AANA Journal Course No. 7
Examination Information
Advanced scientific concepts: Update for nurse anesthetists

With this issue of the AANA Journal, the seventh course has been completed. The course consisted of a six-part series, beginning with the April, 1987 issue and concluding in the February, 1988 issue. The series was published as follows:

- Part 1—(April, 1987)—Advanced scientific concepts—The cardiovascular system
- Part 2—(June, 1987)—Advanced scientific concepts—The renal system: Physiology, pathophysiology, and anesthesia management
- Part 3—(August, 1987)—Advanced scientific concepts—The respiratory system
- Part 4—(October, 1987)—Advanced scientific concepts—The autonomic nervous system and anesthesia
- Part 5—(December, 1987)—Advanced scientific concepts—Standards and safety components for anesthesia delivery systems
- Part 6—(February, 1988)—Advanced scientific concepts—The Henderson-Hasselbalch equation in clinical anesthesia decisions

Each article included a self-assessment quiz, along with a suggested reading list for reference and study.

The examination printed in this issue incorporates material from all six articles. The examination consists of 60 multiple-choice questions, 10 questions from each article. The examination is clearly marked as to which questions refer to which article. Remember, as you are taking the examination, you are free to refer back to the original articles. Note also that there is but one correct answer to be marked for each question.

About your Continuing Education Credit ...
To ensure that a certain level of knowledge has been attained, a minimum of 70% correct answers (42 out of 60) must be achieved. A total of 6 hours of Continuing Education (CE) Credit will be awarded for the successful completion of the examination; partial continuing education credit will not be awarded.

Only those passing the examination will be notified by mail of the successful completion of the course. (The time of this mailing will be dependent on the volume of response; however, notification will be effected prior to the close of the CE Year—July 31, 1988.) AANA members will automatically have their 6 CE Credits recorded for them. Individuals with record-keeping contracts through the AANA will also have the credits recorded for them.

The correct answers to the examination will appear in the August, 1988 issue of the AANA Journal. By keeping a copy of your answers, you will automatically be able to see how you scored.

How to fill out the answer sheet ...
It is recommended that you first mark your answers on the examination itself (so that you have your own record). Then, transfer your answers in pencil to the answer sheet, which appears on the other side of this page. Be sure to include your name, address, and AANA identification number. (Non-AANA members should include a $30 tuition fee—payable to the AANA: Journal Course—along with their examination answer sheet.)

Important deadline ...
The examination answers must be post-marked by June 17, 1988. Adequate time must be allowed for the examination to be processed to ensure that all CE Credits are recorded prior to the end of the CE year. Mail your answer sheet to:

American Association of Nurse Anesthetists
216 Higgins Road
Park Ridge, Illinois 60068-5790
Attn: Journal Course

Much success ...
We hope that you have found this seventh AANA Journal course to be of value. We wish you well in its successful completion.
American Association of Nurse Anesthetists
216 Higgins Road
Park Ridge, Illinois 60068

AANA Journal Course No. 7 Examination
Advanced scientific concepts:
Update for nurse anesthetists
(Issued April, 1988)

Please PRINT.

Name: _____________________________
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Address: __________________________________________
(street) (city) (state) (zip code)

AANA Membership ID Number: □ □ □ □ □

☐ If you are not an AANA member, check here. Be sure to enclose your $30 tuition fee payable to AANA.

Please circle one response for each question.
For example, 36. 1 2 3 4 would indicate that the third alternative was chosen in response to question 36.
Please erase completely any changed responses.

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Advanced scientific concepts—
The cardiovascular system

1. Which of the following is correct with regard to compliance:
   1. its determination integrates flow and pressure
   2. it is a measure of change in volume over change in pressure
   3. it remains constant across a broad physiologic range
   4. it remains constant in the face of hemodynamic alterations

2. Which of the following are primary determinants of coronary blood flow:
   1. diastolic pressure
   2. LVEDP
   3. heart rate
   4. all of the above

3. Which of the following is not true with regard to the endocardial viability ratio (EVR):
   1. it integrates indices of supply and demand
   2. it normally remains above 1.0
   3. it remains independent of heart rate
   4. values <0.7 parallel relative reduction in subendocardial flow

4. Which is not true with regard to resistance and afterload:
   1. resistance is a determinant of pressure
   2. the two are interchangeable correlates
   3. afterload indicates the inotropic state necessary to initiate the ejection phase of systole
   4. resistance may be a determinant of afterload in the normal state

