

FExNet 2026

Collated SAQs: Emergency Anaesthesia

ANSWER BOOKLET

Model answers for the 22 emergency anaesthesia SAQs. References cited at the foot of each question. Items marked [core] are required for full marks. Drug doses confirmed with current ANZCA / DAS difficult airway guidelines, ANZCA / AAGBI LAST guideline, Australian Malignant Hyperthermia Service, and ACEM clinical policies.

22 questions • 220 marks

ACEM-aligned format. Sub-questions labelled a) b) c). Mark allocations indicative; references cited in the Answer Booklet. Question and answer indexes are clickable.

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Question 1 | Rapid Sequence Induction — Principles (12 marks)

A 45-year-old male is brought to your emergency department after a high-speed motor vehicle collision. He has a Glasgow Coma Score of 8 (E1 V2 M5), is unable to protect his airway, with vomiting and snoring respirations. His vital signs: heart rate 110 beats per minute, blood pressure 110/70 millimetres of mercury, respiratory rate 22, peripheral oxygen saturation 92 percent on room air, temperature 36.5 degrees Celsius. You decide to perform rapid sequence induction and intubation.

a) List 4 indications for emergency department intubation in adults. (4 marks)

- **Failure of airway protection** — decreased Glasgow Coma Score (≤ 8 a guide, but clinical judgement), vomiting, blood / secretions, obstruction (e.g. trauma, swelling, anaphylaxis) [core]
- **Failure of oxygenation** — refractory hypoxia despite maximum non-invasive support [core]
- **Failure of ventilation** — hypercapnia, respiratory exhaustion, severe metabolic acidosis where compensation is failing [core]
- **Anticipated clinical deterioration** — burns with progressive airway compromise, severe sepsis, transport, imaging needs [core]
- Procedural — to facilitate operative procedure or imaging (e.g. CT, surgery)

b) Describe the '7 Ps' of RSI preparation. (5 marks)

- **Preparation** — equipment (suction, oxygen, ETT $\times 2$ sizes, video laryngoscope, supraglottic airway, bag-valve-mask, cricothyroidotomy kit), drugs drawn up, monitoring (SpO_2 , ECG, EtCO_2 , BP), backup operator, checklist [core]
- **Pre-oxygenation** — 3 minutes of 100 percent oxygen via tight-fitting mask; apnoeic oxygenation via nasal cannula at 15 L/min during the apnoeic period; sit patient at 25-30° head-up where possible [core]
- **Pre-treatment / Pre-optimisation** — address hypotension (fluid bolus, vasopressor); consider lignocaine 1.5 mg/kg IV (selected cases); pre-load with noradrenaline if shocked [core]
- **Paralysis with induction** — induction agent + neuromuscular blocker given together in rapid succession (no bag ventilation between); see below [core]
- **Position, Pass the tube, Post-intubation management** — head in 'sniffing' position; intubate; confirm with EtCO_2 waveform; secure tube; commence sedation infusion; post-intubation CXR [core]
- Plan B — clearly articulated before starting; communicate to team
- Pressure (cricoid) — controversial; reduces regurgitation but may worsen laryngoscopic view

c) State the typical induction and neuromuscular blocker doses for this patient (70 kg adult). (3 marks)

- **Ketamine 1-2 mg/kg IV** = 70-140 mg (preferred — haemodynamic-sparing in trauma with potential hypovolaemia); OR propofol 1.5-2.5 mg/kg IV (causes hypotension); OR etomidate 0.3 mg/kg IV (haemodynamic-stable, less in Australia) [core]
- **Rocuronium 1.2 mg/kg IV** = approximately 80-100 mg (provides intubating conditions within 60 seconds; lasts 60-90 minutes); OR **suxamethonium 1.5 mg/kg IV** = 100-150 mg (faster onset 30-60 sec, shorter duration 5-10 min, but contraindications) [core]
- **Sugammadex 16 mg/kg IV** = 1.1 g IV bolus — specific reversal of rocuronium / vecuronium; useful in 'can't intubate, can't oxygenate' scenarios [core]
- Fentanyl 1-3 $\mu\text{g/kg IV}$ — analgesic adjunct, blunts sympathetic response to laryngoscopy
- Post-intubation sedation: propofol 1-3 mg/kg/h + fentanyl 1-2 $\mu\text{g/kg/h}$ infusions

References: ANZCA / Difficult Airway Society (DAS) guidelines • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 28

Question 2 | Suxamethonium Contraindications (10 marks)

Your registrar is preparing to perform rapid sequence intubation on a 60-year-old man with respiratory failure secondary to a chronic obstructive pulmonary disease exacerbation. The registrar plans to use suxamethonium for neuromuscular blockade. You are reviewing the drug choice.

a) List 5 contraindications to suxamethonium. (5 marks)

- **Hyperkalaemia or risk of hyperkalaemia** — known potassium >5.5, renal failure with anuria / oliguria; pre-existing or evolving muscular denervation (stroke, spinal cord injury, Guillain-Barré syndrome — typically >48 hours and up to 6-12 months post-injury) **[core]**
- **Burns >24 hours old** (extrajunctional acetylcholine receptor proliferation → severe hyperkalaemia with subsequent doses); extensive crush injury, rhabdomyolysis **[core]**
- **Neuromuscular disease** — muscular dystrophy (Duchenne's — this is a classic exam pitfall in young boys), myasthenia gravis, myotonic dystrophy, Lambert-Eaton syndrome **[core]**
- **Personal or family history of malignant hyperthermia (MH)** — suxamethonium is a known trigger **[core]**
- **Pseudocholinesterase deficiency** (inherited or acquired — liver disease, pregnancy, cancer) — prolonged paralysis **[core]**
- Open globe injury (transient rise in intraocular pressure)
- Penetrating eye injury, raised intracranial pressure (relative)
- Children <5 years (unrecognised myopathies; preference for rocuronium)

b) List 3 advantages of rocuronium over suxamethonium. (3 marks)

- **Reversibility with sugammadex** 16 mg/kg IV — provides complete reversal within 3 minutes; particularly useful in failed intubation **[core]**
- **No contraindications** — safe in hyperkalaemia, burns, neuromuscular disease, malignant hyperthermia history **[core]**
- **Avoids fasciculations** (suxamethonium causes muscle fasciculations with associated myalgia, transient hyperkalaemia, raised intracranial pressure / intraocular pressure) **[core]**
- Smoother haemodynamic profile

c) List 2 advantages of suxamethonium. (2 marks)

- **Faster onset (30-60 seconds)** and ideal intubating conditions **[core]**
- **Shorter duration of action (5-10 minutes)** — allows return of spontaneous ventilation if intubation fails (though sugammadex reverses rocuronium even faster) **[core]**
- Cheaper, longer history of use

References: ANZCA / Difficult Airway Society (DAS) guidelines • eTG (Therapeutic Guidelines, current) • Tintinalli's Emergency Medicine 9e Ch 28

Question 3 | Failed Intubation — DAS Algorithm (12 marks)

A 55-year-old man with severe community-acquired pneumonia is being intubated by your registrar in the resuscitation bay. After induction with ketamine and rocuronium, the first attempt at intubation has failed (poor view due to secretions and blood). The patient's peripheral oxygen saturation has dropped from 100 percent to 85 percent. You are now responsible for managing this difficult airway.

a) Describe the 4 plans of the Difficult Airway Society algorithm. (4 marks)

- **Plan A: Tracheal intubation** — maximum 3 attempts with optimisation between (position, paralysis, secretions, video / different blade, different operator); senior support **[core]**
- **Plan B: Maintain oxygenation — supraglottic airway device (LMA, iGel)**; maximum 3 attempts; if successful, continue ventilation and discuss with senior team; consider intubation through SGA, wake the patient, postpone procedure **[core]**
- **Plan C: Face-mask ventilation** (2-person technique, oropharyngeal / nasopharyngeal airways) — if successful, wake the patient; if unsuccessful, declare 'can't intubate, can't oxygenate' (CICO) **[core]**
- **Plan D: Emergency front of neck access (FONA)** — scalpel-bougie or needle cricothyroidotomy; cricothyroidotomy is the definitive rescue technique **[core]**

b) Describe the scalpel-bougie cricothyroidotomy technique (4 steps). (4 marks)

