

Comprehensive Basic Science Sample Items

1. In a steady state, the difference in CO₂ content between the venous blood leaving a tissue and the arterial blood entering the tissue is determined by which of the following ratios?
 - (A) Alveolar ventilation to tissue blood flow
 - (B) Alveolar ventilation to tissue O₂ consumption
 - (C) Tissue CO₂ production to tissue blood flow
 - (D) Tissue CO₂ production to tissue O₂ consumption
 - (E) Tissue CO₂ production to venous P_{CO₂}
2. A 16-month-old boy is brought to the physician by his mother for a well-child examination. His mother expresses concern that he did not walk until the age of 14 months, whereas his older sister walked at the age of 10 months. Physical examination shows no abnormalities. Which of the following best explains this patient's condition?
 - (A) Autism spectrum disorder
 - (B) Child abuse
 - (C) Oppositional defiant disorder
 - (D) Sensory integration disorder
 - (E) Normal development
3. A 77-year-old woman is visited by the home care nurse who notes that the patient is more lethargic than usual. Her skin and mucous membranes are dry. An increase in the serum concentration or activity of which of the following provides the strongest indication that the patient is dehydrated?
 - (A) Albumin
 - (B) Alkaline phosphatase
 - (C) Bilirubin
 - (D) Calcium
 - (E) Uric acid
4. A male newborn delivered at 26 weeks' gestation develops respiratory distress immediately after a spontaneous vaginal delivery. His respirations are 40/min. Physical examination shows cyanosis and lower rib retractions with respiration. Heart sounds are normal. Bilateral breath sounds are heard on auscultation. A chest x-ray shows bilateral lung opacities. The most likely cause of this patient's breathing difficulties is insufficient production of which of the following substances?
 - (A) Collagen, type III
 - (B) α -Fetoprotein
 - (C) Meconium
 - (D) Retinoic acid
 - (E) Surfactant
5. A 28-year-old woman, gravida 1, para 1, comes to the physician because of progressive fatigue since delivering a male newborn 6 months ago. She is sleeping 8 to 10 hours nightly, but she is still tired during the day. She also has not had a menstrual period since her pregnancy. Pregnancy was complicated during the third trimester by severe bleeding from placenta previa. She required multiple blood transfusions during the cesarean delivery, but she did well after the delivery. She was unable to breast-feed her newborn because of poor milk production. Which of the following is the most likely diagnosis?
 - (A) Anemia
 - (B) Cardiomyopathy
 - (C) Major depressive disorder
 - (D) Postpartum pituitary infarction
 - (E) Thyroiditis

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6. A 12-year-old African American boy is brought to the physician by his mother because of a swollen right earlobe for 3 weeks. He had the ear pierced at a local mall 6 weeks ago. The swelling has persisted despite removal of the earring 3 weeks ago. The mother developed a thick rubbery scar on her abdomen after a cesarean delivery 12 years ago. His temperature is 37°C (98.6°F). Physical examination shows a nontender, flesh-colored swelling of the right earlobe. The skin is intact over the swelling, and it is soft and nontender. There is no cervical lymphadenopathy. Which of the following is the most likely cause of the swelling in this patient?
- (A) Bacterial infection
 - (B) Contact dermatitis
 - (C) Foreign body
 - (D) Keloid
 - (E) Lipoma
7. A 5-year-old boy is brought to the physician by his parents because of an 8-month history of difficulty walking. His parents say that he limps when he walks and has a waddling gait; he also has difficulty standing. When getting up from a sitting position, he uses his hands to walk up his thighs and push his body into a standing position. His parents have not noticed any weakness of his arms. His mother is an only child, but she has an uncle who became bedridden as a child and died of respiratory arrest. Physical examination shows prominent calf muscles. Muscle strength is 4/5 at both hips but normal elsewhere. This patient most likely has a mutation in the gene coding for which of the following proteins?
- (A) Actin
 - (B) Dystrophin
 - (C) Frataxin
 - (D) Myelin
 - (E) Myosin
8. A 27-year-old man comes to the physician because of pain with urination for 3 days. He has had no fever or chills. He is sexually active with three partners and does not use condoms consistently. He began having sexual relations with his most recent partner 1 week ago. His temperature is 37°C (98.6°F). Physical examination shows no abnormalities except for a clear, watery urethral discharge. Urinalysis shows 10–20 WBC/hpf but no bacteria. Which of the following is the most likely causal organism?
- (A) *Chlamydia trachomatis*
 - (B) *Entamoeba histolytica*
 - (C) *Escherichia coli*
 - (D) *Helicobacter pylori*
 - (E) *Shigella flexneri*
9. A 20-year-old college student develops fever, severe pharyngitis, hepatosplenomegaly, and lymphadenopathy. The pathogenesis of this syndrome most likely involves a double-stranded DNA virus infection of which of the following cells?
- (A) B lymphocytes
 - (B) Kupffer cells
 - (C) Macrophages
 - (D) Neutrophils
 - (E) T lymphocytes

