Directions: For each question below, choose the single best answer. If you have a question, raise your hand and ask a proctor; you have nothing to lose.

Pharmacology questions are indicated by: 

Pathology questions are indicated by: 

1. FRC (functional residual capacity) is best characterized as:
   a. The volume of gas present in the lungs when a patient has exhaled as much as (s)he can
   b. The volume of gas present in the lungs after a patient takes in a normal tidal volume
   c. The maximal volume of gas a patient can exhale starting from the normal end-expiratory lung volume
   d. The volume of gas present in the lungs when the respiratory muscles are totally relaxed
   e. The volume of gas a patient can inhale from the end-inspiratory point of tidal volume to total lung capacity

Answer: d

2. Under normal conditions, lung sterility is maintained by:
   a. Cough and gag reflexes
   b. The mucociliary escalator, phagocytic cells, and bronchus-associated lymphoid tissue
   c. Surfactant production by Type I cells
   d. Filtering of air in the nasal passages
   e. Alveolar macrophages

Answer: b

3. Chemoreceptors control ventilation through the following mechanisms:
   a. Elevated PaCO$_2$ leads to a decrease in respiratory drive
   b. Low PaO$_2$, leads to increased output from the respirator control center in the medulla
   c. Low pH leads to decreased output from the medullary control center
   d. Hypercarbia is sensed in both the peripheral and the central chemoreceptors
   e. b and d

Answer: e
4. The section of lung displayed above represents which of the following?
   a. The canalicular stage of lung development
   b. Normal lung from an adult or older child
   c. Paraseptal emphysema
   d. Bronchiectasis

   Answer: b

Answer a. true or b. false to the following:

5. Definitive alveoli do not form until late in gestation and their formation continues during the first few years of life.

   Answer: a

6. Type II pneumocytes appear late in the first trimester and are thin, flat epithelial cells lining the alveolar walls.

   Answer: b
A term newborn died on day 2 of life. The photo below is of the open thorax at autopsy.

7. Which of the following abnormalities can be recognized? (1 point)
   a. The thymus is enlarged and shows signs of asphyxia
   b. The lungs are hypoplastic
   c. The heart shows dextrocardia
   d. The rib cage is constricted

   Answer: b

8. Of the following, which is the most likely underlying cause of the abnormality illustrated?
   a. Bilateral congenital diaphragmatic hernia
   b. Renal agenesis
   c. Deficiency of surfactant
   d. Pompe disease

   Answer: b
9. The newborn probably died as a result of which of the following?
   a. Renal failure
   b. Cerebral hemorrhage
   c. Respiratory insufficiency
   d. Congestive heart failure

   Answer: c

10. A patient with upper airway obstruction presents with stridor. She is given heliox to
    breath by face mask, which is a 70:30 mix of helium:oxygen. Assuming there is no
    leakage around the mask, that the patient has a PaCO\textsubscript{2} of 40 mm Hg, and
    that the patient has a normal Aa gradient of 9 mm Hg, what is the patient’s PaO\textsubscript{2}?
    a. 141 mm Hg
    b. 91 mm Hg
    c. 164 mm Hg
    d. 178 mm Hg
    e. 155 mm Hg

   Answer: e

11. As blood moves from the lungs to the tissues, the oxyhemoglobin dissociation curve
    shifts:
    a. Right
    b. Left
    c. Up
    d. Down

   Answer: a

12. Which of the following statements regarding ventilation and perfusion in the lungs is/are true?
    a. In the upright position, the lung bases receive a greater proportion of ventilation
       than the apices
    b. Alveoli at the top of the lungs, relative to gravity, are larger than those at the lung
       bases
    c. Lung perfusion tends to be greater in the most dependent regions than in the least
       dependent
    d. a, b, and c
    e. Dead space ventilation usually causes hypoxia

   Answer: d
13. Which of the following statements is/are true?
   a. The size of the Aa gradient on room air helps differentiate between V/Q mismatch and shunt
   b. As the fraction of shunted blood through the lungs increases, the response to oxygen is unchanged
   c. The relative failure of shunt to correct much with higher $F_{I}O_{2}$ has to do with the solubility of oxygen in the blood
   d. The relative failure of shunt to correct much with higher $F_{I}O_{2}$ has to do with the saturation of hemoglobin
   e. c and d

   Answer: e

14. A paralyzed vocal cord will impair a patient’s lung defense against infection through the following means:
   a. Impaired ability to prevent aspiration
   b. Causing stridor
   c. Interfering with cough
   d. a, b, and c
   e. a and c

