 4.4 - 7 | 4.4 - 6.3 | 4.8 - 5.8 | N/A | 4.6 - 6.3 | 3.8 - 6.2 | mmol/L |
| Cl | 102 - 110 | 98 - 117 | 99 - 112 | 113 - 120 | N/A | 102 - 114 | 109 - 129 | mmol/L |
| CPK | N/A | 50 - 350 | 0 - 110 | 11 - 153 | 28 - 130 | 8 - 100 | N/A | U/L |
| T4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | nmol/L |
| CHOL | 1.0 - 2.4 | 1.6 - 5.2 | 2.4 - 5.8 | 0.8 - 2.6 | 2.0 - 3.1 | 1.6 - 2.5 | 1.8 - 7.5 | mmol/L |
| TRIG | 0.5 - 0.9 | 0 - 0.4 | 0 - 0.4 | N/A | 0 - 0.4 | 0 - 0.4 | N/A | mmol/L |
| Mg | N/A | 0.74 - 1.23 | 0.53 - 0.99 | 0.58 - 1.19 | N/A | 0.95 - 1.23 | N/A | mmol/L |
| UA | 30 - 42 | N/A | N/A | N/A | N/A | N/A | N/A | μmol/L |
| tCO2 | N/A | N/A | N/A | N/A | N/A | 19 - 34 | N/A | mmol/L |
| UREA | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| LIPA | N/A | 0 - 25 | 0 - 25 | N/A | N/A | 0 - 25 | N/A | U/L |
| LAC | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |

# Reference Ranges SI Unit

| Avian I | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Item | Reference Range | | | | | | | SI Unit |
| | Parrots Amazon Blue | Parrots Amazon Yellow | Parrots Eclectus | Parrots African Grey | Cockatoos Grey Cheek | Cockatoos Moluccan | Cockatoos Umbrella | |
| ALB | 7 - 17 | 7 - 13 | 6 - 13 | 8 - 49 | 8 - 49 | 10 - 29 | 9 - 27 | g/L |
| TP | 37 - 50 | 34 - 46 | 35 - 50 | 26 - 49 | 25 - 45 | 36 - 55 | 38 - 55 | g/L |
| GLU | 12.9 - 16.4 | 12.2 - 16.4 | 12.9 - 21.8 | 12.4 - 17.1 | 11.1 - 19.4 | 10.5 - 14.5 | 10.7 - 15.4 | mmol/L |
| ALP | 15 - 109 | 31 - 198 | 97 - 668 | 24 - 94 | 0 - 3000 | 40 - 160 | 30 - 204 | U/L |
| ALT | 0 - 12 | N/A | 0 - 10 | 0 - 14 | 0 - 631 | 0 - 1 | 0 - 7 | U/L |
| AST | 73 - 160 | 67 - 151 | 19 - 159 | 28 - 200 | 150 - 400 | 53 - 140 | 84 - 143 | U/L |
| GGT | 1 - 12 | 2 - 19 | 0 - 1 | 0 - 900 | 0 - 900 | 0 - 1 | 0 - 3 | U/L |
| TBIL | N/A | 0 - 1.7 | 0 - 1.7 | 0 - 458.4 | 0 - 458.4 | 0 - 3.4 | 0 - 5.1 | µmol/L |
| BA | N/A | N/A | N/A | N/A | N/A | N/A | N/A | µmol/L |
| AMY | 402 - 882 | 264 - 798 | 425 - 981 | 211 - 519 | 0 - 2500 | 414 - 972 | 424 - 759 | U/L |
| BUN | N/A | N/A | N/A | 1.1 - 41.8 | 1.1 - 41.8 | N/A | N/A | mmol/L |
| CREA | 0 - 9 | 0 - 9 | 9 - 18 | 9 - 35 | 9 - 35 | 9 - 53 | 9 - 18 | µmol/L |
| Ca | 2.03 - 2.98 | 1.93 - 2.75 | 1.98 - 3.15 | 1.7 - 2.43 | 0.48 - 4.1 | 1.83 - 3.23 | 2.1 - 2.9 | mmol/L |
| PHOS | 0.7 - 1.2 | 0.5 - 1 | 0.8 - 1.6 | 0.4 - 1.5 | 0.3 - 3.8 | 0.6 - 1.5 | 0.3 - 1.6 | mmol/L |
| Na | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| K | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| Cl | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| CPK | 97 - 450 | 98 - 646 | 144 - 418 | 71 - 408 | 100 - 300 | 60 - 606 | 112 - 559 | U/L |
| T4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | nmol/L |
| CHOL | 5.4 - 11.3 | 3.8 - 7.8 | 4.8 - 8.3 | 5.6 - 8.1 | 0.7 - 11.7 | 3.6 - 8.3 | 3.2 - 9.0 | mmol/L |
| TRIG | 1.2 - 3 | 1 - 2.4 | 0.8 - 3.4 | 0.6 - 1.6 | 0 - 4.2 | 1.2 - 3.3 | 2.2 - 4.2 | mmol/L |
| Mg | 1.32 - 1.56 | 0.95 - 1.52 | 0.74 - 1.28 | 0- 1.56 | 0 - 1.58 | 0.70 - 1.44 | 0.74 - 1.28 | mmol/L |
| UA | 101.1 - 368.8 | 60 - 393 | 167 - 553 | 208 - 446 | 262 - 750 | 179 - 797 | 226 - 732 | µmol/L |
| tCO2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| UREA | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| LIPA | 0 - 25 | 0 - 25 | 0 - 25 | 0 - 35 | 0 - 35 | 0 - 25 | 0 - 25 | U/L |
| LAC | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |

# Reference Ranges SI Unit

| Avian II | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Item | Reference Range | | | | | | | SI Unit |
| |  Budgerigar |  Cockatiel |  Canary |  Conure |  Macaw Blue and Gold |  Macaw Blue Hyacinth |  Macaw Scarlet | |
| ALB | 8 - 49 | 8 - 49 | 8 - 49 | 8 - 49 | 4 - 19 | 14 - 20 | 6 - 21 | g/L |
| TP | 20 - 30 | 30 - 50 | 30 - 50 | 25 - 45 | 37 - 52 | 39 - 46 | 38 - 51 | g/L |
| GLU | 14.1 - 22.1 | 11.1 - 25 | 11.1 - 25 | 11.1 - 19.4 | 12.6 - 17.2 | 11.9 - 15.3 | 11.4 - 16.2 | mmol/L |
| ALP | 54 - 326 | 0 - 3000 | 0 - 3000 | 0 - 3000 | 27 - 205 | 3 - 84 | 9 - 74 | U/L |
| ALT | 0 - 13 | 0 - 631 | 0 - 631 | 0 - 631 | 0 - 4 | 0 - 1 | N/A | U/L |
| AST | 55 - 154 | 100 - 350 | 150 - 350 | 125 - 350 | 17 - 126 | 68 - 122 | 32 - 95 | U/L |
| GGT | 0 - 900 | 0 - 900 | 0 - 900 | 0 - 900 | 0 - 1 | 0 - 1 | 0 - 1 | U/L |
| TBIL | 0 - 458.4 | 0 - 458.4 | 0 - 458.4 | 0 - 458.4 | 0 - 17.1 | 0 - 3.4 | 0 - 5.1 | µmol/L |
| BA | N/A | N/A | N/A | N/A | N/A | N/A | N/A | µmol/L |
| AMY | 187 - 582 | 0 - 2500 | 0 - 2500 | 0 - 2500 | 295 - 506 | 283 - 595 | 217 - 710 | U/L |
| BUN | 1.1 - 41.8 | 1.1 - 41.8 | 1.1 - 41.8 | 1.1 - 41.8 | 0 - 1.1 | 0 - 1.4 | 0 - 2.5 | mmol/L |
| CREA | 9 - 35 | 9 - 35 | 9 - 35 | 9 - 44 | 9 - 18 | 9 -27 | 9 - 11 | µmol/L |
| Ca | 1.53 - 2.95 | 2.15 - 3.48 | 0.48 - 4.1 | 2 - 4.08 | 1.75 - 3.35 | 1.85 - 2.63 | 2 - 2.8 | mmol/L |
| PHOS | 0.4 - 0.7 | 0.3 - 3.8 | 0.3 - 3.8 | 0.3 - 3.8 | 0.6 - 2 | 0.6 - 1.5 | 0.6 - 1.6 | mmol/L |
| Na | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| K | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| Cl | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| CPK | 54 - 252 | 100 - 300 | 0 - 2015 | 100 - 300 | 62 - 393 | 284 - 871 | 76 - 406 | U/L |
| T4 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | nmol/L |
| CHOL | 4.5 - 7.1 | 0.7 - 11.7 | 0.7 - 11.7 | 0.7 - 11.7 | 2.5 - 5.0 | 2.2 - 4.2 | 3.1 - 7.9 | mmol/L |
| TRIG | 1.2 - 3.1 | 0 - 4.2 | 0 - 4.2 | 0 - 4.2 | 1 - 3.3 | 0.9 - 2.3 | 0.9 - 3 | mmol/L |
| Mg | 0 - 1.56 | 0 - 1.58 | 0 - 1.56 | 0 - 1.56 | 0.82 - 1.56 | 0.53 - 1.15 | 0.62 - 1.32 | mmol/L |
| UA | 202 - 541 | 232 - 690 | 262 - 750 | 149 - 214 | 65 - 857 | 232 - 1231 | 125 - 506 | µmol/L |
| tCO2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| UREA | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |
| LIPA | 0 - 35 | 0 - 35 | 0 - 35 | 0 - 35 | 0 - 30 | 0 - 30 | 0 - 30 | U/L |
| LAC | N/A | N/A | N/A | N/A | N/A | N/A | N/A | mmol/L |

