2014 International Mock Board Exam Coalition

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Written Section – 230 Questions

**Referenced Answers – 75 Pages**

***This examination is meant to be used as a study tool when preparing for the ACLAM or ECLAM Certifying Examinations. The material presented in this mock examination follows the ACLAM role delineation document, but is not necessarily reflective of the ACLAM or ECLAM Certifying Examinations.***

**2014 Exam Contributors**

**Asia**

Bryan Ogden DVM, DACLAM – Coordinator

Anna Acuna, DVM

Michele Bailey, DVM DACLAM

Enoka Bandularatne, BVSc, DACLAM, PhD  
Ralph Bunte, DVM, DACVP

Michelle Loh, DVM

Rex Manguiat, DVM

Diana Scorpio, DVM, MPH, DACLAM

Wendy Williams DVM, DACLAM

**Canada**

Patricia V. Turner, MSc, DVM, DVSc, DACLAM, DABT - Coordinator

Dave Hanwell, MS, DVM, DVSc, DACLAM

Mahesh Jonnalagadda, DVM, MS, PhD, DACLAM

Shawn Petrik, MSc, DVM, Dipl Path

Andrew Winterborn, DVM, DACLAM

**Caribbean/Latin America**

Marilyn Arce, DVM, MLAS, DACLAM - Coordinator

Olga D. Gonzalez, DVM, DACVP

**Europe (Mock ECLAM Exam)**

Michael Wilkinson, DVM, CertLAS, PhD, DipECLAM - Coordinator

José M. Sánchez-Morgado, DVM, MSc, PhD, DipECLAM

Yolanda Saavedra, DVM, PhD, DipECLAM

**Midwest (Colorado)**

Ryan Curtis, DVM (Coordinator)

Lon Kendall, DVM, PhD, DACLAM (Coordinator)

Jessica Ayers, DVM, DACLAM

Suhrim Fisher, DVM

Lynne Kesel, DVM

Carmen Ledesma-Feliciano, DVM

James Owiny, DVM, DACLAM

Wendy Tuttle, DVM

Sue VandeWoude, DVM, DACLAM

**Midwest (Indiana)**

Deb Hickman, MS, DVM, DACLAM – Coordinator

**Midwest (Wisconsin)**

Andres F. Mejia, DVM, MS, DACLAM – Coordinator

Jennifer Coonen, DVM, DACLAM

Christina Cruzen, DVM, DACLAM

Casey Fitz, DVM

Rebekah Franklin, DVM

Bettina Gentry, DVM, PhD

Jatinder Gulani, DVM, PhD, DACLAM

Raman Muthuswamy, BVSc, MVSc, PhD, DACVP

Heather Simmons, DVM, DACVP

**2014 Exam Contributors**

**Mid-Atlantic**

Susan Goodwin DVM, MS, DACLAM - Coordinator

LTC Carrie G. Benton DVM, DACLAM (Co-Chair)

LTC Larry Shelton, DVM, MPH, DACLAM, DACVPM (Co-Chair)

MAJ Vince Hawley, DVM, MPH, DACLAM (Co-Chair)

MAJ Krystal Bean, DVM, DACLAM

LTC Dave Bentzel, DVM, MPH, DACLAM, DACVPM

LTC Mike Bonhage, DVM, MPH, DACLAM, DACVPM

LTC Sarah Bro, DVM, MPH, DACLAM

LTC Todd Collins, DVM, MPH, DACLAM, DACVPM

LTC Ken Despain, DVM, MS, DACLAM, DACVPM

LTC Dawn Fitzhugh, DVM, MPH, DACLAM, DACVPM

LTC Chad Foster, DVM, DACLAM

Jatinder Gulani, DVM, PhD, DACLAM

Alec Hail, DVM, DACLAM

COL Chris Hanson, DVM, MPH, DACLAM

LTC Joe Harre, DVM, MPH, DACLAM

LTC Ken Jacobsen, DVM, MPH, DACLAM, DACVPM

MAJ Matt Johnson, DVM, DACLAM

LCDR Jan Linkenhoker, DVM, MSPH, DACLAM

Rohan Rajapakse, DVM, MS, DACLAM

LTC (P) PJ Rico, DVM, MPH, DACLAM

MAJ Joe Royal, DVM, MPH, DACLAM, DACVPM

Raja Sriperumbudur, DVM, PhD, DACLAM

LTC Julie Stephens-DeValle, DVM, MPVM, DACLAM, DACVPM

MAJ Brett Taylor, DVM, MPH, DACLAM, DACVPM

**Northeast (CT)**

Jodi Scholz, DVM, DACLAM - Coordinator

Peter Smith, DVM, DACLAM - Coordinator

Dil Ekanayake Alper, DVM, PhD

Meghan Connolly, MVB

Morgan Oexner, DVM, MS

Steven Wilson, VMD, DACLAM

**Northeast (NY)**

Kerith Luchins, DVM, DACLAM - Coordinator

Gillian Braden, MLAS, VMD

Chereen Collymore, DMV

Leslie Diaz, DVM

Philip Gerwin, MS, DVM

Andrew Gorman, DVM

Robin Kramer, DVM

Christine Lieggi, DVM, DACLAM

Melissa Nashat, DVM, PhD

Irka Redelsperger, MLAS, DVM

Rodolfo Ricart, DVM, DACLAM

**2014 Exam Contributors**

**Pacific Northwest**

Thea Brabb, DVM, PhD, DACLAM - Coordinator

Stanton Gray, DVM, PhD, DACLAM – Coordinator

Stephanie Murphy, VMD, PhD, DACLAM - Coordinator

Andrew Burich, DVM, MS, DACLAM

Lesley Colby, DVM, MS, DACLAM

Brandy Dozier, DVM

Jennifer Grossman, DVM

Charlotte Hotchkiss, DVM, PhD, DACLAM

Jeff Stanton, DVM, MA, DACLAM

**Southeast**

Julia Whitaker, DVM, MS, DACLAM- Coordinator

Craig Fletcher, DVM, PhD, DACLAM- Coordinator

Angela King-Herbert, DVM, DACLAM

Terry Blankenship-Paris, DVM, DACLAM

Diane Forsythe, DVM, DACLAM

Anna Hampton, DVM, DACLAM

Glicerio Ignacio, DVM, MS, DACLAM

David M. Kurtz, DVM, PhD, DACLAM

Kathy Laber, DVM, MS, DACLAM

Leslie Martin, JD, DVM, DACLAM

Jacquelyn Tubbs, DVM, DACLAM

Debbie Vanderford, DVM, CPIA, DACLAM

Chandra Williams, DVM, CPIA, DACLAM

Kyha Williams, DVM, DACLAM

Mary Ann Vasbinder, DVM, DACLAM

Coralie Zegre-Cannon, DVM, DACLAM

**West Coast (Northern California)**

Sean Adams, DVM, PhD - Coordinator

Laurie Brignolo, DVM, DACLAM - Coordinator

Angela Chang, DVM - Coordinator

Monika Huss, DVM - Coordinator

Elizabeth Carbone, DVM

Helen Chum, DVM

Christie Ferrecchia, DVM

Kristin Grimsrud, DVM, PhD

Andrew Haertel, DVM

Krista Lindstrom, DVM, DACLAM

Gregory Salyards, DVM

Rebecca Sammack, DVM, DACLAM

Travis Seymour, DVM

**West Coast (Southern California)**

Trinka Adamson, MS, DVM, DACLAM - Coordinator

Ari Aycock-Williams, DVM, DACLAM

Deepti Chadalavada, DVM

James Finlay, DVM

Sumanth Putta, DVM, MS, PhD, DACLAM

**1.** Which of the following features is absent from a pseudoprehensile tail but present on a prehensile tail?

a. Bone

b. Hair

c. Mobility

d. Tactile pad

**Answer:** **d. Tactile pad**

**Reference:** Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 16 - Nonhuman Primates, pp. 678-679.

**Domain 1**

**2.** Administration of alpha-2 adrenergic agonists in rodents may cause all of the following **EXCEPT**?

a. Analgesia

b. Diuresis

c. Bradycardia

d. Hypothermia

e. Hypoglycemia

**Answer: e. Hypoglycemia**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 22 – Preanesthesia, Anesthesia, Analgesia, and Euthanasia, p. 958-959.

2) Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd ed. Academic Press, San Diego, CA. Chapter 10 – Anesthesia and Analgesia for Laboratory Rodents, p. 262.

**Domain 2**

**3.** The elevated plus maze has been validated in mice for behavioral phenotyping to measure which of the following?

1. Coordination and strength
2. Fear and anxiety
3. Learning and memory
4. Locomotor activity and hyperactivity

**Answer: b. Fear and anxiety**

**References:**

1) Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 3 – Normative Biology, Husbandry, and Models. Academic Press: San Diego, CA. Chapter 15 – Behavioral Testing, p. 517.

2) Bailey et al. 2006. Behavioral phenotyping of transgenic and knockout mice: practical concerns and potential pitfalls. ILAR Journal47(2):124-131.

**Domain 3; Primary Species – Mouse (Mus musculus)**

**4.** Which of the following animal housing situations requires a hand washing sink located near the exit of the animal room and decontamination of clothing before laundering?

1. Bats of unknown rabies status
2. Macaques naturally infected with cercopithecine herpesvirus 1
3. Mice experimentally infected with vaccinia strain modified virus Ankara
4. Syrian hamsters experimentally infected with lymphocytic choriomeningitis virus

**Answer d. Syrian hamsters experimentally infected with lymphocytic choriomeningitis virus**

**Reference:** U. S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and National Institutes of Health. 2009. Biosafety in Microbiological and Biomedical Laboratories. 5th ed. U.S. Government Printing Office, Washington, D. C. Section V—Vertebrate Animal Biosafety Level Criteria for Vivarium Research Facilities, p. 103 (http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5\_sect\_V.pdf ) and Section VIII – Agent Summary Statement, pp. 207, 216, 219 221

(http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5\_sect\_VIII.pdf)

**Domain 4; Secondary Species - Syrian Hamster (Mesocricetus auratus)**

1. According to the Animal Welfare Act and its regulations, no individual dealer or exhibitor shall use any identification tag number for a dog more than once within a period of how many years?
   1. 1
   2. 3
   3. 5
   4. No time limitation as long as identification tag number is assigned to only one animal at a time

**Answer: c. 5**

**Reference:** Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 2 – Regulations, Subpart E - Identification of Animals, §2.51 (c) - Form of official tag (11-06-13 Edition, p. 45) (http://www.aphis.usda.gov/animal\_welfare/downloads/

Animal%20Care%20Blue%20Book%20-%202013%20-%20FINAL.pdf)

**Domain 5; Primary Species - Dog (Canis familiaris)**

**6.** Which of the following organizations was developed to provide scientific standards for laboratory animal use, production, husbandry, transportation, education and training in laboratory animal science, as well as a good mechanism to facilitate information exchange about laboratory animals internationally?

1. AALAS
2. APHIS
3. ILAM
4. ILAR

e. NABR

**Answer: d. ILAR**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 1 – Laboratory Animal Medicine: Historical Perspectives, p. 12-13.
2. http://dels.nas.edu/global/ilar/About-Us

**Domain 6**

**7.** All of the following are common tumors observed in Mongolian gerbils **EXCEPT**?

1. Granulosa cell tumor
2. Adenocarcinoma of the ventral marking gland
3. Ovarian tumors
4. Cutaneous tumors
5. Neoplasms of the lymphopoietic system

**Answer: e. Neoplasms of the lymphopoietic system**

**References:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 4 - Gerbil, p. 215
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 7 – Biology and Diseases of Other Rodents, pp. 278-279
3. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section VI – Other Rodents, Chapter 52 – Gerbils, p. 1146

**Domain 1; Secondary Species – Gerbil (Meriones spp.)**

**8.** Which of the following rodents is used as a model to study monkeypox virus in the laboratory?

1. Cynomys ludovicianus
2. Geomys bursarius
3. Graphiurus kelleni
4. Marmota monax
5. Sigmodon hispidus

**Answer: c. Graphiurus kelleni**

**References:**

1) Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Chapter 47 - Dormouse, pp. 1089, 1092.

2) Kastenmayer et al. 2010. Management and care of African dormice (Graphiurus kelleni). JAALAS 49(2):173-176.