   Answer: e

15. Fine crackles on examination of the lung indicate:
   a. Pulmonary edema
   b. Pneumonia
   c. Secretions in large airways
   d. Interstitial Lung Disease
   e. a, b, and d

   Answer: e

16. You are called to see a patient in the ER who is hypoxic and wheezing. You instruct your medical student to place the patient on 2 liters per minute of oxygen via nasal cannula; in 5 minutes the patient’s oxygen saturation has risen from 83% to 92%. You inform your student that this patient’s hypoxia is most likely due to:
   a. Shunt
   b. V/Q mismatch
   c. Diffusion defect
   d. Low $F_{I}O_{2}$
   e. Hypoventilation

   Answer: b
17. You are working with a patient in the pulmonary function laboratory who has been referred by a physician investigating the patient’s dyspnea with exertion. You notice the patient has kyphoscoliosis. She tells you she had Harrington rod insertions done when she was 17; she is now 42 years old. She tells you she’s never had asthma or wheezing before, and she has never been a cigarette smoker or lived or worked in an environment in which she’s been exposed to significant amounts of cigarette smoke. You coach her through her spirometry; her FVC is 2.53 liters (53% predicted) and her FEV₁ is 2.02 L (52% predicted). You conclude:
   a. She has obstructive airways disease
   b. She has no evidence of obstruction at this time
   c. She has small airways disease
   d. She has a diffusion defect
   e. She hypoventilates

   Answer: b

18. You next perform lung volume measurements. You have a choice between doing gas dilution technique and using the body box (plethysmograph). You decide:
   a. Use the plethysmograph, to avoid underestimating lung volumes due to gas not in communication with the airways due to bullous emphysema
   b. Use the gas dilution technique, as it will be more accurate given the abnormal body structure
   c. It doesn’t matter; both techniques will give roughly the same results

   Answer: c

19. The patient’s diffusion capacity is 75% predicted; when it is divided by the total lung capacity expressed as percent predicted, the resultant value is 113%. Your guess is that this patient’s lung elastic recoil forces are:
   a. Normal
   b. Increased
   c. Decreased

   Answer: a
A 15 year old girl suddenly developed severe dyspnea with wheezing. A chest x-ray revealed hyperlucent lung fields. Sputum cytology revealed Charcot-Leyden crystals. She had had several similar attacks per year since age 7.

20. Which of the above light microscopic photos of a bronchus corresponds to the above scenario?

   Answer: b

21. Which of the following is the diagnosis?

   a. bronchial asthma
   b. chronic bronchitis
   c. alpha1-antitrypsin deficiency
   d. acute laryngotracheobronchitis

   Answer: a
22. Which of the following statements is true regarding asthma drug “relievers” and “controllers”?
   a. All relievers are bronchodilators, and all controllers are anti-inflammatory agents.
   b. All relievers are anti-inflammatory agents, and all controllers are bronchodilators.
   c. Relievers address the fundamental disease process, whereas controllers generally do not.
   d. Controllers address the fundamental disease process, whereas relievers generally do not.
   e. Controllers are always given by inhalation, while relievers are given systemically.

   Answer: d

23. Your first strategy in treating an acute asthma attack should be to:
   a. Block leukotriene receptors
   b. Block nicotinic cholinergic receptors
   c. Block muscarinic cholinergic receptors
   d. Activate β₂-adrenergic receptors
   e. Activate β₁-adrenergic receptors

   Answer: d

24. The best drug to use in long-term control of chronic asthma would be:
   a. Albuterol
   b. Theophylline
   c. Fluticasone
   d. Terbutaline
   e. Ipratropium

   Answer: c

25. Salmeterol should not be used in an acute asthma attack because of its:
   a. Slow onset of action
   b. Ability to desensitize β-receptors
   c. Slow metabolism
   d. Cardiovascular side effects
   e. Drug interaction profile

   Answer: a
26. Which of the following drugs has the least direct bronchodilating effect?:

   a. Theophylline
   b. Ipratropium
   c. Beclomethasone
   d. Montelukast
   e. Formoterol

   Answer: c

27. A 35-year-old male patient with a history of mild asthma complains of wheezing and slight difficulty breathing after taking his daily morning jogs. In addition, you find that he likes to run in a park located near a factory that has been cited several times for air quality violations. Among the drugs listed below, which would be the best to prescribe for him?

   a. Salmeterol
   b. Ipratropium
   c. Methylprednisolone
   d. Zileuton
   e. Cromolyn

