Put your name on the front and on the back

Name_____

Section _____

In the problems be certain to show all your work/thought processes and circle your answers.

1 Define renal clearance

Hypothetical plasma volume containing the amount of any substance excreted in the urine per minute

2. Calculate the renal clearance of substance x given the following:

Cardiac Output	5,000 ml/min
Urine Volume	40 ml/5min
Filtration Fraction	20%
Renal clearance of Inulin	120
Plasma Concentration of x	15 mg/100 ml
Filtration pressure	15 mm Hg
Urine concentration of x	60 mg/4 ml
Renal fraction	25 %
Hematocrit	50

$$R.C. = \frac{(Amt\ Ex.)}{[Plas]}$$

$$= \frac{\left(40ml/5min\right)\left(60mg/4ml\right)}{15mg/100ml}$$

$$= \boxed{800}$$

3. Calculate the tubular load of substance x given the following information

Cardiac Output	6,000 ml/min
Filtration Fraction	30%
Renal clearance of uric acid	100
Real clearance of PAH = RPV	700
Concentration of x in urine	4 mg/ml
T-max of x	100 mg/min
Plasma concentration of x	4 mg/ml
pO2 in renal artery	105 mm Hg
Renal Fraction	20%

$GFR = (R.P.V)(F.F)$

$= (700)(0.30)$

$= 210\ ml/min$

$T_L = GFR \times [Plas]$

$= (210 ml/min)(4 mg/ml)$

$= \boxed{840\ mg/min}$

4. Calculate glomerular blood pressure given the following

Arterial blood pressure	120/80 mm Hg
Net filtration pressure	25 mm Hg
Inulin clearance	110
Osmotic pressure of plasma proteins	20 mm Hg
Atmospheric pressure	760 mm Hg
Interstitial pressure	5 mm Hg
Bowman's capsule	15 mm Hg
Hematocrit	50

$(NFP) = (B.P) + (-O.P.) + (-BCP)$

$(25\ mm\ Hg) = (x) - (20\ mm\ Hg) - (15\ mm\ Hg)$

$25 = x - 35$

$x = \boxed{60\ mm\ Hg}$

5. Calculate the tubular load of angiotensinogen given the following:

Cardiac Output	5000 ml/min
Renal fraction	20 %
Hematocrit	50
Filtration fraction	20 %
Urine volume	30 ml/5 min
Plasma concentration of angiotensinogen	3 mg/ml
Renal clearance of sodium	20

$\emptyset$ Angiotensinogen not filtered

6. Calculate the filtration fraction given the following:

Tubular load of x	60 mg/min
Cardiac output	6,000 ml/min
Urine volume	20 ml/min
Renal fraction	20%
Plasma concentration of x	0.2 mg/ml
HCT	40
Net filtration pressure	10 mm Hg
T-max of x	200 mg/min

$$F.F = \frac{GFR}{RPV}$$

$$RPV = (C.O)(R.F)\cdot(1-Hct)$$
$$= (6,000)(0.20)(0.6)$$
$$= 720\ ml = RPV$$

$$FF = \frac{300.}{720}$$
$$= \boxed{41.7\%}$$

$$GFR = \frac{T_L}{[PLAS]}$$
$$= \frac{60\ mg/min}{0.2\ mg/ml}$$
$$= 300\ ml/min = GFR$$

7. Calculate the renal plasma threshold of x given the following

Renal blood volume	2000 ml/min
Renal fraction	20%
Urine volume	20 ml/min
Concentration of x in the urine	90 mg/30 min
T-max of x	200 mg/min
Concentration of x in plasma	1.5 mg/ml
HCT	50
Blood pressure	120/80 mm Hg