3) http://edocket.access.gpo.gov/2003/03-27557.htm

**Domain 3; Tertiary Species – Other Rodents**

**9.** Which of the following isone of the most common factors leading to intestinal disorders in rabbits?

1. Diet low in fermentable carbohydrates and high in insoluble fiber
2. Diet high in calcium
3. Diet high in fermentable carbohydrates and low in insoluble fiber
4. Diet high in non-fermentable carbohydrates and low in insoluble fiber
5. Diet low in vitamin D

**Answer: c. Diet high in fermentable carbohydrates and low in insoluble fiber**

**References:**

1) Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Chapter 9 – Rabbit Colony Management and Related Health Concerns, pp. 236-237.

2) Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd edition. Blackwell Publishing: Ames, Iowa. Chapter 6 – Rabbit, pp. 277-278.

3) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 9 – Biology and Diseases of Rabbits, pp. 335-336.

**Domain 4; Primary Species – Rabbit (Orytolagus cuniculus)**

**10.** How frequently must a research facility update their registration form with Animal Care Regional Director at APHIS?

1. Every 6 months
2. Annually
3. Every 2 years
4. Every 3 years
5. Every 5 years

**Answer: d. Every 3 years**

**Reference:** Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 2 – Regulations, Subpart C – Research Facilities, §2.30 Registration, (a)(1) (11-06-13 Edition, p. 31) (http://www.aphis.usda.gov/animal\_welfare/downloads/

Animal%20Care%20Blue%20Book%20-%202013%20-%20FINAL.pdf)

**Domain 5**

**11.** Which of the following etiological agents is thought to cause proliferative enteritis and intestinal neoplasia in Danio rerio?

1. Mycobacterium chelonae
2. Myxidium spp.
3. Pseudocapillaria tormentosa
4. Pseudoloma neurophila

**Answer: c. Pseudocapillaria tormentosa**

**References:**

1. Spitsberger et al. 2012. Neoplasia and neoplasm-associated lesions in laboratory colonies of zebrafish emphasizing key influences of diet and aquaculture system design. ILAR Journal 53(2):114-125.
2. Kent et al. 2012. Documented and potential research impacts of subclinical diseases in zebrafish, ILAR Journal 53(2):126-134.

**Domain 1; Secondary Species - Zebrafish (Danio rerio)**

**12.** What is the minimum alveolar concentration for nitrous oxide in swine?

1. 35 volume %
2. 75 volume %
3. 125 volume %
4. 195 volume %
5. 205 volume %

**Answer: d. 195 volume %**

**References**:

1) Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd ed. Academic Press, San Diego, CA. Chapter 15 - Anesthesia and Analgesia in Swine, p. 417.

2) Swindle M. 2007. Swine In The Laboratory: Surgery, Anesthesia, Imaging, And Experimental Techniques. 2nd edition. Academic Press: San Diego, CA. Chapter 2 – Anesthesia, Analgesia and Perioperative Care, p. 61.

**Domain 2; Primary Species – Pig (Sus scrofa)**

**13.** According to the Guide for the Care and Use of Laboratory Animals and the Animal Welfare Act and its regulations, whose responsibility is it to ensure that all scientists, research technicians, animal technicians and other personnel involved in animal care, treatment and use are qualified to perform their duties?

1. Attending veterinarian
2. IACUC
3. Principal investigator
4. Research facility or institution

**Answer: d. Research facility or institution**

**References:**

1) National Research Council. 2011. Guide for the Care and Use of Laboratory Animals, 8th ed. National Academies Press, Washington D.C. Chapter 2 – Animal Care and Use Program, pp. 15-16.

2) Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 2 – Regulations, Subpart C – Research Facilities, §2.32 (a) Personnel qualifications (11-6-13 Edition, p. 35)

(http://www.aphis.usda.gov/animal\_welfare/downloads/Animal%20Care%20Blue%20Book%20-%202013%20-%20FINAL.pdf)

**Domain 5**

**14.** According to the Guide for the Care and Use of Laboratory Animals and the Guide for the Care and Use of Agricultural Animals in Research and Teaching,who should be consulted before applying pesticides in an animal room or housing area?

1. Attending veterinarian
2. Biosafety officer
3. IACUC chair
4. Institutional official
5. Investigators

**Answer: e. Investigators**

**References:**

1. Institute for Laboratory Animal Resources. 2011. Guide for the Care and Use of Laboratory Animals. National Academy Press, Washington, D.C. Chapter3 – Environment, Housing, and Management, p.74.
2. Committees to Revise the Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching. 2010. GUIDE for the Care and Use of Agricultural Animals in Research and Teaching. 3rd Edition. Federation of Animal Science Societies, Savoy, IL. Chapter 3 - Husbandry, Housing, and Biosecurity, p. 24 (http://www.fass.org/docs/agguide3rd/Ag\_Guide\_3rd\_ed.pdf)

**Domain 4**

**15.** What is the minimum cage size required to house a 5 kg nursing female rabbit and her litter in order to be in compliance with the Animal Welfare Act and its regulations as well as the Guide for the Care and Use of Laboratory Animals?

a. 5 ft2 floor area, 14 in height

b. 6 ft2 floor area, 14 in height

c*.* 7.5 ft2 floor area, 14 in height

d. 6 ft2 floor area, 16 in height

e. 7.5 ft2 floor area, 16 in height

**Answer: d. 6 ft2 floor area, 16 in height**

**References:**

1. Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 3 – Standards, Subpart C – Specifications for the Human Handling, Care, Treatment and Transportation of Rabbits, §3.53 (b) (2) Primary enclosures (11-6-13 Edition, p. 87) (http://www.aphis.usda.gov/animal\_welfare/downloads/Animal%20Care%20Blue%20Book%20-%202013%20-%20FINAL.pdf)

2) Institute for Laboratory Animal Research. 2011. Guide for the Care and Use of Laboratory Animals Academies Press: Washington, D.C. Chapter 3 – Environment, Housing, and Management, p. 59

**Domain 5; Primary Species – Rabbit (Oryctolagus cuniculus)**

**16.** In which of the following tissues is the life-long latency of B virus (Macacine herpesvirus 1) established in both infected macaques and humans that survive this zoonosis?

a. Ventral root of spinal ganglia and ventral motor neurons

b. Cranial ganglia and dorsal root of spinal ganglia

c. Cerebellar Purkinje neurons and pituitary

d. Peripheral nerves and Basal nuclei

e. Salivary glands

**Answer: b. Cranial ganglia and dorsal root of spinal ganglia**

**References:**

1. Katz et al. 2012. Reassessing the detection of B-virus-specific serum antibodies. Comparative Medicine 62(6):516-526
2. Elmore and Eberle. 2008. Monkey B virus (Cercopithecine herpesvirus 1). Comparative Medicine 58(1):11-21

**Domain 1; Primary Species – Macaques (Macaca spp.)**

**17.** Which of the following laboratory animals is a commonly used model of human otitis media?

1. Cat
2. Chinchilla
3. Degu
4. Gerbil
5. Rabbit

**Answer:** **b. Chinchilla**

**References:**

1) Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Chapter 18 – The Rabbit as an Experimental Model, pp. 542; Chapter 43 – Chinchillas as Experimental Models, pp. 1010-1011; Chapter 44 – Degu, pp. 1047-1049; Chapter 52 – Gerbils, pp. 1146-1149

2) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 7 – Biology and Diseases of other Rodents, pp. 275-276, 284, 286; Chapter 9 – Biology and Diseases of Rabbits, pp. 330-331; Chapter 12 – Domestic Cats as Laboratory Animals, pp. 460-462

**Domain 3; Tertiary Species – Other Rodents**

**18.** According to the Guide for the Care and Use of Agricultural Animals in Research and Teaching, who should be contacted for guidance on extra-label drug use in farm animals destined for human consumption?

1. AVMA
2. FDA
3. State Veterinarian
4. USDA

**Answer: b. FDA**

**Reference:** Committees to Revise the Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching. 2010. GUIDE For the Care and Use of Agricultural Animals in Research and Teaching. 3rd Edition. Federation of Animal Science Societies, Savoy, IL. Chapter 2 - Agricultural Animal Health Care, p 13. (http://www.fass.org/docs/agguide3rd/Ag\_Guide\_3rd\_ed.pdf)

**Domain 4**

**19.** Which of the following select agents or toxins can be regulated by either the CDC or the USDA?

* 1. Avian influenza virus
  2. Bacillus anthracis
  3. Macacine herpesvirus 1
  4. Xylella fastidiosa
  5. Yersina pestis

**Answer: b. Bacillus anthracis**

**References:** Kastenmayer et al. 2012. Select agent and toxin regulations: beyond the eighth edition of the Guide for the Care and Use of Laboratory Animals. JAALAS 51(3):333-338.

**Domain 5**

**20.** All of the following diseases in swine can result in the passage of dark, hard feces and high body temperatures **EXCEPT**?

a. Intestinal hemorrhagic syndrome

b. Salmonella cholerasuis

c. Swine dysentery

d. Transmissable gastroenteritis

**Answer: a. Intestinal hemorrhagic syndrome**

**References:** Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 15 - Biology and Diseases of Swine, p. 663.

**Domain 1; Primary Species - Pig (Sus scrofa)**

**21.** Which of the following injectable anesthetics has no residual effects following administration and no known active metabolites, with 90% of the drug being excreted in the urine as water-soluble by-products?

1. Avertin
2. Ketamine
3. Pentobarbital
4. Propofol
5. Xylazine

**Answer: d. Propofol**

**References:**

1. Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd ed. Academic Press, San Diego, CA. Chapter 10 – Anesthesia and Analgesia for Laboratory Rodents, pp. 257-261.
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 22 - Preanesthesia, Anesthesia, Analgesia and Euthanasia, pp. 957-959

**Domain 2**

**22.** Which of the following best describes whole body plethysmography?

a. Invasive, direct method of studying respiratory function in animals

b. Invasive, direct method for studying cardiac output in animals

c. Noninvasive, indirect method of studying respiratory function in animals

d. Noninvasive, indirect method of studying cardiac output in animals

**Answer: c. Noninvasive, indirect method of studying respiratory function in animals**

**References**

1. Raşid et al. 2012. Assessment of routine procedure effect on breathing parameters in mice by using whole-body plethysmography. JAALAS 51(4):469-474
2. Foster et al. 2008. Whole-body plethysmography in African green monkeys (Chlorocebus aethiops) with and without jackets.JAALAS 47():52-55

**Domain 3**

**23.** Newly imported nonhuman primates must be quarantined for a minimum of how many days at a CDC-registered primate import facility?

1. 10 days
2. 31 days
3. 40 days
4. 61 days
5. 91 days

**Answer: b. 31 days**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 16 - Nonhuman primates, p. 724.
2. Roberts and Andrews. 2008. Nonhuman primate quarantine: its evolution and practice. ILAR J 49(2):145-156.
3. 42 CFR, Part 71 – Foreign Quarantine, Subpart F – Importations, §71.53 Nonhuman Primates. (10-1-03 Edition, p. 433)
4. http://www.cdc.gov/animalimportation/lawsregulations/nonhuman-primates/nprm/questions-answers-importers.html
5. Abee CR, Mansfield K, Tardif S, Morris T, eds. 2012. Nonhuman Primates in Biomedical Research, 2nd edition, Volume - Biology and Management, Academic Press: San Diego, CA. Chapter 2 – Laws, Regulations and Policies Relating to the Care and Use of Nonhuman Primates, p. 50.

**Domain 4**

1. According to the Animal Welfare Act and its regulations, all of the following statements are applicable to the sanitation of primary enclosures for rabbits **EXCEPT**?

a. Washed with hot water (180ºF) and soap or detergent as in a mechanical cage washer

b. Washed with a detergent solution followed by a safe and effective disinfectant

c. Sanitized at least once every 14 days

d. Cleaned with live steam

e. Cleaned with live flame

**Answer: c. Sanitized at least once every 14 days**

**Reference:** Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 3 – Standards, Subpart C - Specifications for the Humane Handling, Care, Treatment and Transportation of Rabbits, § 3.56 Sanitation (b)(1)(3) Sanitation of primary enclosures (11-6-13 Edition, p. 88) (http://www.aphis.usda.gov/animal\_welfare/downloads/Animal%20Care%20Blue%20Book%20-%202013%20-%20FINAL.pdf)

**Domain 5; Primary Species - Rabbit (Oryctolagus cuniculus)**

**25.** What does the principle of non-maleficence mean?

a. All living creatures deserve respect

b. Minimization of distress, pain and suffering is a moral imperative

c. Different species can raise different ethical concerns

d. Animal research can be justified if it benefits society

e. If the intention is good, the means can be justified

**Answer: b. Minimization of distress, pain and suffering is a moral imperative**

**References:**

1) Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Chapter 1 - Ethical Considerations and Regulatory Issues, p. 6

2) Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd ed. Academic Press, San Diego, CA. Chapter 24 – Ethical Issues in Anesthesia and Analgesia in Laboratory Animals, p. 563.