   Answer: e

28. Aspirin can precipitate an asthma attack in sensitive individuals because it:

   a. Causes a drop in body temperature
   b. Causes accumulation of arachidonic acid
   c. Inhibits blood clotting
   d. Blocks leukotriene receptors
   e. Inhibits mast cell degranulation

   Answer: b
29. A 35 year-old male patient comes to see you in the office for the first time. He is complaining of frequent respiratory infections, often requiring hospitalization. He has just moved to your area from out of state. He is not medically sophisticated, but he tells you his internal organs are all on the opposite side, so they always think his chest X-ray has been labeled backwards. You anticipate finding this patient has:

a. Immotile cilia
b. Similarly affected children
c. Bilateral basilar bronchiectasis
d. a and c
e. a, b, and c

Answer: d

30. You are seeing a 53 year old man in your office for the first time for complaints of dyspnea on exertion. He is a trial lawyer, and he has noticed he is no longer keeping up with his partners at their health club. He has smoked ¾ of a pack of cigarettes daily since he was 19, though he quit two years ago when his office went “smoke-free”. He did not have wheezing or asthma as a child, and did not have frequent bronchitis or pneumonia previously. He now is coughing almost daily, and raises 1½ tablespoons of yellow sputum over the course of his average day. You order PFT’s and an ABG. As a chronic bronchitis patient, you expect which of the following patterns?

a. Small airways disease, hypercarbia, and a borderline acceptable PaO₂
b. A reduced FEV₁/FVC ratio, a severely reduced diffusing capacity, and a reasonably normal PaO₂ at rest
c. Approximately equal percent reductions in FEV₁ and FVC, an increased FEV₁/FVC ratio, and a reduced diffusion capacity
d. Normal PFTs with a large A-a gradient

Answer: a

31. The patient tells you he has been increasingly depressed, and feels that he’s only getting worse since he quit smoking. He wants to know what would actually happen to him if he resumes smoking. You tell him:

a. He will not notice any change
b. He will develop wheezing, worsening oxygen deficits and increased impairment of his activities, and ultimately right-sided heart failure
c. He will develop bilateral basilar emphysematous changes to his lungs
d. His breathing will not change, but he will probably develop lung cancer

Answer: b
32. The patient is started on a beta-2-agonist and anticholinergic combination medication. He comes back to you a year later for follow-up and tells you he initially felt better with the inhaler, but lately he has noted he is again being limited by his breathing. He has tried looking up COPD on the internet, but he can’t understand “all that medical jargon” and asks you to explain in layman’s terms why he still can’t breathe normally after quitting smoking three years ago. You respond:
   a. The smooth muscle in his breathing tubes is all in spasm, so the airways are very narrow.
   b. His airways have lost their structural supports, so they are just snapping shut every time he exhales
   c. His lungs are full of trapped gas so he has little room to inhale, and this is also forcing his breathing muscles to work at a mechanical disadvantage
   d. He has abnormal small airways due to swelling and infiltration with WBCs, fibrosis, increased numbers of mucous glands, and some mucus blocking the airways, making it difficult for him to exhale normally

   Answer: d

A 64 year old man with a history of smoking 2 packs of cigarettes daily for 40 years presents with hemoptysis and weight loss. A Papanicolaou-stained sputum specimen is shown below.

33. If we saw sections of the lung lesion in this case we would most likely see which of the following:
   a. Small tumor cells resembling lymphocytes, positive staining for neuron-specific enolase
   b. Large, undifferentiated tumor cells consistent with metastatic melanoma
   c. Intercellular bridges between tumor cells
   d. Bronchioloalveolar carcinoma

   Answer: c
34. If this patient had a paraneoplastic syndrome, it would most likely be due to ectopic production of which of the following by the tumor cells:
   a. ACTH
   b. A parathyroid related peptide, a peptide distinct from parathormone
   c. Serotonin
   d. TSH

   Answer: b

35. A 68 year old man enters the hospital for acute worsening of chronic shortness of breath and a nonproductive cough. He is a lifelong nonsmoker, though he did work in the jewelry industry. He has no cardiac risk factors other than age and male sex. His primary physician saw him in the office earlier and noted an oxygen saturation of 83% on room air, a respiratory rate of 28, fine “Velcro” crackles at the lung bases without wheezing, and clubbing. A chest X-ray shows a “reticulonodular pattern” that is most prominent at the lung bases. A CT angiogram obtained in the ER shows no evidence of pulmonary embolism; a high resolution CT scan the following day shows subpleural honeycomb changes mostly at the lung bases, some traction bronchiectasis, and thickened interlobular septa. The most likely pathophysiologic explanation for this man’s hypoxia is:
   a. Diffusion defect
   b. V/Q mismatch
   c. a and b
   d. Shunt
   e. Hypoventilation