5. The blood supply to the anterior portion of the left ventricle is:
   1. circumflex artery
   2. right coronary artery
   3. posterior descending artery
   4. left anterior descending artery

6. Which of the following is inaccurate with regard to the cardiovascular effects of the inhalation agents?
   1. systemic vascular resistance is decreased with all volatile agents
   2. nitrous oxide mildly increases systemic vascular resistance
   3. concomitant use of nitrous oxide may offset some of the hemodynamic effects of the volatile agents
   4. at 1 MAC, the degree of myocardial depression is the same with all the agents

7. Which of the following is/are true with regard to aortic stenosis?
   1. bradycardia may be beneficial to its management
   2. cardiac output may become rate dependent as stroke volume becomes limited
   3. use of myocardial depressants to prevent tachycardia and to reduce inotropy is indicated
   4. both “2” and “3”
8. Which of the following is not true of ventricular compliance?
1. it is unchanged with hypertrophy
2. compliance is reduced with ventricular ischemia or inotropic drugs
3. noncompliant ventricles require higher filling pressures for maintenance of normal left ventricular volumes
4. the pressure-volume relationship is no longer linear

9. Which of the following is not true of vascular resistance:
1. it can be calculated with known mean pressures and cardiac output
2. normal values are 50-250 for PVR and 9-15,000 for SVR
3. resistance relates linearly and inversely with compliance
4. responsiveness to vasodilators is partially dependent upon the vascular system involved

10. Select the false statement regarding coronary blood flow:
1. the major determinant is PaCO2
2. normal flow is about 225 cc/min
3. 70% of flow occurs during diastole
4. autoregulation occurs over mean pressures of 60-150 mmHg

11. Compensatory mechanisms for chronic anemia include:
1. tachycardia
2. increased blood viscosity
3. decreased 2,3 DPG
4. alkalosis

12. The glomerulus and peritubular capillaries are separated from each other by the:
1. afferent arteriole
2. arcuate artery
3. efferent venule
4. efferent arteriole

13. The loop of Henle is well suited for its role in urine concentration because:
1. its water permeability is so closely regulated by ADH
2. its anatomy allows for a countercurrent transfer of solutes and water between the limb and interstitium
3. its active secretion of K+ which contributes to the solute gradient
4. its active transport of water in the thick ascending limb allows for the remaining solutes to be concentrated

14. A 75-year-old, 70-kg male is admitted for repair of a right inguinal hernia. All laboratory work is normal except for a BUN 30 mg/100 ml, serum creatinine 2 mg/100 ml, and K+ 5.0 mEq/L. What is the estimated creatinine clearance?
1. 12.6 ml/min
2. 151 ml/min
3. 31 ml/min
4. 125 ml/min

15. Serum potassium can be lowered by all of the following except:
1. calcium
2. glucose insulin infusion
3. hyperventilation
4. sodium bicarbonate

16. The patient with end stage renal disease is likely to have the following electrolyte abnormality:
1. hypokalemia
2. hypomagnesemia
3. hypophosphatemia
4. hypocalcemia

17. In the patient with chronic renal disease who is not dependent on hemodialysis, the following anesthetic should be avoided:
1. enflurane
2. fentanyl
3. halothane
4. isoflurane

18. The ideal nondepolarizing muscle relaxant in patients with chronic renal failure is:
1. pancuronium
2. atracurium
3. d-Tubocurarine
4. metocurarine

19. A patient with suspected renal disease has a creatinine clearance of 25 ml/minute. This represents:
1. normal renal function
2. mild renal dysfunction
3. moderate renal dysfunction
4. severe renal dysfunction

20. The following renal blood vessel plays an important role in the concentration of urine:
1. glomerulus
2. peritubular capillary
3. arcuate artery
4. vasa recta
21. Boyle's law states that in a closed system pressure changes:
1. directly with volume
2. inversely with volume
3. inversely with temperature
4. independently of volume

22. Which of the following is true regarding expenditure during the respiratory cycle?
1. inspiration and expiration are active
2. inspiration and expiration are passive
3. inspiration is passive, expiration is active
4. inspiration is active, expiration is passive

23. Which of the following is not a collateral means of ventilation?
1. Lamberts canals
2. Pores of Kohn
3. Bucket's tubules
4. interductal tubes

24. Alveolar surface area in a normal adult is approximately:
1. 70 sq. meters
2. 10 sq. meters
3. 7 sq. meters
4. 1 sq. meter