**Domain 6**

**26.** Dosing rodents with alloxan may require treatment with which of the following compounds for long term supportive care?

1. Cephalexin
2. Dexamethasone
3. Glucose
4. Insulin
5. Saline

**Answer: d. Insulin**

**Reference:** Federiuk et al. 2004. Induction of type-1 diabetes mellitus in laboratory rats by use of alloxan: route of administration, pitfalls, and insulin treatment. Comparative Medicine 54(3):252-257

**Domain 1; Primary Species – Rat (Rattus norvegicus)**

**27.** The production of monoclonal antibodies in mouse cell culture as opposed to harvesting them in a mouse ascites fluid is an example of which of the following concepts?

1. Refinement
2. Relative replacement
3. Reduction
4. Absolute replacement
5. Responsibility

**Answer: b. Relative replacement**

**References:**

1) Silverman J, Suckow MA, Murthy S. 2006. The IACUC Handbook, 2nd edition. CRC Press: Boca Raton FL. Chapter 12 – Justification for the Use of Animals, p. 162.

2) National Research Council. 2011. Guide for the Care and Use of Laboratory Animals, 8th ed. National Academies Press, Washington D.C. Chapter 1 – Key Concepts, p. 5.

3) http://altweb.jhsph.edu/pubs/books/humane\_exp/het-toc

**Domain 3; Primary Species – Mouse (Mus musculus)**

**28.** What is the recommended illumination level for sheep and goats in a laboratory setting?

a. 100 lux

b. 220 lux

c. 325 lux

d. 400 lux

e. 800 lux

**Answer: b. 220 lux**

**References:**

1. Committees to Revise the Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching. 2010. GUIDE For the Care and Use of Agricultural Animals in Research and Teaching. 3rd Edition. Federation of Animal Science Societies, Savoy, IL. Chapter 10 – Sheep and Goats, p. 131.

(http://www.fass.org/docs/agguide3rd/Ag\_Guide\_3rd\_ed.pdf)

2) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 14 – Biology and Diseases of Ruminants: Sheep, Goats, and Cattle, p. 524.

**Domain 4; Secondary Species – Sheep (Ovis aries) and Goats (Capra hircus)**

1. All of the following can be used for leak-testing HEPA filters and their seals **EXCEPT**?

a. Di(2-ethylhexyl) sebecate

b. Medical grade light mineral oil

c. 2-Methylbutane

d. Poly alpha olefin

e. Polyethylene glycol

**Answer:** **c.** **2-Methylbutane**

**References:**

1. U. S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and National Institutes of Health. 2007. Biosafety in Microbiological and Biomedical Laboratories. 5th ed. U.S. Government Printing Office, Washington, D. C. Appendix A – Primary Containment for Biohazards: Selection, Installation and Use of Biological Safety Cabinets, p. 309

(http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5\_appendixA.pdf).

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 10 – Microbiological Quality Control For Laboratory Rodents and Lagomorphs, p. 369

**Domain 5**

1. You are using an ELISA to detect IgG antibodies to mouse hepatitis virus (MHV) in serum. This test is 96% sensitive and 98% specific. The prevalence of MHV in your colonies is 20%. What is the positive predictive value of your assay?
   1. 80%
   2. 88%
   3. 99%
   4. 84%
   5. 92%

**Answer: e. 92%**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 10 - Microbiological Quality Control for Laboratory Rodents and Lagomorphs, pp. 385-386.
2. Festing et al. 2002. Guidelines for the design and statistical analysis of experiments using laboratory animals. ILAR J 43(4):244-258

**Domain 1; Primary Species - Mouse (Mus musculus)**

1. According to the AVMA Guidelines for the Euthanasia of Animals: 2013 Edition, what would be the recommendation regarding rapid cooling for euthanasia of adult zebrafish?
2. Rapid cooling was not discussed in AVMA Guidelines for Euthanasia of Animals: 2013 Edition
3. Rapid cooling is unacceptable
4. Rapid cooling is acceptable with conditions, if followed by MS-222 immersion
5. Rapid cooling is acceptable with conditions, if followed by maceration
6. Rapid cooling is acceptable

**Answer: e. Rapid cooling is acceptable**

**References:**

1. American Veterinary Medical Association. 2013. AVMA Guidelines for the Euthanasia of Animals: 2013 Edition, p. 73 (https://www.avma.org/KB/Policies/Documents/euthanasia.pdf).
2. Wilson et al. 2009. Evaluation of rapid cooling and tricaine methanesulfonate (MS222) as methods of euthanasia in zebrafish (Danio rerio). JAALAS 48(6):785-789.

**Domain 2; Secondary Species – Zebrafish (Danio rerio)**

**32.** Octodon degusare most frequently used to study which of the following in laboratory research?

1. Circadian rhythms
2. Hepatitis
3. Interstitial cystitis
4. Obesity

e. Sjogren’s syndrome

**Answer: a. Circadian rhythms**

**References**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 7 – Biology and Disease of Other Rodents, p. 284
2. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section VI – Other Rodents, Chapter 44 - Degu, p. 1032.

**Domain 3; Tertiary Species – Other Rodents**

**33.** Which of the following describes the main purpose of a Venturi valve in a laboratory animal facility?

a. Regulates the flow of gas within an anesthesia circuit

1. Provides a constant flow of water to an animal cage while maintaining a drop of water at the end of the valve to make it easier for the animals to find the water source
2. Prevents clogging of bedding removal systems
3. Maintains constant airflow, independent of air pressure, indefinitely without requiring recalibration or routine maintenance

**Answer: d. Maintains constant airflow, independent of air pressure, indefinitely without requiring recalibration or routine maintenance**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 21 - Design and Management of Animal Facilities, pp. 921, 923.
2. http://www.triatek.com/products/Venturi-Valve.html
3. http://www.tsi.com/en-1033/products/2266/venturi\_valves.aspx

4)http://www.phoenixcontrols.com/prodinfo.html#AccelValve

**Domain 4**

**34.** According to the Guide for the Care and Use of Laboratory Animals, responsibility for review and investigation of animal welfare concerns in the United States rests with the ?

a. Attending veterinarian

b. Institutional official and IACUC

c. IACUC Chair

d. CEO or Vice President of Research

**Answer: b. Institutional official and IACUC**

**Reference:** National Research Council. 2011. Guide for the Care and Use of Laboratory Animals, 8th ed. National Academies Press, Washington D.C. Chapter 2 – Animal Care and Use Program, p. 23.

**Domain 5**

**35.** Measles in marmosets is generally fatal and manifests with which of the following clinical findings?

1. Conjunctivitis
2. Maculopapular rash
3. Meningitis
4. Necrotizing gastroenteritis
5. Pneumonia

**Answer: d. Necrotizing gastroenteritis**

**Reference:** Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 16 – Nonhuman Primates, pp. 753-754, Table LIV.

**Domain 1; Secondary Species – Marmoset/Tamarins (Callitrichidae)**

**36.** Which of the following **WOULD NOT** be considered a method of sleep deprivation in rodents?

1. Co-housing with aggressive cage mate
2. Gentle handling
3. Intermittent forced locomotion

d. Placing animals on a small platform

**Answer: a. Co-housing with aggressive cage mate**

**Reference:** Bittman et al. 2013. Animal care practices in experiments on biological rhythms and sleep: report of the joint task force of the Society for Research and Biological Rhythms and the Sleep Research Society. JAALAS 52(4):437-443.

**Domain 3**

**37.** Which of the following temperature ranges is consider acceptable for adequate growth of Xenopus laevis?

1. 14 - 26˚C
2. 21 - 26˚C
3. 20 - 22˚C
4. 22 - 26˚C
5. None of the above

**Answer: c. 20 - 22˚C**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 17 – Biology and Diseases of Amphibians, p. 810.
2. Green. 2010. The Laboratory Xenopus sp. CRC Press: Boca Raton, FL. Chapter 2 – Husbandry, p. 38.

**Domain 4; Secondary Species – African Clawed Frog (Xenopus spp.)**

**38.** An investigator conducting an experiment in an animal model is using an anesthetic agent that is extremely difficult to obtain, and thus is requesting that the IACUC grant approval for use past the expiration date. The IACUC can approve this situation under which of the following circumstances?

a. If the investigator provides adequate proof that the agent is difficult to obtain

b. If scientific justification is provided as to why alternative agents cannot be used

c. Only if the procedure is terminal

d. If it is in accordance with the IACUC-approved policy on expired materials

e. Under no circumstances

**Answer: e. Under no circumstances**

**Reference:** USDA Animal and Plant Health Inspection Service Animal Care Policy Manual. Policy # 3: Veterinary Care. March 25, 2011. (http://www.aphis.usda.gov/animal\_welfare/policy.php?policy=3)

**Domain 5**

**39.** Which of the following routes is thought to be the primary means of natural transmission of lactate dehydrogenase-elevating virus between mice?

1. Airborne
2. Fecal-oral
3. Mechanical transfer from aggressive behavior
4. Oro-nasal

**Answer: c. Mechanical transfer from aggressive behavior**

**References:**

1. Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 2 – Diseases. Academic Press: San Diego, CA. Chapter 8 – Lactate Dehydrogenase-Elevating Virus, pp. 226-227.
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 1 – Mouse, pp. 30-31
3. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, p. 65

**Domain 1; Primary Species – Mouse (Mus musculus)**

**40.** According to the AVMA Guidelines for the Euthanasia of Animals: 2013 Edition, euthanizing four mice with CO2 in a chamber that measures 10 liters will require a flow rate of how many liters per minute?

1. 1-3
2. 4-6
3. 7-9
4. 10-12

**Answer: a. 1-3**

**Reference:** American Veterinary Medical Association. 2013. AVMA Guidelines for the Euthanasia of Animals: 2013 Edition, pp. 26, 49 (https://www.avma.org/KB/Policies/Documents/euthanasia.pdf).

**Domain 2; Primary Species – Mouse (Mus musculus)**

**41.** Which of the following inbred strains of rat is used as a model of prostate adenocarcinoma?

* 1. Brown Norway
  2. Copenhagen
  3. Gunn
  4. Lewis
  5. Wistar-Furth

**Answer: b. Copenhagen**

**Reference:** Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 4 – Biology and Diseases of Rats, p. 122.

**Domain 3; Primary Species – Rat (Rattus norvegicus)**

**42.** Dystocia in guinea pigs, due to failure of the pubic symphysis to separate, is most commonly found in sows bred for the first time over how many months of age?

1. 3
2. 5
3. 7
4. 12

**Answer: c. 7**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 6 – Biology and Diseases of Guinea Pigs, p. 237.
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 5 – Guinea Pig, p. 217.
3. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section III – Guinea Pigs, Chapter 21 – Management, Husbandry, and Colony Health, p. 611

**Domain 4; Secondary Species – Guinea Pig (Cavia porcellus)**

**43.** According to the Animal Welfare Act and its regulations,all of the following apply to primary enclosures for guinea pigs and hamsters **EXCEPT**?

1. Interior height for hamster enclosures shall be at least 6 inches
2. Interior height for guinea pig enclosures shall be at least 7 inches
3. Hamsters weighing >100g need a minimum of 19 in2 of floor space
4. Guinea pigs weighing >350g need a minimum of 101 in2 of floor space
5. A nursing female hamster and her litter can be housed with one other adult hamster

**Answer: e. A nursing female hamster and her litter can be housed with one other adult hamster**

**Reference:** Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 3 – Standards, Subpart B – Specifications for the Humane Handling, Care, Treatment, and Transportation of Guinea Pigs and Hamsters, §3.28 Primary enclosures, (c)(1)(ii)(iii)(2)(ii)(iii)(iv) Space requirements for primary enclosures acquired on or after August 15, 1990 (11-6-13 Edition, pp. 77-78)

(http://www.aphis.usda.gov/animal\_welfare/downloads/Animal%20Care%20Blue%20Book%20-%202013%20-%20FINAL.pdf)

**Domain 5; Secondary Species – Guinea Pig (Cavia porcellus) and Syrian Hamster (Mesocricetus auratus); Tertiary Species – Other Rodents**

**44.** Which of the following strains of mice is most susceptible to giardiasis?

a. BALB/c

b. C57BL/10

c. C3H/He

d. 129

**Answer: c. C3H/He**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 4 – Biology and Diseases of Mice, p. 98.
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd edition. Blackwell Publishing: Ames, Iowa. Chapter 1 – Mouse, p. 89

**Domain 1; Primary Species – Mouse (Mus musculus)**

**45.** Systemic administration of MPTP in macaques is a model for which of the following conditions?

1. Multiple sclerosis
2. Parkinson’s disease
3. Huntington’s disease
4. Alzheimer’s disease

**Answer: b. Parkinson’s disease**

**References:**

1. Emborg. 2007. Nonhuman primate models of Parkinson’s disease. ILAR J 48(4):339-355.
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 30 – Animal Models in Biomedical Research, p. 1187.
3. Jakowec and Petzinger. 2005. 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine-lesioned model of Parkinson's disease, with emphasis on mice and nonhuman primates. Comparative Medicine 54(5): 497-513

**Domain 3; Primary Species – Macaques (Macaca spp.)**

**46.** Guinea pig feed is generally supplemented with which of the following?

1. Carnitine
2. Glucosamine
3. Taurine

d. Vitamin C

e. Vitamin D

**Answer: d. Vitamin C**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 6 – Biology and Disease of Guinea Pigs, p. 205

2) Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section III – Guinea Pigs, Chapter 21- Management, Husbandry, and Colony Health , pp. 613-614.

