1. Regarding formulas to calculate hypoxia which is **incorrect**
    a) Arterial oxygen content = 0.0031xPaO2 + 1.38 x Hb x SaO2
    b) Typical Sea level PAO2 = 0.21 (760 – 47) – PaCO2/0.8
    c) The A – a gradient in a young healthy individual should be <10mmHg regardless of supine or erect positioning
    d) The A – a gradient corrected for age = 2.5 x 0.21 (age in years) (+/- 11)

2. In compensation formulas for respiratory acidosis or alkalosis which is **incorrect**
    a) Expected bicarbonate for acute respiratory acidosis = 24 + (paCO2 – 40) / 10
    b) Expected bicarbonate for chronic respiratory acidosis = 24 + 4 x (paCO2 – 40) / 10
    c) Expected bicarbonate for acute respiratory alkalosis = 24 – (40 – paCO2) / 10
    d) Expected bicarbonate for chronic respiratory alkalosis = 24 – 5 x (40 – paCO2) / 10

3. Compensation for metabolic acidosis and alkalosis which is **incorrect**
    a) For metabolic acidosis the expected paCO2 = 1.5 x bicarbonate + 8
    b) For metabolic alkalosis the expected paCO2 = 0.7 x bicarbonate + 20
    c) Measured paCO2 would rarely drop below 10mmHg to compensate metabolic acidosis
    d) Maximal paCO2 compensation usually takes 2 hours to reach for metabolic acidosis

4. Regarding FEV1 values which is correct
    a) Normal FEV1 is > 90% of predicted value
    b) FEV1 of 60% demonstrates a mild airflow obstruction
    c) FEV1 of 30% is severe airflow obstruction
    d) Change in FEV1 of 5% post bronchodilator indicates a significant response

5. In carbon monoxide poisoning
    a) Co-oximetry readings may be falsely elevated as it cannot detect Carboxyhaemaglobin vs Oxyhaemaglobin
    b) PaO2 can be normal in CO poisoning
    c) Smoking can give a COHb level of 15%
    d) CO moves Hb dissociation curve to the right

6. In distinguishing between exudate and transudate in pleural effusions, which of the following characteristic is consistent with an **exudate**
    a) Protein to serum protein ratio 0.8
    b) LDH to serum LDH ratio 0.4
    c) LDH level 1/3 above upper normal value of serum LDH
    d) Serum albumin level – pleural fluid albumin level = 2 g/dL

7. Which is an etiology for transudate pleural effusion
    a) SLE autoimmune
    b) Uremia
    c) Amiodarone induced
    d) Cirrhosis Liver

8. Regarding hemoptysis which is correct
    a) Majority of massive hemoptysis are from the pulmonary circulation
    b) Hemoptysis is alkali whilst hematemesis is acidic
    c) PE is a common cause of gross hemoptysis
    d) Whilst both Wegners granulomatosis and Goodpasture's syndrome involves hemoptysis and renal impairment, Goodpasture's also involves other organs and systems

9. EMQ: match clinical symptoms and sputum and CXR signs with organism that causes pneumonia
    i. Strep pneumoniae
    ii. Staph aureus
    iii. Klebsiella
    iv. Pseudomonas
    v. HiB
    vi. Legionella
    vii. Moraxella
    viii. Chlamydia
    ix. Mycoplasma
    x. Anaerobic

a. Sudden onset, rigors, usually affecting patients in nursing homes or alcoholic, "brown currant jelly" or bloody sputum, CXR upper lobe infiltrate and bulging fissure sign, abscess formation

b. Recently hospitalized or immunocompromised, CXR patchy infiltrate with frequent abscess formation

c. Fever, dry cough, headache, malaise, anorexia, diarrhea, vomiting, CXR multiple patchy infiltrates progresses to consolidation occasional pleural effusion and cavitation

d. Upper and lower respiratory tract symptoms, non productive cough, bullous myringitis, headache, malaise, CXR interstitial infiltrates, reticulonodular pattern and patchy densities

e. Gradual onset, especially in alcoholics, putrid sputum, CXR consolidation of dependent portions of lung with abscess formation

f. Sudden onset, rigors, chest pain, “rust coloured” sputum, CXR lobar infiltrates with occasional pleural effusion

g. Gradual onset, especially in elderly and COPD, chest pain, CXR patchy, basilar, multilobar infiltrates, occasional pleural effusion

h. Gradual onset, especially after a viral infection, purulent sputum, CXR patchy, multilobar, empyema and abscess

i. Gradual onset, dry cough, wheezing, occasional sinus symptoms, CXR patchy subsegmental infiltrates

j. Indolent course of cough, fever, sputum, more common in COPD, CXR diffuse infiltrates