$(GFR)(R.P.F) = T_L = T_{max}$

$T_{1000} - 200\,mg = Amt\ Ex$

$T_{1000} = 260\,mg/min$

$T_{1000} - T_{max} = Amt\ Ex = (Urine\ Vol/min)([Urine])$

$= (90\,ml/30\,min)(2.0)$

$= 60\,mg/min = Amt\ Excreted$

$GFR = \frac{T_{1000}}{[Plasma]}$

$= \frac{260}{1.5} = 173.3\,ml/min = GFR$

$(173.3)X = 200$

$= 1.15\,mg/ml = R.P.T$

8. Calculate the hematocrit (HCT) given the following

Filtration fraction	20%
Renal fraction	30%
Creatinine clearance = GFR	200
Urine Volume	20 ml/min
T-max of glucose	300 mg/min
Cardiac output	6000 ml/min
Atmospheric pressure	750 mm Hg
Glucose clearance	130

$HCT = 1 - \frac{RPV}{RBV}(100)$

$RBV = (C.O)(R.F)$

$= (6000\,ml/min)(0.30)$

$= 1800 = RBV$

$R.P.V = \frac{GFR}{FF}$

$= \frac{200}{0.20}$

$= 1,000 = RPV$

$HCT = 1 - \frac{1,000}{1,800}$

$= 1 - 0.555$

$= 44.5$

Put all remaining answers on your scan sheet. Only these answers will be graded. In all cases assume that the question refers to a normal individual unless instructed otherwise.

1. The following would cause an increase in thirst
   A. ANP
   B. ADH
   C. Simulating atrial volume receptors
   D. All of these
   E. Two of these

2. Water loss
   A. Is typically less than the water gained
   B. Can be regulated by decreasing the rate of insensible sweating
   C. Can be regulated by decreasing the rate of sensible sweating
   D. None of these
   E. Two of these

3. A single molecule of glucose could take the following route in a single pass through the kidney. Intervening structures may be left out, only the sequence is important
   A. Interlobular artery, arcuate artery, Bowman's capsule, collecting duct
   B. Afferent arteriole, Bowman's capsule, Loop of Henle, collecting duct
   C. Arcuate artery, efferent arteriole, proximal convoluted tubule, calyx
   D. Glomerulus, proximal convoluted tubule, Peritubular capillary network, renal vein
   E. Two of these

4. A single molecule of hemoglobin could take the following route in a single pass through the kidney…as above conditions
   A. Renal artery, glomerulus, Bowman's capsule, collecting duct
   B. Interlobular artery, efferent arteriole, vasa recta, renal vein
   C Bowman's capsule, descending Loop of Henle, collecting duct
   D. Renal artery, interlobar artery, segmental artery, renal vein
   E. Two of these

5. Podocytes
   A. Are part of the tubular portion of the nephron
   B. Are regulated by ADH
   C. Form fenestra
   D. All of these
   E. Two of these

6. Inulin
   A. Is freely filtered
   B. Would be in the same concentration in the afferent arteriole as the efferent arteriole
   C. Would be in the same concentration in the glomerulus and in the urine.
   D. All of these
   E. Two of these

7. ANP

D

A. Decreases ADH secretion
B. Causes relaxation of the mesangial cells
C. Is released in response to increased venous return
D. All of these
E. Two of these

8. If the macula densa senses too much sodium in the filtrate

P

A. It will release angiotensin II
B. It will cause vasodilation of the afferent arteriole
C. It will cause a subsequent increase in the GFR
D. None of these
E. Two of these

9. Potassium

D

A. Is freely filtered
B. Is reabsorbed in the proximal tubule
C. Is secreted in the distal convoluted tubule
D. All of these
E. Two of these

10. The ascending Loop of Henle

Delete

A. Is impermeable to ammonia
B. Is impermeable to water
C. Contains fluid that is less concentrated that is the interstitial fluid immediately adjacent to it
D. All of these
E. Two of these

11. The following would decrease the renal clearance of potassium

B

A. LASIX
B. DYAZIDE
C. MANITOL
D. All of these
E. Two of these

12. Decreasing the plasma pH

Delete

A. May cause one to become lethargic
B Would stimulate the medulary chemroreceptors causing an increase in breathing
C. Would cause a decrease in the amount of bicarbonate that is filtered
D. All of these
E. Two of these

13. Someone with untreated d. mellitus

E

A. Would likely have more ammonium ion in their urine than a normal person
B. Would likely breathe more frequently than a normal person
C. Would stop filtering bicarbonate
D. All of these
E. Two of these