**Domain 4; Secondary Species – Guinea Pig (Cavia porcellus)**

**47.** Which of the following is a requirement for IACUC full committee review of research projects?

* 1. Quorum of IACUC members must be present
  2. Attending Veterinarian must be present
  3. Member with a conflicting interest can participate in approval
  4. IACUC chair must be present

**Answer: a. Quorum of IACUC members must be present**

**References:**

1. Office of Laboratory Animal Welfare. 2002. Public Health Service Policy on Humane Care and Use of Laboratory Animals. National Institutes of Health, Bethesda, MD. p. 14

(http://www.grants.nih.gov/grants/olaw/references/phspol.htm)

1. Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 2 - Regulations, Subpart C – Research Facilities, §2.31 Institutional Animal Care And Use Committee (IACUC) (d) (2) IACUC review of activities involving animals. (11-6-13 Edition, p. 34)

(http://www.aphis.usda.gov/animal\_welfare/downloads/Animal%20Care%20Blue%20Book%20-%202013%20-%20FINAL.pdf)

1. Applied Research Ethics National Association (ARENA) and Office of Laboratory Animal Welfare (OLAW). 2002. Institutional Animal Care and Use Committee Guidebook. 2nd Edition. OLAW, Bethesda, MD. A.2. Authority, Composition and Functions, pp. 15-16.

**Domain 5**

**48.** Which of the following is the most frequently occurring tumor in most rat stocks and strains?

1. Squamous cell carcinoma
2. Melanoma
3. Fibroadenocarcinoma
4. Mammary fibroadenoma
5. Papilloma

**Answer: d. Mammary fibroadenoma**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 4 – Biology and Diseases of Rats, pp. 154-156.
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 2 – Rat, pp. 169-176.
3. Suckow MA, Weisbroth SH, Franklin CL, eds. 2006. The Laboratory Rat, 2nd edition. Elsevier Academic Press: San Diego, CA. Chapter 14 – Neoplastic Disease, pp. 501-502.

**Domain 1; Primary Species – Rat (Rattus norvegicus)**

**49.** Which of the following organizations enforces CITES?

1. Animal Plant and Health Inspection Service
2. Centers for Disease Control
3. Environmental Protection Agency
4. National Institutes of Health
5. United States Fish and Wildlife Service

**Answer: e. United States Fish and Wildlife Service**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press, San Diego, CA. Chapter 2 – Laws, Regulations, and Policies Affecting the Use of Laboratory Animals, p. 30
2. http://www.cites.org/common/disc/sec/CITES-USFWS.pdf

**Domain 5**

**50.** Which of the following statements best describes the C3B6F1 mouse?

1. Male parent is a C3H
2. These mice will accept tissue grafts from C57BL/6 mice
3. Brother x sister mating will result in offspring genetically identical to the parents
4. They are congenic

**Answer: b. These mice will accept tissue grafts from C57BL/6 mice**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, pp. 36-37.

2) Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 1 – History, Wild Mice, and Genetics. Academic Press: San Diego, CA. Chapter 4 – Breeding Systems: Considerations, Genetic Fundamentals, Genetic Background and Strain Types pp. 65-67; Chapter 5 – Mouse Strain and Genetic Nomenclature: An Abbreviated Guide, pp. 81-83, 87

3) International Committee on Standardized Genetic Nomenclature for Mice and Rat Genome and Nomenclature Committee. Guidelines for Nomenclature of Mouse and Rat Strains. October 2013. http://www.informatics.jax.org/mgihome/nomen/strains.shtml#hybrids

4) http://research.jax.org/grs/type/hybrid/index.html

**Domain 3; Primary Species – Mouse (Mus musculus)**

**51.** When housing Heterocephalus glaber, how should water generally be provided?

a. Automatic watering system

b. Water bottles

c. Shallow bowls on the floor of the enclosure

d. No water is generally provided to this species

**Answer: d. No water is generally provided to this species**

**References:**

1. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Elsevier Academic Press: San Diego, CA. Section VI – Other Rodents, Chapter 45 – Naked Mole Rat, p. 1067.
2. Artwohl et al. 2002. Naked mole rats: unique opportunities and husbandry challenges. Lab Animal (NY) 31(5):32-66.

**Domain 4; Tertiary Species – Other Rodents**

**52.** According to the NIH Recombinant DNA Guidelines, all of the following apply to the Biological Safety Officer **EXCEPT**?

1. Appointed if institution engages in recombinant or synthetic nucleic acid molecule research at BSL-2
2. Conduct periodic inspections to ensure laboratory standards are being followed
3. Develop emergency plans for handling accidental spills
4. Providing advice on laboratory security

**Answer: a. Appointed if institution engages in recombinant or synthetic nucleic acid molecule research at BSL-2**

**Reference:** NIH Guidelines for Research Involving Recombinant of Synthetic Nucleic Acid Molecules, November 2013. National Institutes of Health. Section IV-B-3 – Biological Safety Officer. http://oba.od.nih.gov/oba/rac/Guidelines/NIH\_Guidelines.htm#\_Toc351276256

**Domain 5**

1. Which of the following is the most common abnormality found during echocardiographic examination of owl monkeys?
   1. Aortic stenosis
   2. Cardiomyopathy
   3. Interventricular septal defect
   4. Mitral regurgitation
   5. Right atrial dilatation

**Answer: b. Cardiomyopathy**

**References:**

1. Knowlen et al. 2013. Hypertrophic cardiomyopathy in owl monkeys (Aotus spp.). Comparative Medicine 63(3):279-287
2. Rajendra et al. 2010. The normal and abnormal owl monkey (Aotus sp.) heart: looking at cardiomyopathy changes with echocardiography and electrocardiography. J Med Primatol 39(3):143-150
3. Rishniw et al. 2005. Cardiomyopathy in captive owl monkeys (Aotus nancymae). Comparative Medicine 55(2):162-168.

**Domain 1; Tertiary Species – Other Nonhuman Primates**

**54.** What is the mode of inheritance for hydronephrosis in the Brown Norway rat?

1. Autosomal dominant
2. Autosomal polygenic with incomplete inheritance
3. Autosomal recessive with incomplete inheritance
4. X-linked

**Answer: b. Autosomal polygenic with incomplete inheritance**

**References:**

1. Suckow MA, Weisbroth SH, Franklin CL, eds. 2006. The Laboratory Rat, 2nd edition. Elsevier Academic Press: San Diego, CA. Chapter 15 – Metabolic, Traumatic, and Miscellaneous Diseases, p. 531
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 2 – Rat, p. 163
3. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 4 – Biology and Diseases of Rats, p. 156

**Domain 3; Primary Species – Rat (Rattus norvegicus)**

**55.** Inwhich of the following species isthe FETAX system utilized by developmental biologists and toxicologists to document developmental abnormalities associated with environmental chemicals?

1. Phodopus spp.
2. Danio spp.
3. Rana spp.
4. Xenopus spp.

**Answer: d. Xenopus spp.**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 17 - Biology and Diseases of Amphibians, p. 795.
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 30 – Animal Models in Biomedical Research, p. 1188.

**Domain 4; Secondary Species - African Clawed Frog (Xenopus spp.)**

**56.** The Guide for the Care and Use of Laboratory Animals recommends that rooms housing albino animals have which of the following light levels ?

1. 30 lux at 1 foot above the floor
2. 30 lux at 3.3 feet above the floor
3. 325 lux at 1 foot above the floor
4. 325 lux at 3.3 feet. above the floor

**Answer: d.** **325 lux at 3.3 feet above the floor**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 21 – Design and Management of Animal Facilities, p. 926.

2) Institute for Laboratory Animal Research. 2011. Guide for the Care and Use of Laboratory Animals Academies Press: Washington, D.C. Chapter 2 – Animal Care and Use Program, pp. 15-17, and Chapter 3 – Environment, Housing, and Management, p. 48.

**Domain 4; Primary Species – Mouse (Mus musculus)**

**57.** Which of the following strains of mice are most susceptible to MPV and will likely have prolonged shedding?

1. B6.129P2-*Tcrbtm1Mom*/J
2. B6.129S2-*Cd4tm1Mak/*J
3. B6.129S2-*Ighmtm1Cgn/*J
4. B6.129S7-*Ifngtm1Ts/*J
5. B6.129S7-*Rag1tm1Mom/*J

**Answer: e. B6.129S7-*Rag1tm1Mom/*J**

**References:**

1. Macy et al. 2013. Effect of immunodeficiency on MPV shedding and transmission. JAALAS 52(4):467-474.
2. Besselsen et al. 2007. Temporal transmission studies of mouse parvovirus 1 in BALB/c and C.B-17/Icr-prkdc (scid) mice. Comparative Medicine 57(1):66-73.

**Domain 1; Primary Species – Mouse (Mus musculus)**

**58.** Which of the following refers to the condition when pain is induced by a non-noxious stimulus?

a. Hyperalgesia

b. Allodynia

c. Subanalgesia

d. Hypersensitivity

e. Sensitization

**Answer: b. Allodynia**

**References:**

1. Curtin CI et al. 2009. Evaluation of buprenorphine in a postoperative pain model in rats. Comparative Medicine 59(1):60-71.
2. Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd ed. Academic Press, San Diego, CA. Chapter 1 – Anatomy, Physiology, and Effects of Pain, pp. 4-5.

**Domain 2**

1. Which of the following complications is a potential adverse event resulting from administration of Complete Freund’s Adjuvant?
2. Blindness
3. Granulomas
4. Immunosuppression
5. Impotency

**Answer: b. Granulomas**

**Reference:** Applied Research Ethics National Association (ARENA) and Office of Laboratory Animal Welfare (OLAW). 2002. Institutional Animal Care and Use Committee Guidebook. 2nd Edition. OLAW, Bethesda, MD. C.3.b. Antibody Production, pp. 126-127

**Domain 3**

1. Which type of diet has been assayed for contaminants and is commercially available for use in select studies, such as preclinical toxicology, conducted in compliance with FDA GLP standards?
   1. Natural ingredient diet
   2. Purified diet
   3. Certified diet
   4. Chemically defined

**Answer: c. Certified diet**

**References**:

1. Institute for Laboratory Animal Research. 2011. Guide for the Care and Use of Laboratory Animals The National Academies Press: Washington, D.C. Chapter 3 – Environment, Housing, and Management, p. 65.
2. Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 3 – Normative Biology, Husbandry, and Models. Academic Press: San Diego, CA. Chapter 10 - Nutrition, pp. 351-353.
3. Suckow MA, Weisbroth SH, Franklin CL, eds. 2006. The Laboratory Rat, 2nd edition. Elsevier Academic Press: San Diego, CA. Chapter 9 – Nutrition, pp.269-271.

**Domain 4**

**61.** For which of the following species does the USDA Animal and Plant Health Inspection Service Animal Care Policy Manual describe general requirements for providing sufficient unobstructed enclosure volume to enable movement by flying and sufficient roosting space to allow all individuals to rest simultaneously?