- **Identify the cricothyroid membrane** by palpation (depression below the thyroid cartilage, above the cricoid cartilage); stabilise the larynx with the non-dominant hand **[core]**
- **Make a vertical midline incision** (3-4 cm) through the skin to expose the membrane; horizontal stab incision through the cricothyroid membrane (through the centre of the membrane) **[core]**
- **Insert the bougie** through the incision into the trachea (caudal direction); rotate 90° if needed for passage past the vocal cords **[core]**
- **Railroad the cuffed tracheal tube** (size 6.0 mm) over the bougie into the trachea; remove bougie; inflate cuff; confirm placement with end-tidal carbon dioxide and bilateral chest rise; secure tube **[core]**
- Use senior support; document procedure; arrange definitive surgical airway / tracheostomy

c) List 4 difficult airway anatomical predictors. (4 marks)

- **Limited mouth opening** (inter-incisor distance <3 cm) — limited laryngoscope insertion **[core]**
- **Short / immobile neck, limited neck extension** (less than 35° head extension); cervical immobilisation **[core]**
- **Mallampati class III-IV** (visualisation only of hard palate / uvula); receding mandible (small thyromental distance <6 cm) **[core]**
- **Obesity (BMI >30)** — redundant tissue, thick neck, limited mouth opening, increased metabolic demand **[core]**
- Facial / oropharyngeal trauma, burns, oedema
- Pre-existing pathology — tumours, airway abscess, congenital syndromes
- Patient factors — uncooperative, haemodynamically unstable
- Bearded / heavily moustached (face-mask seal difficulty)

References: ANZCA / Difficult Airway Society (DAS) guidelines • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 28

Question 4 | Post-Intubation Hypotension (10 marks)

A 45-year-old female has just been intubated in your resuscitation bay for severe asthma. The intubation was straightforward with first-pass success. Two minutes after intubation, her blood pressure drops from 130/85 to 70/45 millimetres of mercury, with heart rate increasing from 110 to 130 beats per minute. Peripheral oxygen saturation remains 100 percent on 100 percent inspired oxygen.

a) List 5 causes of immediate post-intubation hypotension (DOPES mnemonic for ventilated patients). (5 marks)

- **D — Displaced ETT** (oesophageal or mainstem intubation, accidental extubation) [core]
- **O — Obstruction** (blood, secretions, kinked tube, bronchospasm, biting on tube) [core]
- **P — Pneumothorax** (especially in asthma — tension PTX from positive pressure ventilation; barotrauma) [core]
- **E — Equipment failure** (ventilator malfunction, disconnection, oxygen failure) [core]
- **S — Stacked breaths / auto-PEEP / Sedation** — gas trapping in obstructive airways (asthma, COPD) with intrinsic PEEP; effect of induction agents (propofol — vasodilation; ketamine — usually well-tolerated) [core]
- **Hypovolaemia** (especially in trauma, shock; positive pressure further reduces venous return)
- **Cardiac causes** — acute MI, arrhythmia, tamponade
- Anaphylaxis to induction or neuromuscular blocker (rocuronium, suxamethonium)

b) State 3 immediate management steps to diagnose and treat (in priority order). (3 marks)

- **Disconnect from the ventilator** AND auscultate / observe chest — exclude breath-stacking / auto-PEEP (allows passive exhalation); if improves, reduce ventilator rate / tidal volume / increase expiratory time [core]
- **Confirm ETT position** — end-tidal carbon dioxide waveform, bilateral chest expansion / breath sounds, depth of ETT (typically 22 cm at lip in adult); chest radiograph [core]
- **Assess for tension pneumothorax** — unilateral absent breath sounds, tracheal deviation, hyper-resonance; needle / finger thoracocentesis or intercostal catheter without delay [core]
- Fluid bolus 250-500 mL crystalloid; vasopressor (noradrenaline 0.05-0.5 µg/kg/min) for ongoing hypotension
- Investigate other causes — pulmonary embolism, anaphylaxis (rocuronium, suxamethonium), myocardial event
- Optimise sedation depth — propofol may cause vasodilation; consider switching to midazolam in haemodynamically unstable

c) List 2 specific considerations for ventilating an asthmatic patient. (2 marks)

- **Use low tidal volumes (6 mL/kg ideal body weight), low rate (8-10 breaths/min), prolonged expiratory time (I:E ratio 1:4-1:5)** to allow complete exhalation [core]
- **Accept permissive hypercapnia** (target pH >7.2); aggressive minute ventilation increases gas trapping [core]
- Continue bronchodilators (salbutamol via ventilator), steroids, magnesium
- Consider ECMO or extracorporeal CO₂ removal for refractory cases

References: ANZCA / Difficult Airway Society (DAS) guidelines • eTG (Therapeutic Guidelines, current) • Tintinalli's Emergency Medicine 9e Ch 28 • ACEM clinical policies and statements

Question 5 | Pre-Intubation Optimisation in Severe Acidosis (11 marks)

A 35-year-old female presents to your emergency department with severe diabetic ketoacidosis (pH 7.05, bicarbonate 6, glucose 32, sodium 132, potassium 5.8, lactate 2.5). She has been compensating with deep Kussmaul respirations (respiratory rate 38 breaths per minute) but is now tiring with Glasgow Coma Score deteriorating to 11. Her vital signs: heart rate 130 beats per minute, blood pressure 95/55 millimetres of mercury, peripheral oxygen saturation 99 percent on room air. You decide intubation is needed.

a) Explain why intubation is high-risk in this patient (4 considerations). (4 marks)

- **Loss of compensatory hyperventilation** — positive pressure ventilation can only match her pre-intubation minute ventilation (38 breaths/min × ~600 mL = 22-25 L/min); under-ventilation results in rapid pH fall to 6.8-6.9 and cardiac arrest **[core]**
- **Cardiovascular collapse** on induction — vasoplegic from severe acidosis, hypovolaemic from osmotic diuresis; induction agents may precipitate cardiac arrest **[core]**
- **Severe hypovolaemia and hypoperfusion**; reduced cardiac output (acidosis-related myocardial depression) **[core]**
- **Risk of cerebral oedema** (particularly paediatric / young patients), hyperkalaemia (insulin withheld pre-intubation) **[core]**
- Increased pulmonary shunt if pulmonary oedema / ARDS

b) List 4 pre-intubation optimisation measures. (4 marks)

- **Aggressive intravenous fluid resuscitation** — 0.9 percent saline 20 mL/kg bolus (1-2 L) prior to induction; vasopressor (noradrenaline) drawn up and ready **[core]**
- **Correct hyperkalaemia and acidosis cautiously** — calcium gluconate 10 mL of 10% IV (for ECG changes), insulin started (once K replacement available), consider sodium bicarbonate 1-2 mmol/kg IV only if pH <6.9 (per ANZICS DKA guidance) **[core]**
- **Choice of induction agent** — **ketamine 1-1.5 mg/kg IV** (haemodynamic-sparing); AVOID propofol (vasodilation, cardiac depression) and high-dose etomidate (adrenal suppression) **[core]**
- **Ventilation strategy planned** — high respiratory rate (25-35) and tidal volume (8-10 mL/kg) matching pre-intubation minute ventilation; target similar pCO₂ to pre-intubation; senior airway operator **[core]**
- Adequate pre-oxygenation; apnoeic oxygenation
- Continuous cardiac monitoring; arterial line if available

c) State the initial ventilator settings for this patient. (3 marks)

- **Mode:** volume control ventilation (predictable minute ventilation); **Tidal volume 8-10 mL/kg ideal body weight** (high to match metabolic demand) **[core]**
- **Respiratory rate 25-35** breaths/min to match pre-intubation minute ventilation; **PEEP 5**; FiO₂ 1.0 initially, wean as tolerated **[core]**
- **Target end-tidal carbon dioxide approximating the patient's pre-intubation value** (will be low — 12-18 mmHg); allow gradual rise as the metabolic acidosis is corrected by insulin and fluid **[core]**
- Monitor pH closely with arterial blood gas; may need to increase RR if pH falls