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10. A 2-year-old boy with Down syndrome is brought to the physician by his mother for a follow-up examination. His blood pressure is increased in the upper extremities and decreased in the lower extremities. Physical examination shows cyanosis of the lower extremities. An AP x-ray of the chest shows notching of the inferior surfaces of the 3rd through 8th ribs. The diagnosis of left ventricular hypertrophy is suspected. Which of the following is the most likely underlying abnormality in this patient?

(A) Atrial septal defect
 (B) Coarctation of the aorta
 (C) Persistent truncus arteriosus
 (D) Tetralogy of Fallot
 (E) Transposition of the great arteries

11. A 1-day-old neonate has hemolytic disease of the newborn. The parents are both Rh-positive, but IgG isohemagglutinins are found in the mother's blood. Which of the following parental blood types is most likely to cause this condition?

	Mother	Father
(A)	A	O
(B)	AB	O
(C)	B	A
(D)	B	O
(E)	O	AB

12. A previously healthy 42-year-old woman comes to the emergency department because of progressive shortness of breath and intermittent cough productive of blood-tinged sputum for 10 days. She has no history of major medical illness and takes no medications. Her respirations are 24/min. Diffuse rhonchi are heard in both lung fields on auscultation. A chest x-ray shows patchy opacities bilaterally. Laboratory studies show:

Serum creatinine	2.5 mg/dL
Urine	
Protein	3+
RBC	3+
RBC casts	numerous

A serum anti-glomerular basement membrane autoantibody assay is positive. Which of the following is the most likely diagnosis?

(A) Goodpasture syndrome
 (B) Hemolytic uremic syndrome
 (C) Löffler syndrome
 (D) Mucocutaneous lymph node syndrome (Kawasaki disease)
 (E) Granulomatosis with polyangiitis

13. A 10-year-old boy is found to have mild iron deficiency anemia. His mother informs the physician that the family members belong to a religious denomination that does not consume meat. Her son refuses to eat dark green vegetables or to take vitamin pills, stating that they make him feel nauseated. It is most appropriate for the physician to ask the mother which of the following questions next?

(A) "Are you concerned that if you let him get away with not eating right when he's 10, he'll be more likely to give you trouble when he's a teenager?"
 (B) "Can you tell me exactly why your religion prohibits meat?"
 (C) "Would you like information on other iron rich foods consistent with a vegetarian diet?"
 (D) "Would you like me to write a note to your religious leader requesting a medical exemption from your dietary requirements?"
 (E) "Wouldn't your son rather eat spinach than get an iron shot every week?"

