ITE 1 Practice Exam — CA-1

50 single-best-answer questions. Answer key follows the questions. An interactive version lives at ite1-quiz.html.

Questions

1. A full E-cylinder of oxygen reads 2000 psi at room temperature. Approximately how many liters of oxygen does it contain?
A. 1100 L
B. 660 L
C. 300 L
D. 1590 L

2. At 20°C, the saturated vapor pressure of isoflurane is 238 mmHg. What fraction of gas leaving an isoflurane vaporizing chamber is isoflurane vapor (barometric pressure 760 mmHg)?
A. 44%
B. 31%
C. 16%
D. 23%

3. Desflurane requires a heated, pressurized vaporizer because:
A. It is highly soluble in blood
B. Its vapor pressure at room temperature is very high (669 mmHg)
C. It decomposes in the presence of metal
D. Its boiling point is below room temperature at sea level

4. In a circle breathing system, rebreathing of exhaled gas is prevented primarily by:
A. Unidirectional (inspiratory/expiratory) valves
B. The APL valve
C. The fresh gas flow rate alone
D. The reservoir bag

5. During general anesthesia, the capnograph suddenly shows a flat line with an unchanged ventilator pressure waveform and the SpO2 beginning to fall. The most likely diagnosis is:
A. Circuit disconnection or loss of sampling line
B. Endobronchial intubation
C. Bronchospasm
D. Malignant hyperthermia

6. A "shark-fin" capnograph waveform with a prolonged upslope is most consistent with:
A. Hyperventilation
B. Pulmonary embolism
C. Circuit leak
D. Bronchospasm / obstructive lung disease

7. A patient with a pneumothorax under general anesthesia receives nitrous oxide. The most important concern is that N2O:
A. Decreases the inspired oxygen concentration via the second gas effect
B. Is combustible and supports combustion in the chest
C. Is 35 times more soluble than nitrogen and diffuses into the air-filled space, expanding it
D. Increases pulmonary vascular resistance and worsens the pneumothorax

8. Boyle's law states that at constant temperature:
A. Pressure is inversely proportional to volume
B. The total pressure of a gas mixture is the sum of partial pressures
C. Volume is directly proportional to temperature
D. Pressure is directly proportional to absolute temperature

9. According to ASA fasting guidelines, a healthy patient may ingest clear liquids up to how long before elective anesthesia?
A. 4 hours
B. 6 hours
C. 2 hours
D. 1 hour

10. Which induction agent is most appropriate for a hemodynamically unstable patient in septic shock who needs rapid sequence intubation?
A. Propofol 2 mg/kg
B. Ketamine 1.5 mg/kg
C. Midazolam 0.3 mg/kg
D. Thiopental 4 mg/kg

11. Etomidate is favored in patients with cardiac disease because it is hemodynamically stable, but its major limiting side effect is:
A. Histamine release
B. Prolonged apnea
C. Adrenocortical suppression (inhibition of 11β-hydroxylase)
D. Pain on injection only

12. A patient with 40% TBSA burns sustained 2 days ago should NOT receive succinylcholine because:
A. Burns prolong the duration of succinylcholine
B. Upregulation of extrajunctional acetylcholine receptors can cause life-threatening hyperkalemia
C. Succinylcholine is a trigger for malignant hyperthermia in burn patients only
D. Burns cause hypersensitivity to succinylcholine

13. Rocuronium is reversed by sugammadex, which works by:
A. Selective binding/encapsulation of rocuronium in plasma
B. Calcium replacement
C. Inhibiting acetylcholinesterase
D. Blocking presynaptic calcium channels

14. Neostigmine reversal of nondepolarizing blockade can cause significant bradycardia because it:
A. Increases acetylcholine at muscarinic receptors
B. Stimulates nicotinic receptors
C. Causes histamine release
D. Blocks vagal afferents

15. Remifentanil is unique among opioids because it is:
A. Excreted unchanged by the kidney
B. Highly lipid soluble with a long context-sensitive half-time
C. Metabolized by CYP3A4
D. Metabolized by nonspecific blood and tissue esterases, making its half-time independent of infusion duration

16. The maximum safe dose of plain lidocaine without epinephrine is approximately:
A. 7 mg/kg
B. 2 mg/kg
C. 9 mg/kg
D. 4–5 mg/kg

17. Early signs of local anesthetic systemic toxicity (LAST) typically include:
A. Perioral numbness, tinnitus, agitation, and seizures
B. Wheezing and urticaria
C. Hypertension and bradycardia
D. Hyperthermia and rigidity