25. Which of the following is true concerning the hypoxic pulmonary vasoconstrictor (HPV) response?
1. it is a locally mediated response
2. halothane has been shown to inhibit this response
3. the use of nitrous oxide can attenuate the response
4. all of the above

26. Which of the following is true in the administration of anesthesia to a patient with emphysema?
1. denitrogenation will occur rapidly in a patient with emphysema
2. isoflurane is the inhalation agent of choice
3. the use of nitrous oxide may lead to the rupture of bullae and a tension pneumothorax
4. narcotics are an unacceptable alternative because of the high degree of respiratory depression postoperatively

27. Which of the following can be determined from an FVC?
1. FEV1
2. MMEFR
3. 1 and 2
4. none of the above

28. Which of the following is NOT true regarding obstructive pulmonary disease?
1. the horizontal length of the flow volume loop is shortened
2. decreased FEV1%
3. there is a large reduction in FEV1
4. spirometry should be repeated after bronchodilator therapy

29. Which of the following statements best summarizes the effect of restrictive lung disease?
1. increase work of breathing, primary effect expiratory
2. decrease work of breathing, primary effect expiratory
3. increase work of breathing, primary effect inspiratory
4. decrease work of breathing, primary effect inspiratory

30. Which of the following would indicate an obstructive process?
1. increased resistance to inspiration
2. increased resistance to expiration
3. decreased expiratory time
4. increased inspiratory time

31. The immediate precursor for the synthesis of norepinephrine is:
1. epinephrine
2. GABA
3. dopa
4. dopamine

32. Pancuronium may cause tachycardia by:
1. stimulation of basal ganglia
2. blockade of muscarinic receptors
3. direct stimulation of beta 2 receptors in the heart
4. stimulation of muscarinic receptors in the heart

33. Bradycardia associated with narcotic administration is primarily due to:
1. stimulation of the vagal nucleus
2. a reduction in central sympathetic outflow
3. a direct myocardial depressant effect
4. blockade of beta 1 receptors in the heart

34. Stimulation of presynaptic alpha 2 receptors will:
1. facilitate the release of norepinephrine
2. cause vasoconstriction of all smooth muscle
3. alpha 2 receptors do not exist presynaptically
4. inhibit further release of norepinephrine
35. With spinal or epidural anesthesia, the sympathetic cardioaccelerator fibers are fully blocked at:
1. sensory dermatome block to T-7
2. sensory dermatome block to T-10
3. sensory dermatome block to T-4
4. cardioaccelerator fibers will only be blocked if a total spinal occurs

36. Which of the following cranial nerves makes the greatest contribution to parasympathetic nervous system (PNS) function:
1. III (oculomotor)
2. X (vagus)
3. IX (glossopharyngeal)
4. VII (facial)

37. Which of the following conditions alert the anesthesiologist to autonomic dysfunction:
1. Shy-Drager syndrome
2. ankylosing spondylitis
3. sickle cell anemia
4. Martan's syndrome

38. The action of norepinephrine is terminated primarily by:
1. MAO metabolism
2. diffusion away from the receptor site
3. reuptake into postsynaptic storage sites
4. reuptake into the presynaptic nerve terminal

39. Which of the following inhalational agents does not attenuate baroreceptor control of heart rate:
1. halothane
2. nitrous oxide
3. enflurane
4. isoflurane

40. The sympathetic blockade and consequent hypotension that occurs with spinal or epidural anesthesia can be attributed primarily to:
1. blockade of cardioaccelerator fibers
2. an increase in venous return
3. arterial vasodilation
4. an increase in venous capacitance

41. The organization which set forth the 1979 standards for minimum performance and safety of anesthesia machines is:
1. American Association of Nurse Anesthetists
2. National Institute of Occupational Safety and Health
3. American National Standards Institute
4. American Society for Testing and Materials

42. Standards for minimum performance and safety of equipment serve the anesthesia community in the following way(s):
1. they guide manufacturers toward the level of performance and safety needed in practice
2. they direct the course of uniformity among machine systems produced
3. they ensure that anesthesia machines purchased meet minimum safety requirements
4. all of the above

43. There are more than 400 organizations that write standards in the United States. Select the example below that is not listed in the text as a standards-writing body.
1. American Society for Testing and Materials
2. American National Standards Institute
3. Food and Drug Administration
4. Association for the Advancement of Medical Instrumentation