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14. A 45-year-old man is diagnosed with gastroesophageal reflux disease. Omeprazole treatment is initiated. Which of the following is the mechanism of action of this drug?
- (A) Binds to H_2 receptors
 - (B) Creates a cytoprotective layer in the stomach
 - (C) Inhibits H^+-K^+ ATPase
 - (D) Prevents absorption of dietary acids
 - (E) Stimulates serotonin receptors
15. A 64-year-old man comes to the physician because of a 3-day history of painful rash over his right flank. Three days before the rash appeared, he had pain in the same area. His temperature is $37.4^{\circ}C$ ($99.3^{\circ}F$), pulse is 78/min, respirations are 17/min, and blood pressure is 130/70 mm Hg. Physical examination shows clustered lesions in a band-like area over the right flank. The lesions have an erythematous base and are crusted. Which of the following is the most likely causal virus?
- (A) Cytomegalovirus
 - (B) Epstein-Barr virus
 - (C) Human papillomavirus
 - (D) Kaposi sarcoma virus
 - (E) Varicella-zoster virus
16. A 27-year-old man with AIDS is brought to the hospital 30 minutes after having a seizure. He currently takes no medications. A CT scan of the head shows multiple ring-enhancing lesions. Which of the following is the most likely diagnosis?
- (A) Amoebiasis
 - (B) Cysticercosis
 - (C) Echinococcosis
 - (D) Schistosomiasis
 - (E) Toxoplasmosis
 - (F) Trichinosis
17. An investigator has conducted an experiment to determine whether certain environmental exposure morbidity is eliminated if a person carries a specific allele of three different genes on three separate chromosomes. The frequencies of an individual having the allele for these respective genes are 0.6, 0.2, and 0.1. All three alleles are necessary to confer protection. The probability that a randomly selected individual will have all three alleles is closest to which of the following?
- (A) 0.900
 - (B) 0.600
 - (C) 0.200
 - (D) 0.100
 - (E) 0.012
18. A health inspector confiscates chickens smuggled into Taiwan from mainland China after she discovers them in the hold of a ship. Testing shows that, although the chickens appear healthy, they are infected with the H5N1 subtype of the influenza A virus. Which of the following is the primary concern for human health from these virus-infected chickens?
- (A) Mutation of the virus to a form that causes fatal encephalitis
 - (B) Mutation of the virus to a form that causes fatal renal disease
 - (C) Mutation of the virus to a form that is highly infectious among humans
 - (D) Secretion of a product that will cause immunosuppression in those that eat the meat
 - (E) Secretion of a product that will cause mutations of the virus in the fetuses of mothers that eat the meat
 - (F) Secretion of a product that will make the meat of the chicken poisonous to eat

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19. A 35-year-old woman has hypertension and truncal obesity. Serum studies show:

Cortisol (AM)	100 µg/dL (N=5–20)
Cortisol (PM)	100 µg/dL (N=2.5–10)
ACTH (AM)	100 µg/dL (N=20–100)
Cortisol 8 h after 1 mg dexamethasone	95 µg/dL
Cortisol 8 h after 8 mg dexamethasone	30 µg/dL (N=5–20)

Which of the following is the most likely cause of this woman's increased serum cortisol concentration?

- (A) Adrenocortical adenoma
 - (B) Ectopic corticotropin-releasing hormone producing neoplasm
 - (C) Ectopic corticotropin-secreting neoplasm
 - (D) Pituitary microadenoma
 - (E) Self-administration of synthetic glucocorticoids
20. A 42-year-old woman comes to the physician for a routine health maintenance examination. She says that she feels fine. She is 170 cm (5 ft 7 in) tall and weighs 86 kg (190 lb); BMI is 30 kg/m². Her blood pressure is 131/82 mm Hg. Physical examination shows no other abnormalities. Fasting serum studies show:

Glucose	105 mg/dL
Cholesterol, total	210 mg/dL
Triglycerides	185 mg/dL
C-reactive protein	0.35 mg/L (N=20–100)

This patient is at increased risk for developing which of the following conditions?

- (A) Atherosclerosis
- (B) Chronic lymphocytic (Hashimoto) thyroiditis
- (C) Systemic lupus erythematosus
- (D) Systemic sclerosis (scleroderma)
- (E) Type 1 diabetes mellitus

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**Answer Form for Comprehensive Basic Science Sample
Questions**

(Questions 1–20)

1. _____
2. _____
3. _____
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Answer Key for Comprehensive Basic Science Sample Questions

(Questions 1–20)

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|-----|---|-----|---|
| 1. | C | 11. | E |
| 2. | E | 12. | A |
| 3. | A | 13. | C |
| 4. | E | 14. | C |
| 5. | D | 15. | E |
| 6. | D | 16. | E |
| 7. | B | 17. | E |
| 8. | A | 18. | C |
| 9. | A | 19. | D |
| 10. | B | 20. | A |