   Answer: c

36. You would predict the following:
   a. He has reduced lung compliance with normal chest wall compliance, resulting in a reduction in FRC, TLC, and normal to increased expiratory flows
   b. He has reduced lung and chest wall compliance, leading to reductions in TLC, FRC, and RV
   c. He has increased recoil forces of his chest wall, resulting in a restrictive pattern
   d. His FRC should be elevated due to gas trapping from airway closure

   Answer: a
37. If you thought there was a high probability this patient had pulmonary sarcoidosis, you would favor the following approach for making a diagnosis:
   a. Check a serum angiotensin converting enzyme level
   b. Perform a fiberoptic bronchoscopy with transbronchial and endobronchial forceps biopsies
   c. Perform a mediastinoscopy for mediastinal lymph node sampling
   d. Obtain a VATS (video-assisted thoracic surgery) biopsy of the lung
   e. Obtain a closed pleural biopsy

   Answer: b

38. A 33 year old woman contacts your office for a new prescription for her oral contraceptive because her current pharmacy is refusing to fill the prescription on “moral grounds”. You give her the prescription. One month later she calls you complaining of shortness of breath at rest that is significantly worse with exercise. She has just returned to Providence from a business meeting in Chile. She denies fever, chills, sweats, cough, or sputum. You ask her to come to the emergency room; her oxygen saturation is 94%, but she has a respiratory rate of 24. You ask for an arterial blood gas on room air, and the results are: 7.47//PaCO$_2$ 31// PaO$_2$ 72. On exam, you see no jugular venous distention, hear no abnormal lung sounds, and hear only a normal $S_1$ and $S_2$. You do notice some mild edema of her left leg; the patient was not aware of this. You order a duplex ultrasound of her legs; the result shows a deep vein thrombosis in the left popliteal vein and the left superficial femoral vein. The factors that are most likely responsible for this patient’s DVT are:
   a. A hypercoaguable state and venous stasis
   b. Endothelial damage
   c. Trauma to the leg
   d. Lower extremity cellulites
   e. Left lower extremity immobilization

   Answer: a

39. You order a CT angiogram which comes back showing multiple segmental and subsegmental filling defects of the pulmonary arteries. Which pathophysiologic processes are likely occurring in this patient?
   a. Increased dead space
   b. Reduction in right ventricular preload
   c. Hypoventilation
   d. Extrinsic compression of pulmonary vessels by interstitial collagen deposition
   e. All of the above

   Answer: a
40. This patient should begin treatment with:
   a. Coumadin
   b. TPA (tissue plasminogen activator)
   c. A direct thrombin inhibitor
   d. IV heparin
   e. TED stockings and sequential venous compression boots

   Answer: d

41. Possible mechanisms that would increase the rate of pleural fluid formation include:
   a. Increased permeability of the pleural capillaries
   b. Decreased hydrostatic pressure in the pleural capillaries
   c. Low colloid osmotic (oncotic) pressure in the pleural capillaries
   d. Obstruction of the pulmonary lymphatic channels
   e. a, c, and d

   Answer: e

42. The finding(s) on physical examination supporting a diagnosis of a pleural effusion is/are:
   a. Dullness to percussion on the affected side
   b. Egophony throughout the affected side
   c. Increased tactile fremitus on the affected side
   d. Whispered pectoriloquy on the affected side
   e. All of the above

   Answer: a

43. Light’s Criteria:
   a. Help one differentiate transudative pleural effusions from exudative pleural effusions
   b. Require all three criteria to be met to diagnose an exudate
   c. State that a pleural fluid protein greater than 2/3 the upper normal limit for serum protein is satisfactory for diagnosing an exudate
   d. Indicate the fluid is probably a transudate if the cell count has fewer than 5% mesothelial cells
   e. a, c, and d

   Answer: a

44. In a normal individual, exercise induces which of the following changes in the cardio-respiratory system:
   a. Increase in heart rate
   b. Increase in tidal volume
   c. Decrease in stroke volume
   d. Reduction in mixed venous oxygen content
e. a, b, and d