1. Ambystoma mexicanum
2. Carassius auratus
3. Coturnix japonica

d. Gallus gallus domesticus

e. Myotis lucifugus

**Answer: e. Myotis lucifugus**

**Reference:** USDA Animal and Plant Health Inspection Service Animal Care Policy Manual. Policy #9 – Adequate Enclosures for Flying Species and Aquatic Species. March 25, 2011. (http://www.aphis.usda.gov/animal\_welfare/policy.php?policy=9**)**

**Domain 5; Tertiary Species – Other Mammals**

**62.** Which of the following is caused by fur mite infestations in mice?

1. Lymphadenopathy, hypergammaglobulinemia, secondary amyloidosis, lymphocytopenia and splenic hypertrophy
2. Lymphadenopathy, hyperfibrinogenemia, primary amyloidosis, lymphocytosis, and splenic hypertrophy
3. Lymphadenopathy, hyperfibrinogenemia, secondary amyloidosis, lymphocytosis and splenic contracture
4. Lymphadenopathy, hypergammaglobulinemia, secondary amyloidosis, eosinophilia and splenic hypertrophy
5. Lymphadenopathy, hyperfibrinogenemia, secondary amyloidosis, lymphocytopenia, and splenic hypertrophy

**Answer: a. Lymphadenopathy, hypergammaglobulinemia, secondary amyloidosis, lymphocytopenia and splenic hypertrophy**

**References:**

1) Rice et al. 2013. Evaluation of diagnostic methods for Myocoptes musculinis according to age and treatment status of mice (Mus musculus). JAALAS 52(6):773–781

2) Baker DG, ed. 2007. Flynn’s Parasites of Laboratory Animals, 2nd edition. Blackwell Publishing, Iowa, USA. Chapter 11 – Parasites of Rats and Mice, pp. 361-362

**Domain 1; Primary Species – Mouse (Mus musculus)**

**63.** Which of the following types of viruses could cause posterior paralysis in ferrets?

1. Orthomyxovirus
2. Paramyxovirus
3. Rotavirus
4. Rhabdovirus

**Answer: d. Rhabdovirus**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 13 - Biology and Diseases of Ferrets, pp. 498-501.
2. Hamir et al. 2011. Recovery from and clearance of rabies virus in a domestic ferret. JAALAS 50(2):248-251.

**Domain 1; Secondary Species – Ferret (Mustela putorius furo)**

**64.** In guinea pigs, infection with which of the following types of viruses has been used as a model of mononucleosis?

1. Adenovirus
2. Arenavirus
3. Coronavirus
4. Cytomegalovirus
5. Paramyxovirus

**Answer: d. Cytomegalovirus**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 6 – Biology and Diseases of Guinea Pigs, pp. 221-222

2) Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section III – Guinea Pigs, Chapter 25 – Guinea Pigs as Experimental Models, pp. 712-713.

3) Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter5 - Guinea Pig, pp. 221-222

**Domain 3; Secondary Species – Guinea Pig (Cavia porcellus)**

**65.** Males from which of the following mouse strains are known for being rather pugilistic?

1. 129
2. BALB/c
3. C3H/He
4. C57BL/6
5. FVB/N

**Answer: b. BALB/c**

**References:**

1) Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 1 – Mouse, p. 5

2) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, p. 108

**Domain 4; Primary Species – Mouse (Mus musculus)**

**66.** Which of the following offices within NIH is responsible for reviewing and coordinating all activities relating to the NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules?

1. OAR
2. OBA
3. ORIS
4. OLAW
5. OSE

**Answer: b. OBA (Office of Biotechnology Activities)**

**Reference:** NIH Guidelines For Research Involving Recombinant DNA Molecules. 2013. I-E-3. General Definitions, p. 12 (http://oba.od.nih.gov/oba/rac/Guidelines/NIH\_Guidelines.pdf)

**Domain 5**

1. What percentage of the total volume of water in a zebrafish recirculating water system should be drained off and replaced each day?
   1. 0-5%
   2. 5-10%
   3. 10-15%
   4. 20-25%

**Answer: b. 5-10%**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 19 – Biology and Management of the Zebrafish, p. 873.
2. Lawrence and Mason. 2012. Zebrafish housing systems: a review of basic operating principles and considerations for design and functionality. ILAR J 53(2):179-191

**Domain 4; Secondary Species – Zebrafish (Danio rerio)**

**68.** Tricaine blocks conduction of which of the following types of channels?

1. Calcium
2. Chloride
3. Potassium
4. Sodium

**Answer: d. Sodium**

**Reference**: Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd ed. Academic Press, San Diego, CA. Chapter 21 - Anesthesia and Restraint of Laboratory Fish, p. 525.

**Domain 2**

**69.** What is the primary method used to introduce point mutations for genetic screens in zebrafish?

1. Treatment of sperm with UV light
2. ENU (*N*-nitroso-*N-*ethylurea) treatment of male fish
3. γ-irradiation of sperm
4. Generation of haploid embryos

**Answer: b. ENU treatment of male fish**

**Reference:** Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 19 – Biology and Management of the Zebrafish, p. 864.

**Domain 3; Secondary Species - Zebrafish (Danio rerio)**

**70.** What is the recommended minimum level of protein content in commercial diets for laboratory hamsters?

1. 10%
2. 12%
3. 14%
4. 16%
5. 18%

**Answer: d. 16%**

**References:**

1. Harkness JE, Turner PV, VandeWoude S, Wheler CL. 2010. Harkness and Wagner’s Biology and Medicine of Rabbits and Rodents, 5th ed. Wiley-Blackwell: Ames, IA. Chapter 2 – Biology and Husbandry, p. 70.
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 5 – Biology and Diseases of Hamsters, p. 174.
3. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section IV – Hamsters, Chapter 28 – Management, Husbandry, and Colony Health, pp. 768-769

**Domain 4; Secondary Species – Syrian Hamster (Mesocricetus auratus); Tertiary Species – Other Rodents**

**71.** What forms should be prepared and kept by employers according to OSHA to document work-related injuries and illness?

a. OSHA 100 log and OSHA form 101

b. OSHA 200 log and OSHA form 201

c. OSHA 300 log and OSHA form 301

d. OSHA 400 log and OSHA form 401

**Answer: c. OSHA 300 log and OSHA form 301**

**Reference:** http://www.osha.gov/recordkeeping/new-osha300form1-1-04.pdf

**Domain 5**

**72.** Which of the following are most likely to support heavy infestations of Mycoptes musculinus?

1. Female group-housed mice that are 4 to 6 weeks of age
2. Female group-housed mice that are > 24 weeks of age
3. Male group-housed mice that are 4 to 6 weeks of age
4. Male group-housed mice that are > 28 weeks of age
5. Single-house male and female mice of any age

**Answer: a. Female group-housed mice that are 4 to 6 weeks of age**

**References:**

1. Rice et al. 2013. Evaluation of diagnostic methods for Mycoptes musculinus according to age and treatment status of mice. JAALAS 52(6):773-781.
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, p. 103.

**Domain 1; Primary Species – Mouse (Mus musculus)**

**73.** What is the minimum concentration of chlorine dioxide gas needed to achieve sterilization?

1. 200-250 ppm
2. 300-400 ppm
3. 450-500 ppm
4. 500-550 ppm
5. 600-650 ppm

**Answer: d. 500-550 ppm**

**References:** Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 3 – Normative Biology, Husbandry, and Models. Academic Press: San Diego, CA. Chapter 7 – Gnotobiotics, p. 224

**Domain 3; Primary Species – Mouse (Mus musculus)**

**74.** Which of the following chemical disinfectants is classified as reactant?

1. Chlorine dioxide
2. Ethanol
3. Glutaraldehyde
4. Hydrogen peroxide
5. Povidone-iodine

**Answer: c. Glutaraldehyde**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 10 – Microbiological Quality Control for Laboratory Rodents and Lagomorphs, pg. 370.
2. Block SS, eds. 2001. Disinfection, Sterilization, and Preservation. Lipincott, Williams, and Wilkins. Philadelphia, PA. Chapter 17 – Glutaraldehyde, pp. 361-382.

**Domain 4**

**75.** Which one of the following **DOES NOT** apply to a Foreign Assurance required for institutions outside the U.S. that receive PHS funds directly through a grant or contract award or that receive PHS funds indirectly (named as a performance site by a primary awardee institution)?

* 1. Before submitting a grant application to NIH for the first time, a foreign institution must apply for an OLAW-approved animal welfare assurance
  2. OLAW will contact the awardee institution to negotiate whether a Foreign Assurance is required
  3. The funding component or Institute in NIH will notify OLAW that an Assurance is required for the pending award
  4. Foreign institutions should not submit an Assurance unless requested to do so by OLAW
  5. Foreign Assurances are renewed only if the institution has current PHS funding

**Answer: a. Before submitting a grant application to NIH for the first time, a foreign institution must apply for an OLAW-approved animal welfare assurance**

**References:**

1. Office of Laboratory Animal Welfare, Obtaining an Assurance. http://grants.nih.gov/grants/olaw/obtain\_assurance.htm
2. National Institutes of Health ([NIH](http://www.nih.gov)), Change In Criteria For Renewal of Animal Welfare Assurances For Foreign Institutions.For Notice of Intent to Publish, replace “TITLE OF RFA (ACTIVITY CODE)” with the actual title of the RFA and the activity code. For other Notices, replace text above with title of notice.

Notice Number: NOT-OD-12-081, Release Date: March 8, 2012.

**Domain 5**

**76.** Which of the following strains of mice is particularly susceptible to the age-dependent poliomyelitis often associated with LDV?

1. B6
2. C58
3. CD-1
4. DBA

**Answer: b. C58**

**References:**

1. Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 2 – Diseases. Academic Press: San Diego, CA. Chapter 8 – Lactate Dehydrogenase-Elevating Virus, p. 225.
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002 Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, pp. 65-66.

**Domain 1; Primary Species – Mouse (Mus musculus)**

**77.** Which of the following anesthetics is thought to antagonize vanilloid receptor TRPV1?

a. Alphaxalone

b. Eugenol

c. Ketamine

d. Propofol

e. Urethane

**Answer: b. Eugenol**

**References:**

1. Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd ed. Academic Press, San Diego, CA. Chapter 2 – Pharmacology of Injectable Anesthetics, Sedatives, and Tranquilizers, p. 59.
2. Goulet et al. 2010. Eugenol anestehsia in african clawed frogs (*Xenopus laevis*) of different body weights. JAALAS 49(4):460-463

**Domain 2**

**78.** Experimental autoimmune (allergic) encephalomyelitis is a widely used model of what disease?

1. Amyotrophic lateral sclerosis
2. Ataxia-telangiectasia
3. Huntington’s disease

d. Multiple sclerosis

e. Niemann-Pick disease

**Answer: d. Multiple Sclerosis**

**References:**

1) Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 4 - Immunology.  Academic Press: San Diego, CA.  Chapter 15 – The Mouse Trap: How Well Do Mice Model Human Immunology, pp. 308-309.

2) Emerson et al. 2009. Enhancing the ability of experimental autoimmune encephalomyelitis to serve as a more rigorous model of multiple sclerosis through refinement of experimental design. Comparative Medicine 59(2):112-128

**Domain 3**

**79.** An automated recirculating watering system for mice should maintain what range of constant water pressure in order to ensure proper drinking valve operation and eliminate airlocks in the system?

1. 3-5 psi
2. 7-9 psi
3. 10-12 psi
4. 15-20 psi
5. 20-30 psi

**Answer: a. 3-5 psi**

**References:**

1. Hessler JR, Lehner NDM, eds. 2009. Planning and Designing Research Animal Facilities. Academic Press, San Diego, CA. Chapter 32 - Plumbing: Special Considerations, pp. 441-445
2. Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 3 – Normative Biology, Husbandry, and Models. Academic Press: San Diego, CA. Chapter 12 - Environmental and Equipment Monitoring, p. 419

**Domain 4; Primary Species – Mouse (Mus musculus*)***

1. Which of the following requires review and approval by the Institutional Biosafety Committee, Recombinant DNA Advisory Committee and the NIH Director?
   1. Experiments with a recombinant DNA (rDNA) modified restricted agent in a whole animal
   2. Experiments that deliberately transfer drug resistance traits
   3. Creating stable germ line alterations of rodents using rDNA that require BSL-1 containment
   4. Purchase or transfer of transgenic rodents

**Answer: b. Experiments that deliberately transfer drug resistance traits**

**Reference:** NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules. 2013. Section III-A. Experiments that Require Institutional Biosafety Committee Approval, RAC Review, and NIH Director Approval Before Initiation, p. 16.

(http://osp.od.nih.gov/sites/default/files/NIH\_Guidelines.pdf)

**Domain 5**

**81.** Which of the following organizations was established by the 1985 amendments to the Animal Welfare Act to provide information on improved methods of animal experimentation that could reduce or replace animal use and minimize pain and distress?

1. AWI
2. AWIC
3. ICCVAM
4. ILAR

**Answer: b. AWIC**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 2 – Laws, Regulations, and Policies Affecting the Use of Laboratory Animals, p. 23.

