



CRCE Through the Journal—2007

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CRCE through the Journal, a program for American Association for Respiratory Care (AARC) members to gain credit for continuing education, is now in its eighteenth year. By reading *RESPIRATORY CARE*—the science journal for respiratory care professionals—and completing this examination, AARC members may earn credit for continuing education.*

This 50-item, multiple-choice examination is based on papers published from June 2006 through May 2007 in *RESPIRATORY CARE*. The issue and page numbers of the paper on which a question is based are shown in brackets following the question. You may consult the cited paper; however, we encourage you to read the paper in its entirety before answering the question. Choose the single most-correct answer, and mark the answer sheet, which is located on the back of this page.

Your answer sheet is the worksheet you will use to record your answers in the AARC's web-based testing module. After registering for the test, paying the \$15 fee by credit card, and entering your answers, your test will be instantly scored. If you correctly answer 35 or more of the 50 items, you will be able to print a signed Certificate of Completion to present to your state board as evidence that you have earned 6 CRCE contact hours. Your CRCE contact hours will also be instantly added to your web-based AARC transcript. You will have two attempts to achieve a passing score. To register and pay for the test go to <http://www.rcjournal.com/> and click on *CRCE Through the Journal—2007*. The online test will be available from **August 1st to October 1st, 2007**. The test answers will be published in the October 2007 issue of the Journal.

We are indebted to Timothy B Op't Holt EdD RRT AE-C FAARC, William Pruitt MBA RRT RPFT AE-C, and William V Wojciechowski MSc RRT, faculty members in the Department of Cardiorespiratory Care at the University of South Alabama, Mobile, Alabama.

*The acceptance of these credits for the fulfillment of license-mandated continuing education is dictated solely by the licensure law of each individual state.

CRCE through the Journal — Answer Sheet

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QUESTIONS: *Please follow the instructions on Page 1069 and use the worksheet we have provided on Page 1070 to mark your answers. You will have two attempts to achieve a passing score. To register and pay for the test go to <http://www.RCJournal.com/> and click on CRCE Through the Journal--2007. The online test will be available from August 1st to October 1st, 2007. The test answers will be published in the October 2007 issue of the Journal.*

1. According to the article entitled *The History and Physics of Heliox*, which of the following definitions describes Graham's law?

- A. The rate of diffusion of a gas is directly related to the molecular weight of the gas density.
- B. The rate of diffusion of a gas is directly related to the square root of the gas density.
- C. The rate of diffusion of a gas is inversely related to the square root of the gas density.
- D. The rate of diffusion of a gas is inversely related to the square of the density of the gas

[June 2006;51(6):608-612]

2. In the article by Myers, a double-blind, randomized controlled trial, conducted by Carter et al, involving the use of 70:30 heliox and 30% O₂ both for 15 minutes on 11 children with status asthmaticus was cited. What conclusion was drawn from this study?

- A. No differences in clinical or dyspnea symptom scores were found.
- B. The patients receiving the 30% O₂ had higher FVCs and FEV₁s than the patient who received 70:30 heliox.
- C. The patients receiving the 70:30 heliox mixture had lower clinical or dyspnea symptom scores than those receiving 30% O₂.
- D. The patients receiving the 70:30 heliox responded better to bronchodilator therapy than those who received 30% O₂.

[June 2006;51(6):619-631]

3. What were the findings of a prospective randomized multicenter study using heliox with noninvasive positive-pressure support ventilation during COPD exacerbations, cited by Venkataraman in his article entitled *Heliox During Mechanical Ventilation*?

- I. Improved the patients' activities of daily living
- II. Decreased the patients' need for daytime oxygen
- III. Decreased the cost of hospitalization
- IV. Decreased post-ICU stay by about 6 days

- A. I, III only
- B. III, IV only
- C. I, II, III only
- D. I, III, IV only

[June 2006;51(6):633-639]

4. Based on the article by Fink, which of the following 2 gases or gas mixtures share the same threaded connections of the regulator-to-cylinder connectors?