# Reference Ranges SI Unit

| Reptile | | | | | |
|---|---|---|---|---|---|
| Item | Reference Range | | | | SI Unit |
| | Snake | Tortoise | Sea Turtle | Lizard | |
| ALB | N/A | 13 - 30 | 10 - 25 | N/A | g/L |
| TP | 29 - 80 | 30 - 70 | 36 - 68 | 30 - 81 | g/L |
| GLU | 0.6 - 6 | N/A | 4 - 6.9 | 3 - 11 | mmol/L |
| ALP | 80 - 145 | 36 - 156 | 24 - 48 | 60 - 99 | U/L |
| ALT | 3 - 242 | N/A | N/A | N/A | U/L |
| AST | 5 - 35 | 14 - 18 | 66 - 315 | 5 - 103 | U/L |
| GGT | 1.0 - 1.5 | N/A | N/A | 1 - 10 | U/L |
| TBIL | N/A | 1.7 - 10.3 | N/A | N/A | μmol/L |
| BA | N/A | N/A | N/A | N/A | μmol/L |
| AMY | N/A | N/A | N/A | N/A | U/L |
| BUN | 0 - 3.2 | 6.4 - 12.1 | 12.5 - 37.1 | 0 - 3.6 | mmol/L |
| CREA | 9 - 44 | 9 - 35 | 9 - 27 | 9 - 18 | μmol/L |
| Ca | 2.58 - 6.15 | 2.58 - 3.93 | 1.1 - 3.78 | 1.88 - 2.58 | mmol/L |
| PHOS | 0.9 - 1.6 | 0.8 - 3.2 | 1.6 - 2.6 | 0.7 - 1.5 | mmol/L |
| Na | N/A | N/A | N/A | N/A | mmol/L |
| K | N/A | N/A | N/A | N/A | mmol/L |
| Cl | N/A | N/A | N/A | N/A | mmol/L |
| CPK | N/A | N/A | N/A | N/A | U/L |
| T4 | N/A | N/A | N/A | N/A | nmol/L |
| CHOL | 1.8 - 3.8 | N/A | 4 - 10.7 | 1.7 - 3.8 | mmol/L |
| TRIG | 0.6 - 2 | N/A | 0 - 2.9 | 0.6 - 1.2 | mmol/L |
| Mg | N/A | N/A | 2.76 - 3.87 | N/A | mmol/L |
| UA | 83 - 631 | 95 - 190 | 42 - 131 | 184 - 506 | μmol/L |
| tCO2 | N/A | N/A | N/A | N/A | mmol/L |
| UREA | N/A | N/A | N/A | N/A | mmol/L |
| LIPA | N/A | N/A | N/A | N/A | U/L |
| LAC | N/A | N/A | N/A | N/A | mmol/L |

# VB1 Analyzer Main Specifications

| | |
|---|---|
| **Principle** | |
| Colormetry Method<br>Turbidimetry Method | 8 LEDs with 340nm~940nm wavelength |
| **Sample & Panel** | |
| Test Profiles | Panels, Single Tests and Dual Tests |
| Measurement Time | Panel : 15min(whole blood) up to 15 tests.<br>Single/Dual assay test: Up to 6 tests in 12 min. |
| Sample Type & Volume | 200µL Whole blood (PCV<60%), plasma or serum<br>＊220ul pipette instead is offered to give more tolerance for operators. |
| **System Design** | |
| User Interface | 5 inch color LCD touch screen |
| Internal Memory | Store up to 50,000 analysis results |
| Printer | Built in thermal printer or<br>External USB printers (PCL 3GUI, PCL5, PCL6) |
| USB type-A (Host) | External USB Printer (PCI 3GUI, PCL5, PCL6),<br>USB flash drive (FAT16/32) |
| PC Connection | RS232 serial port,<br>Skyla Data Manager PC software |
| Dimensions | 233 (W) X 285 (D) X 300 (H) mm |
| Weight | 5.5 kg |
| **Operating Condition** | |
| Humidity & Temperature | 5 to 90 % ; 10 ~ 32 ˚C |

# Total Available Markers (29 +7)

| | |
|---|---|
| ALB | Albumin |
| ALP (ALKP) | Alkaline phosphatase |
| ALT (GPT) | Alanine aminotransferase |
| AST (GOT) | Aspartate aminotransferase |
| AMY (AMYL) | Amylase |
| BA (BileAcid, TBA) | Total bile acid |
| BUN (UREA) | Blood urea nitrogen |
| Ca | Calcium |
| CHOL (TCHOL) | Cholesterol |
| Cl | Chlorine |
| CPK (CK) | Creatinine kinase |
| CREA | Creatinine |
| FRU | Fructosamine |
| GGT (γGT) | γ-glutamyltransferase |
| GLU | Glucose |
| K | Potassium |
| LAC | Lactate |
| LIPA (pLIPA) | Pancreatic specific lipase |
| Mg | Magnesium |
| Na | Sodium |
| PHOS (IP) | Phosphate |
| T4 (Total T4) | Thyroxine |
| TP | Total protein |
| TRIG | Triglyceride |
| TBIL | Total bilirubin |
| tCO2 | Total carbon dioxide |
| UA | Blood uric acid |
| UPRO | Urine protein |
| UCRE | Urine creatinine |
| UPC# | UPRO/UCRE ratio |
| GLOB# | Globulin |
| AGap# | Anion gap |
| A/G# | ALB/GLOB ratio |
| B/C# | BUN/CREA ratio |
| Na/K# | Sodium/Potassium ratio |
| cCa# | Corrected Calcium (considerable while ALB is low) |

# Test Profiles

| | |
|---|---|
| **Preanesthetic Panel**<br>900-100 (7 +3 items) | ALP, ALT, BUN (UREA), CREA, GLU, TP, ALB, GLOB#, A/G#, B/C# |
| **Renal Panel**<br>900-110 (9 +3 items) | BUN (UREA), CREA, ALB, PHOS, Ca, Na, K, Cl, tCO2, AGap#, B/C#, Na/K# |
| Diagnosis Panel<br>900-120 (13 +3 items) | ALP, ALT, AST, BUN (UREA), CREA, GLU, TP, ALB, TBIL, AMY, PHOS, Ca, CHOL, GLOB#, A/G#, B/C# |
| **Liver Panel**<br>900-130 (8 +2 items) | ALP, ALT, AST, BUN (UREA), TP, ALB, TBIL, GGT, GLOB#, A/G# |
| **Diagnosis Plus Panel**<br>900-140 (13 +4 items) | ALP, ALT, BUN (UREA), CREA, GLU, TP, ALB, TBIL, AMY, PHOS, Ca, Na, K, GLOB#, A/G#, B/C#, Na/K# |
| **Equine Panel**<br>900-150 (14 +4 items) | ALP, AST, BUN (UREA), CREA, GLU, TP, ALB, TBIL, Ca, Na, K, GGT, CPK, tCO2, GLOB#, A/G#, B/C#, Na/K# |
| **Thyroid/T4 Panel**<br>900-160 (2 items) | T4, CHOL |
| **Large Animal Panel**<br>900-170 (14 +3 items) | ALP, AST, BUN (UREA), GLU, TP, ALB, PHOS, Ca, Na, K, Cl, GGT, CPK, Mg, GLOB#, A/G#, Na/K# |
| **Liver Plus Panel**<br>900-180 (10 +2 items) | ALP, ALT, AST, BUN (UREA), TP, ALB, TBIL, GGT, CHOL, BA, $NH_3$*, GLOB#, A/G# |
| **Avian & Reptile Panel**<br>900-190 (12 +3 items) | AST, GLU, TP, ALB, PHOS, Ca, Na, K, Cl, CPK, BA, UA, GLOB#, A/G#, Na/K# |
| **Diabetes Panel**<br>900-300 (4 +1 items) | FRU, GLU, ALB, TP, GLOB# |
| **Electrolyte Panel**<br>900-310 (4 +2 items) | Na, K, Cl, tCO2, AGap#, Na/K# |
| **Diagnosis-II Panel**<br>900-320 (14 +3 items) | ALP, ALT, BUN (UREA), CREA, GLU, TP, ALB, TBIL, AMY, PHOS, Ca, GGT, CHOL, LIPA, GLOB#, A/G#, B/C# |
| **Critical Care Panel**<br>900-330 (14 +5 items) | ALP, ALT, BUN (UREA), CREA, GLU, TP, ALB, Ca, Na, K, Cl, CPK, tCO2, LAC, GLOB#, AGap#, A/G#, B/C#, Na/K# |
| **Single Tests** | CREA, BUN, Cl, TBIL, LAC |
| **Dual Tests** | Na+K (Na/K#), Ca+PHOS, AST+CPK, ALB+TP (GLOB#, A/G#), ALP+ALT, TRIG+CHOL, GGT+CPK, LIPA+AMY, UPRO+UCRE (UPC#) |

# Test Application

## 900-100
## Preanesthetic Panel
(7 assays + 3 calculated items)

**Test Items** (# calculated item, items are subject to change without notice.)

ALP, ALT, BUN (UREA), CREA, GLU, TP, ALB,

GLOB#, ALB/GLOB#, BUN/CREA#

**Application**

- Apply before canine and feline sedation or surgery anesthesia to improve the assessment of the physical condition in order to minimize the risk of anesthesia.
- Biochemical tests before anesthesia can be used to detect early stages of disease in dogs and cats, and no significant clinical symptoms have been reported.
- Also suitable for basic health examinations for puppies and kittens under six months of age.
- Can also be used as follow-up examination for non-steroidal anti-inflammatory drugs (NSAIDs).