14. Someone with severe emphysema

E

A. Would be classified as having a COPD
B. Might increase their tidal volume in an attempt to compensate
C. Might excrete an acidic urine
D. All of these
E. Two of these

15. A person with metabolic acidosis
    A. May have had severe vomiting
    B. May have asthma
    C. May be excreting sodium dihydrogen phosphate in their urine
    D. All of these
    E. Two of these

16. The vagus nerves
    A. Innervate the internal intercostals
    B. Carry sensory information from the Herring Brewer reflex to the brain
    C. Carry sensory information from the chemroreceptors located at the bifurcation of the carotid arteries to the brain
    D. All of these
    E. Two of these

17. The following could cause an increase in inspiration
    A. Stimulating the pneumotaxic center
    B. Simulating the vasomotor center
    C. Stimulating the spinal cord
    D. All of these
    E. Two of these

18. The change in this plasma constituent has the most potent effect on respiration
    A. Decreasing oxygen
    B. Increasing CO2
    C. Increasing hydrogen ions
    D. Decreasing pH
    E. Two of these

19. Communicates directly with or found within the nasopharynx
    A. Nasolacrimal ducts
    B. Eustachian tubes
    C. Tonsils
    D. All of these
    E. Two of these

20. Associated with or found within the dead space
    A. Carina
    B. Alveolar duct
    C. Fauces
    D. All of these
    E. Two of these

21. At a systemic capillary
    A. One would likely see the Haldane effect
    B. The pO2 of blood entering it is approximately equal to 105
    C. The oxyhemoglobin disassociation curve would shift to the right
    D. All of these
    E. Two of these

22. Suppose you were considering the amount of "CO2" (any of the transport forms) in the efferent arteriole as compared to the afferent arteriole. Which of the following is/are true assuming a filtration fraction of 50%

P

A. There would be the same amount in the efferent and the afferent arteriole
B. There would be about 50% as much in the efferent as the afferent
C. There would be about 12 % as much in the efferent as the afferent
D. There would be about 60% as much in the efferent as the afferent
E. There would be about 23% as much in the efferent as the afferent

23. The predominant form of hemoglobin in the carotid artery

B

A. HHB
B. KHbO2
C. HHbO2
D. HBO
E. KHb

24. Type of anemia associated with EPOGEN therapy

C

A. Nutritional
B. Aplastic
C. Renal
D. Pernicious
E. Hemolytic

25. Bilirubin

B

A. Contains iron
B. Can be neurotoxic
C. Is found in the urine
D. All of these
E. None of these

26. An antitussive

B

A. Guanifenesin
B. Dextromethorphan
C. Serevant
D. Mucomyst
E. Atrovent

27. The following are functions of the liver

D

A. Synthesize plasma proteins
B. Gluconeogenesis
C. Transamination
D. All of these
E. Two of these

28. The liver

C

A. Receives blood from the hepatic portal artery
B. Produces bile salts which hydrolyze fats
C. Produces lipoproteins
D. All of these
E. Two of these

29. The following are effective *in vivo* anticoagulants

E

A. Heparin
B. Plasmin
C. Coumadin
D. All of these
E. Two of these

30. The most common type of hepatitis worldwide

D

A. HAV
B. HBV
C. HCV
D. HEV
E. SUV

31. Steroidal hormones

D

A. Are all made in the liver
B. Found in the anterior pituitary
C. Found in the posterior pituitary
D. None of these
E. Two of these

32. The adenohypophysis

D

A. Is embryologically derived from the infundibulum
B. Produces releasing hormones
C. Produces melatonin
D. None of these
E. Two of these

33. Hormone that causes the secretion of milk

B

A. Oxytocin
B. Prolactin
C. Estrogen
D. Lactogen
E. Progesterone

34. Somatostatins

B

A. Are also called insulin-like growth factors
B. Are produced in the hypothalamus
C. Are produced in the liver
D. All of these
E. Two of these

35. Growth hormone

E

A. Secretion is greatest during sleep
B. Is the most plentiful hormone in the anterior pituitary
C. Is inhibited by ghrelin
D. All of these
E. Two of these