- A. Oxygen and helium
- B. Helium and nitric oxide
- C. Heliox and oxygen
- D. Carbogen and heliox

[June 2006;51(6):651-660]

5. In the study conducted by Berkenbosch and Tobias, what were the advantages of using the forehead reflectance sensor manufactured by Nellcor/Tyco Healthcare?

- I. Perfusion to the forehead increases during conditions of decreased perfusion.
- II. Attachment of sensors to the forehead is more secure than digital probes.
- III. Forehead sensors respond more rapidly than digital sensors.
- IV. Less motion artifact is related to forehead sensors than to digital sensors.

- A. I, III only
- B. II, III, only
- C. I, II, IV only
- D. I, III, IV only

[July 2006;51(7):726-731]

6. Based on the study done by Knowles et al entitled *Effects of Syringe Material, Storage Time, and Temperature on Blood Gases and Oxygen Saturation in Arterialized Human Blood Samples*, how should an arterial blood sample obtained from a patient with leukocytosis be processed before analysis?

- A. Obtained in a glass syringe and stored at 0° C to 4° C
- B. Obtained in a plastic syringe and stored at 0° C to 4° C
- C. Stored in a glass syringe at room temperature
- D. Obtained in a glass syringe at room temperature, and analyzed immediately

[July 2006;51(7):732-736]

7. In the research performed by Tearl et al, what were the jobs of the primary respiratory therapist when respiratory-technology-dependent children were discharged from the hospital?

- I. To select a durable medical equipment company for the patient
- II. To complete a demographic database
- III. To ensure patient compliance with the therapeutic regimen in the home
- IV. To oversee the training provided to the family by the ward-based respiratory therapist

- A. I, III only
- B. II, IV only
- C. II, III only
- D. I, II, IV only

[July 2006;51(7):744-749]

8. Based on principles of inspiratory muscle thixotropy as defined by Izumizaki et al, which of the following outcomes is possible?

- A. Improving lung compliance
- B. Decreasing the work of breathing
- C. Reducing lung hyperinflation
- D. Decreasing overall airway resistance

[July 2006;51(7):750-757]

9. What are the groups of automatic, medullary, breathing controllers located on either side of the central neuro-axis, as discussed by Dr Joshua Benditt?

- I. The pontine center
- II. The apneustic center
- III. The ventral respiratory group
- IV. The dorsal respiratory group

- A. I, II only
- B. III, IV only
- C. I, IV only
- D. II, III only

[August 2006;51(8):829-837]

10. According to MacIntyre, what form of treatments should be used to improve respiratory and systemic muscle dysfunction in patients who have chronic inflammatory states?

- I. Bronchodilators
- II. Exercise therapy
- III. Nutritional repletion
- IV. Glucocorticosteroids

- A. I, IV only
- B. I, III only
- C. II, III only
- D. I, II, III only

[August 2006;51(8):840-848]

11. In the article authored by Brown et al, what tidal volume during invasive positive pressure ventilation is suggested to improve the speech of spinal cord injury patients receiving mechanical ventilation?

- A. < 1.0 L
- B. 1.2 L
- C. 2.6 L
- D. > 3.0 L

[August 2006;51(8):855-867]

12. According to Lechtzin, what is the most common form of treatment for chronic hypoventilation in patients with amyotrophic lateral sclerosis?

- A. Noninvasive positive pressure ventilation
- B. Continuous mechanical ventilation
- C. Intermittent positive pressure breathing
- D. Rocking bed

[August 2006;51(8):871-881]

13. According to Hess, who authored the article entitled *Noninvasive Ventilation in Neuromuscular Disease: Equipment and Application*, what are the problems associated with using a heat-and-moisture exchanger (HME) with NPPV?

- I. An HME reduces the amount of PEEP set on the noninvasive ventilator.
- II. An HME produces increased dead space, which potentially causes an increased triggering pressure.
- III. An HME might increase the resistance causing difficulty with ventilator cycling.
- IV. An HME tends to cause a buildup of condensate in the ventilator tubing, interfering with ventilator triggering.