2) http://awic.nal.usda.gov/

**Domain 6**

**82.** Which class of virus has been determined to cause an acute respiratory disease and death in rabbits mimicking acute pasteurellosis?

1. Coronavirus
2. Encephalomyocarditis virus
3. Herpesvirus

e. Picornavirus

**Answer: c. Herpesvirus**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 9 – Biology and Diseases of Rabbits, p. 345.

2) Sunohara-Neilson et al. 2013. Experimental infection of New Zealand white rabbits (Oryctolagus cuniculi) with Leporid herpesvirus 4. Comparative Medicine 63(5):422-431.

3) Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 6 – Rabbit, pp. 259-261

4) Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section II – Rabbits, Chapter 14 – Viral Diseases, pp. 381-382, 389-392

**Domain 1; Primary Species - Rabbit (Oryctolagus cuniculus)**

**83.** Which of the following terms describesalleles at a given locus which both express distinct, recognizable phenotypes in a heterozygote?

a. Codominant

b. Hemizygous

c. Recessive

d. Semidominant

**Answer: a. Codominant**

**Reference:** Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 1 – History, Wild Mice, and Genetics. Academic Press: San Diego, CA. Chapter 4 – Breeding Systems, pp. 56-57.

**Domain 3**

**84.** According to the Guide for the Care and Use of Laboratory Animals, what chemicals **MUST** be removed from water used in aquatic systems before housing fish and amphibians?

1. Ammonia and nitrite
2. Calcium carbonate and magnesium
3. Chlorine and chloramines
4. Nitrite and nitrate

**Answer: c. Chlorine and chloramines**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 19 – Biology and Management of the Zebrafish, p. 873, Chapter 17- Biology and Diseases of Amphibians, p. 797.

2) Institute for Laboratory Animal Resources. 2011. Guide for the Care and Use of Laboratory Animals. National Academy Press, Washington, D.C. Chapter 3 – Environment, Housing and Management, pp. 78-79.

**Domain 4**

**85.** According to the Animal Welfare Act and its regulations, how many years must the institutional animal care and use committee maintain records after completion of a protocol involving animals?

* 1. 1
  2. 2
  3. 3
  4. 4
  5. 5

**Answer: c. 3**

**References:**

1. Animal Welfare Act, 9 CFR Part 2 – Regulations, Subpart C – Research Facilities, §2.36(f) Recordkeeping requirements (1-1-00 Edition, p. 26)
2. Applied Research Ethics National Association (ARENA) and Office of Laboratory Animal Welfare (OLAW). 2002. Institutional Animal Care and Use Committee Guidebook. 2nd Edition. OLAW: Bethesda, MD. E.1. Recordkeeping and Reporting, p. 170.
3. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 2 – Laws, Regulations, and Policies Affecting the Use of Laboratory Animals, p. 23

**Domain 5**

**86.** Which of the following species has proportionally the largest adrenal glands?

1. Mouse
2. Rat
3. Hamster
4. Gerbil
5. Guinea pig

**Answer: d. Gerbil**

**References:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd edition. Blackwell Publishing: Ames, Iowa. Chapter 4 – Gerbil, p. 207.
2. Harkness JE, Turner PV, VandeWoude S, Wheler CL. 2010. Harkness and Wagner’s Biology and Medicine of Rabbits and Rodents, 5th ed. Wiley-Blackwell: Ames, IA. Chapter 2 – Biology and Husbandry, p. 76.
3. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section VI – Other Rodents, Chapter 52 – Gerbils, p. 1135

**Domain 1; Secondary Species –Gerbil (Meriones unguiculatus)**

**87.** The compound 4-vinlycyclohexene diepoxide is used in research to induce which of the following physiological or disease processes in mammals?

1. Diabetes
2. Multiple sclerosis
3. Obesity
4. Peripheral neuropathy
5. Regression of primordial and primary ovarian follicles

**Answer: e. Regression of primordial and primary ovarian follicles**

**References:**

1. Perez et al. 2013. Effects of chemically induced ovarian failure on voluntary wheel-running exercise and cardiac adaptation in mice. Comparative Medicine 63(3):233-243
2. Appt et al. 2010. Experimental induction of reduced ovarian reserve in a nonhuman primate model (Macaca fascicularis).Comparative Medicine 60(5):380-388
3. Muhammad et al. 2009. Effects of 4-vinylcyclohexene diepoxide on peripubertal and adult Sprague Dawley rats: ovarian, clinical, and pathologic outcomes. Comparative Medicine 59(1):46-59

**Domain 3**

**88.** Which of the following is attributed to the high resistance of parvoviruses to disinfection with UV and gamma irradiation?

1. Highly efficient DNA repair capabilities and small genome volume
2. Small size of the organism
3. Solubility and structure
4. Association with dirt and organic matter
5. Lack of an envelope

**Answer: a. Highly efficient DNA repair capabilities and small genome volume**

**Reference:** Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 10 – Microbiological Quality Control For Laboratory Rodents And Lagomorphs, p. 369

**Domain 4**

**89.** An Institutional Biosafety Committee must consist of no fewer than how many members?

1. 3
2. 4
3. 5
4. 6

**Answer: c. 5**

**References:**

1. NIH Guidelines For Research Involving Recombinant DNA Molecules. 2013. Section IV-B-2-a. Membership and Procedures, p. 26 (http://oba.od.nih.gov/oba/rac/Guidelines/NIH\_Guidelines.pdf)
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 24 – Control of Biohazards Associated with the Use of Experimental Animals, pp. 1053-1054

**Domain 5**

**90.** Which of the following statements is most consistent regarding laboratory animal allergies?

a. Urine proteins are the main source of allergenic proteins in mice and rats

b. Saliva proteins are the main source of allergenic proteins in mice and rats

c. Personal protective equipment should be the major protective mechanism for allergies

d. Laboratory animal allergies are not a concern of the institutional health and safety programs

**Answer: a. Urine proteins are the main source of allergenic proteins in mice and rats**

**References**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 24 – Control of Biohazards Associated with the Use of Experimental Animals, p. 1054.
2. National Research Council. 2011. Guide for the Care and Use of Laboratory Animals, 8th ed. National Academies Press, Washington D.C. Chapter 2 – Animal Care and Use Program, pp. 22-23
3. Committee on Occupational Safety and Health in Research Animal Facilities, Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1997. Occupational Health and Safety in the Care and Use of Research Animals. National Academy Press, DC. Chapter 4 - Allergens, pp. 54-56.
4. Glueck et al. 2012. Exposure of laboratory animal care workers to airborne mouse and rat allergens. JAALAS 51(5):554-560

**Domain 4; Primary Species – Mouse (Mus musculus) And Rat (Rattus norvegicus)**

**91.** What is the most likely cause of epistaxis and mucohemorrhagic nasal discharge in cynomolgus macaques?

1. Klebsiella pneumoniae
2. Moraxella bovis
3. Moraxella catarrhalis
4. Mycobacterium bovis
5. Pasteurella multocida

**Answer: c. Moraxella catarrhalis**

**Reference:** Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 16 – Nonhuman Primates, pp. 734-739.

**Domain 1; Primary Species - Macaques (Macaca spp.)**

**92.** What is generally recommended as the maximum percentage of circulating blood volume that can be safely withdrawn from rodents in a single sample?

a. 1%

b. 10%

c. 15%

d. 25%

**Answer: b. 10%**

**References:**

1) Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section I – General, Chapter 3 – Clinical Biochemistry and Hematology. p. 60

2) Harkness JE, Turner PV, VandeWoude S, Wheler CL. 2010. Harkness and Wagner’s Biology and Medicine of Rabbits and Rodents, 5th ed. Wiley-Blackwell: Ames, IA. Chapter 3 – Clinical Procedures, p. 107

**Domain 3**

**93.** The following are all characteristics of ATP luminometers **EXCEPT**?

1. Results are expressed in Relative Light Units (RLU)
2. Sensitivity of detection varies widely among substrates
3. Provides good detection of gram-negative bacteria
4. No standard RLU baseline values exist

**Answer: c. Provides good detection of gram-negative bacteria**

**References:**

1. Luchins et al. 2011. Manzanita wood: a sanitizable enrichment option for nonhuman primates. JAALAS50(6):884-887.
2. Turner et al.2010. Efficacy and limitation of an ATP-based monitoring system. JAALAS 49(2):190–194.

**Domain 4**

**94.** Which of the following species would be regulated by the United States Department of Agriculture?

* 1. Meleagris gallopava as a model of dilated cardiomyopathy
  2. Aplysia californica in a behavior study for memory learning
  3. Equis caballus in an undergraduate class teaching handling techniques
  4. Suncus murinus in testing the efficacy of novel antiemetics
  5. Capra hircus in evaluating the feed efficiency of a new maintenance diet

**Answer: d. Suncus murinus in testing the efficacy of novel antiemetics**

**References:**

1. Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 1 – Definition of Terms, §1.1 Definitions (11-06-13 Edition, p. 17) (http://www.aphis.usda.gov/animal\_welfare/downloads/Animal%20Care%20Blue%20Book%20-%202013%20-%20FINAL.pdf)
2. Animal Care. January 2002. APHIS Fact Sheet: The Animal Welfare Act. (http://www.ca-biomed.org/pdf/media-kit/oversight/USDAAWA.pdf)

**Domain 5; Tertiary Species - Other Rodents**

**95.** Detection of mouse parvovirus (MPV) can be problematic in genetically engineered mouse colonies on a C57BL/6 background because of which of the following reasons?

a. Extremely high infection prevalence among mice on a C57BL/6 background

b. Immunodeficient phenotype of mice on C57BL/6 background

c. Relatively high resistance of mice on C57BL/6 background to MPV

d. Relatively long dormant phase of MPV infection in mice

## Answer: c. Relatively high resistance of mice on C57BL/6 background to MPV

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, pp. 62-63
2. Watson. 2013. Unsterilized feed as the apparent cause of a mouse parvovirus outbreak. JAALAS 52(1):83-88

**Domain 1; Primary Species – Mice (Mus Musculus)**

**96.** Which person at a research facility is responsible for appointing an Institutional Animal Care and Use Committee?

1. Attending Veterinarian
2. Chairman
3. Chief Executive Officer
4. Institutional Official
5. Doctor of Veterinary Medicine

**Answer: c. Chief Executive Officer**

**References:**

1) Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 2 – Regulations, Subpart C – Research Facilities, §2.31 (a) Institutional Animal Care and Use Committee (IACUC) (11-6-13 Edition, p. 32) (http://www.aphis.usda.gov/animal\_welfare/downloads/Animal%20Care%20Blue%20Book%20-%202013%20-%20FINAL.pdf)

2) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 2 – Laws, Regulations, and Policies Affecting the Use of Laboratory Animals, p. 21

**Domain 5**

**97.** Molecular sequencing evidence suggests that H3N8, the agent of canine influenza, originated in what species and is what type of a virus?

1. Ducks, enzootic
2. Pigs, endemic

c. Horses, species-specific

d. Humans, zoonotic

e. Turkeys, epizootic

**Answer: c. Horses, species-specific**

**References:**

1) Anderson et al. 2013. Prevalence of and exposure factors for seropositivity to H3N8 canine influenza virus in dogs with influenza-like illness in the United States. JAVMA 242(2):209-216.

2) CDC. Key Facts About Canine Influenza (http://www.cdc.gov/flu/canine/)

**Domain 3; Primary Species - Dog (Canis familiaris)**

**98.** All of the following arerequired for animal biosafety level 3 **EXCEPT**?

1. Class I or II biosafety cabinet
2. Directional airflow
3. Double door autoclave
4. Sealable seams and windows
5. Self-closing doors

**Answer: c. Double door autoclave**

**References:**

1. U. S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and National Institutes of Health. 2009. Biosafety in Microbiological and Biomedical Laboratories. 5th ed. U.S. Government Printing Office, Washington, D. C. Section IV – Laboratory Biosafety Level Criteria, p. 58 **(**http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5\_sect\_IV.pdf)
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 24 – Control of Biohazards, p. 1049.

**Domain 4**

**99.** Which of the following statements best describes a class I laser according to the American National Standards Institute?