Answer: e

45. A 35 year old woman presents complaining of increasing shortness of breath on exertion and a fainting episode. She has a family history of premature death due to “heart failure”. Chest roentgenogram, pulmonary function tests and arterial blood gases are normal and echocardiogram reveals no evidence of valvular disease. You are considering a diagnosis of pulmonary arterial hypertension. Appropriate next test(s) would be:
   a. Erythropoetin level
   b. Activated Protein C level
   c. Left Heart catheterization and coronary arteriograms
   d. DNA Microarray profile
   e. Tests for thromboembolic disease—leg ultrasound, perfusion lung scan, CT pulmonary angiogram

Answer: e

46. A 65 year old with severe COPD visits the emergency room complaining of bilateral leg swelling. On exam, you note jugular venous distension and signs of right ventricular overload. An arterial blood gas on room air is obtained and shows pH 7.29, PCO2 55, PO2 45. The one treatment most likely to improve the leg swelling is:
   a. Digoxin IV
   b. Angiotensin converting enzyme inhibitor orally
   c. Oxygen
   d. Heparin IV infusion
   e. Prednisone

Answer: c

47. After conversing with the patient, you learn that he is considering a vacation in the mountains at Aspen, Colorado, after his leg swelling has subsided. You give him the following advice.

   a. Use oxygen while on the plane to Aspen.
   b. Drive to Aspen and avoid air travel.
   c. Change vacation plans and go to Miami, Florida, instead.
   d. Arrange for emergency Medevac from Aspen, if needed.
   e. Ambulate on a regular basis to avoid deep vein thrombosis.

Answer: c
This section is from the lung of a 60 year old man with dyspnea and pleuritic chest pain. (Ignore the asterisk)

48. Which of the following is correct?
   a. The lesion has been present for at least 3 weeks as indicated by extensive organization
   b. The lesion indicates plexogenic pulmonary arteriopathy
   c. The lesion might have resulted from a mural thrombus secondary to a lateral wall infarct in the left ventricle
   d. The patient might have a hypercoagulable state

   Answer: d

49. Pulmonary infarcts are usually hemorrhagic because:
   a. The lung has a dual arterial blood supply
   b. The patient usually has pulmonary hypertension
   c. The patient usually has a prolonged prothrombin time
   d. Pulmonary capillaries are more fragile than capillaries elsewhere

   Answer: a
50. An 18 year old male suffers multiple trauma including long bone fractures in an automobile accident. He is hypotensive and requires transfusion of 10 units of blood and 24 liters of normal saline. Twenty four hours later he becomes short of breath. An arterial blood gas shows pH 7.48, PCO2 30, PO2 45 on 100% oxygen. Chest X-ray shows bilateral infiltrates. Which one of the following tests is most likely to confirm a diagnosis of Acute Respiratory Distress Syndrome?
   a. Swan-Ganz catheterization showing normal wedge pressure
   b. Perfusion lung scan showing no pulmonary emboli
   c. Echocardiogram showing normal left ventricular function
   d. CBC showing elevated white count
   e. PFTs showing low lung volumes

   Answer: a

51. Which one of the following effects of PEEP (Positive End-Expiratory Pressure) enhances oxygenation?
   a. Increases pleural pressure
   b. Decreases venous blood return to right ventricle
   c. Decreases lung lymphatic flow
   d. Increases intra-alveolar pressure at end-exhalation
   e. Decreases pulmonary capillary wedge pressure

   Answer: d

52. Which of the following characteristics of the alveolar capillary septum serve to prevent water loss from pulmonary capillaries?
   a. Attenuated cytoplasm of lung endothelial cells
   b. Tight junctions between lung capillary endothelial cells
   c. Presence of lung interstitial fibroblasts
   d. Lack of perfusion at lung apices
   e. Lamellar bodies in Type II cells

   Answer: b
The photo below is of diffuse alveolar damage.

Answer **a. true** or **b. false** to the following: (1 point each)

53. The photo shows the late, fibrosing phase of diffuse alveolar damage

   Answer: **b**

54. Diffuse alveolar damage is the pathological equivalent of the clinician’s acute respiratory distress syndrome

   Answer: **a**

55. Diffuse alveolar damage can occur at any age including the newborn

   Answer: **a**

56. In an infant born at 26 weeks gestation the appearance of hyaline membranes indicates that the infant was probably in shock and suffers from “shock lung”