- A. I, III only
- B. I, IV only
- C. II, III only
- D. II, III, IV only

[August 2006;51(8):896-911]

14. In the article written by Dhand and Johnson pertaining to the care of chronic tracheostomy, evidence favors performing a tracheostomy on mechanically ventilated ICU patients who are expected to require mechanical ventilation for what length of time?

- A. > 1 week
- B. > 2 weeks
- C. > 3 weeks
- D. > 4 weeks

[September 2006;51(9):984-1001]

15. In the article entitled *Full-Time Noninvasive Ventilation: Possible and Desirable*, written by Benditt, who is given credit for developing the iron lung?

- I. Shaw
- II. Dalziel
- III. Drinker
- IV. Affeldt

- A. II only
- B. III only
- C. I, III only
- D. II, IV only

[September 2006;51(9):1005-1012]

16. Based on the article *Clinical Approach to the Weak Patient in the Intensive Care Unit*, written by Dhand, which of the following signs are useful for ascertaining spinal cord involvement in ICU patients presenting with generalized weakness?

- I. Babinski sign
- II. Loss of anal reflex
- III. Ptosis
- IV. Flexor spasms

- A. I, III only
- B. II, IV only
- C. I, II, IV only
- D. II, III, IV only

[September 2006;51(9):1024-1040]

17. Based on the review written by Deem, what is the only intervention to date that diminishes the incidence of ICU-acquired neuromuscular disorders?

- A. Noninvasive positive pressure ventilation
- B. Neuromuscular blockade
- C. Corticosteroid administration
- D. Insulin therapy

[September 2006;51(9):1042-1052]

18. In the article by Walsh et al describing exhaled breath condensate pH in mechanically ventilated patients, which of the following was given as a normal airway pH?

- A. pH between 7.2 – 7.5
- B. pH between 7.3 – 7.5
- C. pH between 7.4 – 7.7
- D. pH between 7.5 – 7.8

[October 2006;51(10):1125-1131]

19. In the article on PEEP and lung recruitment, which of the following describes the impact on F_{IO_2} and PEEP after the recruitment maneuver was performed?

- A. The F_{IO_2} setting was decreased by 31%; the PEEP setting was decreased by 23%
- B. The F_{IO_2} setting was decreased by 23%; the PEEP setting was increased by 11%
- C. The F_{IO_2} setting was decreased by 10%; the PEEP setting was decreased by 18%
- D. The F_{IO_2} setting was decreased by 18%; the PEEP setting was not changed significantly

[October 2006;51(10):1132-1139]

20. In the article describing the effects of apparatus dead space on P_{aCO_2} , which of the following describes how this research differed from the 2 other similar studies regarding V_T and \dot{V}_E ?

- A. This project used a higher V_T with a similar \dot{V}_E compared to the other 2.
- B. This project used a lower V_T with a lower \dot{V}_E compared to the other 2.
- C. This project used a similar V_T with a higher \dot{V}_E compared to the other 2.
- D. This project used a lower V_T with a similar \dot{V}_E compared to the other 2.

[October 2006;51(10):1140-1144]

21. In the evaluation of a transcutaneous and end-tidal capnometer, what circumstances called for a re-estimation of effectiveness of the Tosca system?

- I. When the patient is breathing supplemental oxygen by mask
- II. When the temperature setting is at 42° C
- III. When the sensor is placed on the earlobe
- IV. When the sensor is used for an application time of 12 hours

- A. I, II only
- B. I, III only
- C. II, III only
- D. III, IV only

[October 2006;51(10):1162-1165]

22. In Farha's article concerning NPPV utilized on the regular hospital ward, which of the following is true concerning reasons for NPPV failure in the full-support patients?

- A. Bilateral infiltrates were given the number one association with NPPV failure.
- B. A specific underlying cause of respiratory failure had the first listed association with NPPV failure.
- C. Increased secretions were the primary association with NPPV failure.
- D. Claustrophobia and intolerance were the major association with NPPV failure.

