


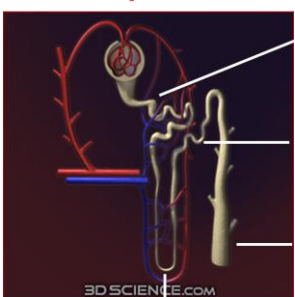


Question No. 1 of 10

Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.

 <p>Question #01</p>	<p>1. The normally functioning kidney has the ability to completely reabsorb glucose in the _____.</p> <p>(A) Thin descending loop of Henle (B) Early distal convoluted tubule (C) Thick ascending loop of Henle (D) Collecting tubules (E) Proximal tubule</p>
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 <p>Feedback</p>	<p>A. Incorrect! Passive reabsorption of water occurs in the thin descending loop of Henle.</p> <p>B. Incorrect! In the early distal convoluted tubule, Na and Cl continue to be actively reabsorbed. Reabsorption of Ca ions also takes place in this part.</p> <p>C. Incorrect! The thick ascending loop of Henle is the primary site for active reabsorption of Na, K and Cl ions. This in turn induces the reabsorption of Mg and Ca.</p> <p>D. Incorrect! The collecting tubules reabsorb Na in exchange for secreting K or H ions. Additionally, there is reabsorption of water.</p> <p>E. Correct! The normally functioning kidney has the ability to completely reabsorb glucose in the proximal tubule.</p>
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 <p>Solution</p>	<p>The normally functioning kidney has the ability to completely reabsorb glucose in the proximal tubule. If there is too much glucose in the blood, it spills over and is classified as glucosuria at plasma glucose levels of 200mg/dL or above. At 350mg/dL, the transport mechanism becomes saturated. Glucosuria is clinically important in the diagnosis of diabetes mellitus.</p> <div style="text-align: center;">  <p>Nephron</p> <p>Proximal Tubule</p> <p>Distal Tubule</p> <p>Collecting Duct</p> <p>Loop of Henle</p> </div> <p>(E) Proximal tubule</p>
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Question No. 2 of 10

Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.



Question #02

2. The overall effect of angiotensin II is to _____.

(A) Reduce the release of renin and increase the glomerular filtration rate.
 (B) Increase intravascular volume and raise the blood pressure.
 (C) Increase the calcium reabsorption in the distal convoluted tubule.
 (D) Decrease the delivery of sodium to the distal tubule.
 (E) Increase sympathetic tone.



Feedback

A. Incorrect!
 Atrial natriuretic peptide reduces the release of renin and increases the glomerular filtration rate.

B. Correct!
 The overall effect of angiotensin II is to increase intravascular volume and raise the blood pressure.

C. Incorrect!
 Parathyroid Hormone causes an increase in calcium reabsorption in the distal convoluted tubule.

D. Incorrect!
 The JG cells decrease the delivery of sodium to the distal tubule.

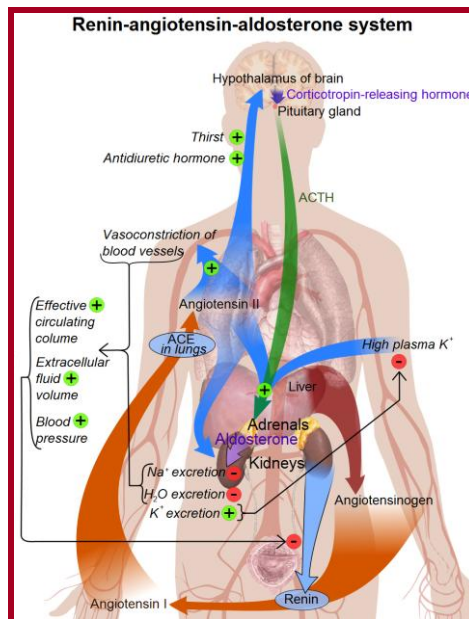
E. Incorrect!
 The JG cells increase sympathetic tone.



Solution

Angiotensin II has the following actions: Potent vasoconstriction. Release of aldosterone from adrenal cortex. Release of ADH from posterior pituitary. Stimulates hypothalamus thereby increasing thirst. The overall effect of angiotensin II is to increase intravascular volume and raise the blood pressure.

(B) Increase intravascular volume and raise the blood pressure.



Question No. 3 of 10


Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.



Question #03

3. A 39 year old male with suspected renal disease requires injection of creatinine to determine:

- (A) Filtration fraction
- (B) Glomerular Filtration Rate (GFR)
- (C) Effective renal plasma flow (ERPF)
- (D) Free water clearance
- (E) Glucose clearance



Feedback

A. Incorrect!
The filtration fraction can be calculated using the equation: Filtration fraction = GFR/RPF.

B. Correct!
The glomerular filtration rate of the kidneys can be calculated using the clearance of creatinine.

C. Incorrect!
The effective renal plasma flow (ERPF) can be estimated using PAH.

D. Incorrect!
Free water clearance can be calculated using the urine flow rate and the osmolarity of urine and plasma.

E. Incorrect!
The normally functioning kidney has the ability to completely reabsorb glucose in the proximal tubule. If there is too much glucose in the blood, it spills over and is classified as glucosuria at plasma glucose levels of 200mg/dL or above.