10. Regarding pneumonia scoring system: SMART-COP which is correct
    a) It does not determine mortality only risk of intensive respiratory or vasopressor support
    b) Advanced age gives a score of 2
    c) No xrays are needed for scoring in SMART-COP
    d) A score of >3 has a 50% risk of needing an ICU admission

11. Which is **not** true of the Pneumonia scoring systems: Pneumonia Severity Index (PSI), CURB 65, SMART-COP and CORB
    a) Pneumonia Severity Index (PSI) and CURB 65 predicts mortality
    b) CORB score does not need laboratory investigations
    c) Only PSI includes co-morbidities excluding age
    d) Only PSI identifies low risk patients that can be treated as an outpatient, the rest only determines high risk patients likely needing ICU

12. Regarding pneumonia in the immunocompromised patient which is correct
    a) Transplant patients have a greater mortality rate from pneumonia after 6 months post-transplant
    b) Pseudomonas is the most common pathogen to cause pneumonia in HIV patients
    c) Pneumocystis Jiroveci Pneumonia (or PCP) is more common in HIV patients with CD4+ counts less than 200 and should be given prophylaxis
    d) Pneumonia with Miliary nodules on CXR or CT is exclusively due to TB

13. Which is **not** a stage of empyema
    a) Exudative phase
    b) Fibrinopurulent
    c) Loculation phase

d) Organizational (pleural peel)

14. Which is correct regarding TB
    a) Up to 20% of people will develop active primary disease after exposure to TB
    b) Mantoux test is positive 1 week after infection
    c) Ghon focus are due to secondary reactive TB
    d) Nucleic Acid Amplifications Tests (NAA) and Ziehl-Neelsen staining can take weeks to return a positive result

15. Which is **not** an important adverse drug effect of "typical" **first line** anti TB medicaitons
    a) Rifampicin = liver dysfunction
    b) Isoniazid = peripheral neuropathy
    c) Ethambutol = optic neuritis
    d) Amikacin = hearing loss

16. Which is the **most** common risk factor for spontaneous pneumothorax
    a) Asthma
    b) Smoking
    c) COPD
    d) Interstitial lung disease

17. Which paring of sensitivities of radiological diagnosis of pneumothorax is **incorrect**
    a) Erect CXR about 90%
    b) Supine CXR about 80%
    c) Ultrasound chest about 85%
    d) CT scan almost 100%

18. Which is not a CXR sign of a small pneumothorax
    a) 2.5 cm from thoracic apex to lung cupola
    b) 1.5 cm from chest wall to visible rim
    c) Average interpleural distance of 3 cm
    d) A light Index 12%

19. Regarding pneumothorax resorption
    a) Average is 3 to 4% re-expansion per day without oxygen
    b) Recurrence rate is 30% regardless of the type of non-surgical treatment
    c) Observation without instrumentation is successful in 50% of primary spontaneous pneumothorax

d) Diving can be recommenced after 12 months if pneumothorax is treated conservatively

20. Which is **not** true about asthma
    a) Reversible airway obstruction is >12% improvement in FEV1
    b) Symptoms are triad of dyspnea, wheeze and cough
    c) Pathologically consists of bronchial smooth muscle contraction, hypersecretion of mucus and edema
    d) Increased airway responsiveness secondary to infections rarely occur after 2 weeks

21. Which is **not** a potential feature of life threatening asthma in adults
    a) Loud widespread wheeze
    b) Altered conscious state
    c) Bradycardia
    d) Inability to speak

22. Which is likely to herald an impending respiratory failure in patient with severe asthma clinically
    a) PEFR = 35% of predicted
    b) $PaCO_2$ = 42
    c) FEV1 = 1.5L
    d) PEFR = 250 mL

23. For a 8 year old child with critical asthma which is **not** a recommended medication
    a) Methylprednisolone 1mg/kg
    b) IV $MgSO_4$ 50mg/kg
    c) Ipatropium inhaled 8 puffs every 20 minutes
    d) Aminophylline 10mg/kg

24. Which mechanism of action matches with the asthma drug
    a) Ipatropium – beta agonist
    b) Heliox – lower airway resistance
    c) Theophylline – anticholinergic
    d) Montelukast – Mast cell modifier