References: ANZCA / Difficult Airway Society (DAS) guidelines • eTG (Therapeutic Guidelines, current) • ANZICS DKA guideline 2023 • ACEM clinical policies and statements

Question 6 | Emergency Department Extubation (12 marks)

A 35-year-old male was intubated overnight in your emergency department by the night registrar after ingestion of an unknown quantity of alcohol and methadone (indication: airway protection for low Glasgow Coma Score). He has spent the night in the ED as no intensive care unit beds were available. Bedside glucose was normal and CT brain shortly after intubation was normal. You are considering ED extubation. Current vital signs: heart rate 80, blood pressure 120/80, peripheral oxygen saturation 100 percent on FiO₂ 0.4, temperature 37.2 degrees Celsius.

a) List 6 clinical criteria that must be met to ensure safe extubation in the ED. (6 marks)

- **Underlying cause of intubation resolved** (e.g. drug effect worn off; this patient's methadone / alcohol effects largely cleared) **[core]**
- **Awake, alert, and able to protect own airway** — Glasgow Coma Score ≥ 10 , able to follow commands, cough and gag reflexes intact, able to clear secretions **[core]**
- **Adequate spontaneous ventilation** — RSBI (Rapid Shallow Breathing Index) < 105 (RR/Vt); negative inspiratory force < -20 ; vital capacity > 10 mL/kg **[core]**
- **Adequate oxygenation** — SpO₂ > 94 percent on FiO₂ ≤ 0.40 and PEEP ≤ 5 cm H₂O; PaO₂/FiO₂ ratio > 200 **[core]**
- **Haemodynamically stable** — no ongoing vasopressor requirement; stable heart rate and blood pressure **[core]**
- **Cuff leak test positive** (reduces risk of post-extubation stridor in patients with risk factors for laryngeal oedema); afebrile **[core]**
- Acid-base normal; electrolytes corrected
- No major surgical or procedural intervention planned in the immediate future

b) List 4 non-clinical criteria for safe ED extubation. (4 marks)

- **Appropriately trained personnel** — consultant or senior registrar with extubation experience available; second airway operator on standby **[core]**
- **Adequate equipment immediately available** — reintubation equipment (laryngoscope, ETT, video laryngoscope), suction, oxygen, supraglottic airway, cricothyroidotomy kit, monitoring **[core]**
- **Appropriate environment** — resuscitation bay or monitored bed; 1:1 nursing care; avoid extubation during busy ED periods if possible **[core]**
- **Clear plan and documentation** — indications met documented; post-extubation plan including monitoring duration; disposition agreed (admit / discharge / transfer) **[core]**
- Communication with admitting / receiving team
- Pharmacy availability for reversal agents (naloxone, flumazenil if applicable)

c) List 2 complications anticipated after extubation in this patient. (2 marks)

- **Respiratory depression / opiate rebound** (methadone has long half-life — risk of recurrent respiratory depression as plasma concentration fluctuates) **[core]**
- **Laryngospasm or post-extubation stridor** — from laryngeal oedema; more likely with prolonged intubation, traumatic intubation **[core]**
- Aspiration if cough / gag inadequate
- Agitation or delirium
- Hypoxia or hypercapnia from inadequate ventilation

References: ANZCA / Difficult Airway Society (DAS) guidelines • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 28

Question 7 | Local Anaesthetic Systemic Toxicity (11 marks)

A 65-year-old woman undergoes ultrasound-guided femoral nerve block in your emergency department for analgesia following a fractured neck of femur. She receives 30 millilitres of 0.5 percent ropivacaine. Approximately 5 minutes after injection, she becomes agitated and complains of circumoral tingling and tinnitus. She then has a generalised tonic-clonic seizure followed by cardiovascular collapse with broad-complex rhythm on ECG. Her weight is 60 kilograms.

a) Calculate the maximum dose of 0.5 percent ropivacaine for this patient AND state whether the dose was excessive. (3 marks)

- **Maximum safe dose of ropivacaine** = 3 mg/kg = 60 × 3 = **180 mg [core]**
- **30 mL of 0.5 percent solution** = 30 × 5 mg/mL = **150 mg total dose given [core]**
- **Dose 150 mg is below the maximum (180 mg)** — toxicity here is likely due to inadvertent intravascular injection rather than dose excess; document weight-based calculation pre-procedure **[core]**
- Maximum doses (with adrenaline / without): lignocaine 4.5-7 mg/kg; bupivacaine 2 mg/kg (no upper limit established with adrenaline); ropivacaine 3 mg/kg

b) List the progressive features of LAST in order. (4 marks)

- **Early CNS toxicity** — circumoral tingling, tinnitus, metallic taste, lightheadedness, perioral numbness, muscle twitching (this patient — the warning signs) **[core]**
- **Late CNS toxicity** — agitation, confusion, seizures (often generalised tonic-clonic), loss of consciousness **[core]**
- **Cardiovascular toxicity** — initial hypertension and tachycardia (early); progressing to hypotension, bradycardia, arrhythmia (broad-complex, VT, asystole) **[core]**
- **Cardiovascular collapse and cardiac arrest** — drug-resistant; prolonged resuscitation may be successful with intralipid **[core]**
- Bupivacaine — high cardiotoxicity; ratio of CC:CNS toxicity narrower than ropivacaine

c) State 4 management priorities for LAST (per ANZCA / AAGBI guideline). (4 marks)

- **STOP injecting** the local anaesthetic immediately; call for help; assess and manage airway, breathing, circulation **[core]**
- **Intralipid 20 percent** (soybean lipid emulsion): **1.5 mL/kg bolus IV over 1 minute** = 90 mL for this 60 kg patient; follow with **0.25 mL/kg/min infusion** = 15 mL/min; repeat bolus up to 2 times; double infusion rate if BP remains low; max 12 mL/kg over first hour **[core]**
- **Treat seizures** — small doses of benzodiazepine (midazolam 1-5 mg IV titrated); avoid propofol (cardiac depressant) **[core]**
- **Cardiopulmonary resuscitation** if cardiac arrest — standard ALS with modification: avoid lignocaine and antiarrhythmics (worsen toxicity); adrenaline doses smaller (0.1-0.5 mg increments); prolonged resuscitation often successful (extended CPR until intralipid effect) **[core]**
- Cardiopulmonary bypass / ECMO if available and refractory
- Notify pharmacy / track resources; report to AAGBI / LAST reporting database

References: ANZCA / AAGBI Local Anaesthetic Systemic Toxicity guideline • eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements

Question 8 | Anaphylaxis to Anaesthetic Agents (10 marks)

A 35-year-old man undergoes rapid sequence induction for severe pneumonia. Approximately 60 seconds after administration of rocuronium 100 mg IV, he develops widespread erythema, urticaria, and severe hypotension (BP 65/40), tachycardia (HR 140), and difficulty bag-mask ventilating. Peak inspiratory pressure rises to 45 cm H₂O with reduced chest compliance.

a) List 4 features of intra-anaesthetic anaphylaxis. (4 marks)

- **Cardiovascular collapse** (hypotension, tachycardia or bradycardia, cardiac arrest) — most common feature in anaesthetic anaphylaxis; may be ONLY feature **[core]**
- **Bronchospasm** — high airway pressures (this patient — 45 cm H₂O), wheeze, reduced chest compliance, difficulty bag-mask ventilating **[core]**
- **Mucocutaneous** — widespread urticaria, erythema, angio-oedema; however absent in ~10 percent of anaesthetic anaphylaxis (under drapes, dependent areas) **[core]**
- **Temporal relationship** to anaesthetic drug — typically within minutes of induction or neuromuscular blocker administration **[core]**
- Other organ systems — gastrointestinal (vomiting), neurological (decreased GCS)

b) List the 3 most common anaesthetic drug causes of anaphylaxis (in order). (3 marks)