[November 2006;51(11):1237-1243]

23. What was a notable item in the article concerning NPPV utilized on the regular hospital ward in regard to the patients in the do-not-intubate (DNI) group included in this research?

- A. 3 of the 5 DNI patients were successfully treated and discharged home.
- B. The number of patients with COPD, pneumonia, and pulmonary edema were equal to each other when examining the cause for respiratory failure and the need for NPPV.
- C. Pneumonia was the number one cause for respiratory failure and the need for NPPV.
- D. Bilateral infiltrates and claustrophobia and intolerance were the primary associations with NPPV failure.

[November 2006;51(11):1237-1243]

24. In the article involving a way to increase jet nebulizer delivery in ventilated newborns, what was the only irreversible modification mentioned in the article?

- A. The ventilator circuit had a spinning disk glued in place in the expiratory limb.
- B. The nebulizer had a baffle added in the outflow track.
- C. The heated wire on the inspiratory limb was lengthened by 4 inches.
- D. The nebulizer had a hole cut into the top.

[November 2006;51(11):1244-1250]

25. In the article by Wall and Schnapp on radiation pneumonitis, which of the following were considered to be risk factors for radiation-induced lung injury?

- I. Steroid withdrawal
- II. Female sex
- III. Pentoxifylline therapy
- IV. Performance status

- A. I, II, IV only
- B. III, IV only
- C. I, II, III only
- D. I, II only

[November 2006;51(11):1255-1260]

26. In the article about patients with Guillain-Barré syndrome, what percentage of patients in the years 1980 – 1990 had atelectasis during the time they received mechanical ventilation?

- A. 60
- B. 15
- C. 31
- D. 22

[December 2006;51(12):1403-1407]

27. In the article about patients with Guillain-Barré syndrome, how many of the patients received noninvasive ventilation?

- A. 3
- B. 9
- C. 7
- D. 0

[December 2006;51(12):1403-1407]

28. In the article from the Netherlands on time to wean after tracheostomy, what did the authors do that caused the incidence of tracheostomy to increase from 7% to 16%?

- A. They adjusted the results by including cardiopulmonary surgery patients.
- B. They excluded uncomplicated cardiopulmonary surgery and general surgery patients.
- C. They limited the results to view only the neurology/neurosurgery patients.
- D. They excluded patients who were initially intubated in the operating room.

[December 2006;51(12):1408-1415]

29. In the article by Baddar et al on asthma management protocol, what was considered by the authors to be a major limitation to this research project?

- A. The study did not evaluate the standards of asthma management.
- B. The study did not enroll a sufficient number of female patients.
- C. The protocol relied on PEF and did not include spirometry.
- D. The study did not enroll patients who had surgery within the last 3 months.

[December 2006;51(12):1432-1440]

30. In the article regarding the time course of physiologic variables in response to VILI, what was found concerning lung-unit collapse under conditions of high inflation pressure?

- A. High inflation pressures accelerated the drop in P_{aO_2} .
- B. High inflation pressures blunted the occurrence of lung-unit collapse in ventral lung regions.
- C. Stretching and shearing caused an elevation of IL-6 and TNF- α .
- D. Overstretching may be more harmful in injured tissue than in normal tissue, thus causing the injury to propagate.

[January 2007;52(1):31-37]

31. In the article concerning humidification during NPPV, what did the researchers find concerning delivered pressure (P_D) when using the heated humidifier?

- A. P_D was not significantly changed when using the heated humidifier.
- B. P_D decreased by about 1 cm H₂O when using the heated humidifier.
- C. P_D decreased by about 3 cm H₂O when using the heated humidifier.
- D. P_D decreased by about 6 cm H₂O when using the heated humidifier.

[January 2007;52(1):38-44]

32. In the case report concerning chronic necrotizing pulmonary aspergillosis, how long of a possible delay factor for making this diagnosis was mentioned?

- A. 2 to 5 weeks
- B. 1 to 3 months
- C. 3 to 7 months
- D. 1 to 1½ years

[January 2007;52(1):56-58]

33. Based on the arterial blood gas results reported in the teaching case concerning *pneumocystis jiroveci* pneumonia, while breathing room air, what was the patient's P_{aO_2}/F_{IO_2} (P/F ratio)?

