Review Questions for Chapter 4, “Decompression Sickness”

1. Sir Robert Boyle was the first to observe bubble formation *in vivo* during decompression in a hypobaric chamber. In what animal was this observed (“a conspicuous Bubble moving to and fro in the waterish humour of one of its Eyes.”)
   A. pig
   B. dog
   C. snake
   D. human

2. Gas Law: The volume of a given mass of gas varies inversely with pressure (at constant temperature). For example, with a two-fold increase pressure increase on a gas, there is a resulting decrease by one-half of the original volume.”
   A. Henry’s Law
   B. Dalton’s Law
   C. Charles’ Law
   D. Boyle’s Law
   E. General Gas Law

3. Gas Law: The quantity of a gas dissolved in a liquid is proportional to the partial pressure of the gas in contact with the liquid.
   A. Henry’s Law
   B. Dalton’s Law
   C. Charles’ Law
   D. Boyle’s Law
   E. General Gas Law

4. The severity of DCS is graded by the subdivision of signs and symptoms into “types.” Which is the correct association?
   A. “bends” = general DCS
   B. “chokes” = Type I
   C. “staggers” = Type II
   D. “creeps” = Type II

5. Differences between hypobaric/altitude DCS and hyperbaric/divers’ DCS include all of the following EXCEPT:
   A. Altitude exposure is associated with smaller nitrogen loads, but with an increased rate of release.
   B. Altitude DCS is generally associated with less severe symptomatology than hyperbaric DCS.
   C. There is a generally a different spectrum of clinical manifestations, but significant overlap exists between the two.
   D. Altitude DCS can put the mission at risk as the individual becomes symptomatic during the operational tasks.
6. The basic physical principle responsible for bubble formation with decreased ambient pressures is the concept of supersaturation. This concept is based on which gas law?
A. Henry’s Law
B. Dalton’s Law
C. Charles’ Law
D. Boyle’s Law

7. J.S. Haldane showed that the human body could tolerate a 2:1 decrease in ambient pressure without DCS (i.e. a diver can safely decompress from 33’ to the surface at 1 atm). So, as a general rule, the lowest altitude where a sea-level acclimatized individual may encounter symptoms of DCS is approximately:
A. 5,000’
B. 7,000’
C. 10,000’
D. 18,000’
E. 23,000’

8. Pulmonary: Venous gas embolization results in a dose-dependent _________ of pulmonary artery pressure and subsequent _________ in pulmonary vascular resistance.
A. Decrease; decrease
B. Increase; increase
C. Decrease; increase
D. Increase; decrease

9. Pulmonary: In the above question, this air embolization of the pulmonary vascular bed results in V-Q mismatching leading to _________ peripheral arterial O₂ saturation and _________ end-tidal CO₂.
A. Decrease; decrease
B. Increase; increase
C. Decrease; increase
D. Increase; decrease
10. Cardiovascular: The occurrence of arterIALIZation of venous bubbles with DCS, such as with a PFO, results in __________ systemic vascular resistance and __________ cardiac output. Bonus question: It has been estimated that what percentage of the population has a PFO?
A. Decrease; decrease
B. Increase; increase
C. Decrease; increase
D. Increase; decrease

11. CNS: Which of the following is NOT true regarding cerebral occlusion due to DCS bubbles:
A. Experimental evidence exists for subsequent transport of gas bubbles through capillaries to venous bed.
B. Occlusion results in marked local and downstream microcirculation vasoconstriction.
C. 60% of divers with cerebral DCS recover before recompression therapy.
D. Neurologic defects are postulated to be the result of secondary microvasculature/endothelium changes as opposed to actual blood flow obstruction.

12. Incidence Data: Over a ten year period, the USAF reported a DCS mishap rate of about __________ per 100,000 flight hours.
A. 0.02
B. 0.2
C. 2
D. 20

13. Select the factor(s) that have NOT been shown to be associated with increased incidence of DCS:
A. Older age.
B. Female gender.
C. Exercise/physical exertion at altitude.
D. Obesity.
E. Dehydration.

14. The denitrogenation curve while breathing 100% O₂ demonstrates greater overall nitrogen elimination between:
A. Initially at 0-30 minutes
B. Significant elimination doesn’t occur until times >120 minutes
C. Doesn’t matter; it’s a linear curve
15. DCS treatment scenario: A pilot reports possible DCS symptoms of “joint awareness” in left knee during high-altitude reconnaissance flight. Symptoms resolved upon decent and he is now asymptomatic (and remains so with no recurrence). After a thorough Hx and PE, treatment should consist of:
A. Observation only for minimum of 12 hours.
B. Observation only for 24 hours.
C. 100% ground-level oxygen (GLO) for 2 hours with 24 hours observation.
D. 100% GLO for 24 hours with observation.
E. USN Table 5.

16. DCS treatment scenario: You are treating a Type I DCS case with a hyperbaric dive using the standard USN Table 5. After a 10 minute interval on 100% O₂ at 60 fsw, the patient’s pain has significantly improved, but not completely resolved. You should now:
A. Continue Table 5 as scheduled; the decision to modify treatment (if necessary) is made at the conclusion of the first 20 minute interval.
B. Plan to continue Table 5; the 135 minute Table begins only after symptoms have completely resolved.
C. Commit to a Table 6 dive.
D. Commit to a Table 7 dive.
Answers:
1. C. Snake (viper). Page 67
4. C. CNS = Type II DCS. Page 68.
7. D. 18,000’ represents ½ atm. Page 70.
9. A. V-Q mismatch reduces both peripheral arterial O₂ sat and end-tidal CO₂. Page 72.
11. B. CNS occlusion is marked by marked dilation of the downstream microcirculation. Page 73-74.
12. B. 0.2 to 0.3 per 100,000 hours (49 cases). Page 74.
13. D. There is no scientific evidence to suggest that obesity contributes to DCS. B is sort of a trick question: retrospective studies indicated initially that the incidence of DCS in females is significantly higher, but prospective studies have not revealed any significant differences. Page 75-76.
14. A. N₂ elimination is time and tissue perfusion dependent with a nonlinear curve with the greatest elimination in the initial 30 minutes. Page 77.
15. C. Page 83.
16. C. If Sx do not completely disappear within 10 minutes, the patient is committed to a USN Treatment Table 6. Page 84.