- **Neuromuscular blockers** (60-70 percent of anaesthetic anaphylaxis) — particularly rocuronium and suxamethonium; cross-reactivity common between agents **[core]**
- **Antibiotics** (15-20 percent) — beta-lactams (penicillins, cephalosporins); pre-operative prophylactic antibiotics **[core]**
- **Latex** (5-10 percent) — particularly in patients with multiple surgeries (spina bifida, neurogenic bladder), atopy, food allergies (banana, kiwi, avocado, chestnut) **[core]**
- Induction agents — propofol (egg / soya), thiopentone (rare)
- Local anaesthetics (rare — true allergy; much more often vasovagal or methaemoglobinaemia)
- Colloids (gelatins, hydroxyethyl starch); blood products

c) State 3 immediate management priorities. (3 marks)

- **Adrenaline 50-100 µg IV bolus** (or 0.5 mg IM if no IV access); repeat as needed; commence infusion if persistent shock (0.05-0.5 µg/kg/min) **[core]**
- **Fluid resuscitation** — crystalloid 20 mL/kg IV bolus (approximately 1.5 L for this 75 kg patient); repeated as needed; vasoplegia common — vasopressor support **[core]**
- **Sugammadex 16 mg/kg IV** (= 1.1 g for this patient) if rocuronium-induced — reverses rocuronium AND may bind the rocuronium molecule responsible for anaphylaxis (evidence emerging) **[core]**
- Stop offending drug (rocuronium in this case)
- Hydrocortisone 200 mg IV; antihistamine (chlorphenamine 10 mg IV) — second-line
- Tryptase level at 1-4 hours (peak), 24 hours (baseline); allergy clinic referral; yellow card / red flag notification on medical record

References: ASCIA Acute Anaphylaxis Guidelines • ANZAAG Anaphylaxis Guidelines • eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements

Question 9 | Malignant Hyperthermia (10 marks)

A 25-year-old male underwent rapid sequence induction with thiopentone and suxamethonium for an unrelated emergency. Approximately 20 minutes after induction, while ventilated with sevoflurane (1 percent end-tidal), he develops tachycardia, generalised muscle rigidity (including jaw rigidity that prevented full mouth opening), and a rapidly rising end-tidal carbon dioxide (now 75 mmHg from 38 mmHg baseline) despite adequate ventilator settings. His temperature has risen from 36.5 to 39.0 degrees Celsius. Skin appears mottled.

a) List 3 early features supporting malignant hyperthermia. (3 marks)

- **Rising end-tidal carbon dioxide** (EtCO_2) despite adequate minute ventilation — most specific early feature **[core]**
- **Generalised muscle rigidity** (particularly masseter spasm / trismus following suxamethonium); **tachycardia disproportionate to stimulus** **[core]**
- **Hyperthermia (late but characteristic)**; mottled skin; cyanosis; metabolic and respiratory acidosis **[core]**
- Triggers: volatile anaesthetic agents (halothane, isoflurane, sevoflurane, desflurane) and suxamethonium; non-triggering agents include propofol, ketamine, opioids, benzodiazepines, nitrous oxide, rocuronium
- Pathophysiology: autosomal dominant mutation (typically RyR1 gene) → uncontrolled calcium release from sarcoplasmic reticulum → hypermetabolic state in skeletal muscle

b) State 4 immediate management priorities. (4 marks)

- **Cease all triggering agents** — stop volatile anaesthetic; switch to non-triggering agents (propofol infusion); change ventilator circuit (or use activated charcoal filter); hyperventilate with 100 percent oxygen at high flows **[core]**
- **Dantrolene 2.5 mg/kg IV** (initial dose; can be repeated to total 10 mg/kg) — specific antidote; binds RyR1 receptor and inhibits calcium release **[core]**
- **Active cooling** — cold intravenous fluids, cooled gastric lavage, surface cooling (ice packs, wet sheets); cease when core temperature reaches 38.5 degrees Celsius **[core]**
- **Treat complications** — hyperkalaemia (calcium gluconate, insulin/dextrose, salbutamol); metabolic acidosis (sodium bicarbonate if pH <7.2); rhabdomyolysis (aggressive fluids, urinary alkalinisation); arrhythmias **[core]**
- Call for senior anaesthetic support, ICU admission; document and notify Australian Malignant Hyperthermia Service
- Long-term: genetic testing for patient and family; alert / medical bracelet

c) List 3 differential diagnoses to consider. (3 marks)

- **Neuroleptic malignant syndrome** (NMS) — typically delayed onset (days), associated with antipsychotic use; treatment includes dantrolene **[core]**
- **Serotonin syndrome** — recent serotonergic drug use; rigidity, hyperreflexia, clonus, fever; treat with cyproheptadine, supportive **[core]**
- **Thyroid storm** — uncontrolled hyperthyroidism; tachycardia, fever, delirium **[core]**
- Sepsis with hypermetabolic state
- Pheochromocytoma crisis (rare; manifests with intra-operative hypertensive crisis)
- Heat stroke
- Hypoxia / hypoventilation with raised EtCO_2

References: Australian Malignant Hyperthermia Service • Anaesthesia Society of MH Guidelines • eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements

Question 10 | Paediatric Procedural Sedation (12 marks)

A 12-year-old boy is brought to your emergency department after falling off a swing. He has a dorsally angulated displaced fracture of the right distal radius. The fracture requires closed manipulation under sedation and casting in the ED. He weighs 40 kilograms and is otherwise well.

a) List 4 pre-procedural assessment requirements (ASA / SAGES principles). (4 marks)

- **ASA physical status classification** — I (healthy), II (mild systemic disease — comorbid asthma controlled), III+ (severe systemic disease — increased risk of complications) **[core]**
- **Fasting status** — clear fluids 2 hours, light meal 6 hours pre-procedure (per current ASA recommendations); reduced fasting times for emergency procedures with documented justification **[core]**
- **Airway assessment** — Mallampati, mouth opening, thyromental distance, neck extension, prior anaesthetic history, family history of anaesthetic complications **[core]**
- **Allergies, current medications, comorbidities, drug history** — specific to opioid / benzodiazepine tolerance, respiratory disease, OSA **[core]**
- Consent (parental for children; assent from child)
- Plan: monitoring, equipment, personnel, post-procedure observation; weight-based dose calculation

b) List 3 procedural sedation options with one pro and one con for each (with doses). (6 marks)

- **Ketamine 1-1.5 mg/kg IV** (= 40-60 mg for 40 kg) OR 4 mg/kg IM. **Pro:** maintains airway protective reflexes, haemodynamic-sparing, analgesic. **Con:** emergence reactions (rare in children, more common in adults), nausea, mild hypersalivation **[core]**
- **Nitrous oxide 50-70 percent** (inhaled, mixed with oxygen). **Pro:** rapid onset/offset, self-administered, no IV needed. **Con:** limited depth of sedation; bone marrow suppression with chronic use; nausea; contra-indicated in pneumothorax / bowel obstruction / pneumoperitoneum **[core]**
- **Propofol 1-2 mg/kg IV** (= 40-80 mg for 40 kg). **Pro:** rapid onset, deep sedation, anti-emetic, rapid offset. **Con:** respiratory depression common; hypotension; no analgesic effect (often combined with fentanyl or ketamine) **[core]**
- **Fentanyl 1-2 µg/kg IV** (= 40-80 µg for 40 kg) + midazolam 0.05-0.1 mg/kg IV (= 2-4 mg for 40 kg). **Pro:** balanced analgesia and sedation. **Con:** respiratory depression and hypotension additive
- **Ketofol** (1:1 mix ketamine and propofol) — combines benefits of both; reduced haemodynamic effects
- Regional anaesthesia (haematoma block, Bier's block) — alternative or adjunct

c) List 2 monitoring requirements during procedural sedation. (2 marks)

- **Continuous SpO₂, ECG, non-invasive BP, end-tidal carbon dioxide** (capnography highly recommended); pulse oximetry alone is insufficient **[core]**
- **Dedicated personnel** — minimum of nurse and operator (operator not performing the procedure); second clinician available for rescue **[core]**
- Resuscitation equipment available (bag-valve-mask, airway adjuncts, suction, oxygen, defibrillator, reversal agents naloxone and flumazenil)
- Documentation — depth of sedation (Ramsay or modified Ramsay scale), every 5 minutes during procedure, and recovery period

References: ACEM clinical policies and statements • ACEM Procedural Sedation Policy • eTG (Therapeutic Guidelines, current) • Tintinalli's Emergency Medicine 9e Ch 109