Solution

The glomerular filtration rate of the kidneys can be calculated using creatinine clearance since this compound is freely filtered but not reabsorbed or secreted.

$$GFR = U_{inulin} \times V / P_{inulin} = C_{inulin}$$
$$= K_f [(P_{GC} - P_{BS}) - (\pi_{GC} - \pi_{BS})]$$

(GC = glomerular capillary; BS = Bowman’s space.)
 π_{BS} normally equals zero.

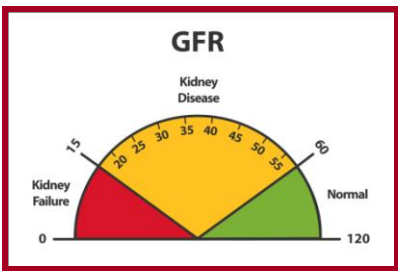


Image courtesy of National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health.

(B) Glomerular Filtration Rate (GFR)

Question No. 4 of 10

Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.



Question #04

4. The _____ is also known as the “workhorse of the nephron”.

- (A) Collecting tubules
- (B) Thin descending loop of Henle
- (C) Early distal convoluted tubule
- (D) Early proximal convoluted tubule
- (E) Thick ascending loop of Henle



Feedback

A. Incorrect!

The collecting tubules reabsorb Na in exchange for secreting K or H ions, an action that is regulated by aldosterone. Additionally, there is reabsorption of water that is regulated by vasopressin.

B. Incorrect!

Passive reabsorption of water via intermedullary hypertonicity occurs in the thin descending loop of Henle, making the urine hypertonic.

C. Incorrect!

As urine passes into the early distal convoluted tubule, Na and Cl continue to be actively reabsorbed. Reabsorption of Ca ions also takes place in this part, but this is under the control of the parathyroid hormone.

D. Correct!

The Early Proximal Convoluted Tubule is also known as the “workhorse of the nephron”.

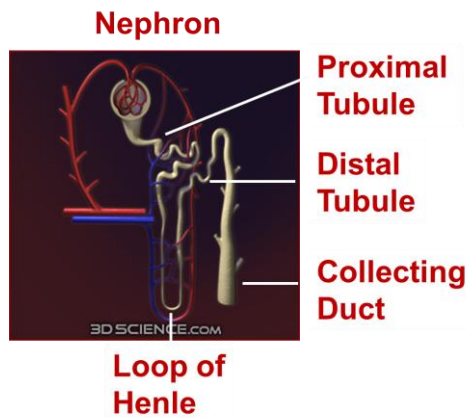
E. Incorrect!

The thick ascending loop of Henle is known as the diluting segment.



Solution

The Early Proximal Convoluted Tubule is also known as the “workhorse of the nephron”. It contains a brush border that allows for reabsorption of all the glucose and amino acids and most of the bicarbonate, sodium and water via isotonicity. This part of the nephron also secretes ammonia that acts as a buffer for secreted hydrogen ions.



(D) Early proximal convoluted tubule

Question No. 5 of 10

Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.



Question #05

5. When considering hormones that act on the kidneys, _____ is secreted in response to an increase in atrial pressure and increases the glomerular filtration rate as well as the excretion of sodium.

- (A) Atrial natriuretic factor
- (B) Parathyroid hormone
- (C) Renin
- (D) Vasopressin (ADH)
- (E) Aldosterone



Feedback

A. Correct!

Atrial natriuretic factor is secreted in response to an increase in atrial pressure and increases the glomerular filtration rate as well as the excretion of sodium.

B. Incorrect!

Parathyroid Hormone is secreted in response to decreased plasma calcium. It causes an increase in calcium reabsorption in the distal convoluted tubule, a decrease in phosphate ion reabsorption in the proximal convoluted tubule and increased Ca and Phosphate absorption from the gut.

C. Incorrect!

Renin is released by the JGA in response to a decreased blood volume.

D. Incorrect!

Vasopressin (ADH) is secreted in response to increased plasma osmolarity and decreased blood volume. This hormone binds to the receptors on the principal cells causing an increase in the number of water channels and hence increased water reabsorption.

E. Incorrect!

Aldosterone is secreted in response to a decrease in blood volume and an increase in plasma potassium. It results in increased sodium reabsorption, increased indirect potassium secretion and increased hydrogen ion secretion.