- A. 452
- B. 333
- C. 238
- D. 200

[January 2007;52(1):59-63]

34. In their study of mechanically ventilated patients without obstructive disease who received bronchodilators, Chang et al concluded that:

- A. Airway resistance was less in those receiving bronchodilators.
- B. 36% of the patients they included in their study received bronchodilators without clear indication.
- C. The cost of delivering bronchodilators to their experimental group was more than in the control group.
- D. Work of breathing was higher in those receiving bronchodilators.

[February 2007;52(2):154-158]

35. Which of the following parameters had the greatest affect on the outcome of a one-hour spontaneous breathing trial, according to Chao and Scheinhorn in their study of a weaning protocol?

- A. Rapid shallow breathing index
- B. Age of the patient
- C. Patient's tracheostomy tube size
- D. Patient's gender

[February 2007;52(2):159-165]

36. What was the purpose of the impedance threshold device studied by Idris et al?

- A. Use as an inspiratory muscle trainer in patients with chronic obstructive pulmonary disease.
- B. The device is to be used as a PEEP device for transport ventilators.
- C. It is to be used for secretion clearance in patients with retained secretions.
- D. It is used to increase venous return and blood pressure maintenance in those with clinical autonomic dysfunction.

[February 2007;52(2):177-183]

37. What are the characteristics of the aerosol delivery systems for Iloprost described by VanDyke and Nikander?

- I. They are all jet nebulizers.
- II. The I-neb incorporates mesh technology to create a mist.
- III. They are breath actuated.
- IV. They all have an integrated air compressor.

- A. I, III only
- B. II, III only
- C. I, IV only
- D. II, IV only

[February 2007;52(2):184-190]

38. Which of the following small volume nebulizer (SVN) use policies are supported by O'Malley's bacteriologic surveillance study in patients with cystic fibrosis?

- A. Daily decontamination of the SVN by central supply
- B. Use of a single SVN by the patient for their entire stay, unless it is visibly soiled
- C. Daily replacement of the SVN with a new SVN
- D. Bedside disinfection of the SVN by the therapist after each treatment

[March 2007;52(3):258-262]

39. Which of the following educational methods was determined to be best for maximizing scores in performance of the mini-BAL procedure, in the study by Tuttle et al?

- A. Power-point presentation
- B. Lecture/demonstration
- C. Observation of competent peers
- D. Use of a simulator

[March 2007;52(3):263-270]

40. In their study of F_{IO_2} during high frequency percussive ventilation, Allan and Naworol reported that

- A. Supplemental oxygen will restore the F_{IO_2} in patients who have acute respiratory distress syndrome, with a deflated endotracheal tube cuff.
- B. In a lung model, supplemental oxygen can restore F_{IO_2} lost due to ambient air entrainment through the failsafe valve of the high frequency percussive ventilator.
- C. During cuff deflation, F_{IO_2} increases during high frequency percussive ventilation because there is less air entrainment through the venturi.
- D. Occlusion of the inspiratory fail safe valve increased ventilatory pressures during high frequency percussive ventilation in patients with acute respiratory distress syndrome.

[March 2007;52(3):271-277]

41. Several problems with aerosolized antibiotics were discussed by MacIntyre and Rubin. Among them were:
- I. There have been no studies showing effectiveness of aerosolized antibiotics in any population
 - II. The inability of aerosolized antibiotics to penetrate deeply in to the tracheobronchial tree
 - III. Antibiotic resistance
 - IV. Bronchospasm due to inhalation of the antibiotic
- A. I, II, III only
 - B. II, III, IV only
 - C. I, II, IV only
 - D. I, III, IV only

[April 2007;52(4):416-421]

42. Inaccuracy during capnography is caused by which of the following factors, according to Cheifetz and Myers?
- I. Insensitivity of capnography to endotracheal tube dislodgement or movement
 - II. Sampling errors
 - III. Diseases that increase dead space
 - IV. Diseases that increase extrapulmonary shunt
- A. I, II, III only
 - B. I, III, IV only
 - C. I, II, IV only
 - D. II, III, IV only