18. The first-line treatment for confirmed LAST after bupivacaine infiltration is:
A. Amiodarone 300 mg IV
B. 20% lipid emulsion 1.5 mL/kg IV bolus
C. Propofol infusion for seizure suppression
D. Epinephrine 1 mg IV bolus

19. Local anesthetics with a pKa close to physiologic pH (e.g., lidocaine, pKa 7.9) have:
A. Slower onset because more drug is ionized
B. Greater protein binding
C. Faster onset because a greater fraction is uncharged and crosses the nerve membrane
D. Longer duration

20. Which local anesthetic has the highest risk of fatal cardiotoxicity relative to its anesthetic potency?
A. Bupivacaine
B. Mepivacaine
C. Lidocaine
D. Chloroprocaine

21. MAC (minimum alveolar concentration) is best described as:
A. The alveolar concentration that produces loss of consciousness in 95% of patients
B. The blood:gas partition coefficient
C. The concentration at which EEG burst suppression occurs
D. The alveolar concentration preventing movement in response to surgical stimulus in 50% of patients

22. Which factor INCREASES MAC?
A. Acute alcohol intoxication
B. Hyperthermia
C. Advanced age (>80)
D. Hypothermia

23. Ketamine is the induction agent of choice in an asthmatic because it:
A. Suppresses the hypothalamic-pituitary axis
B. Decreases airway secretions
C. Produces bronchodilation via sympathomimetic effects
D. Blocks histamine release

24. Dexmedetomidine provides sedation attractive for awake fiberoptic intubation because it:
A. Causes profound respiratory depression
B. Increases heart rate and blood pressure
C. Causes reliable amnesia
D. Provides sedation and analgesia with minimal respiratory depression

25. An otherwise healthy patient's room-air arterial blood gas shows PaO2 60 mmHg, PaCO2 32 mmHg, pH 7.48. A-a gradient is elevated. The most likely cause of hypoxemia is:
A. Low inspired FiO2
B. Increased cardiac output
C. Hypoventilation
D. V/Q mismatch or shunt

26. Which condition shifts the oxyhemoglobin dissociation curve to the LEFT?
A. Acidosis
B. Hyperthermia
C. Hypocapnia/alkalosis
D. Increased 2,3-DPG

27. A right-shifted oxyhemoglobin dissociation curve means:
A. Increased P50
B. Decreased affinity; oxygen unloads more readily at the tissue
C. B and C
D. Increased affinity of hemoglobin for oxygen; easier loading

28. In West's lung zones, blood flow is greatest in Zone 3 because:
A. Alveolar pressure exceeds arterial pressure
B. Pulmonary venous pressure exceeds alveolar pressure (Ppa > Ppv > PA)
C. Gravity is irrelevant in the upright lung
D. Pulmonary arterial pressure exceeds both alveolar and venous pressures

29. The anatomic dead space in an adult is approximately:
A. 7 mL/kg
B. 2 mL/kg
C. 5 mL/kg
D. 1 mL/kg

30. In an elderly patient, closing volume exceeds FRC during tidal breathing. The physiologic consequence is:
A. Decreased work of breathing
B. Increased compliance
C. Improved oxygenation
D. Airway closure during normal tidal ventilation, causing increased A-a gradient and hypoxemia

31. According to the Frank-Starling mechanism, increasing preload will:
A. Always decrease stroke volume
B. Decrease myocardial oxygen consumption
C. Only affect heart rate
D. Increase stroke volume until the plateau of the length-tension relationship is reached

32. Oculocardiac reflex is triggered by traction on extraocular muscles and is mediated by:
A. Vagal afferent → trigeminal efferent
B. Glossopharyngeal afferent → vagal efferent
C. Trigeminal (V1) afferent → vagal efferent
D. Facial afferent → glossopharyngeal efferent

33. A patient with a T4 sensory level spinal anesthetic develops profound hypotension and bradycardia. The bradycardia is best explained by:
A. Direct myocardial depression by local anesthetic
B. Bezold-Jarisch reflex only
C. Block of the cardioaccelerator fibers (T1–T4), leaving unopposed vagal tone
D. Vagal stimulation from visceral traction

34. Total oxygen content of arterial blood (CaO_2) is best calculated as:
A. $(0.003 \times Hb \times SaO_2) + (1.34 \times PaO_2)$
B. $1.34 \times Hb \times SaO_2$ only
C. $0.003 \times PaO_2$ only
D. $(1.34 \times Hb \times SaO_2) + (0.003 \times PaO_2)$