# Test Application

## 900-110
## Renal Panel
(9 assays + 3 calculated items)

**Test Items** (# calculated item, items are subject to change without notice.)

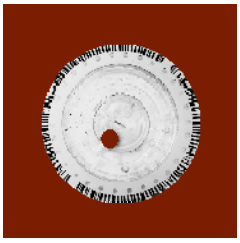
BUN (UREA), CREA, ALB, PHOS, Ca, Na, K, Cl,

AGap#, Na/K#, BUN/CREA#

**Application**

- Check for kidney related diseases in dogs and cats kidney.
- When dogs and cats show low energy, anorexia, polyuria, anuria, ascites, edema and other clinical symptoms, use the kidney reagent disk to assist in diagnosis
- Can also be used to monitor the use of hepatotoxic drugs, dogs and cats with Addison's Symptoms and feline urinary tract diseases.
- It also provides complete electrolyte testing to help determine kidney disease.

# Test Application



## 900-120
## Diagnosis Panel
(13 assays + 3 calculated items)

**Test Items** (# calculated item, items are subject to change without notice.)

ALP, ALT, AST, BUN (UREA), CREA, GLU, TP, ALB, TBIL, AMY,

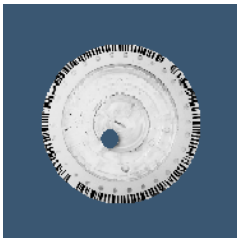
PHOS, Ca, CHOL,

GLOB#, ALB/GLOB#, BUN/CREA#

**Application**

- Canine and feline comprehensive health examination.
- CHOL gives initial diagnosis about endocrine problems. If the result is abnormal, please do test further on T4 Panel.
- AMY has a preliminary diagnosis of pancreatic problems. If the results are abnormal, please further test LIPA on the LIPA/AMY dual test cartridge for pancreatic problems.
- Use Diagnosis Panel to track health status. Particularly with older dogs and cats over the age of seven, or dogs and cats that suffered from major diseases or underwent operation within two years.
- Use before sedatives or surgical anesthesia for older dogs and cats over 7 years of age or with major illnesses to assess physical condition and reduce the risk of anesthesia.

# Test Application



## 900-130
## Liver Panel
(8 assays + 2 calculated items)

**Test Items** (# calculated item, items are subject to change without notice.)

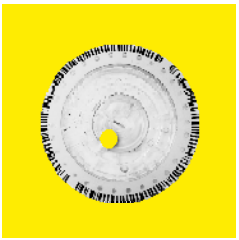
ALP, ALT, AST, BUN (UREA), TP, ALB, TBIL, GGT,

GLOB#, ALB/GLOB#

**Application**

- When dogs and cats show symptoms possibly implicating liver disease, apply liver reagent disk for detection as early as possible.
- GGT result can be used to diagnose ileus in cats.
- Liver biochemical tests should be performed once every six months to one year in middle to old age dogs or dogs who have had a history of liver abnormalities.

# Test Application



## 900-140
## Diagnosis Plus Panel
(13 assays + 4 calculated items)

**Test Items** (# calculated item, items are subject to change without notice.)

ALP, ALT, BUN (UREA), CREA, GLU, TP, ALB, TBIL, AMY, PHOS,

Ca, Na, K,

GLOB#, ALB/GLOB#, BUN/CREA#, Na/K#

**Application**

- Provides complete biochemical and Na/K# testing. Can be used on healthy, sick or older dogs and cats for further health examinations. Dogs and cats under drug-treatment, suffering from critical disease, or chronic disease assessment.
- Diagnosis Plus Panel is particularly useful for the treatment of dogs and cats with chronic kidney disease, the results of which can help veterinarians narrow down the diagnosis or provide additional testing directions.
- Also for pre-anesthesia check on elderly dogs and cats.

# Test Application

## 900-150
## Equine Panel
(14 assays + 4 calculated items)

**Test Items** (# calculated item, items are subject to change without notice.)

ALP, AST, BUN (UREA), CREA, GLU, TP, ALB, TBIL, Ca, Na, K,

GGT, CPK, tCO2,

GLOB#, ALB/GLOB#, BUN/CREA#, Na/K#

**Application**

- Provide complete biochemical and Na/K# testing for horse and pony.
- Use the Equine Panel to track health status. Particularly with older horse that suffered from major diseases or underwent operation within two years.
- CPK is for snake-bite examinations and also helps diagnose muscle damage caused by strenuous exercise.
- For horse under drug-treatment, suffering from critical disease, or chronic disease assessment.
- Also could be useful for the treatment of horses with chronic kidney disease, the results of which can help veterinarians narrow down the diagnosis or provide additional testing directions.

# Test Application

## 900-160
## Thyroid/T4 Panel
(2 assays)

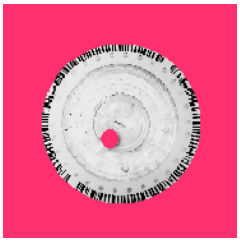
**Test Items** (Items are subject to change without notice.)

T4, CHOL

**Application**

- To detect canine hypothyroidism and hyperthyroidism, also to monitor thyroid hormone replacement therapy and medication.
- CHOL gives you a reference index for the judgement.
- Add Thyroid/T4 Panel to all the comprehensive healthy check for old dogs and cats.
- Iodine-131 treatment for thyroid can be used on felines or thyroidectomy follow-up. Thyroid problem is one of the endocrine diseases prone to older dogs and cats.
- Dogs over seven years of age or with a history of thyroid disease are advised to follow up with thyroid reagent trays one to two times a year.

# Test Application



## 900-170
## Large Animal Panel
(14 assays + 3 calculated items)

**Test Items** (# calculated item, items are subject to change without notice.)

ALP, AST, BUN (UREA), GLU, TP, ALB, PHOS, Ca, Na, K, Cl,

GGT, CPK, Mg,

GLOB#, ALB/GLOB#, Na/K#

**Application**

- Provide complete biochemical and electrolyte testing for economic large animals such as cattle, goat, sheep, pig…etc.
- Use the Large Animal Panel to track health status. For sick large animals under drug-treatment, suffering from critical disease, or chronic disease assessment.
- CPK is for snake-bite examinations and also helps diagnose muscle damage caused by strenuous exercise.
- For detections on postpartum paralysis, a condition in which the cow shortly after calving can not rise and stand on its own, mainly caused by hypocalcaemia due to metabolic alkalosis and magnesium deficiency.
- Mg is suitable for the detection of grass mites, also known as hypomagnesemia, magnesium deficiency syndrome.
- Please select “Other Species 1-6” (the user can rename the species by himself), and the reference range needs to be established by the veterinarian.

# Test Application

## 900-180
## Liver Plus Panel
(10 assays + 2 calculated items)

**Test Items** (# calculated item, items are subject to change without notice.)

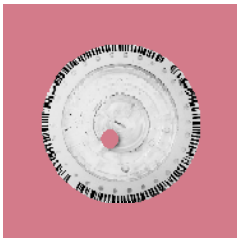
ALP, ALT, AST, BUN (UREA), TP, ALB, TBIL, GGT, CHOL, BA, $NH_3$*

GLOB#, ALB/GLOB#

**Application**

- The BA bile acid test in particular, is a clinically highly sensitive liver-specific test. The BA value can be compared between the 12 hours before the meal and the 2 hours after the meal. If only one test can be done, please test it after the meal.
- Apply to confirm liver disease in dogs and cats, also to monitor the condition of dogs and with liver diseases.
- It can also be used to monitor the usage of non-steroidal anti-inflammatory drugs (NSAIDs) and other potential hepatotoxic drugs.
- GGT result can be used to diagnose ileus in cats.
- Middle-aged dogs or dogs with a history of abnormal liver disease should have a liver biochemical examination every six months.
- CHOL gives initial diagnosis about endocrine problems. If the result is abnormal, please do test further on T4 Panel.
- Measurement of blood ammonia ($NH_3$) can detect hepatic disorders associated with hepatic encephalopathy (HE), an altered level of consciousness as a result of liver failure.

# Test Application



## 900-190
## Avian & Reptile Panel
(12 assays + 3 calculated items)

**Test Items** (# calculated item, items are subject to change without notice.)

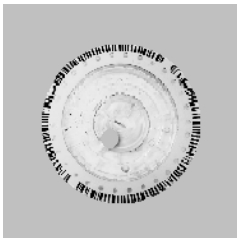
AST, GLU, TP, ALB, PHOS, Ca, Na, K, Cl, CPK, BA, UA,

GLOB#, ALB/GLOB#, Na/K#

**Application**

- Suitable for general health examination of birds and reptile animals, assessment of renal function, electrolyte status, liver integrity and function, snake-bite examinations or for assessment before anesthesia and long-term monitoring after rehabilitation.
- For sick avian and reptile animals under drug-treatment, suffering from critical disease, or chronic disease assessment.
- Please select “Other Species 1-6” (the user can rename the species by himself), and the reference range needs to be established by the veterinarian.