   Answer: **b**
57. A 53 year old nurses’ aide is sent to see you. She works in a nursing home, and has a PPD every year. This year’s test, which was done 2 weeks ago, was positive for the first time. You repeat the PPD yourself and order a chest X-ray. You interview this woman, who denies having any family members, friends, or acquaintances who have TB. She does recall caring for a patient in the nursing home six months ago who was subsequently hospitalized with pneumonia, and the your patient heard it was diagnosed as TB. She denies cough or sputum, fever, chills, sweats, dyspnea, change in appetite or weight. On her return two days later, her PPD exhibits 12 mm of induration; her chest X-ray is normal. You inform her:

a. She has tuberculosis and needs to begin therapy with 4 drugs
b. She has latent tuberculosis and should begin treatment with INH
c. She has tuberculous infection and should be closely monitored for the development of symptoms.
d. She has primary tuberculosis, and should be treated with at least three drugs

Answer: b

58. The BEST way to control active tuberculosis is:

a. 4 drug initial therapy
b. 1 drug initial therapy
c. isolation
d. 4 drug initial therapy and DOT
e. ultraviolet light therapy

Answer: d

59. The LEAST useful way to diagnose active tuberculosis is:

a. pleural biopsy
b. sputum AFB smear
c. sputum culture
d. lymph node biopsy
e. PPD

Answer: e
Match the following with **a. sarcoïd** or **b. tuberculosis** (1 point each)

60. Photo 1 above
   
   Answer: b

61. Cutaneous anergy
   
   Answer: a

62. Remission, with or without treatment, in the majority of cases
   
   Answer: a

63. More likely to be localized to the apex of the upper lobe(s)
   
   Answer: b
64. Pyridoxine is used in the treatment of tuberculosis because:

   a. It inhibits ATP production in M. tuberculosis
   b. It reduces resistance to rifampin
   c. It reduces side effects of isoniazid treatment
   d. It inhibits bacterial metabolism of streptomycin
   e. It inhibits M. tuberculosis cell wall synthesis

   Answer: c

65. The main reason that rifampin would be replaced by rifabutin in the treatment of tuberculosis:

   a. To avoid discoloration of contact lenses
   b. To inhibit isoniazid metabolism in fast acetylators
   c. To allow for more effective passage of pyrazinamide into macrophages
   d. To reduce the total length of time needed for tuberculosis treatment
   e. To reduce cytochrome P450 induction

   Answer: e

66. An anti-tuberculosis drug that works via inhibition of bacterial DNA topoisomerase (gyrase) enzyme:

   a. Ciprofloxacin
   b. Capreomycin
   c. Streptomycin
   d. Clarithromycin
   e. Cycloserine

   Answer: a
67. Indicate which of the following statements concerning tuberculosis treatment is correct:

a. As a general approach, it is best to start with single drug therapy using isoniazid: if that doesn't work then add another first-line drug  
b. Rifampin is a pro-drug which is converted to the active form by the bacterial DNA gyrase enzyme  
c. Resistance to streptomycin is extremely rare  
d. Humans are less affected by inhibitors of folic acid synthesis compared to M. tuberculosis because human cells can take up folic acid from the circulation better than the bacteria can  
e. Isoniazid and pyrazinamide are two drugs that should never be given together to the same patient

Answer: d

68. An example of an anti-leprosy drug that works via inhibition of folic acid synthesis:

a. Clofazamine  
b. Dapsone  
c. Rifampin  
d. Azithromycin  
e. Moxifloxacin

Answer: b

69. J.H. is a forty-two-year old female who has been receiving oral ketoconazole anti-fungal drug treatment, which has produced positive therapeutic effects. During her ketoconazole therapy she had a positive PPD (purified protein derivative) tuberculosis skin test, and a chest radiograph showed signs of lung upper lobe infection. She was started on tuberculosis drug therapy, and after about two weeks of tuberculosis therapy, there were signs that the anti-fungal effectiveness of the ketoconazole was diminishing. Which of the following anti-tuberculosis drugs is likely to have caused this ketoconazole failure? (Note: You do not have to know anything about the anti-fungal mechanism of ketoconazole to answer this question!).

a. Pyrazinamide  
b. Ethambutol  
c. Rifampin  
d. Isoniazid  
e. Streptomycin
70. Which of the following findings/risk factors has/have been associated with obstructive sleep apnea?

a. Large tonsils seen on physical exam
b. Elevated blood pressure
c. Neck size greater than 16 inches in a female and 16.5 inches in a male
d. Presence of diabetes mellitus
e. a, b, and c

Answer: e

71. Treatment of obstructive sleep apnea with continuous positive airway pressure (CPAP) has been shown to improve which of the following problems?

a. Elevated blood pressure
b. Daytime hypersomnolence
c. Insulin sensitivity
d. Cardiac ejection fraction
e. All of the above