[April 2007;52(4):423-438]

43. According to Deem and Hurford, what is the most compelling reason for therapeutic hypothermia in cardiac arrest survivors?
- A. Strong encouragement offered by the American Heart Association's Advanced Cardiac Life Support program
 - B. The potential to save lives
 - C. A favorable effect on patients with septic shock
 - D. It decreases the ventricular fibrillation threshold

[April 2007;52(4):443-450]

44. According to Kallet and Branson, recruitment maneuvers and the open-lung approach are based on:
- A. Sustained inflation followed by the addition of PEEP
 - B. The use of PEEP as a lung recruitment maneuver
 - C. The ARDSnet PEEP/F_{IO₂} tables
 - D. The cause of ARDS (pulmonary versus nonpulmonary)

[April 2007;52(4):461-475]

45. What conclusion should be drawn from the discussion of adaptive pressure control modes by Branson and Chatburn?
- A. Weaning is automated with adaptive pressure control modes.
 - B. Breathing is more comfortable on adaptive pressure control modes.
 - C. Transalveolar pressure and risk of barotrauma are lower in adaptive pressure control modes.
 - D. Patient survival is better with adaptive pressure control modes.

[April 2007;52(4):478-485]

46. Failure of noninvasive ventilation is indicated by which of the following factors, according to Hess and Fessler?
- I. Failure to dissipate the signs of respiratory distress
 - II. Failure to decrease the respiratory rate
 - III. Lack of improvement in blood gases within an hour of implementation
 - IV. Failure to increase tidal volume by 25% or 200 mL
- A. I, III, IV only
 - B. I, II, IV only
 - C. I, II, III only
 - D. II, III, IV only

[May 2007;52(5):568-581]

47. According to Hurford and Cheifetz, heliox is an important adjunct in the treatment of patients with severe airways obstruction receiving mechanical ventilation because:
- A. It has an anti-inflammatory mechanism that helps treat bronchospasm.
 - B. Several large randomized clinical trials support its use.
 - C. It passes through narrow airways with less turbulence than air/oxygen mixtures.
 - D. Patients ventilated with heliox are weaned faster than patients breathing air/oxygen mixtures.

[May 2007;52(5):582-591]

48. According to Fessler and Hess, what conclusion may be reached about high frequency oscillatory ventilation (HFOV) for adults in ARDS?
- A. HFOV can provide gas exchange at lower tidal volumes than conventional ventilation.
 - B. Lung recruitment is not as effective with HFOV as with conventional ventilation.
 - C. Less sedation and paralysis are needed with HFOV.
 - D. HFOV is an economical form of ventilation in ARDS.

[May 2007;52(5):595-605]

49. What common pitfalls of weaning protocols did Chatburn and Deem identify in their study?

- I. Inflexibility in the use of the protocol
- II. Variability in adherence with the protocol
- III. Problems with the control group in several studies supportive of protocols
- IV. Appealing therapies become institutionalized before being rigorously proved to improve outcomes

- A. I, II, III only
- B. II, III, IV only
- C. I, III, IV only
- D. I, II, III, IV

[May 2007;52(5):609-619]

50. Which of the following statements refer to performance of a lung recruitment maneuver, according to Kacmarek and Kallet?

- I. Recruitment should be performed up to the point of maximum curvature.
- II. The lung should be recruited with pressure high enough to open recruitable lung.
- III. Lung recruitment should be performed as early as possible in the course of ALI/ARDS.
- IV. The patient should be monitored for hemodynamic compromise and barotrauma.

- A. II, III, IV only
- B. I, III, IV only
- C. I, II, III only
- D. I, II, IV only

[May 2007;52(5):622-631]

Enter the answers to the questions online at <http://www.rcjournal.com/> and click on CRCE Through the Journal—2007. The online test will be available from **August 1st to October 1st, 2007.**