# Test Application



## 900-300
## Diabetes Panel
(4 assays ＋1 calculated item)

**Test Items** (# calculated item, items are subject to change without notice.)

FRU, GLU, TP, ALB

GLOB#

**Application**

- FRU is the average GLU value of past 2 to 3 weeks, it is a more stable index relatively to GLU which could be affected by emotional condition of patients(especial for cats). By the test of FRU together with GLU that could detects whether animals have diabetes.
- TP and ALB provide reference indicators to help veterinarians judge.

# Test Application

## 900-310
## Electrolytes Panel
(4 assays ＋2 calculated items)

**Test Items** (# calculated item, items are subject to change without notice.)

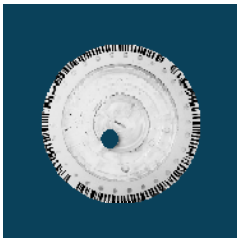
Na, K, Cl, tCO2,

AGap#, Na/K#

**Application**

- To test animal body ion balance, and assist diagnosis of animal heat stroke, heat exhaustion, gastroenteritis and kidney diseases etc.
- Add the Electrolytes Panel to the Diagnosis-II Panel test to have a complete health check profile ever.

# Test Application



## 900-320
## Diagnosis-II Panel
(14 assays + 3 calculated items)

**Test Items** (# calculated item, items are subject to change without notice.)

ALP, ALT, BUN (UREA), CREA, GLU, TP, ALB, TBIL, AMY, PHOS,

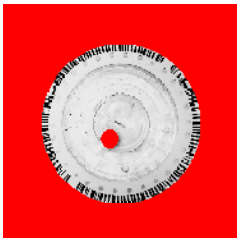
Ca, GGT, CHOL, LIPA,

GLOB#, ALB/GLOB#, BUN/CREA#

**Application**

- A more complete canine and feline comprehensive health examination including specific pancreatic check.
- CHOL gives initial diagnosis about endocrine problems. If the result is abnormal, please do test further on T4 Panel.
- LIPA helps diagnose pancreatitis accurately.
- GGT result can be used to diagnose ileus in cats.
- Use Diagnosis-II Panel to track health status. Particularly with older dogs and cats over the age of seven, or dogs and cats that suffered from major diseases or underwent operation within two years.
- Use before sedatives or surgical anesthesia for older dogs and cats over 7 years of age or with major illnesses to assess physical condition and reduce the risk of anesthesia.

# Test Application



## 900-330
## Critical Care Panel
(14 assays + 5 calculated items)

**Test Items** (# calculated item, items are subject to change without notice.)

ALP, ALT, BUN (UREA), CREA, GLU, TP, ALB, Ca, Na, K, Cl,

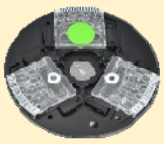
CPK, tCO2, LAC,

GLOB#, AGap#, ALB/GLOB#, BUN/CREA#, Na/K#

**Application**

- For emergency or critical case to check canine and feline diseases and health examination.
- Use Critical Care Panel to track the patient status during therapy and medicine periodically.
- For sick dog and cat under drug-treatment, suffering from critical disease or accident.
- CPK is for snake-bite examinations and also helps diagnose muscle damage caused by strenuous exercise.
- LAC detects insufficient oxygen in the blood and genetic disorder, such as glycogen storage disease.
- Provides complete electrolyte testing & calculated Anion gap to detect kidney diseases.

# Test Application

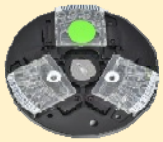


## Single Test (SA)

(5 assays)

**Test Items** (Items are subject to change without notice.)

CREA ; BUN ; Cl ; TBIL ; LAC



## Dual Test (SA)

(9 items)

**Test Items** (Items are subject to change without notice.)

Na+K (Na/K#) ;

Ca+PHOS ;

AST+CPK ;

ALB+TP (GLOB#, ALB/GLOB#) ;

ALP+ALT ;

TRIG+CHOL ;

GGT+CPK ;

LIPA+AMY ;

UPC (UPRO+UCRE)

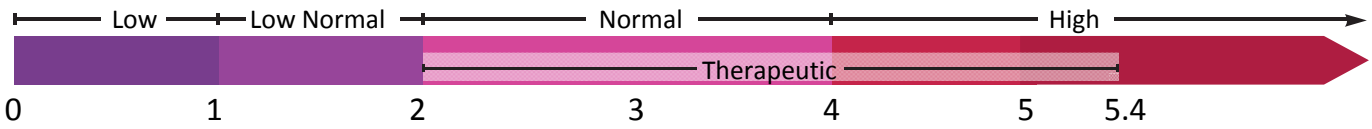
# Add Note

# T4 Testing Guide

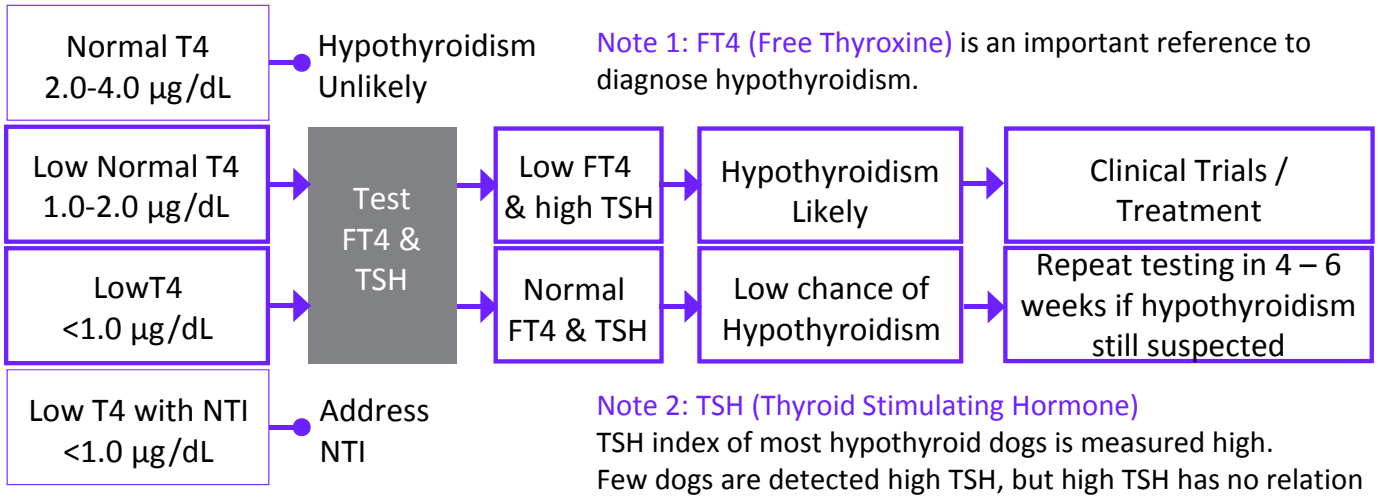
## Canine Hypothyroidism

### Common Unit

#### skyla VB1 T4 (Total T4) Test Results (Unit: µg/dL)




#### Canine Hypothyroidism Endocrine Test (Unit: µg/dL)




Note 1: FT4 (Free Thyroxine) is an important reference to diagnose hypothyroidism.

Note 2: TSH (Thyroid Stimulating Hormone)
TSH index of most hypothyroid dogs is measured high. Few dogs are detected high TSH, but high TSH has no relation with thyroid related disease.

**The doctor can make the initial diagnosis of canine hyperthyroidism by dog's history, clinical symptoms, biochemical tests etc. However, drugs or other diseases can affect the symptoms and development of canine hyperthyroidism, do the following tests help further diagnosis:**

- Blood tests : usually shows slight non-regenerative anemia.
- Biochemical tests : usually measures increases on TRIG and CHOL, and slight increase ALP, ALT, CPK and Ca occasionally.

**Accurate T4, FT4 and TSH disgnostic:**

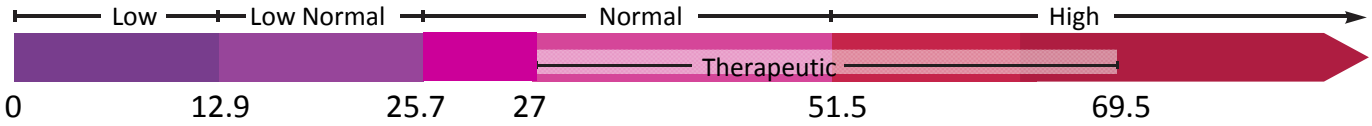
- Thyroid tests : usually concentration of T4 and FT4 is lower than nirmal, concentration of TSH rises.