Answer: e

72. Central sleep apnea and Cheyenne-Stokes respiration has been most commonly associated with which of the following conditions?

a. Diabetes mellitus
b. Parkinson’s disease
c. COPD
d. Congestive heart failure
e. Pulmonary fibrosis

Answer: d

Match the interstitial lung disease with the description/statement below:

73. Usual interstitial pneumonia (UIP)

Answer: c
74. Non-specific interstitial pneumonia (NSIP)
   Answer: d

75. Desquamative interstitial pneumonia (DIP)
   Answer: b

76. Bronchiolitis obliterans with organizing pneumonia (BOOP)
   Answer: a

   a. Polypoid plugs of loose connective tissue in alveolar ducts, alveoli and bronchioles
   b. A smoking-related disorder with abundant alveolar macrophages
   c. No effective treatment; histology reveals heterogeneity with normal lung tissue, organizing lung tissue and end-stage lung tissue in same biopsy specimen.
   d. Histological pattern can be cellular or fibrosing; no fibroblastic foci.

77. Which of the following is a correct statement about Farmers’ Lung?

   a. Almost all of the persons exposed to the offending agent develop the disease
   b. The offending agent is Aspergillus fumigatus
   c. The disease is a hypersensitivity pneumonitis
   d. In the acute phase, the bronchioles are involved and the alveoli are spared

   Answer: c

78. Neuromuscular blocking agents:

   a. Readily enter the central nervous system to block neurotransmission.
   b. Compete with atropine for the muscarinic receptor.
   c. Inhibit acetylcholine synthesis
   d. Do not interfere with pulmonary function.
   e. Lower the required dosage of inhalation anesthetic

   Answer:
79. Intravenous anesthetic induction agents:
   a. Provide muscle relaxation to facilitate intubation.
   b. Hasten the induction of anesthesia and facilitate airway control.
   c. Have little impact on hemodynamics.
   d. Have extremely short elimination half-lives allowing the patient to rapidly awaken.
   e. Is the method most preferred by children.

Answer:

80. Propofol is a popular anesthetic induction agent because it:
   a. Has little impact on blood pressure and cardiac function.
   b. Is easily administered by a vaporizer into the anesthesia circuit.
   c. Increases blood pressure in trauma patients.
   d. Has relatively rapid clearance providing little hangover effect.
   e. Tastes better than isoflurane.

Answer:

81. Balanced anesthesia is a method:
   a. For adjusting the dose of the anesthetic to match the patients weight.
   b. That allows the combination of two different anesthetic vapors.
   c. That combines 8-10 different pharmacologic agents to provide the best anesthetic with the fewest side effects.
   d. That provides the least expensive anesthetic.
   e. To reduce the blood pressure to minimize surgical bleeding.

Answer:

82. Sevoflurane is:
   a. Administered intravenously after the initial induction with propofol.
   b. Very soluble in blood, which speeds its excretion from the body.
   c. A newer agent that allows for fast recovery and the least irritation of the airway.
   d. Associated with hepatic failure, and should only be used for children.
   e. Rapidly being replaced by halothane in modern anesthetic practice.
Answer:
83. Indicate which of the following statements is correct in comparing ketamine and thiopental for the induction of anesthesia:
   a. Thiopental provides less hypotension than ketamine.
   b. Ketamine produces excellent analgesia, while thiopental provides no analgesia.
   c. Thiopental produces seizures and is better for electroconvulsant therapy than ketamine.
   d. Thiopental causes hallucinations while ketamine induces less awareness.
   e. Ketamine is best for reducing cerebral blood flow and decreasing intracranial pressure while thiopental increases cerebral blood flow and intracranial pressure.

Answer:

A single 100mg dose of drug X was administered I.V. to a 70 kg male subject. The concentration of drug X in plasma is reported below.

<table>
<thead>
<tr>
<th>Time (hr)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasma Concentration Of drug X (µg/ml)</td>
<td>100</td>
<td>71</td>
<td>50</td>
<td>35</td>
<td>25</td>
</tr>
</tbody>
</table>

84. These data suggest that the drug is eliminated by:
   a. First-order kinetics with a half-life of 1 hr
   b. First-order kinetics with a half-life of 2 hr
   c. First-order kinetics with a half life of 3 hr
   d. Zero-order kinetics
   e. Zero-order kinetics with a half-life of 3 hr

Answer: b

85. The volume of distribution of drug X in this subject is approximately:
   a. 1 liter
   b. 10 liters
   c. 100 liters
   d. 200 liters
   e. 500 liters