35. The pulse oximeter reads 100% in a patient with severe carbon monoxide poisoning because:
A. CO-Hb reads as deoxyhemoglobin
B. CO-Hb absorbs light at the same wavelengths as oxyhemoglobin, so the device cannot distinguish them
C. CO increases blood flow to the finger
D. The probe cannot adhere to the skin

36. A patient with methemoglobinemia will typically show a pulse oximetry reading of:
A. ~70%
B. 50%
C. 100%
D. ~85%

37. NIBP cuff width should be approximately what fraction of limb circumference?
A. 60%
B. 80%
C. 20%
D. 40%

38. An over-damped arterial line waveform (slurred upstroke, absent dicrotic notch, prolonged flush test) is most commonly caused by:
A. Air bubble or clot in the tubing, kinked catheter, or excessive tubing length/compliance
B. Tachycardia
C. Catheter whip
D. Transducer placed below the phlebostatic axis

39. In the CVP waveform, "cannon a waves" are seen with:
A. Atrial fibrillation
B. Tricuspid regurgitation
C. Junctional rhythm / AV dissociation (right atrium contracts against a closed tricuspid valve)
D. Cardiac tamponade

40. On a PA catheter, the normal wedge pressure closely approximates:
A. Pulmonary arterial systolic pressure
B. Right atrial pressure
C. Left atrial pressure
D. LV end-systolic pressure

41. During general anesthesia with volatile agent, a patient's temperature rises to 39.5°C with EtCO2 68 mmHg, tachycardia, and masseter rigidity. First-line drug treatment is:
A. Dantrolene 2.5 mg/kg IV
B. Sodium bicarbonate 1 mEq/kg
C. Acetaminophen 1000 mg
D. Procainamide

42. During an MH crisis, which actions are correct? (Select the single BEST answer)
A. Continue volatile anesthetic but switch to desflurane
B. Stop triggering agents and observe for 30 minutes before treating
C. Stop triggering agents, call for help, call MHAUS hotline, hyperventilate with 100% O2, dantrolene, cool if temp >39°C
D. Give succinylcholine to relax masseter rigidity

43. A patient becomes hypotensive and bronchospastic 10 minutes after cefazolin administration. Urticaria appears. Most appropriate immediate treatment is:
A. Epinephrine IM/IV per severity, stop the suspected agent, fluids, supportive care
B. Diphenhydramine 50 mg IV alone
C. Hydrocortisone 200 mg IV alone
D. Albuterol inhaler only

44. Which is TRUE about magnesium sulfate therapy for preeclampsia?
A. It prevents/treats eclamptic seizures; toxicity causes loss of deep tendon reflexes, respiratory depression, and treat with calcium gluconate
B. It is contraindicated with neuraxial anesthesia
C. It is an antihypertensive
D. Its antidote is dantrolene

45. For a pregnant patient beyond ~20 weeks undergoing non-obstetric surgery, the table should be tilted left because:
A. It reduces the risk of difficult intubation
B. Supine positioning causes aortocaval compression by the gravid uterus, reducing venous return and uteroplacental perfusion
C. It improves surgeon access
D. It decreases aspiration risk

46. Appropriate uncuffed ETT size for a 4-year-old child:
A. 3.5 mm
B. 5.0 mm (4 + age/4)
C. 6.5 mm
D. 7.0 mm

47. Epinephrine dosing for bradycardia/asystole in a pediatric arrest:
A. 1 mcg/kg
B. 10 mcg/kg (0.01 mg/kg)
C. 100 mcg/kg
D. 1 mg/kg

48. During RSI, cricoid pressure (Sellick maneuver) is intended to:
A. Prevent regurgitation by occluding the esophagus
B. Decrease lower esophageal sphincter tone
C. Prevent tracheal collapse
D. Improve laryngoscopic view

49. A difficult airway cannot be intubated after multiple attempts but the patient can be mask-ventilated. Per the ASA difficult airway algorithm, the next most appropriate step is:
A. Awakening the patient (if elective/non-emergent) or establishing a supraglottic airway (e.g., LMA) as a ventilatory bridge
B. Proceed with mask anesthesia for the case
C. Repeated attempts with the same laryngoscope
D. Immediate surgical airway

50. An ASA 1 patient scheduled for elective laparoscopic cholecystectomy takes metformin. Per most current guidance, metformin:
A. Requires perioperative insulin bridging
B. Must be held 72 hours preoperatively in all patients
C. Is absolutely contraindicated with general anesthesia
D. May be taken on the day of surgery in patients without renal impairment/contrasts (or held only the day of surgery per institutional policy)

Answer Key & Explanations

1. B — E-cylinder: full pressure ~2000 psi ≈ 660 L O2 (psi × 0.33 ≈ liters).

2. B — 238/760 ≈ 31%.

3. **B** — Desflurane VP 669 mmHg at 20°C (near boiling); requires heated pressurized vaporizer to keep output constant.