1. Under normal conditions, does not emit a hazardous level of irradiation
2. Does not have enough power to injure someone accidentally but does have enough power to cause injury if the beam is viewed for extended periods
3. Can cause injury if the beam is viewed directly
4. May also present a fire hazard

**Answer: a. Under normal conditions does not emit a hazardous level of irradiation**

**References:**

1. Committee on Occupational Safety and Health in Research Animal Facilities, Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1997. Occupational Health and Safety in the Care and Use of Research Animals. National Academy Press, DC. Chapter 3 – Physical, Chemical, and Protocol-Related Hazards, pp. 37-38 (http://www.nap.edu/openbook.php?record\_id=4988&page=R1)
2. http://www.fda.gov/radiation-emittingproducts/radiationemittingproductsandprocedures/homebusinessandentertainment/laserproductsandinstruments/default.htm

**Domain 5**

**100.** Which of the following is the recommended light intensity range at the cage level that rats should be housed at to prevent phototoxic retinopathy?

a. 30-130 lux

b. 30-300 lux

c. 60-180 lux

d. 130-325 lux

**Answer: d. 130-325 lux**

**References:**

1. National Research Council. 2011. Guide for the Care and Use of Laboratory Animals, 8th ed. National Academies Press, Washington D.C. Chapter 3 – Environment, Housing, and Management, p. 49.
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 4 – Biology and Disease of Rats, p. 122

**Domain 4; Primary Species – Rat (Rattus norvegicus)**

**101.** For suspected Shigellosis in macaques, what is the recommended collection method and culture frequency that will result in the greatest chance of obtaining a positive result?

* 1. Fresh feces or rectal swab, collected once per week for 3 consecutive weeks
  2. Fresh feces, collected every other day for 1 week
  3. Fresh feces or rectal swab, collected for 3 consecutive days
  4. Rectal swab, collected once per week for 3 consecutive weeks

**Answer: c. Fresh feces or rectal swab, collected for 3 consecutive days**

**References:** Abee CR, Mansfield K, Tardif S, Morris T, eds. 2012. Nonhuman Primates in Biomedical Research: Diseases, 2nd edition. Academic Press: San Diego, CA. Chapter 2– Bacterial and Mycotic Diseases of Nonhuman Primates, p. 138.

**Domain 1; Primary Species - Macaques (Macaca spp*.*)**

**102.** Which of the following mouse strains is used for autoimmune syndrome research?

a. Nude

b. SCID

c. Rag-1

d. Moth-eaten

**Answer: d. Moth-eaten**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, p. 55.

2) Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 4 – Immunology. Academic Press: San Diego, CA. Chapter 10 – Peripheral Tolerance of T Cells in the Mouse, p. 231 and Chapter 13 – Mouse Models of Immunodeficiency, pp. 277-279

**Domain 3; Primary Species – Mouse (Mus musculus**)

**103.** Which of the following criteria or assumptions must be met in order for the binomial distribution formula to accurately determine sample size?

a. Population size must be at least 1,000

b. Transmission of the agent is random

c. Cages should be barrier cages (e.g. microisolator caging)

d. Prevalence of the agent in the population must be 30% or greater

e. Frequency of testing should be on at least a semi-annual basis

**Answer: b. Transmission of the agent is random**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 10 – Microbiological Quality Control for Laboratory Rodents and Lagomorphs, pp. 383-384

2) Shek. 2008. Role of housing modalities on management and surveillance strategies for adventitious agents of rodents. ILAR J 49(3):316-325.

**Domain 4**

**104.** According to the Animal Welfare Act (AWA) and its regulations, all of the following apply to the transportation of rabbits and guinea pigs **EXCEPT**?

* 1. Auxiliary ventilation must be used in the animal holding area when temperatures are ≥ 85oF
  2. No more than 15 rabbits or 15 guinea pigs can be transported in a single enclosure
  3. There are no minimal requirements of height and space of transport enclosures for rabbits
  4. Food and water is required during transport when the transportation duration is more than 6 hours
  5. The AWA does not recognize that guinea pigs can be acclimated to temperatures below 45oF

**Answer: a. Auxiliary ventilation must be used in the animal holding area when temperatures are ≥ 85oF**

**References:**

1. Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 3 - Standards, Subpart B – Specifications for the Humane Handling, Care, Treatment, and Transportation of Guinea Pigs and Hamsters, §3.36 (d) Primary enclosures used to transport live guinea pigs and hamsters, § 3.38 (a) Food and water requirements, §3.40 Terminal facilities (11-6-13 Edition, pp. 80-85)

(http://www.aphis.usda.gov/animal\_welfare/downloads/Animal%20Care%20Blue%20Book%20-%202013%20-%20FINAL.pdf)

1. Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 3 - Standards, Subpart C – Specifications for the Humane Handling, Care, Treatment, and Transportation of Rabbits, §3.61 (a)(d) Primary enclosures used to transport live rabbits,§3.63 (a) Food and water requirements, §3.63 Terminal facilities (11-6-13 Edition, pp. 88-93)

(http://www.aphis.usda.gov/animal\_welfare/downloads/Animal%20Care%20Blue%20Book%20-%202013%20-%20FINAL.pdf)

**Domain 5; Primary Species - Rabbit (Oryctolagus cuniculus) and Secondary Species – Guinea Pig (Cavia porcellus)**

**105.** Which of the following species is resistant to hypothermia, can withstand sub-freezing temperatures in the wild and has a recommended dry-bulb macroenvironmental temperature range of 18-22 ºC (64-72 ºF).

1. Chinchilla laniger
2. Octodon degus
3. Microtus californicus
4. Peromyscus leucopus

**Answer: a. Chinchilla laniger**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 7– Biology and Diseases of Other Rodents, p. 286.
2. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Elsevier: San Diego, CA. Section V - Chinchillas, Chapter 40 – Management, Husbandry and Colony Health, p. 969.

**Domain 4; Tertiary Species – Other Rodents**

**106.** Which of the following laryngoscope blades has a curved design?

* 1. Macintosh
  2. Modified Miller
  3. Phillips
  4. Robertshaw
  5. Wisconsin

**Answer: a. Macintosh**

**References:**

1) Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd ed. Academic Press, San Diego, CA. Chapter 5 – Anesthesia Delivery Systems, p. 159

2) Abee CR, Mansfield K, Tardif S, Morris T, eds. 2012. Nonhuman Primates in Biomedical Research, 2nd edition, Volume - Biology and Management, Academic Press: San Diego, CA. Chapter 17 – Anesthesia and Analgesia in Nonhuman Primates, p. 422

**Domain 2**

1. Which of the following breeds of goat serves as a model of β-mannosidosis?
2. Fainting
3. La Mancha
4. Nubian
5. Pygmy
6. Saanen

**Answer: c. Nubian**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 14 - Biology and Diseases of Ruminants: Sheep, Goats, and Cattle, p. 522.
2. Smith MC and Sherman DM. 2009. Goat Medicine, 2nd edition. Wiley-Blackwell: Ames, IA. Chapter 5 – Neurologic Diseases, p. 238

**Domain 3; Secondary Species - Goat (Capra hircus)**

1. According to the Guide for Care and Use of Laboratory Animals, adult zebrafish in typical biomedical research settings in the United States are generally housed how many fish per liter of water?
2. 3
3. 4
4. 5
5. 6
6. 10

**Answer: c. 5**

**References:**

1. Institute for Laboratory Animal Resources. 2011. Guide for the Care and Use of Laboratory Animals. National Academy Press, Washington, D.C. Chapter 3 - Environment, Housing and Management, p. 83.
2. Koerber and Kalishman. 2009. Preparing for a semiannual IACUC inspection of a satellite zebrafish (Danio rerio) facility. JAALAS. 48(1):65-75

**Domain 4; Secondary Species – Zebrafish (Danio rerio)**

**109.** According to the Guide for the Care and Use of Laboratory Animals, who is responsible for determining that personnel performing surgical procedures are appropriately qualified and trained in surgical procedures?

1. Attending Veterinarian (AV)
2. IACUC
3. Principal investigator (PI)
4. IACUC with the AV
5. PI with the IACUC

**Answer: d. IACUC with the AV**

**References**:

1. National Research Council. 2011. Guide for the Care and Use of Laboratory Animals, 8th ed. National Academies Press, Washington D.C. Chapter 4 – Veterinary Care, pp. 115-116.
2. Clifford et al. 2013. Assessment of proficiency and competency in laboratory animal biomethodologies. JAALAS 52(6):711-716.

**Domain 5**

1. In a breeding colony of Columba livia, there is a reported decrease in egg production. Some of the squabs are anemic and slightly runted. A few flying insects, approximately 7 mm long and brown in color with transparent wings were found in the cage. What were these insects most likely to be?
   1. Columbicola columbae
   2. Goniocotes gallinae
   3. Hemoproteus columbae
   4. Pseudolynchia canariensis

**Answer: d. Pseudolynchia canariensis**

**References:**

1. Baker DG, ed. 2007. Flynn’s Parasites of Laboratory Animals, 2nd edition. Blackwell Publishing, Iowa, USA. Chapter 10 – Parasites of Birds, p. 257.
2. Owiny and French. 2000. Ectoparasites in a pigeon colony. Comparative Medicine 50(2):229-230.

**Domain 1; Tertiary Species – Pigeon (Columbia livia)**

**111.** Which of the following best describes muscular dystrophy in golden retrievers used as a model of Duchenne muscular dystrophy in human children?

1. Autosomal dominant duplication of the gene encoding the muscle protein dystrophin
2. X-linked dominant deletion of the gene encoding the muscle protein dystrophin
3. Autosomal recessive absence of the muscle protein dystrophin
4. X-linked recessive absence of the muscle protein dystrophin
5. Autosomal recessive duplication of the gene encoding the muscle protein dystrophin

**Answer: d. X-linked recessive absence of the muscle protein dystrophin**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 11 – Biology and Diseases of Dogs, p. 396.

2) Rouger et al. 2011. Systemic delivery of allogenic muscle stem cells induces long-term muscle repair and clinical efficacy in Duchene muscular dystrophy dogs. Am J Pathol 179(5):2501-2518.

**Domain 3; Primary Species – Dog (Canis familiaris)**

**112.** All of the following apply to the husbandry and care of gerbils **EXCEPT**?

a. Relative humidity should be kept below 50% to reduce the incidence of nasal dermatitis

1. Gerbils require sand bathing to keep their coats from becoming oily
2. Gerbils develop high blood cholesterol concentrations on diets containing more than 4% fat
3. Gerbil cages require less frequent cleaning than those of other laboratory rodents
4. Pine bedding is recommended to help avoid matting and greasiness of the fur

**Answer: e. Pine bedding is recommended to help avoid matting and greasiness of the fur**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 7 – Biology and Diseases of Other Rodents, p. 276.
2. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Elsevier: San Diego, CA. Section VI - Other Rodents, Chapter 52 – Gerbils, p. 1138.

**Domain 4; Secondary Species – Gerbils (Meriones spp.)**

**113.** All of the following are used by AAALAC, International as primary standardsto evaluate animal care and use programs **EXCEPT**?

1. Guide for the Care and Use of Agricultural Animals in Research and Teaching (FASS 2010)
2. Guide for the Care and Use of Laboratory Animals, 8th edition
3. Guide for the Care and Use of Mammals in Neuroscience and Behavioral Research (ILAR 2003)
4. European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes, Council of Europe (ETS 123)

**Answer: c. Guide for the Care and Use of Mammals in Neuroscience and Behavioral Research (ILAR 2003)**

**References:**

1)http://www.aaalac.org/about/guidelines.cfm

2) Newcomer. 2012. The evolution and adoption of standards used by AAALAC.JAALAS 51(3):293-297.

**Domain 5**

**114.** When making a histological diagnosis of amyloidosis, how do amyloid proteins appear when stained with Congo red?

1. Deep purple and birefringent under polarized light
2. Apple-green and birefringent under polarized light
3. Apple-green when viewed under confocal lens
4. Lemon yellow and birefringent under polarized light

**Answer: b. Apple-green and birefringent under polarized light**

**References:**

1)Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 1 – Mouse, p. 93

2) Rice et al. 2013. Diagnosis of amyloidosis and differentiation from chronic, idiopathic enterocolitis in rhesus (Macaca mulatta) and pig-tailed (M. nemestrina) macaques. Comparative Medicine 63(3):262-271

**Domain 1**

1. Which of the following best describes morphine and its immunomodulatory activity in rodents?
   1. Morphine is a partial mu receptor agonist which decreases corticosteroid secretion and increases natural killer cell activity
   2. Morphine is a mu receptor agonist with limited immunomodulatory effects
   3. Morphine is a mu receptor agonist and kappa antagonist which increases proinflammatory mediators
   4. Morphine is a mu receptor agonist associated with increased endotoxin sensitivity
   5. Morphine is a mu receptor agonist which increases gut motility and bacterial translocation

**Answer: d. Morphine is a mu receptor agonist associated with increased endotoxin sensitivity**

**References:**

1) Cotroneo et al. 2012. Effects of buprenorphine on a cecal ligation and puncture model in C57BL/6 mice. JAALAS 51(3):357-365

2) Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd ed. Academic Press, San Diego, CA. Chapter 4 – Pharmacology of Analgesics, pp. 111-112

**Domain 2; Primary Species – Mouse (Mus musculus)**

**116.** Which of the following mice is commonly used as a model of Chediak-Higashi Syndrome in humans?

1. C3H/HeJ (*Tlr4Lps-d*)
2. CB57BL/10ScCr (*Tlr4Lps-del*)
3. Beige (*Lystbg)*
4. Non-Obese Diabetic
5. SCID (*Prkdcscid*)

**Answer: c. Beige (*Lystbg*)**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 3 - Biology and Diseases of Mice, p. 55 [Table XII].
2. Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 4 – Immunology. Academic Press: San Diego, CA. Chapter 13 – Mouse Models of Immunodeficiency, pp. 277-279.

