

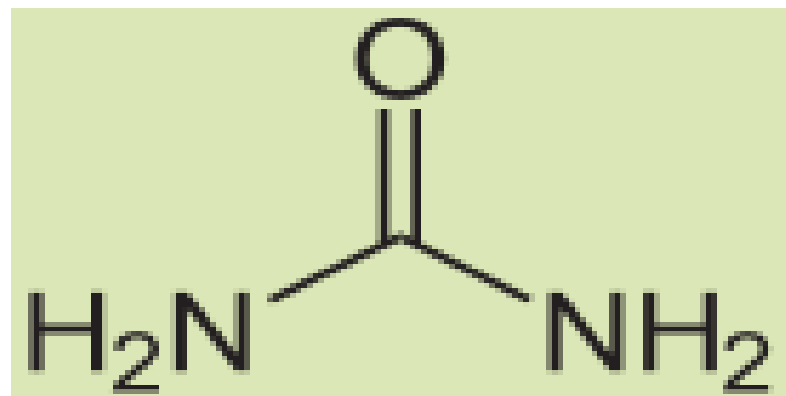


Cls33 I,,,experiment (8):

**Determination of  
serum urea**


# Introduction:

- ❑ **Urea** or **carbamide** is an organic compound with the chemical formula  $(\text{NH}_2)_2\text{CO}$ .
- ❑ The molecule has two amine ( $-\text{NH}_2$ ) groups joined by a carbonyl ( $\text{C}=\text{O}$ ) functional group.



# Physiology:

- ❑ Urea is the main end product of protein metabolism in the body, which takes place in the liver.
- ❑ Normally cleared from the blood by the kidney into the urine.
- ❑ 7 to 20 mg/dL (2.5 to 7.1 mmol/L) is the normal range.



# High Blood Urea Nitrogen (BUN) Uremia or uraemia

- a raised level in the blood of urea and other nitrogenous waste compounds that are normally eliminated by the kidneys.
- Principal abnormality is very low ( $<30$ ) GFR
- elevated both urea **and** creatinine



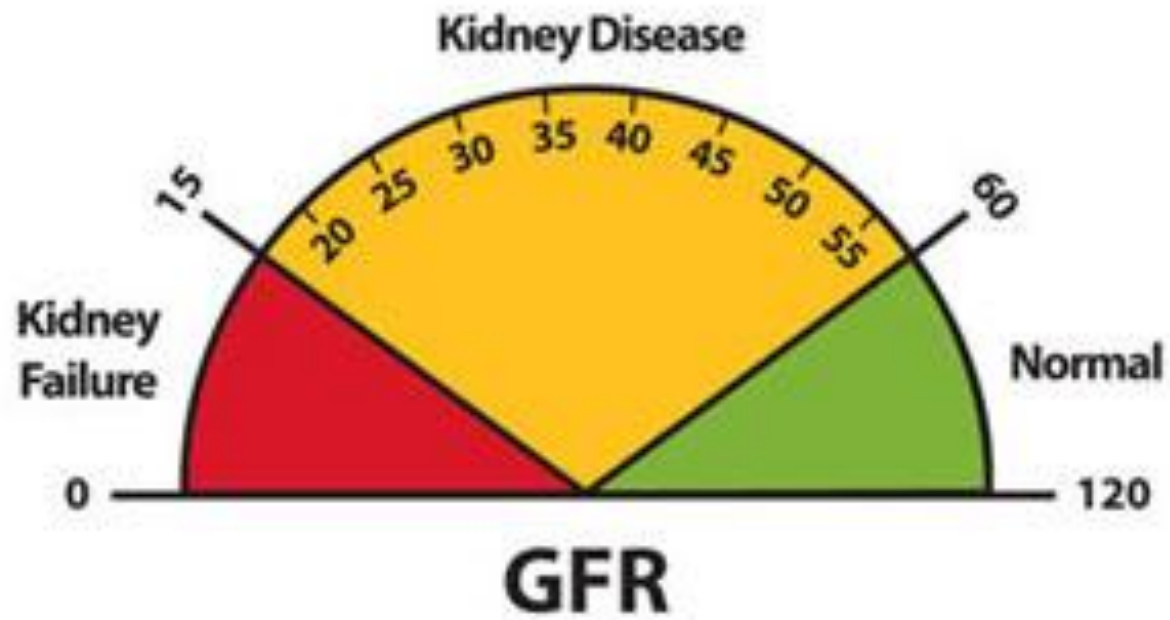
## Azotemia:

is another word that refers to high levels of urea, but is used primarily when the abnormality can be measured chemically but is not yet so severe as to produce symptoms.