Question 11 | Crisis Resource Management (9 marks)

You are the junior consultant on a temporary contract in a metropolitan emergency department, helping in the resuscitation of a 9-year-old male with Duchenne's muscular dystrophy who has pneumonia and is in respiratory failure. Your senior FACEM colleague (an ACEM examiner of 20 years' experience) is the team leader. He has decided to intubate the patient and asks the nurse to draw up ketamine and suxamethonium.

a) Explain the clinical concern AND the rationale. (3 marks)

- **Suxamethonium is contraindicated in Duchenne's muscular dystrophy** — risk of life-threatening hyperkalaemia from upregulated extrajunctional acetylcholine receptors and muscle membrane destabilisation **[core]**
- **Rhabdomyolysis and cardiac arrest** are well-described complications; DMD patients have established cardiac involvement (dilated cardiomyopathy) making them more vulnerable **[core]**
- **Rocuronium 1.2 mg/kg IV** is the appropriate neuromuscular blocker; sugammadex available for reversal **[core]**

b) Describe 4 components of effective communication strategy in this situation (addressing concerns to a senior colleague). (4 marks)

- **Use closed-loop communication** — directly address the senior colleague by name; speak clearly and respectfully but with concern; use the patient's safety as the focus ('I'm concerned about Duchenne's...') **[core]**
- **Use graded assertiveness (PACE framework)** — Probe (curious questioning: 'Could we consider...?'), Alert (suggesting concern: 'I'm worried about...'), Challenge (more direct: 'I'm not sure that's the best...'), Emergency (direct: 'STOP — this will cause harm') **[core]**
- **State your concern explicitly with evidence** — 'Suxamethonium in Duchenne's is contraindicated due to hyperkalaemia risk; rocuronium would be safer' **[core]**
- **Listen actively to response and be prepared to escalate** — if concerns are dismissed, escalate to another senior (call ICU consultant, anaesthetic consultant); be the patient's advocate **[core]**
- Document your concern in the medical record regardless of outcome
- Adopt a 'speak up' culture — patient safety before hierarchy

c) Define human factors AND list 2 categories. (2 marks)

- **Human factors** is the study of human capabilities and limitations in the workplace; how individuals interact with tools, technology, tasks, and teams to influence safety and performance **[core]**
- **Categories:** (1) **Individual** — skill, fatigue, cognitive bias, stress; (2) **Team** — communication, leadership, situational awareness, decision-making; (3) **Environment** — equipment, layout, distractions, organisational culture **[core]**
- Highly relevant to resuscitation, where crisis resource management training has improved outcomes

References: ACEM clinical policies and statements • Crisis Resource Management (Gaba) • ANZCA — Human Factors and Patient Safety

Question 12 | Awake Fibre-Optic Intubation (9 marks)

A 60-year-old male with Ludwig's angina (deep neck space infection from a recent dental abscess) presents to your emergency department with severe trismus (mouth opening less than 1 centimetre), tongue swelling, drooling, and stridor. He is sitting upright and is reluctant to lie supine. His vital signs are: heart rate 120, blood pressure 130/85, peripheral oxygen saturation 95 percent on room air, temperature 38.5 degrees Celsius. You are aware that standard rapid sequence intubation is high-risk; the senior anaesthetic consultant is preparing for awake fibre-optic intubation.

a) List 4 indications for awake fibre-optic intubation. (4 marks)

- **Anticipated difficult airway** with mask ventilation likely impossible (severe trismus, oedema, distortion — this patient) **[core]**
- **Cervical spine immobility** (rheumatoid arthritis, ankylosing spondylitis, halo fixation, severe C-spine fracture); preservation of spinal cord function **[core]**
- **Upper airway pathology** — tumour, abscess, oedema, severe burns involving the airway **[core]**
- **Maxillofacial trauma** or deformity preventing direct laryngoscopy **[core]**
- Pierre Robin syndrome, Treacher Collins, other anatomical anomalies
- Morbid obesity with predicted difficult airway

b) Describe 3 essential preparation steps. (3 marks)

- **Patient preparation** — explain procedure (consent), nil by mouth, anti-sialagogue (glycopyrrolate 200 µg IV) 15 minutes before procedure to reduce secretions, sitting position with oxygen via nasal cannula **[core]**
- **Topical anaesthesia** — lignocaine 10 percent spray to oropharynx; lignocaine 2 percent gel or 4 percent atomised; trans-cricothyroid injection of 4 mL of 4 percent lignocaine (translaryngeal block); maximum total lignocaine dose 4 mg/kg **[core]**
- **Equipment ready** — flexible fibre-optic scope, cuffed ETT (typically 6.5 mm with adult), lubrication, suction, oxygen source via working channel of bronchoscope OR nasal cannula, monitoring; surgical airway kit immediately available (double set-up); senior anaesthetist and ENT surgeon **[core]**
- **Sedation** — careful titration of low-dose fentanyl (25-50 µg) and / or midazolam (0.5-1 mg) for anxiolysis WITHOUT abolishing respiratory drive or airway reflexes; remifentanyl infusion is alternative

c) List 2 complications. (2 marks)

- **Laryngospasm or complete airway obstruction** from instrumenting swollen / friable tissues **[core]**
- **Local anaesthetic toxicity (LAST)** from large doses of topical lignocaine — monitor for early features **[core]**
- Vomiting / aspiration from inadequate fasting or rapid topicalisation
- Difficulty advancing tube past obstruction

References: ANZCA / Difficult Airway Society (DAS) guidelines • ANZCA / AAGBI Local Anaesthetic Systemic Toxicity guideline • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 28

Question 13 | Fascia Iliaca Compartment Block for #NOF (9 marks)

An 85-year-old woman presents to your emergency department after a fall onto her left hip. She has a left subcapital fractured neck of femur. Pain score is 9/10 despite paracetamol 1 gram intravenous and morphine 5 milligrams intravenous. She is mildly delirious (Glasgow Coma Score 14, AMTS 7/10). She weighs 65 kilograms. You plan an ultrasound-guided fascia iliaca compartment block for analgesia.

a) Name the 3 nerves blocked by the fascia iliaca compartment block. (3 marks)

- **Femoral nerve (L2-L4)** — sensory to anteromedial thigh, knee, and medial calf (saphenous branch); motor to quadriceps **[core]**
- **Lateral femoral cutaneous nerve (L2-L3)** — sensory to anterolateral thigh; pure sensory **[core]**
- **Obturator nerve (L2-L4)** — less reliably blocked; medial thigh sensory and adductor motor **[core]**
- Anatomical principles: deposition of local anaesthetic deep to fascia iliaca, lateral to femoral artery, spreads to cover the lumbar plexus

b) Describe the technique for fascia iliaca block (4 steps). (4 marks)

- **Position:** patient supine; expose inguinal area; aseptic prep; consider sedation if cooperative **[core]**
- **Identify landmarks** with linear ultrasound probe (5-10 MHz) at inguinal crease — identify femoral artery, femoral nerve (hyperechoic, lateral to artery), fascia iliaca (hyperechoic line above iliacus muscle, deep to fascia lata) **[core]**
- **Insert needle** in-plane, lateral approach, 1-2 cm lateral to ultrasound probe; advance through fascia lata then fascia iliaca (palpable / visible 'pop'); aspirate to confirm no vascular puncture **[core]**
- **Inject 30-40 mL of 0.25 percent ropivacaine** (75-100 mg; within max dose 3 mg/kg = 195 mg for 65 kg) OR 30-40 mL of 0.25 percent bupivacaine — observe spread on ultrasound (should expand fascia iliaca compartment cephalad and medially) **[core]**
- Aspirate every 5 mL of injection (avoid intravascular injection); communicate with patient throughout

c) List 2 contraindications. (2 marks)

- **Local infection at injection site** OR patient refusal **[core]**
- **Anticoagulation** — therapeutic warfarin / DOAC / LMWH; check timing of last dose and INR per regional anaesthetic guidelines **[core]**
- Allergy to local anaesthetic
- Previous regional anaesthetic failure or complication
- Severe peripheral vascular disease in lower limb (relative)