Solution

Just as the kidney releases hormones that have may affect other systems, various hormones that may also have certain effects on the function of the kidney. Atrial natriuretic factor is secreted in response to an increase in atrial pressure and increases the glomerular filtration rate as well as the excretion of sodium.

(A)Atrial natriuretic factor




Question No. 6 of 10

Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.

 <p>Question #06</p>	<p>6. A patient is brought to the emergency room by paramedics. Her roommate who found her convulsing called 911 and now reports that earlier in the day the college student had complained of a headache. The friend also states that she found an empty Aspirin bottle near the patient in their dorm room. You review the blood gas results. The anion gap is normal. The patient has _____.</p> <p>(A) Metabolic acidosis (B) Metabolic alkalosis (C) Respiratory acidosis (D) Respiratory alkalosis (E) Normal acid-base balance</p>
 <p>Feedback</p>	<p>A. Incorrect! In metabolic acidosis, the cause can be narrowed down by checking the anion gap. An increase in the anion gap may be the result of "MUDPILES": Methanol, Uremia, Diabetic Ketoacidosis, Paraldehyde or Phenformin, Iron Tablets, Lactic Acidosis, Ethylene Glycol or Salicylates. A normal anion gap indicates metabolic acidosis due to diarrhea, glue sniffing, renal tubular acidosis and hyperchloremia.</p> <p>B. Incorrect! PCO₂ is less than 40mmHg, the patient is said to be suffering from metabolic alkalosis with compensation due to diuretic use, vomiting, antacids or hyperaldosteronism.</p> <p>C. Incorrect! Respiratory acidosis can be caused by hypoventilation due to airway obstruction, acute lung disease, and chronic lung disease, medications such as opioids, sedatives and narcotics, weakening of the respiratory muscles.</p> <p>D. Correct! Respiratory alkalosis is seen when the PCO₂ < 40mmHg and may be due to hyperventilation or aspirin ingestion.</p> <p>E. Incorrect! Through the carefully regulated mechanism of filtration, secretion and reabsorption, the kidneys maintain the acid -base balance in the body. However, in some cases, this may go wrong.</p>
 <p>Solution</p>	<p>Alkalemia is said to occur when the pH is greater than 7.4. Respiratory alkalosis is seen when the PCO₂ < 40mmHg and may be due to hyperventilation or aspirin ingestion.</p> <p>(D)Respiratory alkalosis</p>




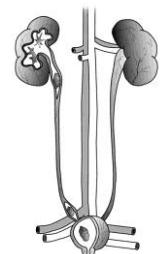
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Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.

 <p>Question #07</p>	<p>7. A 3 year old female is diagnosed with _____, which is the most common renal malignancy of early childhood.</p> <p>(A) Horseshoe kidney (B) Wilm’s tumor (C) Transitional cell carcinoma (D) Potter’s syndrome (E) Renal cell carcinoma</p>
 <p>Feedback</p>	<p>A. Incorrect! Horseshoe kidney is said to occur when the inferior poles of both kidneys fuse. During fetal development, horseshoe kidneys get trapped under the inferior mesenteric artery as they ascend from the pelvis. For this reason they remain low in the abdomen but continue to function normally.</p> <p>B. Correct! Wilm’s tumor is the most common renal malignancy of early childhood.</p> <p>C. Incorrect! Transitional cell carcinoma is the most common tumor of urinary tract system and may be found in the renal calyces, renal pelvis, ureters and bladder. Painless hematuria is a common sign of bladder cancer.</p> <p>D. Incorrect! Potter syndrome, which causes a typical physical appearance, is the result of oligohydramnios secondary to renal diseases such as bilateral renal agenesis. It is characterized by limb deformities, facial deformities, and pulmonary hypoplasia and is the result of the malformation of the ureteric bud.</p> <p>E. Incorrect! Renal cell carcinoma is the most commonly seen renal malignancy. It is primarily seen in males between the ages of 50-70 with an increased incidence in patients that smoke or are obese.</p>
 <p>Solution</p>	<p>Wilm’s tumor is the most common renal malignancy of early childhood. This form of malignancy presents with a huge palpable flank mass and hemihypertrophy and contains embryonic glomerular structures. Wilms tumor can be caused by the deletion of the tumor suppression gene WTI on chromosome 11. It may exist on its own or as a part of the WAGR complex: Wilm’s tumor, Aniridia, Genitourinary malformation and mental motor Retardation.</p> <p>(B)Wilm’s tumor</p>

Question No. 8 of 10

Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.