Answer: a
86. A drug with an apparent volume of distribution of 5 liters per kg is likely to exhibit which of the following characteristics:
   a. Low lipophilicity
   b. At equilibrium a higher concentration in the plasma than in adipose tissue
   c. Access to the central nervous system.
   d. A positive charge at physiological pH
   e. 99% binding to albumin at therapeutic concentrations

   Answer: c

87. The bioavailability of a polar drug with a high molecular weight is likely to be greatest following administration by which route?:
   a. Oral
   b. Subcutaneous
   c. Dermal
   d. Inhalation
   e. Rectal

   Answer: b

88. The elimination half-life of a drug, an organic acid cleared by the kidney, is unusually long in a particular patient. Indicate the most likely explanation for this:
   a. Concomitant administration of another drug with affinity for the same proximal tubular transporter
   b. Concomitant administration of an agent that alkalinizes the urine
   c. Unusually low plasma albumin binding, which would decrease the renal clearance by filtration
   d. Unusually high concentrations of the proximal tubular transporter for organic acids
   e. Unusually small volume of distribution of the drug

   Answer: a
89. Normal glomerular filtration rate (GFR) is approximately 120 ml/min and renal plasma flow is about 650 ml/min. Drug A is not bound to plasma proteins and the renal clearance of Drug A is 50 ml/min in a healthy 70-kg subject. Drug A is most likely cleared by:
   a. Renal tubular secretion
   b. Glomerular filtration and tubular reabsorption.
   c. Glomerular filtration with no tubular reabsorption
   d. Biotransformation in the kidney
   e. Biotransformation in the liver.

   Answer: b

90. Distribution of a basic drug into the brain is increased by:
   a. A decrease in pH of the blood
   b. High affinity for the multidrug resistance p-glycoprotein transporter
   c. High lipophilicity
   d. High affinity for albumin
   e. A low oil:water partition coefficient

   Answer: c

91. A patient receives a drug by continuous intravenous infusion. The drug has an elimination half-life of 1 hr. Twelve hours after the start of the infusion, the patient’s condition deteriorates abruptly, and the total clearance of the drug decreases by 50%. If the same dosing rate is maintained, it can be expected that the plasma concentration will:
   a. Remain the same
   b. Increase 50% to a new plasma steady state concentration after about 4 hr.
   c. Double to a new plasma steady state concentration after more than 4 hr.
   d. Decrease 50% to a new plasma steady state concentration after about 4 hr
   e. Decrease 50% to a new plasma steady state concentration after about 8 hr

   Answer: c
92. The oral bioavailability of two solid formulations of a drug are tested in human subjects. The formulations contain the same amount of active drug. Formulation A has a much lower area under the plasma concentration-time curve than Formulation B. The most likely explanation is:
   a. The dissolution rate of drug from Formulation A is higher compared to Formulation B.
   b. The total clearance of drug is higher for Formulation A.
   c. The bioavailability is less from Formulation A due to factors such as excipients or drug crystal size.
   d. Gastric emptying was faster for Formulation A.
   e. The first pass effect is less for Formulation A.

   Answer: c

93. The rationale for prescribing an oral loading dose as part of an oral dosing regimen is greatest for a drug with:
   a. High total clearance
   b. Long elimination half-life
   c. Small volume of distribution
   d. Low bioavailability
   e. Low therapeutic index

   Answer: b

94. A patient with two mutant alleles for CYP2D6 and low activity of the enzyme is treated with a standard dose of a prodrug. The prodrug is converted by this enzyme to an active drug that is then cleared by glomerular filtration. It can be expected that, compared to subjects with the wild-type gene, in this patient:
   a. The dose will be less efficacious.
   b. The plasma concentrations of active drug will be higher.
   c. The risk of toxicity from the active drug will be greater.
   d. The total clearance of the active drug will be lower.
   e. The plasma elimination half-life of the active drug will be shorter.

   Answer: a
95. Drug M and Drug Y have the same mechanism of action and therapeutic indication. Drug M and Drug Y have elimination half-lives of 3 and 24 hours, respectively. In designing a multiple dosage regimen, you would:
   a. More likely use a loading dose for Drug Y than Drug M
   b. Recommend a shorter dosing interval for Drug Y than Drug M
   c. Not expect to see any drug accumulation if Drug Y were to be given once every 6 hours
   d. Recommend a dosing frequency of once a day for Drug M to maintain therapeutic effect
   e. Expect better compliance with a regimen for Drug M.

Answer: a