4. **A** — Unidirectional valves prevent rebreathing; FGF only matters if valves fail.

5. **A** — Sudden total loss of EtCO2 with unchanged airway pressures → disconnection/sampling failure. (PE gives abrupt EtCO2 drop but pressures change; bronchospasm changes waveform.)

6. **D** — Obstruction (bronchospasm, ETT kink) prolongs upslope → shark fin.

7. **C** — N2O is ~35× more soluble than N2; expands compliant air-filled spaces; avoid in pneumothorax, bowel obstruction, middle ear disease, retinal surgery bubbles.

8. **A** — Boyle: P ∝ 1/V at constant T. (B = Charles, C = Gay-Lussac, D = Dalton.)

9. **C** — 2-4-6-8 rule: clear liquids 2 h, breast milk 4 h, light meal 6 h, fatty/fried/meat 8 h.

10. **B** — Ketamine: sympathomimetic, maintains SVR/BP; avoid propofol/thiopental (vasodilation). (Caveat: in catecholamine-depleted myocardium ketamine can still drop BP.)

11. **C** — Etomidate inhibits 11β-hydroxylase → transient adrenal suppression; also myoclonus and pain on injection.

12. **B** — Burns/denervation/CRPS/immobility upregulate extrajunctional ACh receptors → severe hyperkalemia. Peak risk ~48 h to months.

13. **A** — Sugammadex is a modified γ-cyclodextrin that encapsulates aminosteroid NDMBs (rocuronium > vecuronium) in plasma.

14. **A** — Neostigmine increases ACh at both nicotinic AND muscarinic sites → bradycardia, salivation, GI motility; co-administer glycopyrrolate/atropine.

15. **D** — Remifentanil: ester hydrolysis by nonspecific esterases; context-sensitive half-time ~3–4 min regardless of infusion length.

16. **D** — Plain lidocaine 4–5 mg/kg; with epinephrine ~7 mg/kg. (ASRA anti-infection guidance allows up to ~11.7 mg/kg with epi in some contexts, but classic board answer is 7.)

17. **A** — LAST prodrome: circumoral numbness, tinnitus, metallic taste, agitation, seizures; then CV collapse. IV route can present with CNS or CV signs first.

18. **B** — 20% lipid emulsion 1.5 mL/kg bolus over 1 min, then 0.25 mL/kg/min infusion. Avoid high-dose epinephrine (>1 mcg/kg) and vasopressin; propofol NOT a substitute.

19. **C** — Lower pKa (closer to pH 7.4) → more unionized (RNH+ ■ RN) fraction → faster membrane penetration and onset.

20. **A** — Bupivacaine binds cardiac Na channels avidly and dissociates slowly ("cardio:CN ratio"); use lipid emulsion; ropivacaine safer.

21. **D** — MAC = alveolar concentration preventing movement to surgical stimulus in 50% of patients. MAC-awake ≈ 0.3–0.5 MAC; MAC-BAR ≈ 1.5–2 MAC.

22. **B** — MAC ↑: hyperthermia, chronic EtOH/opioid use, hypernatremia, CNS stimulants, red hair. MAC ↓: hypothermia, acute EtOH, opioids, benzodiazepines, pregnancy, old age, hypoxia, hypercarbia, hypothyroid.

23. **C** — Ketamine causes bronchodilation (sympathetic stimulation + direct relaxation); increases secretions (give antisialagogue); useful in asthma, right-to-left shunts, hypovolemia.

24. **D** — Dexmedetomidine: $\alpha 2$ agonist, sedation+analgesia with minimal respiratory depression, BUT causes bradycardia/hypotension and poor amnesia.

25. **D** — Hypoventilation (elevated $PaCO_2$) and low FiO_2 give NORMAL A-a gradient; patient is hypocapnic with normal FiO_2 → elevated A-a gradient → V/Q mismatch/shunt/diffusion.