A= Increase or greater than
B= Decrease or less than
C= No effect or equal to

B 36. The effect of increasing the concentration of the plasma proteins in the glomerulus on the subsequent filtration fraction

C 37. The effect of increasing glomerular blood pressure on the T-max of glucose (assume d. mellitus)

A 38. The effect of increasing ANP secretion of the subsequent clearance of sodium

C 39. The effect of angiotensin II on the renal fraction

B 40. The concentration of transferrin in the afferent arteriole as compared to the efferent arteriole

A 41. The amount of potassium in the afferent arteriole as compared to the efferent arteriole

B 42. The hematocrit in the afferent arteriole as compared to the efferent arteriole

C 43. The amount of glucose in the descending loop of Henle as compared to the amount in the distal convoluted tubule (Assume d. mellitus)

A 44. The amount of glucose in Bowman's capsule as compared to the amount in the distal tubule (Assume d. mellitus)

Questions 45 to 51 relate to a situation in which you have the same amount and concentration of PAH, creatinine, FSH and glucose in the afferent arteriole. Assume a filtration fraction of 20%

C 45. Compare the concentration of PAH in the afferent arteriole to the concentration of creatinine in the efferent arteriole

C 46. Compare the amount of FSH in the renal vein to the amount of glucose in the renal vein

B 47. Compare the amount of PAH in the renal vein as compared to the amount of creatinine in the renal vein

C 48. Compare the amount of creatinine in Bowman's capsule as compared to the amount of creatinine in the collecting duct

B 49. Compare the concentration of creatinine in Bowman's capsule as compared to the concentration of creatinine in the distal tubule

A 50. Compare the amount of glucose in the renal vein as compared to the amount of creatinine in the renal vein

C 51. Compare the amount of FSH in the vasa recta as compared to the amount of glucose in the renal vein

C 52. Assuming that the GFR's are the same, compare the volume of the filtrate in the descending Loop of Henle of a normal person to one who has d. insipidus

A 53. Compare the concentration of the filtrate in entering the descending loop of Henle to the concentration of the fluid leaving the ascending loop of Henle

A 54. The likely amount of glucose reabsorbed by the kidney of someone suffering from d. mellitus as compared to someone suffering from d. insipidus

B 55. The effect of Probenecid on the renal clearance of penicillin

A 56. The urine volume of someone suffering from proteinuria as compared to a normal person

A 57. The effect of stimulating the dorsal respiratory group on the subsequent contraction of the external intercostals

C 58. The effect of stimulating Botzinger's nucleus on the subsequent diameter of the airways

A 59. The effect of stimulating the apneustic center on the subsequent inspiratory effort

C 60. The effect of exercise on the pO2 of oxygen in the blood

A 61. The number of arytenoid cartilages as compared to the number of thyroid cartilages

C 62. The magnitude (absolute value) of the intra-alveolar pressure at the end of inspiration in someone suffering from IRDS as compared to the intra-alveolar pressure at the end of inspiration of a normal person

B 63. The magnitude (absolute value) of the interpleural pressure during expiration as compared to the magnitude of the intra-alveolar pressure during expiration

A 64. The magnitude of the vital capacity as compared to the volume of the inspiratory reserve volume plus the expiratory volume

A 65. FEV-1 in a normal person as compared to the FEV-1 with asthma

C 66. The pCO2 in the pulmonary vein as compared to the pCO2 in the renal artery

A 67. The effect of the Bohr effect on the p50 of hemoglobin

B 68. The effect of 2,3DPG on the affinity of hemoglobin for oxygen

A 69. The likelihood of finding bile salts in the hepatic portal vein as compared to finding them in the central vein

A 70. The likelihood of LDL's causing atherosclerosis as compared to the likelihood of HDL's causing atherosclerosis

C 71. The effect of dicumerol on fibrinogen synthesis

C 72. The effect of stimulating hypothalamic osmoreceptors on the subsequent secretion of ADH into the hypophyseal portal vein

A 73. The effect of growth hormone on lipolysis