# **Glomerular filtration rate (GFR):**

the volume of water filtered out of the plasma through glomerular capillary walls into Bowman capsules per unit time; it is considered to be equivalent to inulin clearance.





# Causes:

- ❑ renal failure
- ❑ increased production of urea in the liver, due to:
  - ✓ high protein diet
  - ✓ increased protein breakdown (surgery, infection, trauma, cancer)
  - ✓ gastrointestinal bleeding
  - ✓ drugs (e.g. tetracyclines and corticosteroids)
- ❑ decreased elimination of urea, due to:
  - ✓ decreased blood flow through kidney (e.g. hypotension, cardiac failure)
  - ✓ urinary outflow obstruction
  - ✓ bladder rupture
- ❑ dehydration
- ❑ chronic infection of the kidney such as chronic pyelonephritis





## Sings and symptoms:

1. High blood pressure
2. Fluid retention
3. Fatigue/tiredness
4. Bubbly urine, blood urine, decreased urine output and even anuria
5. Gastrointestinal tract symptoms like poor appetite, nausea, vomiting and bad taste in mouth.



## Signs and symptoms:

6. Skin problems like itching skin and dry skin

7. Sleep problem like insomnia

8. Nerve problems like poor concentration, poor memory, insanity and even coma

9. Respiratory system symptoms like shortness of breath, deep and long breath.

10. Bone problems like bone pain and bone fracture.



## N.B.

Still, it is not certain that the symptoms currently associated with uremia are actually caused by excess urea, as one study showed that uremic symptoms were relieved by initiation of dialysis, even when urea was added to the dialysate to maintain the blood urea nitrogen level at approximately 90 mg per deciliter (that is, approximately 32 mmol per liter).<sup>[3]</sup>

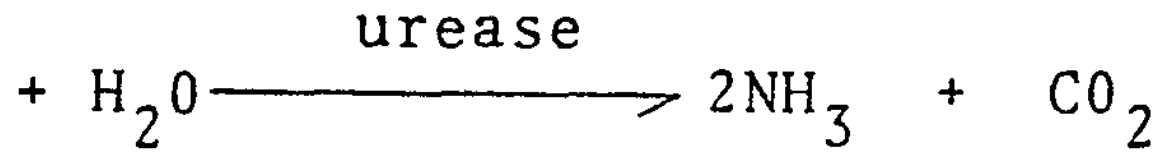
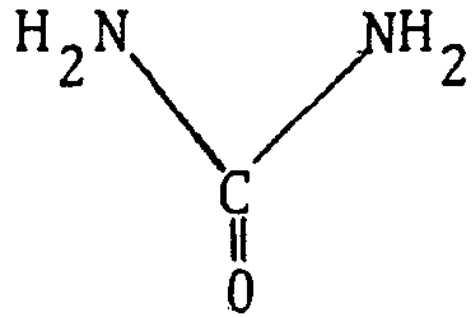
# Principle:

- ❑ Urea is hydrolyzed by the enzyme urease forming ammonia and carbon dioxide.



## NOTES:

- ❑ Urease acts optimally at 55°C & pH (7-8)
- ❑ Inhibited by ammonia & fluoride.





## Berthelot reaction:

Ammonia + salicylate + nitroferricyanide +  
alkaline solution of hypochlorite  $\longrightarrow$  blue-  
green chromophore

## *o*-Phthalaldehyde colorimetric method

- **The principle:**

Urea + phthalaldehyde and Naphthyl ethylene diamine  $\longrightarrow$  orange colored complex.


### **Clinical significance:**

↑ urea in blood (uremia): diets with excess of proteins, renal diseases, renal obstruction and heart failure...

## End point procedure:

	<b>blank</b>	<b>Std.</b>	<b>sample</b>
R1 (ml)	1	1	1
STANDARD D ( $\mu$ l)	-----	25	-----
Sample ( $\mu$ l)	-----	-----	25
R2 (ml)	1	1	1



- 
- Mix and incubate 15 min. at 37<sup>0</sup>c.
  - Read the (A) at 510 nm.
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**Reference values:** 7 to 20 mg/dL (2.5 to 7.1 mmol/L)



## Calculations:

$AC / AS \times C = \text{mg urea / dl Serum}$

C= Concentration of standard =50 mg/dl

**Reference values:** 7 to 20 mg/dL (2.5 to 7.1 mmol/L)