## Clinical Symptoms

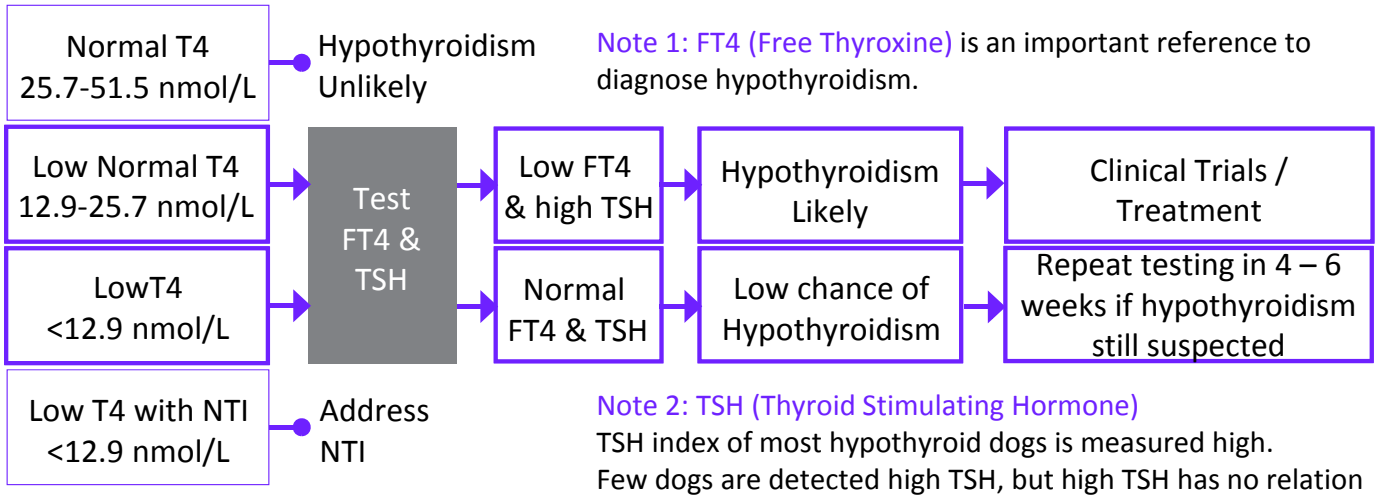
- Obesity
- Exercise intolerance
- Slight non-regenerative anemia
- Sleepiness
- Skin diseases
- Estrus prolongation and estrous cycle disorder

# SI Unit

### skyla VB1 T4 (Total T4) Test Results (Unit: nmol/L)




### Canine Hypothyroidism Endocrine Test (Unit: nmol/L)

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**Accurate T4, FT4 and TSH disgnostic:**

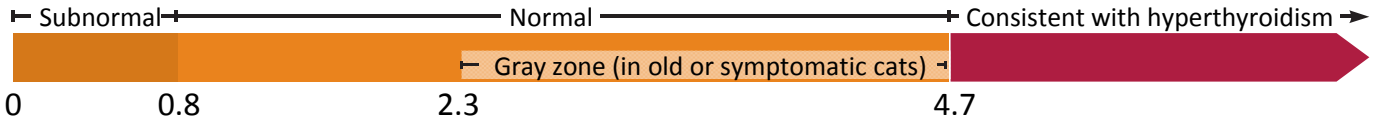
- Thyroid tests : usually concentration of T4 and FT4 is lower than nirmal, concentration of TSH rises.

# T4 Testing Guide

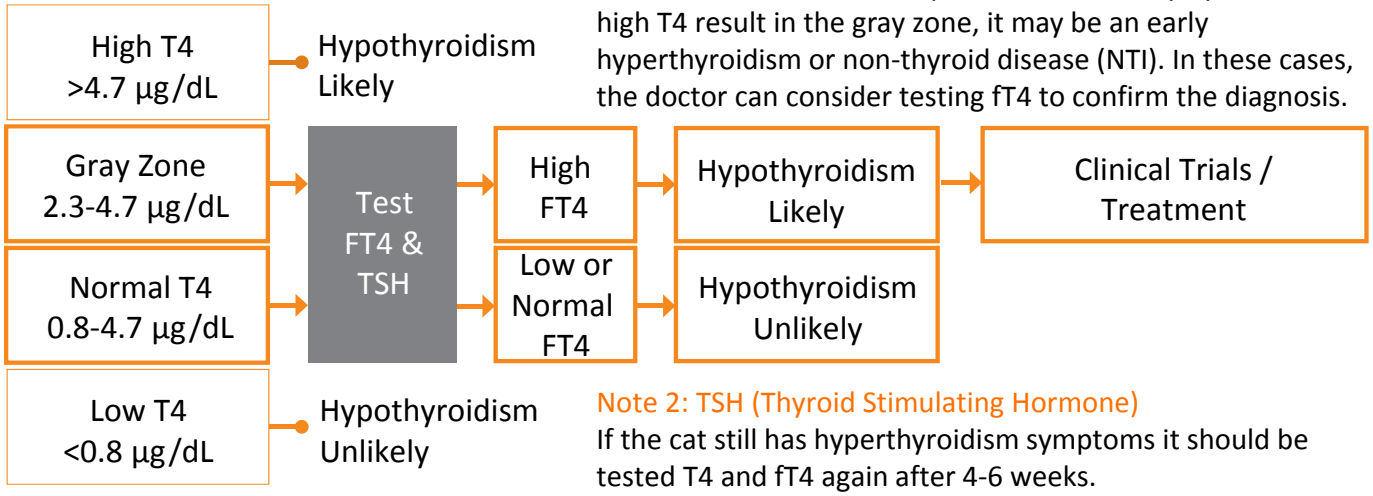
## Feline Hyperthyroidism

### Common Unit

#### skyla VB1 T4 (Total T4) Test Results (Unit: µg/dL)




#### Feline Hypothyroidism Endocrine Test (Unit: µg/dL)




Note 1: FT4 The cat with a persistent clinical symptoms and high T4 result in the gray zone, it may be an early hyperthyroidism or non-thyroid disease (NTI). In these cases, the doctor can consider testing fT4 to confirm the diagnosis.

Note 2: TSH (Thyroid Stimulating Hormone)
If the cat still has hyperthyroidism symptoms it should be tested T4 and fT4 again after 4-6 weeks.

**The doctor can make the initial diagnosis of feline hyperthyroidism by cat's history, clinical symptoms, biochemical tests etc. However, drugs or other diseases can affect the symptoms and development of feline hyperthyroidism, do the following tests help further diagnosis:**

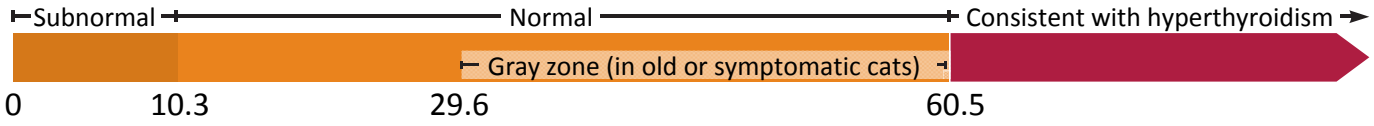
- Blood tests : usually shows neutrophilic leukocytosis.
- Biochemical tests : usually ALT, ALP, AST and LDH increase, K+ decrease.
- Thyroid tests : high value of T4 and fT4 may indicate higher chance of feline hyperthyroidism.

## Clinical Symptoms

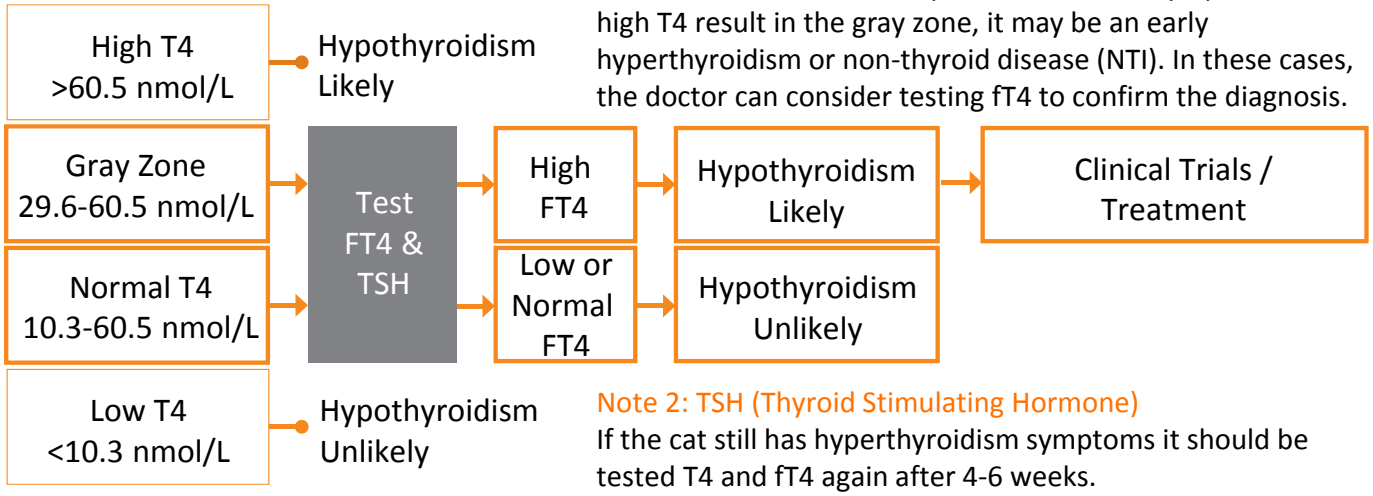
- Continuous weight loss
- Eat more
- Anxiety and irritability
- Frequent thirst and urination
- Rapid heartbeat
- Vomiting and diarrhea
- Poor coat color