25. Which is true of asthmatics who are intubated
    a) Mucous plugging is not a significant issue as high pressures are used
    b) Initial settings should have high respiratory rate to blow off CO_2
    c) Mechanical ventilation relieves airflow obstruction due to higher inspiratory pressures
    d) Oral tracheal intubation is preferred over nasotracheal route

26. Which is accurate regarding definitions and causes of COPD
    a) 85% of COPD suffer primarily from emphysema
    b) Chronic bronchitis is not a prominent feature of COPD
    c) 50% of smokers will develop COPD
    d) Alpha 1 antitrypsin deficiency accounts for <1% of COPD

27. According to GOLD definition of COPD which is **not** correct
    a) Mild COPD = FEV1 > 80% predicted
    b) Moderate COPD = FEV1 between 50 and 79%
    c) Severe COPD = FEV1 between 30% and 50% predicted +/- clinical signs of right heart failure
    d) Very Severe COPD = FEV1 < 30% predicted +/- respiratory failure

28. Which is a common finding on ECGs that can directly be related to COPD
    a) Poor R wave progression
    b) Persistent S wave in lateral leads
    c) Left bundle branch block
    d) Twave inversion in the lateral leads

29. Which intervention has been proven to reduce rate of decline in lung function in COPD
    a) Smoking cessation
    b) Long beta agonists and ipatropium
    c) Inhaled steroids
    d) Oxygen therapy

30. Which is **not** true of acute exacerbations of COPD
    a) 75% of acute exacerbations are due to infection
    b) 50% of infective exacerbations are due to bacterial
    c) Acute exacerbations are primarily due to restriction in airflow from bronchospasm
    d) V/Q mismatch is a prominent feature of exacerbation of COPD

31. Which bicarb result in an ABG corresponds correctly with a pure respiratory acidosis due to chronic COPD with no acute component and no metabolic component if $PaCO_2 = 80$
    a) Bicarb = 28
    b) Bicarb = 34
    c) Bicarb = 40
    d) Bicarb = 44

32. Which is true of NIV and COPD
    a) CPAP is the preferred NIV for COPD since BIPAP can cause increased incidents of AMI
    b) A pH of <7.25 is a predictor for treatment failure of NIV
    c) NIV does not reduce mortality in COPD compared to oxygen therapy alone
    d) If there is no response to NIV after 1/2 hour then there is treatment failure and treatment should be discontinued

33. Which is **not** a high risk factor for relapse within 2 weeks of an ED visit of a patient with exacerbation of COPD
    a) ≥ 3 ED visits per year
    b) High initial respiratory rate > 20 breaths/min
    c) Patient on oral steroids prior to arrival
    d) COPD limiting daily activity

Answers

1. C (A-a gradient in an upright or sitting position, supine will increase gradient)
2. C (Expected bicarbonate for acute respiratory alkalosis = 24 – 2 x (40 – paCO2) / 10. 9.3 bedside rules for assessment of compensation. http://www.anaesthesiamcq.com/AcidBaseBook/ab9_3.php)
3. D (Maximal compensation may take 12 to 24 hours to reach. www.anaesthesiamcq)
4. B (FEV1 > 80% normal, FEV1 50% to 80% mild, FEV1 25% to 50% moderate, FEV1 <25% severe, change of FEV1 >8% to 10% indicates a significant response)
5. B (Co-oximetry can measure direct O2 saturations via an ABG and will not overestimate whilst pulse oximetry measures light spectrum and may overestimate, smoking can give up to 10% COHb levels, CO moves O2 dissociation curve to the left. Carbon Monoxide DUNN RJ emergencymedicinemanual.com 2016. LITFL Co-oximeter 2016. Murray Toxicology Handbook 2nd edition 3.25 Carbon monoxide.)
6. A (Light's criteria is positive for exudate if 1. pleural protein : serum protein > 0.5, or 2. Pleural LDH : serum LDH > 0.6 or 3. Pleural fluid LDH > 2/3 of upper limit of serum LDH. Also additional criteria serum albumin – pleural albumin < 1.2 g/dL. LITFL pleural fluid analysis 2016)
7. D
8. B (90% of massive hemoptysis involves bronchial circulation and thus PE is not a common cause, Wegners is endothelial damage and thus involves multiple organs whilst Goodpasture's is anti-GBM this only affects lungs and renal. Wegner's Granulomatosis & Glomerulonephritis: Nephritic presentation DUNN RJ emergencymedicinemanual.com 2016)
9. A = iii
   B = iv
   C = vi
   D = ix
   E = x
   F = i
   G = v