References: ANZCA / AAGBI Local Anaesthetic Systemic Toxicity guideline • ACEM clinical policies and statements • ASRA Regional Anesthesia Guidelines

Question 14 | Bier's Block — IV Regional Anaesthesia (9 marks)

A 32-year-old female has a displaced, minimally angulated fracture of the right distal radius requiring manipulation in the emergency department. She weighs 60 kilograms and has no significant comorbidities. You plan a Bier's block (intravenous regional anaesthesia).

a) Describe the technique for Bier's block (4 key steps). (4 marks)

- **Two intravenous access points** — one in the affected arm (small cannula in dorsal hand vein, distal to fracture); one in the unaffected arm (resuscitation access) **[core]**
- **Exsanguinate the affected arm** with an Esmarch bandage; apply double-cuff tourniquet (proximal and distal); inflate proximal cuff to 100 mmHg above systolic BP (usually 250-300 mmHg) **[core]**
- **Inject local anaesthetic** — **40 mL of 0.5 percent prilocaine** (or 40 mL of 0.5 percent lignocaine without adrenaline — 200 mg; max dose 4 mg/kg = 240 mg for 60 kg patient); slowly over 1-2 minutes **[core]**
- **Maintain tourniquet for minimum 20 minutes** before release (allows tissue binding of local anaesthetic); if tourniquet uncomfortable, can inflate distal cuff and deflate proximal cuff once anaesthesia established **[core]**
- Onset of anaesthesia in 5-10 minutes; perform procedure; release tourniquet AT LEAST 20 minutes (or longer up to 90 minutes) after injection
- Monitor SpO₂, ECG, BP throughout; monitor for local anaesthetic toxicity on tourniquet release

b) List 3 important safety considerations. (3 marks)

- **DO NOT use bupivacaine** for Bier's block — high cardiotoxicity; deaths reported from tourniquet failure **[core]**
- **DO NOT use adrenaline-containing** local anaesthetic (extreme vasospasm / ischaemia risk) **[core]**
- **Minimum tourniquet time 20 minutes** (max 90 minutes) — premature release risks local anaesthetic toxicity / cardiac arrest **[core]**
- Patient must have intravenous access in the contralateral arm and have resuscitation equipment available (intralipid for LAST)
- Avoid in patients with peripheral vascular disease, sickle cell disease, severe hypertension

c) List 2 complications of Bier's block. (2 marks)

- **Local anaesthetic systemic toxicity (LAST)** — from premature tourniquet release or tourniquet failure; manage with intralipid 20 percent **[core]**
- **Tourniquet pain** (usually tolerated for 20-40 minutes); tourniquet-related nerve palsy (rare with appropriate inflation pressures) **[core]**
- Compartment syndrome (rare; from prolonged tourniquet use)
- Inadvertent intravenous access displacement

References: ANZCA / AAGBI Local Anaesthetic Systemic Toxicity guideline • ACEM clinical policies and statements • ASRA Regional Anesthesia Guidelines

Question 15 | Regional Anaesthesia for Rib Fractures (9 marks)

A 75-year-old man presents to your emergency department after a fall, sustaining fractures of the right 4th to 7th ribs. He has chronic obstructive pulmonary disease and is on warfarin (INR 2.5). His pain is severe and he is splinting with reduced respiratory excursion. SpO₂ 91 percent on room air. He weighs 70 kilograms.

a) List 3 regional anaesthetic options for rib fractures. (3 marks)

- **Serratus anterior plane block** (ultrasound-guided; deposit local anaesthetic deep to serratus anterior muscle at the level of the 4th-5th rib; blocks lateral cutaneous branches of intercostal nerves T2-T9) **[core]**
- **Erector spinae plane (ESP) block** (ultrasound-guided; deposit local anaesthetic deep to erector spinae muscle at level of T5; blocks thoracic dorsal and ventral rami; good for posterior / lateral rib fractures) **[core]**
- **Thoracic epidural anaesthesia** (catheter-based; gold standard for extensive bilateral rib fractures; complicated by anticoagulation — this patient) **[core]**
- Multiple individual intercostal nerve blocks (injection below each rib at the angle of the rib; effective but multiple injections needed; risk of pneumothorax)
- Paravertebral block (similar to epidural; less hypotension, can be unilateral)

b) State 4 considerations for regional anaesthesia in this patient (anticoagulated, elderly, COPD). (4 marks)

- **Anticoagulation** — therapeutic warfarin (INR 2.5) is a relative contraindication to thoracic epidural / paravertebral block; fascial plane blocks (serratus, ESP) are SAFER as they are SUPERFICIAL and away from major vessels **[core]**
- **Reduce LA dose for elderly** — smaller volumes (20-30 mL of 0.25 percent ropivacaine); slower onset and recovery; risk of LAST higher **[core]**
- **Maintain spontaneous breathing** — avoid heavy sedation (COPD patient — respiratory depression and CO₂ retention); regional block ideally complements multimodal analgesia **[core]**
- **Monitor closely** for LAST (particularly with larger volume blocks); resuscitation equipment and intralipid available **[core]**
- Patient consent and cooperation

c) List 2 contraindications to thoracic epidural. (2 marks)

- **Active coagulopathy or therapeutic anticoagulation** — therapeutic warfarin / DOAC / LMWH (check timing per regional anaesthetic society guidelines — at least 12 hours since LMWH prophylaxis, 24 hours for therapeutic; INR <1.5) **[core]**
- **Local infection at insertion site**, sepsis, raised intracranial pressure (relative) **[core]**
- Patient refusal
- Severe haemodynamic instability
- Allergy to local anaesthetic

References: ANZCA / AAGBI Local Anaesthetic Systemic Toxicity guideline • EAST rib fracture guidelines • ASRA Anticoagulation Guidelines

Question 16 | Pre-Hospital Rapid Sequence Intubation (10 marks)

You are a flight medical officer with a state helicopter retrieval service responding to a motor vehicle collision in a remote area. On arrival, you find a 42-year-old male with a severe traumatic brain injury (Glasgow Coma Score 7, isolated head injury, no obvious external injuries). His vital signs: heart rate 95 beats per minute, blood pressure 135/80 millimetres of mercury, respiratory rate 14 breaths per minute, peripheral oxygen saturation 96 percent on 15 litres oxygen via non-rebreather mask. The tertiary trauma centre is 90 minutes away by helicopter.

a) List 4 considerations specific to pre-hospital RSI. (4 marks)

- **Environmental constraints** — limited space, noise, lighting, movement of vehicle / aircraft; fewer personnel; weather; bystanders **[core]**
- **Equipment availability** — pre-packed RSI kit with limited drug selection; mandatory checklist (challenge-response model); video laryngoscopy preferred **[core]**
- **Patient factors** — limited history; potential difficult airway unanticipated; haemodynamic instability; cervical spine precautions in trauma **[core]**
- **Critical decision-making** — weigh benefit of pre-hospital intubation against risk of delay; evidence from PARAMEDIC-2 and AIRWAYS-2 trials suggests no benefit of pre-hospital intubation in cardiac arrest; selective in trauma **[core]**
- Communication and team dynamics with ambulance / paramedic team

b) State 4 indications to defer pre-hospital intubation in favour of transport to definitive care. (4 marks)

- **Short transport time** to definitive care (less than 10-15 minutes) — basic airway management (bag-valve-mask, supraglottic airway) may be safer **[core]**
- **Anticipated difficult airway** (facial trauma, swelling, blood) where pre-hospital management not possible — risk of failure with limited equipment / personnel; basic airway management until arrival **[core]**
- **Inadequate personnel / experience** — RSI requires senior operator and assistant; if not available, supraglottic airway preferred **[core]**
- **Cardiac arrest with ongoing CPR** — evidence supports basic airway management; supraglottic airway has non-inferior outcomes (AIRWAYS-2 trial) **[core]**
- Haemodynamic instability where RSI would precipitate cardiac arrest (rescue with fluid / blood / vasopressor first)

c) State 2 principles of safe pre-hospital RSI. (2 marks)