## SI Unit

### skyla VB1 T4 (Total T4) Test Results (Unit: nmol/L)




### Feline Hypothyroidism Endocrine Test (Unit: nmol/L)

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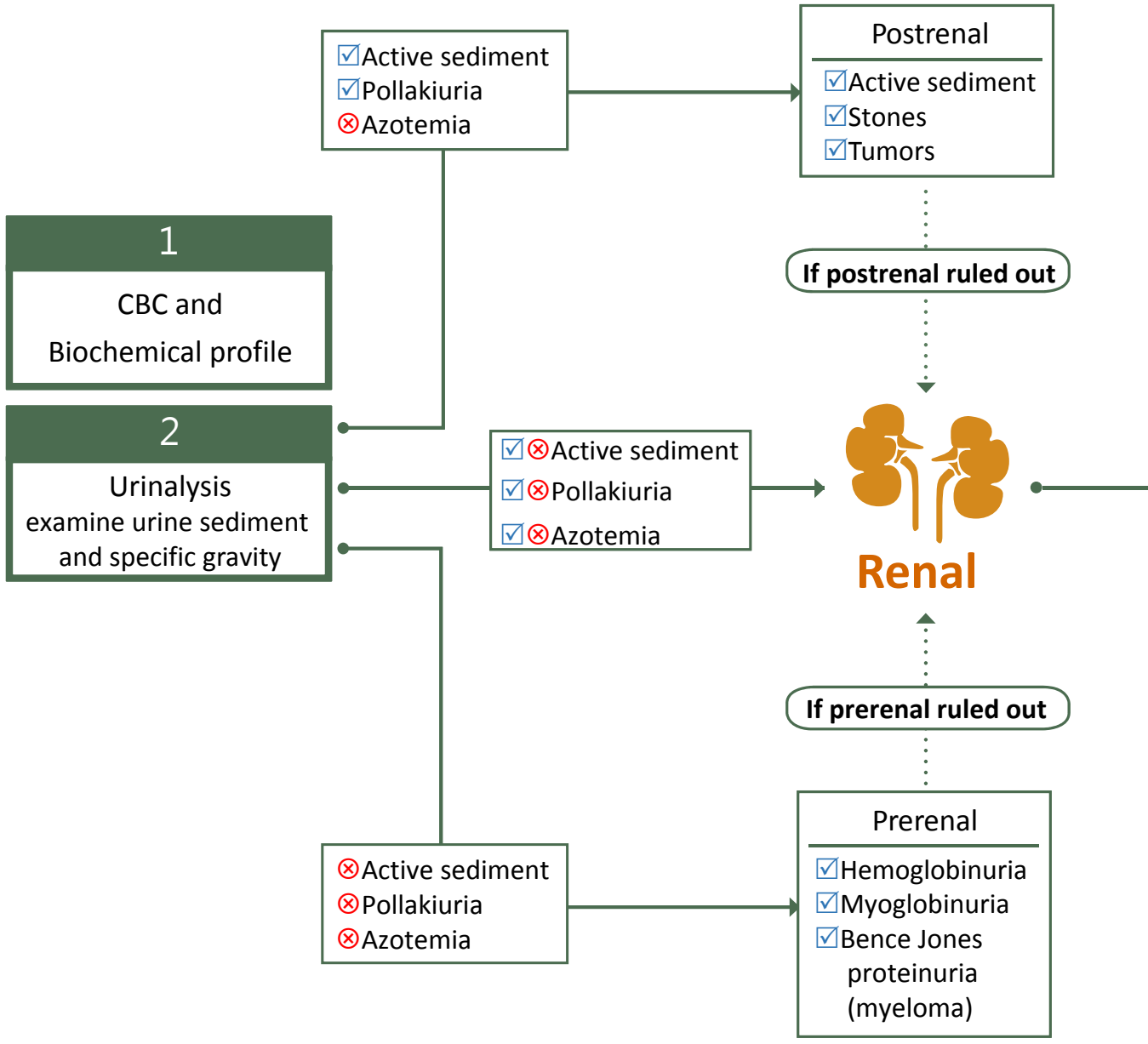
**The doctor can make the initial diagnosis of feline hyperthyroidism by cat's history, clinical symptoms, biochemical tests etc. However, drugs or other diseases can affect the symptoms and development of feline hyperthyroidism, do the following tests help further diagnosis:**

- Blood tests : usually shows neutrophilic leukocytosis.
- Biochemical tests : usually ALT, ALP, AST and LDH increase, K+ decrease.
- Thyroid tests : high value of T4 and fT4 may indicate higher chance of feline hyperthyroidism.

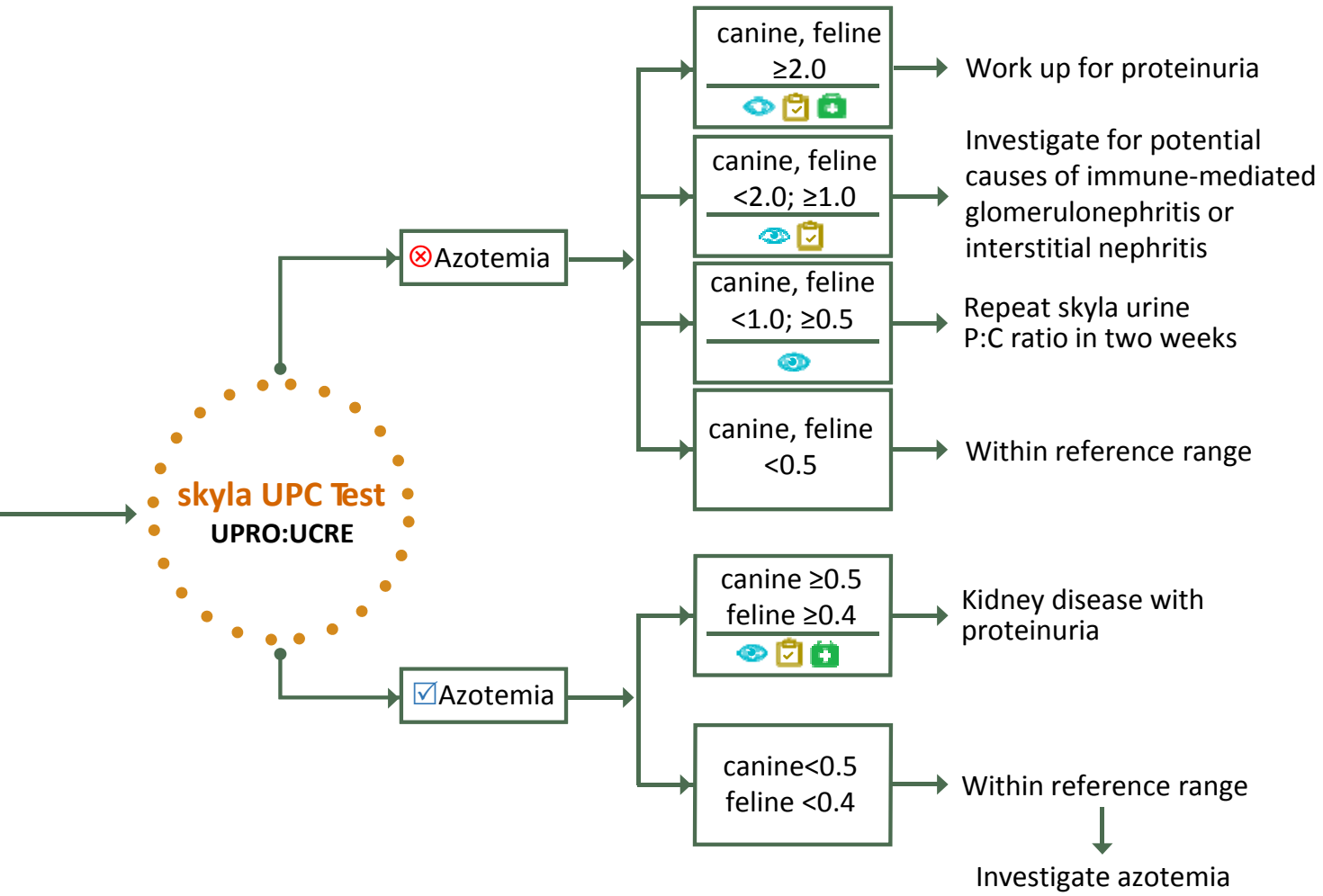
# Urine Protein : Creatinine Ratio Diagnostic Protocol

- Skyla VB1 urine protein to creatinine ratio (UPC) test can help veterinarians detect kidney related diseases in animals before they suffer from azotemia. It can also be regularly used to monitor the response to treatment of animal kidney disease, to help veterinarians effectively assess the condition of the disease.
- After the veterinarian went through the animal's medical history and physical examination
- Coupled with blood routine, biochemical, urine analysis (check urine residue and specific gravity) and other tests, further diagnosis of kidney condition can be made.
- Urine tests must be completed within 30 minutes, exceeding this time period will result in inaccurate test results.



Note：

- Animal's specific urine gravity is related to the amount of water drank. Specific gravity has to be tested several times to provide reference value.
- A decline in animal urine specific gravity may also be related to chronic kidney disease, adrenal insufficiency, pyometra etc.
- Increased urinary specific gravity may also represent dehydration, diarrhea, blood loss and other conditions in animals.