H = ii
I = viii
J = vii

10. A (Age is related to RR and Oxygenation but is not an independent scoring factor, Multi-lobar infiltrates score 1 point, total score 0-2 = low risk, 3-4 = 1 in 8 risk of intensive respiratory or vasopressor support or IRVS, 5-6 = 1 in 3 of IRVS, ≥ 7 = 1 in 2. Pneumonia Scoring Systems DUNN RJ emergencymedicinemanual.com 2016)
11. D (CURB 65 also determines low risk patients that can be treated as an outpatient. SMART-COP and CORB determines IRVS and risk of ICU admit. DUNN RJ)
12. C (Transplant patients have 33% mortality if pneumonia develops in the first 6 months, Strep Pneumo is the most common pathogen for HIV patients, miliary nodules are present in varicella pneumonia, PJP prophylaxis should be given if CD4+<200. Pneumocystis Jiroveci Pneumonia LITFL 2016)
13. C (loculations may occur during the fibrinopurulent phase)
14. A (Mantou test is positive 2-10 weeks after infection, Ghon focus result from primary TB, NAA test and ZN staining have rapid turn arounds <24h but cultures can take 3-8 weeks. Tuberculosis workup update 22/10/2015 http://emedicine.medscape.com/article/230802-workup#c10)
15. D (Amikacin not a 1st line therapy, "typical" 1st line Rifampicin, isoniazid, ethambutol, pyrazinamide)
16. B
17. C (U/S > 90%. Assessment of pneumothorax DUNN RJ emergencymedicinemanual.com 2016)
18. C (American college of Chest Physicians small <3cm apex to lung, British Thoracic Society small <2cm visible rim, Light's formula small <15%, Average interpleural distance 1cm=14%, 2cm=22%, 3cm=31%, 4cm=40%. DUNN RJ, Pneumothorax workup update 21/7/2015 http://emedicine.medscape.com/article/424547-workup#c9)
19. B (Re-expansion rate is 1-2% per day without oxygen and can increase to 3-4 fold with oxygen, observation only is successful in 80-90% of cases, Flying should not occur if pneumothorax is not resolved and diving should not be done if non-surgical resolution of pneumothorax was the treatment. Management of pneumothorax DUNN RJ emergencymedicinemanual.com 2016)
20. D (airway responsiveness can occur 2-8 weeks after infections. Asthma DUNN RJ emergencymedicinemanual.com 2016)
21. A (Silent or quiet chest. Cameron 4th edition page 293)
22. B (Indications of impending resp arrest: PaCO2>40, PEFR <200 mL or <30%, FEV1 <1.0L or <25% predicted. Assessment of Asthma DUNN RJ emergencymedicinemanual.com 2016)
23. C (Continuous salbutamol and 20 minutely ipratropium nebs 250mcg. RCH guidelines asthma acute 2016)
24. B (Ipatropium = anticholinergic, theophylline = xanthine, Montelukast = leukotriene modifier)
25. D (mucous plugging is frequent, initial ventilator settings should have a low RR, mechanical ventilation does not relieve the airflow obstruction)
26. D (85% suffer from chronic bronchitis whilst only 15% suffer from emphysaema primarily, 15% of smokers will develop COPD)
27. C (Severe COPD 30-50% expected FEV1, very severe <30% FEV1 or <50% with respiratory failure or signs of right heart failure)

28. B (Signs of right ventricular hypertrophy: Rightward axis deviation, Tall R wave in V1, persistent S wave laterally, RBBB. or right heart strain: ST depression and T wave inversion inferior and anterior into V4)
29. A
30. C (VQ mismatch is the primary reason for acute exacerbations of COPD whilst bronchospasm is the primary reason for asthma attacks)
31. C (chronic: CO2 rise 40 above 40, bicarb rises 4x4+24 = 40)
32. B (BIPAP is preferred and only 1 study showed increased AMI compared to CPAP in APO patients, unlike APO NIV does reduce mortality rates in COPD, rapid response should be seen within the first 1 to 2 hours. Management of COPD DUNN RJ emergencymedicinemanual.com 2016. LITFL Noninvasive Ventilation and the critically ill. 2016)
33. A (≥5 ED visits per year)