- **Use a checklist** (challenge-response model with second operator); rehearsed team approach; explicit communication of roles and Plan B **[core]**
- **Video laryngoscopy first-line**; have surgical airway equipment immediately available; trained operator with regular RSI experience **[core]**
- Consistent drug regimen (e.g. fentanyl + ketamine + rocuronium); avoid suxamethonium if available (reversibility advantage of rocuronium / sugammadex)

References: ANZCA / Difficult Airway Society (DAS) guidelines • CRRS / NETS retrieval guidelines • ACEM clinical policies and statements

Question 17 | Sedation for Synchronised DC Cardioversion (9 marks)

A 60-year-old man presents to your emergency department with new-onset atrial fibrillation with rapid ventricular response (heart rate 160) for the past 4 hours. His blood pressure is dropping (90/55) and he is symptomatic with chest pain. You plan synchronised DC cardioversion.

a) List 4 considerations specific to sedation for emergency cardioversion. (4 marks)

- **Brief but deep sedation needed** — the shock is painful but the procedure is brief (seconds); deep sedation OR brief general anaesthesia required **[core]**
- **Haemodynamic compromise** (this patient — BP 90/55) — choice of agent matters; avoid agents that further reduce blood pressure if possible **[core]**
- **Fasting status** — emergency indication justifies shorter fasting; aspiration risk should be considered; rapid sequence approach may be warranted **[core]**
- **Cardiovascular reserve** — concurrent cardiac disease; pre-existing coronary artery disease; need for prompt post-procedure assessment of cardiac function **[core]**

b) State 3 drug options for sedation for cardioversion with dose. (3 marks)

- **Propofol 0.5-1 mg/kg IV** (= 35-70 mg for 70 kg adult); rapid onset, brief duration; **watch for hypotension** — give small aliquots and titrate; avoid in severe hypotension without fluid / vasopressor preload **[core]**
- **Etomidate 0.15-0.3 mg/kg IV** (= 10-20 mg for 70 kg adult); haemodynamic-sparing; brief duration; preferred in haemodynamically unstable patients **[core]**
- **Midazolam 0.05-0.1 mg/kg IV** (= 2-5 mg) + fentanyl 1-2 µg/kg IV (= 50-100 µg) — gentle combination but slower onset and longer recovery; consider for less severe scenarios **[core]**
- Ketamine 1-2 mg/kg IV — alternative for haemodynamically unstable; preserves airway reflexes
- Continuous monitoring (SpO₂, ECG, EtCO₂) and rescue equipment (airway, vasopressor)

c) State 2 post-procedure priorities. (2 marks)

- **Confirm successful cardioversion** — observe rhythm, vital signs; 12-lead ECG; treat ongoing tachycardia / instability **[core]**
- **Monitor for recovery** from sedation — continuous SpO₂, ECG, NIBP; until patient is fully alert (Aldrete score 10) and able to ambulate; admission for monitoring if indicated **[core]**
- Anti-arrhythmic / rate control / anticoagulation plan
- Investigate underlying cause of arrhythmia
- Discharge plan and follow-up

References: eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • ANZCA Procedural Sedation

Question 18 | Intubation in Massive Pulmonary Embolism (9 marks)

A 65-year-old female presents to your emergency department with sudden-onset severe shortness of breath and pleuritic chest pain. She is haemodynamically unstable (blood pressure 75/45, heart rate 130). Bedside echocardiogram shows dilated right ventricle with septal D-shape. CTPA confirms a saddle pulmonary embolism. She is becoming increasingly obtunded (Glasgow Coma Score 11).

a) List 4 specific concerns about intubating this patient. (4 marks)

- **Cardiovascular collapse on induction** — right ventricular failure with reduced preload; induction agents (especially propofol) cause vasodilation and myocardial depression; **RV failure cardiac arrest** is the predominant complication **[core]**
- **Positive pressure ventilation reduces venous return** — exacerbates RV failure; PEEP should be minimised initially **[core]**
- **Loss of compensatory hyperventilation** — patient is compensating for shunt by hyperventilation; ventilator settings must match this **[core]**
- **Limited cardiac reserve** for any further insult — aspiration, hypoxia **[core]**

b) State 3 pre-intubation optimisation strategies. (3 marks)

- **Volume optimisation** — careful small fluid boluses (250 mL) if intravascularly depleted (rare in PE); excessive volume worsens RV failure **[core]**
- **Vasopressor / inotrope support** — **noradrenaline 0.05-0.5 µg/kg/min** (preferred — increases MAP without worsening pulmonary vascular resistance); consider dobutamine for inotropic support of RV **[core]**
- **Choice of induction agent** — **ketamine 1-2 mg/kg IV** (haemodynamic-sparing); **AVOID propofol** (vasodilation worsens preload further) **[core]**
- Consider awake intubation with sedation if haemodynamic state precarious
- Concurrent thrombolysis (alteplase 100 mg over 2 hours) — definitive treatment

c) State 2 ventilator settings considerations. (2 marks)

- **Low / minimum PEEP** (5 cm H₂O or less); avoid high intrathoracic pressure (worsens RV afterload and reduces venous return) **[core]**
- **Match patient's minute ventilation** — high RR (25-30) and modest tidal volume (6-8 mL/kg ideal body weight); avoid hypercapnia (worsens pulmonary vascular resistance and RV afterload) **[core]**
- **FiO₂ 1.0** initially, wean as tolerated

References: eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 56

Question 19 | Sedation of the Acutely Agitated Patient (9 marks)

A 28-year-old male presents to your emergency department brought in by police after assaulting two security guards. He is verbally and physically threatening, with police restraint, and is suspected to have taken amphetamines. He is agitated, sweating, tachycardic (140), and hypertensive (170/110). Verbal de-escalation has failed. You are concerned about himself and staff safety.

a) List 3 first-line pharmacological options for chemical restraint (drug, dose, route). (3 marks)

- **Droperidol 10 mg intramuscular** (adults; 5 mg in elderly); preferred first-line per ACEM acute behavioural disturbance position statement; faster onset than haloperidol; less QT prolongation than originally feared **[core]**
- **Olanzapine 10 mg intramuscular OR wafer** (5 mg in elderly); less extrapyramidal effect; anti-cholinergic profile **[core]**
- **Midazolam 5-10 mg intramuscular** (or IV if access); rapid onset; commonly combined with antipsychotic for synergistic effect **[core]**
- Combination droperidol 10 mg IM + midazolam 5-10 mg IM has rapid onset and predictable effect

b) State 3 indications to escalate to ketamine for chemical restraint. (3 marks)

- **Extreme behavioural disturbance** with risk of imminent harm (to self or others) AND failed initial chemical restraint **[core]**
- **Need for rapid sedation** for investigation / management of life-threatening problem; transfer; imaging requiring stillness **[core]**
- **Other agents contraindicated or ineffective** — extreme haemodynamic instability where benzodiazepines or antipsychotics would precipitate collapse **[core]**
- **Ketamine 4-5 mg/kg intramuscular** (higher dose than for procedural sedation); requires intensive monitoring and senior supervision; vomiting / emergence reactions common; airway equipment must be ready

c) State 3 post-sedation monitoring priorities. (3 marks)

- **Continuous monitoring** — SpO₂, ECG, BP, respiratory rate; sedation depth (modified Ramsay scale); resuscitation equipment ready **[core]**
- **Investigate underlying cause** of acute behavioural disturbance — bedside glucose, electrolytes, toxin screen, head imaging if indicated; medical conditions (hypoglycaemia, sepsis, intracranial pathology) should be actively excluded **[core]**
- **Mental health and forensic considerations** — Mental Health Act assessment, social work, child protection considerations; documentation; police continuity **[core]**
- Manage the consequences of substance use — hyperthermia, rhabdomyolysis, acute kidney injury
- Plan disposition once acute behavioural disturbance settles

References: ACEM clinical policies and statements • ACEM Acute Behavioural Disturbance Statement • eTG (Therapeutic Guidelines, current)

Question 20 | Apnoeic Oxygenation in RSI (9 marks)

Your registrar is about to perform rapid sequence intubation in a 75-year-old man with severe community-acquired pneumonia. The patient is hypoxic at baseline (SpO_2 89 percent on 15 L oxygen via non-rebreather mask). His weight is 90 kilograms. The registrar asks about strategies to reduce the risk of desaturation during intubation.