**Monitor**–re-test to confirm the condition; it is recommended to use skyla liver panel, UPC test and electrolyte panel to re-test

**Check**–Determine the underlying cause. If in doubt, consider other tests to help confirm the diagnosis (Radiology, ultrasonography, blood pressure assessment, infectious disease test, endocrine test, autoimmune test)

**Treatment**– Consider the following treatment options accordingly: Dietary changes, ACE inhibitor drug therapy, Phosphatidylcholine, Infusion therapy

# Bile Acid Testing Guide

- Quantitative bile acid test is the most sensitive, the most easy to operate, and the most specific among all liver-specific liver function tests.

  Application:

  1. Assessment of liver function
  2. Identify occult liver disease
  3. When the test value is normal, it can help to exclude hepatic portal shunt
  4. 4. Monitor treatment response

## Bile Acid Interpreting Test Results

Postprandial Results

Pre-prandial Results

Unit: μmol/L

**Postprandial Results <12**

| Test Results | | Retest |
|---|---|---|
| <12 | Hepatic function is normal | No need |
| 12~25 | Animals are anicteric or suspect for liver dysfunction | #Please retest at a later time (days to week) |
| >25 | Suspected for hepatic function decline, Animals are anicteric or suspect for liver dysfunction | #Please retest at a later time (days to week) |

**Postprandial Results 12~25**

| Test Results | | Retest |
|---|---|---|
| <12 | Animals are anicteric or suspect for liver dysfunction | #Please retest at a later time (days to week) |
| 12~25 | Animals are anicteric or suspect for liver dysfunction | #Please retest at a later time (days to week) |
| >25 | Animals are anicteric or suspect for liver dysfunction | #Please retest at a later time (days to week) |

- Bile acid test is one of the most useful tests for liver function. Under normal conditions, serum bile acid levels are very low, but when there is significant liver dysfunction or cholestasis (most liver diseases occur within the liver cholestasis), or portal system shunt, it will cause an abnormal increase in serum bile acid concentration, especially after feeding.
- If fasting and / or postprandial bile acids elevates abnormally , indicate portal system shunt or cholestasis.
- Serum bile acids are more sensitive indicators for liver function than serum bilirubin or albumin, serum bile acids often return to normal levels before liver function returns to normal.

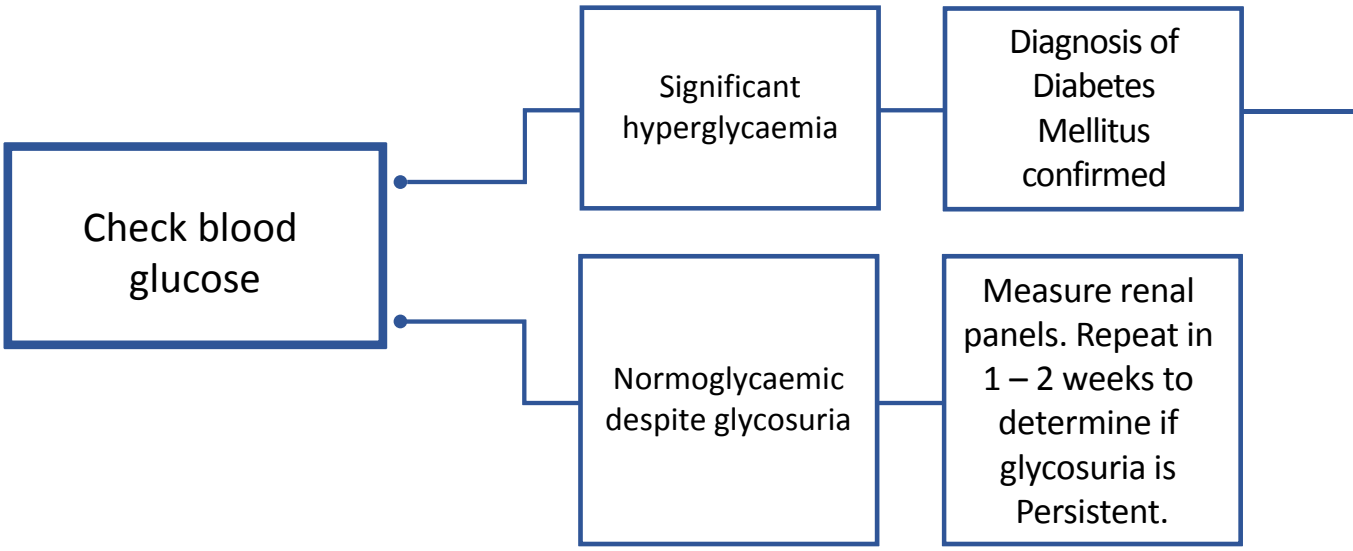
| Postprandial Results | Test Results | Retest |
|---|---|---|
| | <12 Hepatic function continues to decline | No need |
| >25 | 12~25 Hepatic function continues to decline | No need |
| | >25 Hepatic function continues to decline | No need |

Note:

* If the preprandial test results > postprandial test results, it is because of spontaneous gallbladder contraction or the test subject did not undergo fasting accurately before test.
* Before blood collection, be sure to confirm the animal's before meal (fasting time) and after meal time, to avoid making a wrong diagnosis based on incorrect test results.
* Accurate samples are collected after 12 hours of fasting (preprandial) and once more after 2 hours of feeding (postprandial).

# Diabetes Testing Guide

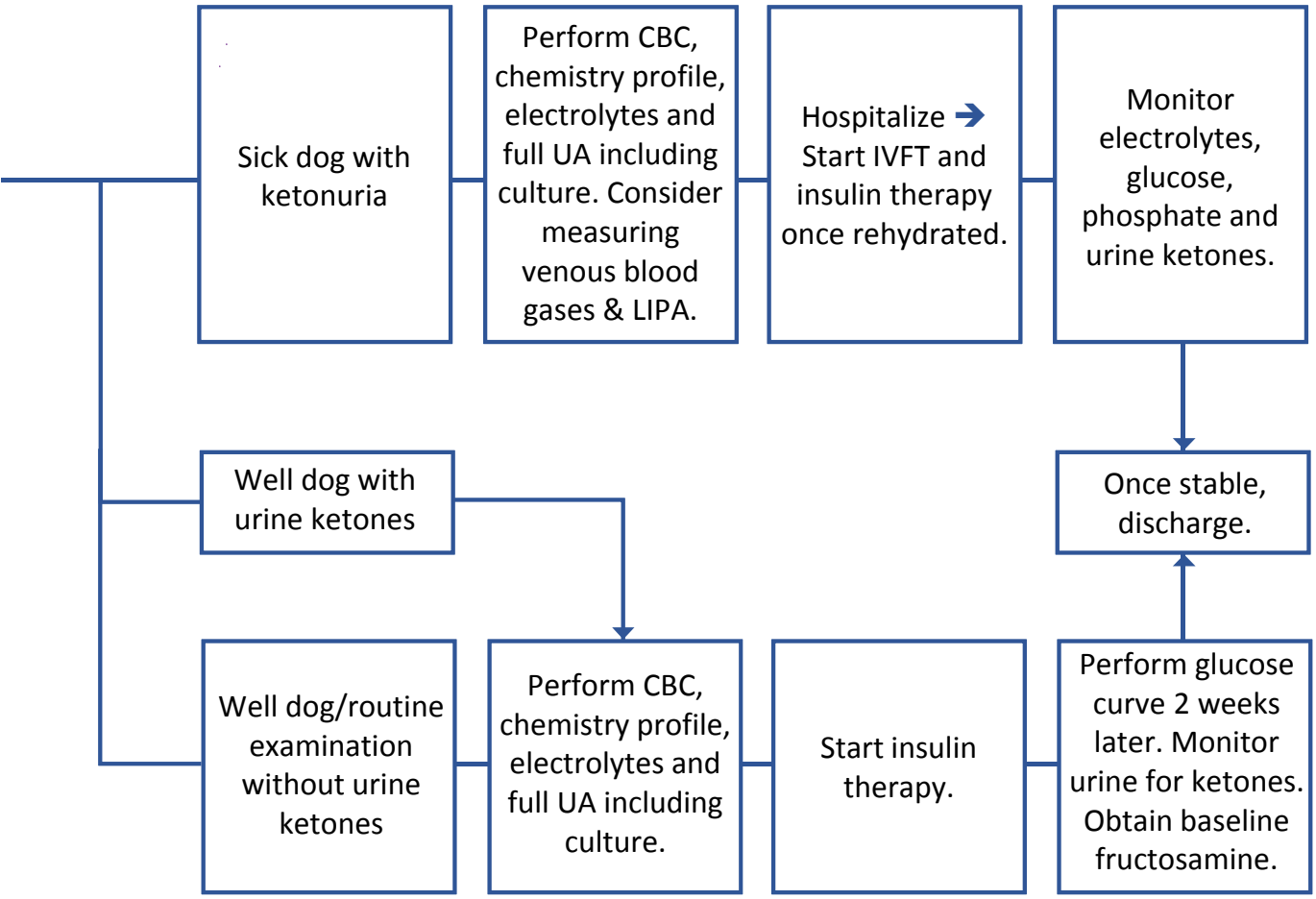
## Canine Hypothyroidism




| Event | Suggested Protocol | Skyla Workflow Key: |
|---|---|---|
| **Diagnosis** | **CBC**<br>**Chemistry Profile**<br>**Electrolytes**<br>**Fructosamine**<br>**Full Urine Analysis** | **Chemistry Profile:**<br>Diagnosis II Panel (Code 900-320)<br>**Electrolytes:**<br>Electrolyte Panel (Code 900-310)<br>Single Assay Na+K (Code 900-201)<br>**Hematology:**<br>Comprehensive Hematology<br>**Fructosamine:**<br>Diabetes Panel (Code 900-300)<br>**Full Urine Screen Analysis**<br>Basic Urine Screen – Urine Chemistry |
| **Monitoring** | **Fructosamine** | **Fructosamine**<br>Diabetes Panel (Code 900-300) |
| **Other Tests** | **Lipase**<br>**Urine Protein : Creatinine Ratio** | **Canine Pancreatic Lipase:**<br>Single Assay LIPA+AMY (Code 900-218)<br>**Urine Protein : Creatinine Ratio**<br>Single Assay UPC (Code 900-223) |

