Creatinine clearance ml/min

Urine Cr (mg/dL) x volume (ml) / Plasma Cr (mg/dL) x Time (min)

FENa % = measures the percent of filtered sodium that is excreted in the urine

you may see two variations once it is rearranged

1-(Una x Scr /Sna x Ucr) x 100

2-[(Una/Pna) / (Ucr/Pcr)] x 100

Fe Urea % = measures the percent of filtered urea that is excreted in the urine

you may see two variations once it is rearranged

1-(Uurea x Scr /Surea x Ucr) x 100

2- [(Uurea/BUN) / (Ucr/Pcr)] x 100

Remember - you can actually calculate fractional excretion of other molecules if above values are given. For example, bicarbonate, calcium etc

e.g FEHCO3 % -(UHCO3 x Scr /SHCO3 x Ucr) x 100

Urine lytes

Know the urine lytes and its interpretation in various clinical scenario- there is no single number that is "normal". You may be given 24-hour urine collection values **or** spot ratios (remember creatinine is excreted at constant rate so ratios with creatinine corrects for variation in urine volume)

For potassium metabolism 24-hour potassium excretion - in a normal person, if hypokalemia present kidney can lower urinary potassium excretion below 25-30 meq/day.

- If it above that range hypokalemia is due to renal loses.
- If it is lower than likely GI cause as kidney will try to limit potassium excretion.

Similarly - For spot urine potassium to creatinine ratio <13 mEq/g when hypokalemia is caused by transcellular potassium shifts, gastrointestinal losses, previous use of diuretics, or poor dietary intake. Higher values can be seen with renal potassium wasting.

Remember - Una <20 is suggestive of pre renal AKI due to increase proximal tubular reabsorption

Equations you may need

ADJUSTING SODIUM FOR HYPERGLYCEMIA

$$Na_{adj} = Na + ((glucose - 100)/100) \times 1.6$$

URINE VOLUME

$$Volume = Solute\ load\ (mOsm) / Concentration\ (mOsm/kg\ H2O)$$

ELECTROLYTE FREE WATER CLEARANCE

$$Clearance_{electrolyte\ free\ water} = Urine\ vol \times (1 - ((Na_{urine} + K_{urine})/Na_{serum})$$

HENDERSON-HASSELBALCH EQUATION

$$pH = 6.1 + Log\ (HCO_3/0.03\ pCO_2)$$

PREDICTING COMPENSATION IN METABOLIC ACIDOSIS, WINTERS FORMULA

$$CO_2 = 1.5 \times HCO_3 + 8 \pm 2$$

PREDICTING COMPENSATION IN METABOLIC ALKALOSIS

CO_2 increases ⅔ for every 1 mmol increase in HCO_3

PREDICTING COMPENSATION IN RESPIRATORY ACIDOSIS

Acute: HCO_3 increases 1 for every 10 mmHg of CO_2

Chronic: HCO_3 increases 3 for every 10 mmHg of CO_2

PREDICTING COMPENSATION IN RESPIRATORY ALKALOSIS

Acute: HCO_3 decreases 2 for every 10 mmHg of CO_2

Chronic: HCO_3 decreases 4 for every 10 mmHg of CO_2

ANION GAP

$$Anion\ gap = Na^+ - (Cl^- + HCO_3)$$

OSMOLAR GAP:

$$Osmolar\ gap = 2 \times Na + glucose/18 + BUN/2.8 + Ethanol/3.7$$

BICARBONATE BEFORE (OR AFTER ACCOUNTING FOR) THE ANION GAP:

$$HCO_{3\ before} = HCO_{3\ now} + (Anion\ Gap_{current} - 12)$$