26. **C** — LEFT shift: alkalosis, hypocapnia, hypothermia, ↓2,3-DPG, fetal Hb, CO poisoning.

27. **C** — Right shift = ↓ affinity = ↑ P50 = easier O_2 unloading at tissues (slightly harder loading in lungs).

28. **B** — Zone 3: Ppa > Ppv > PA → continuous flow, greatest flow. Zone 2: Ppa > PA > Ppv; Zone 1 (no flow): PA > Ppa > Ppv.

29. **B** — Anatomic dead space ~2 mL/kg (~150 mL in 70-kg adult).

30. **D** — When closing volume > FRC, airways close during tidal breathing → shunt-like units → hypoxemia, especially supine/anesthetized elderly.

31. **D** — Frank-Starling: ↑preload → ↑stroke volume up to plateau; beyond it, wall stress and O_2 demand rise.

32. **C** — OCR: V1 afferent → ciliary ganglion → vagus efferent → bradycardia. Treat: stop stimulus, atropine/glycopyrrolate.

33. **C** — T1–T4 carry cardiac sympathetic accelerators; high neuraxial block leaves unopposed vagal tone → bradycardia + hypotension. Treat: ephedrine/epinephrine ± atropine.

34. **D** — $CaO_2 = (1.34 \times Hb \times SaO_2) + (0.003 \times PaO_2)$. Normal ~20 mL/dL; dissolved O_2 contribution is tiny.

35. **B** — Conventional pulse oximetry uses 660/940 nm; CO-Hb mimics O_2Hb at these wavelengths → falsely high SpO_2. CO poisoning needs co-oximetry (ABG).

36. **D** — Met-Hb absorbs equally at both wavelengths → reading locks at ~85% regardless of true SaO_2.

37. **D** — Cuff width ~40% of limb circumference; too narrow → falsely HIGH, too wide → falsely LOW.

38. **A** — Overdamping: air/clot in transducer or tubing, kink, excess tubing. Underdamping (catheter whip, long stiff tubing) → overshoot/artifactual systolic hypertension. Fast-flush test: overdamped = slurred, slow return.

39. **C** — Cannon a waves = RA contracts against closed tricuspid valve (junctional rhythm, AV block, ventricular pacing). Absent a waves = AF. Giant v waves = TR/tamponade.

40. **C** — PCWP ≈ LA pressure (via occluded branch PA, a static column of blood). Normal 8–12 mmHg.

41. **A** — Dantrolene 2.5 mg/kg IV, repeat until signs resolve (up to 10 mg/kg+); stop triggers, 100% O_2 high flow, cool, treat hyperkalemia/acidosis. Acetaminophen is useless.

42. **C** — MH crisis management: stop triggers, get help + MHAUS hotline (1-800-644-9737), 100% O_2 at high flow, dantrolene, treat hyperkalemia ($CaCl_2$, insulin/dextrose), cool if >39°C, monitor for arrhythmias; avoid calcium channel blockers with dantrolene.

43. **A** — Anaphylaxis: remove trigger, IM epinephrine 0.3–0.5 mg (anesthetized: IV titrated 10–100 mcg boluses), fluids, supportive; antihistamines/steroids are adjuncts only, never first-line.

44. **A** — $MgSO_4$ prevents/treats eclamptic seizures (not an antihypertensive). Toxicity sequence: DTR loss → respiratory depression → cardiac arrest. Antidote: calcium gluconate 1 g. Prolongs and potentiates NDMBs.

45. **B** — Left uterine displacement relieves aortocaval compression → restores venous return and uteroplacental flow.

46. **B** — Peds ETT: uncuffed 4 + age/4 (5.0 mm at 4 y); cuffed 3.5 + age/4 (4.5–5.0 mm cuffed).

47. **B** — Peds epinephrine arrest: 0.01 mg/kg = 10 mcg/kg (max 1 mg), q3–5 min.

48. **A** — Cricoid pressure occludes the esophagus to reduce passive regurgitation (evidence debated; current practice varies — know both the intent and the controversy).

49. **A** — Ventilate-but-can't-intubate (non-emergent): awaken or use supraglottic airway. Surgical airway is for CANNOT-ventilate-CANNOT-intubate emergency.

50. **D** — Metformin: no meaningful single-dose risk of lactic acidosis; current guidance = take day of surgery if no renal insufficiency/recent contrast (older blanket 48–72 h hold is outdated; follow institutional policy).