

Please find below two examples of FFICM Final SOE questions:

Example one

Heliox

1. What is heliox?

- Heliox (HeO₂) is an oxygen – helium mixture, usually supplied as a 20 : 80 or 30 : 70 percentage mixture
- Helium is an inert gas with a very low atomic weight and density

2. What are the physical properties of heliox?

- Heliox in an 80% mixture with oxygen is three times less dense than room air
- Reduced density leads to reduced resistance to gas flow in areas of turbulent flow
- As an inert gas helium is highly unlikely to cause any adverse reactions or events (none have been reported so far with its use)

3. How might these be clinically useful?

- As the diameter of patients' airways changes so does the prominent type of airflow – can be calculated using Reynold's number (larger airways have turbulent flow, smaller diameter airways have laminar flow)
- As larger airways have predominantly turbulent flow, diseases of large airways may increase the resistance to turbulent flow and therefore increase the work of breathing.
- The use of low density gas like heliox to reduce resistance to flow may be clinically useful and potentially reduce the resistance to breathing that is seen with such diseases.
- Therefore, traditionally used in upper airways obstruction or narrowing
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4. In which clinical conditions has the use of heliox been used?

- **Asthma**– studies have demonstrated that during severe asthma / status asthmaticus heliox improves dyspnoea and PEFr and reduces muscle work and pulsus paradoxus; also reduces peak AWP and CO₂ in ventilated asthmatic patients; no evidence that it prevents intubation or affects mortality
- **COPD**– reduces resistance to airflow during both inspiration and expiration; due to improved expiratory flow can have beneficial effects upon lung emptying and reducing dynamic hyperinflation and intrinsic PEEP; however in patients with an acute exacerbation of COPD requiring NIV, heliox conferred no advantage in terms of mortality, intubation rates or ICU length of stay compared to oxygen air mixtures
- **Bronchiolitis** – found to have no beneficial clinical effects when used in ventilated children with bronchiolitis
- **Upper airway obstruction** small case series have suggested clinical improvement in symptoms in patients with acute upper airway obstruction (laryngeal obstruction, croup, stridor, tracheobronchitis, mediastinal and laryngeal tumours)

- **Post extubation stridor**– heliox has been demonstrated to provide better relief from the distress of post extubation stridor than oxygen air mixtures; no evidence that its use averts respiratory failure or extubation failure
- **Nebulisation** – bench studies have suggested that heliox may facilitate greater progression of nebulized particles into distal airways than oxygen air mixtures

5. What are the problems associated with its use?

- **“On / off” effect** – heliox does not cure causes of increased airway resistance reduces resistance to airflow whilst a definitive treatment is sought
- **Cost** – much more expensive than either oxygen or air; no studies have assessed the effect of heliox on length of ICU stay or time spent invasively ventilated in order to establish any potential offsetting of cost
- **Ventilator function** – the different physical properties of heliox compared to oxygen air mixtures have led to problems with pneumotachometer function within ICU ventilators, which need calibrating for heliox – may lead to inaccuracy in volume measurement and underestimation of delivered tidal volumes. Hot wire anemometers are more effective in measuring flows
- **Efficacy and limitations** – at mixtures of less than 60% helium, heliox loses its favourable physical properties and has no benefits over oxygen air mixtures; this significantly limits its use in hypoxic patients requiring $FiO_2 > 0.4$

Example two

Principles of antimicrobial therapy

1) What factors do you take into account when you chose an antibiotic?

- The site or likely source
- Community or hospital acquired
- The diagnosis or likely organism
- Patient allergies
- Which antibiotics they have already had
- Known local resistance patterns
- Hospital prescribing policy

2) What sites and types of action do antibiotics have on bacteria: give examples?

Bacteriocidal: inhibits cell wall synthesis eg penicillin and bacteriostatic: inhibits DNA replication and ribosomes eg quinolones.

3) Why does antibiotic therapy fail?

- Wrong drug,
- Inadequate dose/Missed dose
- Wrong frequency
- Too late
- Wrong route
- Failure of penetration of the source
- Emergence of resistant organisms
- Lack of source control
- If the patient is immunosuppressed

4) What is the effect of timing and selection of antibiotics in septic shock?

Effective administration within one hour of the development of hypotension has been associated with an increase in survival in adult patients. However only 50% of septic shock patients received effective antimicrobial therapy within 6 hours of hypotension. (Study of 2000 septic patients, Kumar Crit Care Med 2006).

It may be difficult to select the correct antibiotic. Therefore combination therapy may benefit patients at high risk of death (possibly >25%). Combination may expose patients to higher risk of adverse effects in cases where mortality risk is low.

De-escalation to single therapy, (especially once sensitivities are known) or within 3-5 days has been advocated, but evidence for its use is not strong

5) How does the presence of a toxin producing Group A streptococci, affect your choice of treatment?

- Use of clindamycin to reduce toxin production. This is combined with other antibiotics to reduce the development of clindamycin resistance.
- Consider adjuvant therapy such as immunoglobulins
- Debridement is likely to be necessary if the organism produces necrotising fasciitis.

6) Which antibiotic levels in common use are monitored routinely and why?

- Gentamicin: efficacy and ototoxicity and nephrotoxicity
- Vancomycin: ototoxicity and nephrotoxicity. Needs to maintain an effective level in the blood for a period of time to have its bacteriocidal effect on bacterial cell walls.
- Easy to get high levels with organ failure especially renal failure
- These are drugs with a low volume of distribution and a narrow therapeutic index
- Vancomycin levels may be even more difficult to judge when patient on CVVH