44. A rule that is established by authority, expertise, custom, or general consensus and serves as a model for quality assessment is called a:
1. law
2. standard
3. statute
4. guideline

45. A standard that is developed by representatives of all sectors of a community which have interest in its use and becomes the basis for commercial and regulatory policies is described as a(an):
1. company standard
2. government standard
3. industry standard
4. full-consensus standard

46. Contemporary anesthesia machine designs that help to prevent the delivery of hypoxic mixtures include:
1. in-line oxygen analyzers
2. oxygen/nitrous oxide proportionators
3. gas specific and size dissimilar fittings
4. all of the above

47. What best describes the role of the FDA in dealing with standards for minimum safety and performance of anesthesia machines?
1. requires mandatory compliance with machine standards
2. sets specifications for standards-writing organizations
3. has the authority to promulgate and endorse standards
4. serves to sponsor the activities of standards-writing groups

Advanced scientific concepts — Standards and safety components for anesthesia delivery systems
48. Standards are not legally binding until they become so by a government action. Standard specifications that have become law in more than 33 states and require an oxygen analyzer to check gas delivery following adjustment of an anesthesia machine are found in the:
1. NFPA standard
2. ANSI Z.79 standard
3. NIOSH standard
4. UL standard

49. What safety component was applied as an industry standard 21 years before it became a full consensus standard?
1. pin index safety system
2. self-closing oxygen flush valve
3. check valve in the pipeline inlet
4. pressure sensor shut-off valve

50. More than a decade ago, the advantage of minimum oxygen concentration was specified in industry standards. The purpose of this safety component is to:
1. consistently provide the minimum metabolic level of oxygen to the patient
2. minimize the risk of administering less oxygen to the patient than specified by the manufacturer, e.g., less than 25%
3. limit the practice of administering 100% nitrous oxide to a patient, regardless of the clinical intention
4. all of the above

51. An example of a weak acid is:
1. sodium hydroxide
2. carbonic acid
3. hydrochloric acid
4. hydrazine

52. Maximum physiological compensation for an acid/base imbalance may be expected in:
1. 5 days
2. 15 minutes
3. 18 hours
4. increasingly as time goes by

53. The concentration of the bicarbonate ion in the plasma is normally:
1. 48 meq/L
2. 24 meq/L
3. 6 meq/L
4. 36 meq/L

54. To have a pH of 7.4 it is necessary that:
1. $\frac{HCO_3^-}{PCO_2}$ has a 20/1 ratio
2. $\frac{HCO_3^-}{PCO_2}$ has a 1/5 ratio
3. $\frac{HCO_3^-}{PCO_2}$ has a 1/20 ratio
4. $\frac{HCO_3^-}{PCO_2}$ has a 2/1 ratio

55. Which answer does not describe primary acute respiratory acidosis?
1. this is a reduction is alveolar ventilation for a few minutes to a few hours
2. only the compensation from the chemical buffering system is discernable
3. metabolic acidosis will result
4. metabolic compensation is minimally discernable.

56. A drug that has a pK of "0" means that:
1. 50% of the drug's molecules are charged and 50% are uncharged
2. 0% of the drug's molecules are charged
3. 100% of the drug's molecules are charged
4. 100% of the drug's molecules are uncharged

57. A patient with COPD has the following blood gases: pH = 7.18, $HCO_3^-$ = 24 meq/L, $PCO_2$ = 68 mmHg, and $P_{O_2}$ = 74 mmHg. What is your diagnosis?
1. compensated respiratory acidosis
2. uncompensated metabolic acidosis
3. uncompensated respiratory acidosis
4. compensated metabolic acidosis

58. Which of the following shows the respiratory component not as expected?
1. $HCO_3^- = 19$ meq/L; $CO_2 = 35$ mmHg pressure
2. $HCO_3^- = 31$ meq/L; $CO_2 = 45$ mmHg pressure
3. $HCO_3^- = 35$ meq/L; $CO_2 = 40$ mmHg pressure
4. $HCO_3^- = 24$ meq/L; $CO_2 = 40$ mmHg pressure

59. Which of the following best describes the chemical explanation for the two forms of a drug in the body?
1. Le Chatelier's principle
2. Law of Mass Action
3. drugs are usually weak acids or weak bases
4. all of the above

60. Which of the following is not a compensatory mechanism for acid/base aberrations?
1. fast chemical response
2. fast respiratory response
3. fast hepato/gastrointestinal response
4. slow renal (metabolic) response