 <p>Question #08</p>	<p>8. The most common cause of acute renal failure is _____.</p> <p>(A) Diffuse cortical necrosis (B) Acute pyelonephritis (C) Acute tubular necrosis (D) Drug-induced interstitial nephritis (E) Renal papillary necrosis</p>
 <p>Feedback</p>	<p>A. Incorrect! Diffuse cortical necrosis is an acute generalized infarction of the cortices of both kidneys that is associated with obstetric catastrophes and septic shock.</p> <p>B. Incorrect! Acute pyelonephritis affects the cortex with relative sparing of glomeruli.</p> <p>C. Correct! Acute tubular necrosis is the most common cause of acute renal failure.</p> <p>D. Incorrect! Drug induced interstitial nephritis is an acute interstitial renal inflammation. It is associated with fever, rash, eosinophilia and hematuria 2 weeks after administration of the drugs that act as haptens inducing hypersensitivity.</p> <p>E. Incorrect! Renal papillary necrosis is associated with diabetes mellitus, acute pyelonephritis, chronic phenacetin use and sickle cell anemia.</p>
 <p>Solution</p>	<p>Acute renal failure is associated with an abrupt decline in renal function and an increase in creatine and BUN over a period of several days. Acute tubular necrosis is the most common cause of acute renal failure. It is reversible but can be fatal if left untreated. It is associated with renal ischemia, crush injury and toxins. The whole process occurs in the three phases: inciting event that leads to maintenance (low urine) and eventually recovery. Death most often occurs during the initial oliguric phase, and recovery may occur in 2-3 weeks. There is a loss of cell polarity, epithelial cell detachment, necrosis and the presence of granular casts.</p>  <p><i>Image courtesy of National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health.</i></p> <p>(C) Acute tubular necrosis</p>

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Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.



Question #09

9. A patient recently diagnosed with chronic renal failure comes into the emergency room complaining of her heart feeling like it is skipping beats. She reports that she was having a lovely time at a family picnic when she first noticed the symptoms. Someone had brought a delicious fresh fruit salad full of melon and mango and kiwi. As a lot of the food choices at the picnic had been very high calorie the patient had thought it best to just eat a lot of the fruit salad as was currently on a diet. It was a hot day outside so when she first felt a little unwell she reported that she rested in the shade with a big glass of cold orange juice. The problem seemed to be getting worse, instead of better, so she thought it best to seek medical attention. Her EKG indeed shows the arrhythmia. It also shows a widened QRS complex and peaked T-waves. You order a blood test to evaluate electrolytes and suspect that you will find a ___ level.

- (A) Low serum sodium
- (B) High serum sodium
- (C) Low serum calcium
- (D) Low serum potassium
- (E) High serum potassium



Feedback

A. Incorrect!
Signs of low serum sodium include disorientation, stupor and coma.

B. Incorrect!
Signs of high serum sodium include irritability, delirium and coma.

C. Incorrect!
Signs of low serum calcium include tetany and neuromuscular irritability.

D. Incorrect!
Signs of low serum potassium include U waves on an ECG, flattened T waves, arrhythmias and paralysis.

E. Correct!
Signs of high serum potassium include peaked T waves, wide QRS complex, and arrhythmias.






Solution

High serum potassium is the correct answer. Signs of high serum potassium include peaked T waves, wide QRS, and arrhythmias. With renal failure it is important that the patient be on a low potassium diet. Being newly diagnosed with chronic renal disease it appears that this patient has unknowingly over-indulged in many potassium rich foods in a short period of time.

(E) High serum potassium

Question No. 10 of 10

Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.

 <p>Question #10</p>	<p>10. Spironolactone is a/an _____.</p> <p>(A) Potassium sparing diuretic (B) Thiazide diuretic (C) Sulphonamide loop diuretic (D) Osmotic diuretic (E) Carbonic anhydrase inhibitor</p>
 <p>Feedback</p>	<p>A. Correct! Spironolactone is a potassium sparing diuretic.</p> <p>B. Incorrect! Hydrochlorothiazide is a thiazide diuretic that inhibits the reabsorption of NaCl in the early distal tubule reducing the diluting capacity of the nephron.</p> <p>C. Incorrect! Furosemide is a sulphonamide loop diuretic that inhibits the cotransport system of the thick ascending loop of Henle.</p> <p>D. Incorrect! Mannitol is an osmotic diuretic that increases the osmolarity of the tubular fluid and increases urine flow.</p> <p>E. Incorrect! Acetazolamide is a carbonic anhydrase inhibitor that causes self limited sodium bicarbonate diuresis and reduction in total body bicarbonate stores.</p>
 <p>Solution</p>	<p>Spironolactone, a potassium sparing diuretic exerts its effect by competitive aldosterone receptor antagonism in the cortical collecting tubule. Trimaterene and amiloride act on the same part of the tubule by blocking sodium channels in the CCT. This group of diuretics is particularly useful in hyperaldosteronism, K⁺ depletion and CHF. Toxicity results in hyperkalemia, endocrine effects such as gynecomastia and antiandrogen effects.</p> <p>(A) Potassium sparing diuretic</p>