a) Define apnoeic oxygenation AND state the principle. (3 marks)

- **Apnoeic oxygenation** is the provision of supplemental oxygen via high-flow nasal cannula (15 L/min standard or 30-70 L/min via humidified high-flow) during the apnoeic period of RSI (from induction to successful intubation) **[core]**
- **Principle:** continued oxygen delivery to the alveoli via diffusion (oxygen 'flows down' the airway during apnoea due to a pressure gradient — alveolar oxygen uptake exceeds carbon dioxide release into the alveoli) **[core]**
- **Effect:** prolongs the time to desaturation (<90 percent) during intubation; particularly beneficial in obese, septic, pre-oxygenated patients **[core]**
- Evidence: AIRWAYS-3 (mixed), several observational studies show benefit; particularly in ED population with pre-existing hypoxia

b) List 3 other strategies to optimise pre-oxygenation. (3 marks)

- **Pre-oxygenation duration** — minimum 3 minutes of tidal-volume breathing on 100 percent oxygen via tight-fitting non-rebreather mask (or 8 vital capacity breaths if cooperative) **[core]**
- **Position** — 25-30° head-up (reverse Trendelenburg); reduces atelectasis and improves functional residual capacity **[core]**
- **BiPAP / non-invasive ventilation pre-oxygenation** for patients with inadequate gas exchange on high-flow nasal cannula or non-rebreather; provides PEEP and increased FiO_2 **[core]**
- DSI (Delayed Sequence Intubation) — ketamine for awake / dissociative pre-oxygenation; useful when patient cannot tolerate mask due to agitation
- Recruitment manoeuvres after pre-oxygenation
- Avoid bag-mask ventilation during apnoea period (cricoid pressure not routinely needed)

c) List 3 patient groups who benefit most from apnoeic oxygenation. (3 marks)

- **Obese / morbidly obese patients** (reduced FRC; rapid desaturation) **[core]**
- **Critically ill / septic patients** with limited cardiopulmonary reserve **[core]**
- **Patients with pre-existing hypoxia** (failed adequate pre-oxygenation, e.g. severe pneumonia — this case) **[core]**
- Predicted difficult airway (longer apnoea time anticipated)
- Pregnant patients (reduced FRC, increased oxygen consumption)
- Paediatric patients (although evidence less robust)

References: ANZCA / Difficult Airway Society (DAS) guidelines • ACEM clinical policies and statements • AIRWAYS-3 / PreVent trial evidence

Question 21 | Failed Bag-Mask Ventilation (10 marks)

During rapid sequence intubation of a 55-year-old male, your registrar has failed two attempts at intubation. Bag-mask ventilation is now difficult (poor chest rise, falling SpO₂ 88 percent). The supraglottic airway device has been placed but you are not achieving adequate ventilation (chest rise minimal, no end-tidal CO₂ trace). Your team is approaching 'can't intubate, can't oxygenate' (CICO).

a) List 4 optimisation steps for bag-mask ventilation BEFORE proceeding to surgical airway. (4 marks)

- **Two-person technique** — one operator holds mask with both hands (jaw thrust, optimal mask seal), second operator squeezes bag; achievable as a single operator is often the limiting factor **[core]**
- **Optimise position** — head-tilt, chin lift, jaw thrust; sniffing position if no C-spine concerns; ramp position for obese patients (blocks under shoulders and head) **[core]**
- **Adjuncts** — insert nasopharyngeal and / or oropharyngeal airway (opens airway by displacing tongue) **[core]**
- **Deepen anaesthesia / paralysis** — inadequate paralysis is a common cause of difficulty (give additional muscle relaxant); alternatively, allow patient to wake if appropriate **[core]**
- Suction airway thoroughly (clear blood, secretions, foreign material)
- Switch to a different mask size; remove dentures
- Reduce PEEP / inspiratory pressure if auto-PEEP / asthma physiology

b) Describe the 'CICO' (can't intubate, can't oxygenate) management. (4 marks)

- **Declare CICO** — explicit team communication; helps focus everyone on the same plan; team leader delegates roles clearly **[core]**
- **Emergency front-of-neck access (FONA)** — surgical cricothyroidotomy (scalpel-bougie preferred per DAS 2015 guidelines); needle cricothyroidotomy as a stop-gap if surgical airway delayed; performed within 1-2 minutes of declaring CICO **[core]**
- **Maintain oxygenation** through FONA — connect 6.0 mm cuffed ETT to circuit; confirm placement with EtCO₂ waveform; ventilate **[core]**
- **Senior support** — call for consultant anaesthetic / ENT / surgical assistance; if patient stabilises, arrange definitive tracheostomy **[core]**
- Document the CICO event and procedure; post-procedure imaging (chest radiograph); complications monitoring

c) List 2 complications of cricothyroidotomy. (2 marks)

- **Bleeding** (typically minor; more concerning in coagulopathic / anticoagulated patients) **[core]**
- **Misplacement** — into the oesophagus (no EtCO₂ trace) or paratracheal / subcutaneous (subcutaneous emphysema; ineffective ventilation) **[core]**
- Tracheal stenosis (late complication)
- Subglottic stenosis
- Infection
- Voice change / damage to cricothyroid joint

References: ANZCA / Difficult Airway Society (DAS) guidelines • ACEM clinical policies and statements • Tintinalli's Emergency Medicine 9e Ch 28

Question 22 | Reversal Agents in Anaesthesia and Toxicology (9 marks)

You are managing several patients with different drug-related issues. Match the appropriate reversal agent / antidote to each scenario: Patient A: 70-year-old female with respiratory depression following IV morphine for post-operative pain. Patient B: Young woman who took a benzodiazepine overdose and is now obtunded with respiratory depression in your ED. Patient C: 60-year-old male with cardiac arrest following bupivacaine infiltration during dental procedure. Patient D: 65-year-old after warfarin overdose with active GI bleeding (INR 12).

a) State the reversal agent, dose, and mechanism for each scenario. (5 marks)

- **Patient A (opioid): naloxone 0.04-0.4 mg IV** (titrate to respiration; avoid full reversal in chronic opioid users — withdrawal); mechanism: competitive antagonist at μ -opioid receptors **[core]**
- **Patient B (benzodiazepine): flumazenil 0.2 mg IV** repeated to 1 mg total; controversial — risk of seizures, particularly in mixed overdose with tricyclic / co-ingestants; mechanism: competitive antagonist at GABA_A receptor **[core]**
- **Patient C (LAST): intralipid 20 percent 1.5 mL/kg IV bolus then 0.25 mL/kg/min infusion;** mechanism: lipid sink — sequesters lipophilic local anaesthetic from cardiac tissue **[core]**
- **Patient D (warfarin): vitamin K 10 mg IV + 4-factor prothrombin complex concentrate (Prothrombinex) 50 IU/kg IV;** vitamin K reverses warfarin within 6-8 hours (replaces clotting factor synthesis); PCC provides immediate factor replacement **[core]**
- Aspirate every 5 mL of injection (avoid intravascular injection); communicate with patient throughout

b) State the reversal agent / antidote for: (i) rocuronium; (ii) dabigatran; (iii) apixaban; (iv) heparin. (4 marks)

- **Rocuronium / vecuronium: sugammadex 16 mg/kg IV** (immediate reversal); mechanism: encapsulates aminosteroidal neuromuscular blocker **[core]**
- **Dabigatran: idarucizumab 5 g IV** (2 × 2.5 g vials); mechanism: monoclonal antibody fragment binding dabigatran **[core]**
- **Apixaban / rivaroxaban: andexanet alfa** (specific Xa inhibitor reversal — limited availability in Australia) OR **4-factor PCC 50 IU/kg IV** (alternative) **[core]**
- **Heparin: protamine sulfate 1 mg per 100 IU heparin** (max 50 mg single dose); only ~60 percent effective for LMWH; mechanism: binds and neutralises heparin **[core]**
- Anaphylaxis to protamine — slow infusion, have adrenaline available

References: eTG (Therapeutic Guidelines, current) • ACEM clinical policies and statements • ANZSBT / HSBANZ PCC Guideline