**Clinical Symptoms**

- Weight loss
- Polydipsia (PD)
- Polyuria (PU)
-

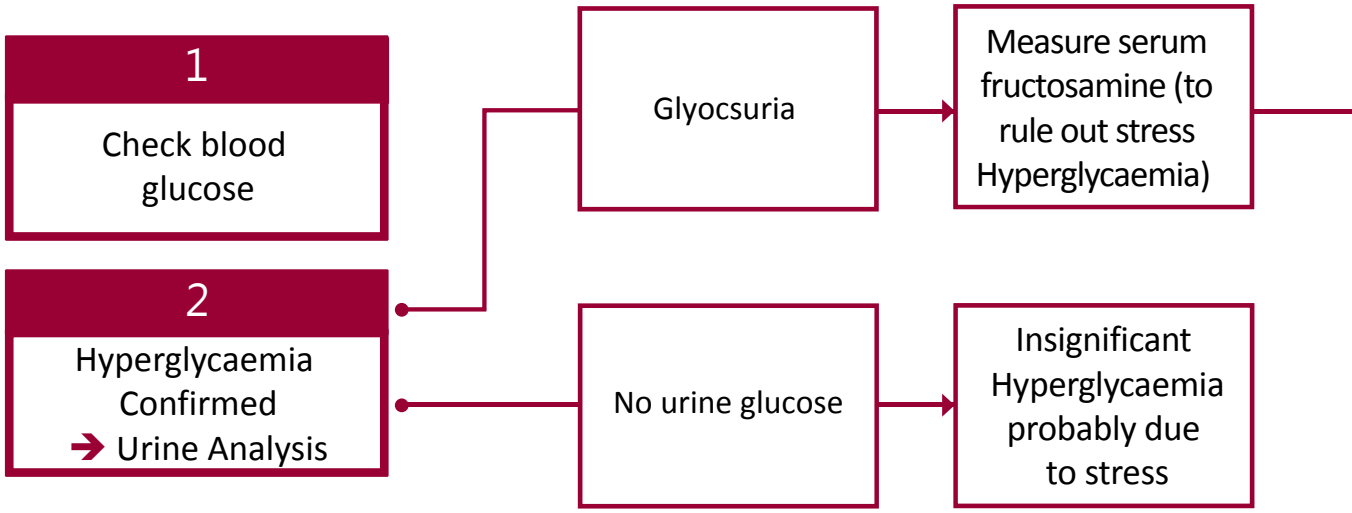



**Client Communication Suggestions:**

- Show your client the diagnosis results and discuss next steps.
- Discuss the requirement to monitor Fructosamine levels.
- When monitoring Fructosamine levels, use the trending graph on Data Manager to communicate to your client.

# Diabetes Testing Guide

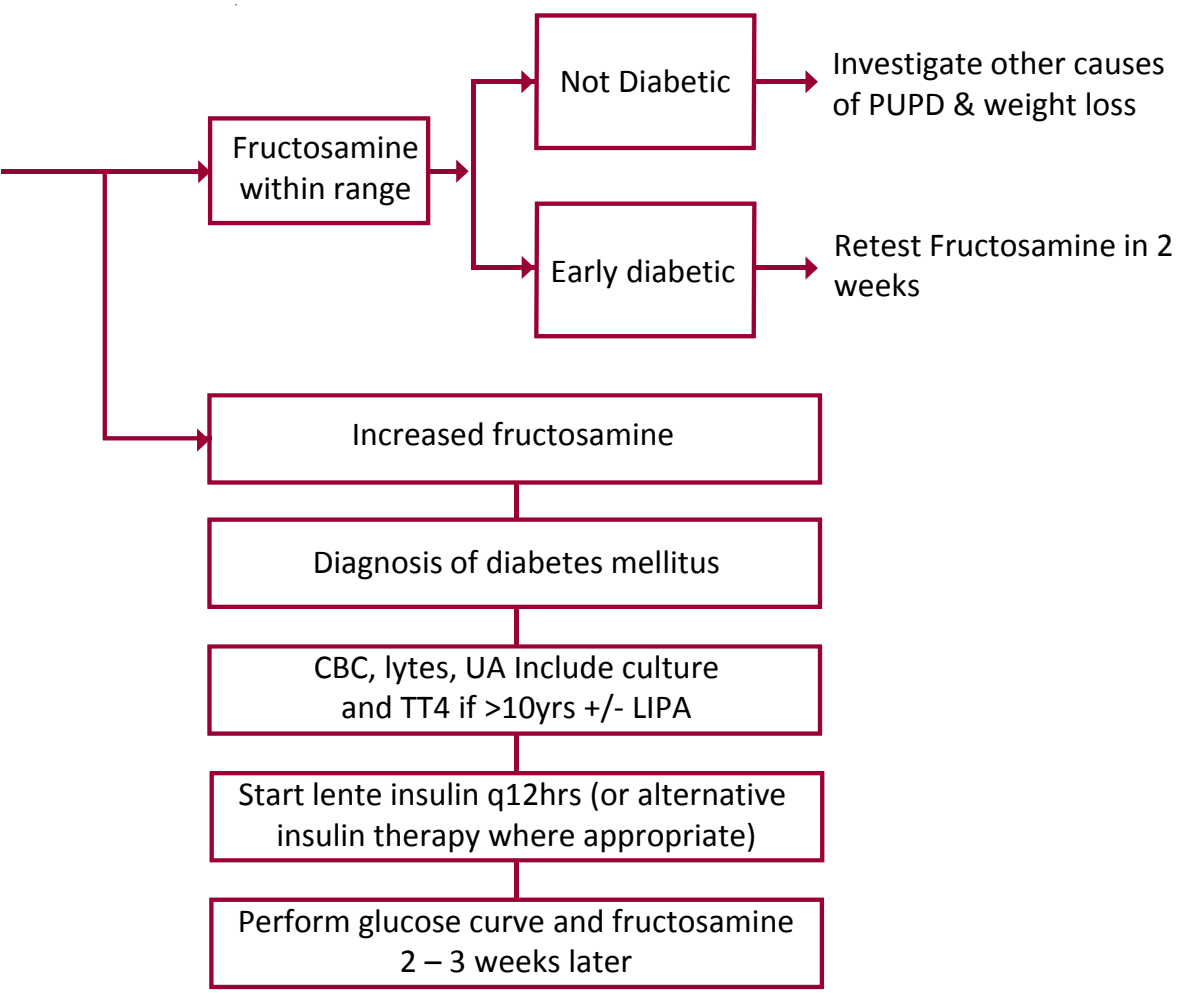
## Feline Glycosuria




| Event | Suggested Protocol | Skyla Workflow Key: |
|---|---|---|
| **Diagnosis** | **CBC**<br>**Chemistry Profile**<br>**Electrolytes**<br>**Fructosamine**<br>**Full Urine Analysis** | **Chemistry Profile:**<br>Diagnosis Panel (Code 900-120)<br>**Electrolytes:**<br>Electrolyte Panel (Code 900-310)<br>Single Assay Na+K (Code 900-201)<br>**Hematology:**<br>Comprehensive Hematology<br>**Fructosamine:**<br>Diabetes Panel (Code 900-300)<br>**Full Urine Screen Analysis**<br>Basic Urine Screen – Urine Chemistry |
| **Monitoring** | **Fructosamine** | **Fructosamine**<br>Diabetes Panel (Code 900-300) |
| **Other Tests** | **Lipase**<br>**Urine Protein : Creatinine Ratio** | **Feline Pancreatic Lipase:**<br>Single Assay LIPA+AMY (Code 900-218)<br>**Urine Protein : Creatinine Ratio**<br>Single Assay UPC (Code 900-223) |

**Clinical Symptoms**

- Weight loss
- Polydipsia (PD)
- Polyuria (PU)
-




Note: Adjust dose of insulin accordingly.

**Client Communication Suggestions:**

- Show your client the diagnosis results and discuss next steps.
- Discuss the requirement to monitor Fructosamine levels.
- When monitoring Fructosamine levels, use the trending graph on Data Manager to communicate to your client.

# About skyla Corp.

skyla, derived from the Latin word "scilla", meaning “passionate and energetic”, in such a way we focus to deliver reliable technological opportunities to the healthcare industry. skyla belongs to the LITE-ON Corporate Group, with multidisciplinary expertise in optics, mechanical, electronic, materials, chemistry biotechnology and medical engineering. Guaranteeing the development of high quality innovative medical products.

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