**Domain 3; Primary Species – Mouse (Mus musculus)**

**117.** Which of the following represents agents listed in order of increasing (lowest to highest) resistance to disinfectants?

a. Clostridium spores 🡪 Candida 🡪 Enterococcus

b. Poliovirus 🡪 Pseudomonas 🡪 HIV

c. Mycobacterium 🡪 Trichophyton 🡪 herpesvirus

d. Salmonella 🡪 Cryptococcus 🡪 Mycobacterium

**Answer: d. Salmonella 🡪 Cryptococcus 🡪 Mycobacterium**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 10 – Microbiological Quality Control for Laboratory Rodents and Lagomorphs, p. 371

2) U. S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and National Institutes of Health. 2009. Biosafety in Microbiological and Biomedical Laboratories. 5th ed. U.S. Government Printing Office, Washington, D. C. Appendix B – Decontamination and Disinfection, p. 330 (Table 1)

(http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5\_appendixB.pdf)

**Domain 4**

**118.** According to the Animal Welfare Act and its regulations, what is the minimum amount of floor space in square feet that must be provided for each dog in a primary enclosure?

a. (Length of the dog from tip of nose to tip of tail in inches)2

144

b. (Length of the dog from tip of nose to tip of tail in inches + 6)2

144

c. (Length of the dog from tip of nose to base of tail in inches)2

144

d. (Length of the dog from tip of nose to base of tail in inches + 6)2

144

e. Need the dog’s weight in kg in order to calculate minimum amount of floor space required

**Answer: d. (Length of the dog from tip of nose to base of tail in inches + 6)2**

**144**

**References:**

1) Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 3 – Standards, Subpart A – Specifications for the humane handling, care, treatment, and transportation of dogs and cats, §3.6(c)(1)(i) Primary Enclosures (11-6-13 Edition, p. 65) (http://www.aphis.usda.gov/animal\_welfare/downloads/Animal%20Care%20Blue%20Book%20-%202013%20-%20FINAL.pdf)

2) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 11 – Biology and Diseases of Dogs, p.397.

3) Institute of Laboratory Animal Resources. 2011. Guide for the Care and Use of Laboratory Animals, 8th edition. Washington, DC: National Academy Press. Chapter 3 – Environment, Housing, and Management, p. 59.

**Domain 5; Primary Species - Dog (*Canis familiaris*)**

**119.** Which of the following would meet the eligibility requirements to qualify for the ALAT certification exam?

1. 0.5 years of lab animal work experience and a high school degree/GED
2. 2 years of lab animal work experience
3. 0.5 years of lab animal work experience and an associate’s degree
4. 1 year of lab animal work experience and a bachelor’s degree

**Answer: c. 0.5 years of lab animal work experience and an associate’s degree**

**Reference:** http://www.aalas.org/pdf/Tech\_Cert\_handbook.pdf#Eligibility (p. 3)

**Domain 6**

**120.** All of the following can occur in neomycin-streptomycin toxicity in gerbils **EXCEPT**?

1. Anemia
2. Ascending flaccid paralysis
3. Coma
4. Death
5. Depression

**Answer: a. Anemia**

**References:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 4 - Gerbil, p. 213
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 7 – Biology and Diseases of Other Rodents, p. 278
3. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section VI – Other Rodents, Chapter 52 – Gerbils, p. 1146

**Domain 1; Secondary Species - Gerbil (Meriones spp.)**

1. Which of the following strains of mice is a model for retinitis pigmentosa?
2. C3H/He
3. C57BL/6
4. BALB/c
5. NOD

**Answer: a. C3H/He**

**Reference:** Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, p. 110.

**Domain 3; Primary Species - Mouse (Mus musculus)**

1. The common marmoset (Callithrix jacchus) is used asa model for all of the following **EXCEPT**?
2. Experimental allergic encephalitis of multiple sclerosis and Parkinson’s disease
3. Gammaherpesvirus models of acute oncogenesis
4. Macacine Herpesvirus 1
5. Reproductive toxicology
6. Regulation of reproductive behavior and models of anxiety and stress

**Answer: c. Macacine Herpesvirus 1**

**References:**

1. Mansfield. 2003. Marmoset models commonly used in biomedical research.Comparative Medicine 53(4):383-392.
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 16 - Nonhuman Primates, pp. 685-686.

**Domain 3; Secondary Species – Marmoset/Tamarins (Callitrichidae)**

**123.** According to the Animal Welfare Act and its regulations as well as the PHS Policy on Humane Care and Use of Laboratory Animals, how often must the Institutional Animal Care and Use Committee inspect all of the research facility’s animal facilities?

1. At least monthly
2. At least quarterly
3. At least once every 6 months
4. At least annually
5. At least once every three years

**Answer: c. At least once every 6 months**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 2 – Laws, Regulations, and Policies Affecting the Use of Laboratory Animals, p. 20.

2) Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 2 – Regulations, Subpart C – Research Facilities, §2.31Institutional Animal Care and Use Committee (IACUC), (c)(1) IACUC functions. (11-6-13 Edition, p. 32)

(http://www.aphis.usda.gov/animal\_welfare/downloads/Animal%20Care%20Blue%20Book%20-%202013%20-%20FINAL.pdf)

3) Office of Laboratory Animal Welfare. 2002. Public Health Service Policy on Humane Care and Use of Laboratory Animals. National Institutes of Health, Bethesda, MD. B. Functions of the Institutional Animal Care and Use Committee, p. 12

**Domain 5**

**124.** Which of the following is documented as reducing the incidence of chromophobe adenomas in rodents?

1. Corn cob bedding
2. Diet restriction
3. Light cycle
4. Presence of enrichment

**Answer: b. Diet restriction**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 4 – Biology and Diseases of Rats, p. 155
2. Suckow MA, Weisbroth SH, Franklin CL, eds. 2006. The Laboratory Rat, 2nd edition. Elsevier Academic Press: San Diego, CA. Chapter 25 – Gerontology and Age-Associated Lesions, p.765.

**Domain 1; Primary Species – Rat (Rattus norvegicus)**

**125.** What is the acetic acid wiping response in amphibians used to assess?

1. Analgesic efficacy
2. Cognition
3. Food palatability
4. Stage of metamorphosis

**Answer: a. Analgesic efficacy**

**References:**

1. Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd ed. Academic Press, San Diego, CA. Chapter 20 – Anesthesia and Analgesia in Amphibians, p. 517.
2. Koeller. 2009. Comparison of buprenorphine and butorphanol analgesia in the eastern red-spotted newt (Notophthalmus viridenscens). JAALAS 48(2):171-175.

**Domain 2; Tertiary Species – Other Amphibians**

**126.** What drug may be administered prior to milk collection in the mouse to stimulate milk flow and increase milk yield?

1. Estrogen
2. Oxytocin
3. Progesterone
4. Prolactin

**Answer: b. Oxytocin**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, p. 51.

2) Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 3 – Normative Biology, Husbandry, and Models. Academic Press: San Diego, CA. Chapter 13 – Biomethodolgy and Surgical Techniques, p. 459.

**Domain 3; Primary Species – Mouse (Mus musculus)**

1. Which of the following statements is **TRUE** regarding an indexing tunnel washer?
2. Is incompatible with robotics for loading and unloading items from the conveyer
3. Uses more chemicals, water, and steam than standard tunnel washers
4. Provides physical separation between each wash and rinse cycle
5. Have a higher through-put than standard tunnel washers

**Answer: c. Provides physical separation between each wash and rinse cycle**

**References:**

1. Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 3 – Normative Biology, Husbandry, and Models. Academic Press: San Diego, CA. Chapter 9 – Design and Management of Research Facilities for Mice, pp. 302-303.
2. Hessler JR, Lehner NDM, eds. 2009. Planning and Designing Research Animal Facilities. Academic Press, San Diego, CA. Chapter 31 - Special Fixed Equipment for Research Animal Facilities, pp. 414-415

**Domain 4**

**128.** Which of the following methods would be appropriate for the disposal of animal carcasses and tissue waste infected with prions?

a. Incineration with a minimum secondary temperature of 900˚C (1652˚F)

b. Exposure to 1N NaOH or KOH heated to 150˚C in a pressurized vessel

c. Exposure to phenol or guanidine iosthiocyanate

d. Immersion for 30 minutes in 96% formic acid

e. Boiling in sodium diodecyl sulfate and urea

**Answer:** **b.** **Exposure to 1N NaOH or KOH heated to 150˚C in a pressurized vessel**

**References:** U. S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and National Institutes of Health. 2009. Biosafety in Microbiological and Biomedical Laboratories. 5th ed. U.S. Government Printing Office, Washington, D. C. Section VIII-H – Prion Diseases, pp. 286-287

(http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5\_sect\_VIII\_h.pdf)

**Domain 5**

**129.** Which of the following is currently the most sensitive and specific test available for diagnosis of Mycobacterium tuberculosis or Mycobacterium bovis in nonhuman primates and is therefore considered the diagnostic “gold-standard”?

1. Bacterial culture
2. Intradermal tuberculin skin test using mammalian old tuberculin
3. Intradermal tuberculin skin test using purified protein derivative
4. Interferon-γ assay
5. Multiplex microbead immunoassay

**Answer: a. Bacterial culture**

**References:**

1. Abee CR, Mansfield K, Tardif S, Morris T, eds. 2012. Nonhuman Primates in Biomedical Research Volume 2: Diseases, 2nd edition. Academic Press: San Diego, CA. Chapter 2 – Bacterial and Mycotic Diseases of Nonhuman Primates, p. 115.
2. Lerche et al. 2008. New approaches to tuberculosis surveillance in nonhuman primates. ILAR J 49 (2):170-178

**Domain 1**

**130.** Which of the following is the most commonly used inbred strain of rat for aging research?

1. ACI
2. BUF
3. F344
4. LEW

**Answer: c. F344**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 4 – Biology and Diseases of Rats, p. 122
2. Suckow MA, Weisbroth SH, Franklin CL, eds. 2006. The Laboratory Rat, 2nd edition. Elsevier Academic Press: San Diego, CA. Chapter 25 - Gerontology and Age-Associated Lesions, p. 762

**Domain 3; Primary Species – Rat (Rattus norvegicus)**

**131.** Which of the following light wavelengths **WOULD NOT** be visible to mice and rats?

a. 412 nm

b. 479 nm

c. 508 nm

d. 654 nm

**Answer: d. 654 nm**

**Reference:** Bittman et al. 2013. Animal care practices in experiments on biological rhythms and sleep: report of the joint task force of the Society for Research and Biological Rhythms and the Sleep Research Society. JAALAS 52(4):437-443.

**Domain 4; Primary Species – Mouse (Mus musculus) and Rat (Rattus norvegicus)**

**132.** According to the Animal Welfare Act and its regulations, which of the following statements is **TRUE** regarding necropsies of animals?

a. All necropsy reports should be signed and dated by the veterinarian and necropsy technician preparing the report

b. Necropsy records should be maintained for at least 3 years or as otherwise specified in Animal Welfare Act regulations and standards

c. A complete necropsy must be conducted by or under the supervision of the attending veterinarian on all marine mammals that die in captivity

d. For marine mammals in captivity, necropsy records will be maintained for a period of 1 year at the facility at which it died

e. Necropsies should be conducted within 24 hours after a suspicious death

**Answer: c. A complete necropsy must be conducted by or under the supervision of the attending veterinarian on all marine mammals that die in captivity**

**References:**

1. USDA Animal and Plant Health Inspection Service Animal Care Policy Manual. Policy # 4: Necropsy Requirements. March 25, 2011.

(http://www.aphis.usda.gov/animal\_welfare/policy.php?policy=4)

1. Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 3 – Standards, Subpart E – Specifications for the Humane Handling, Care, Treatment, and Transportation of Marine Mammals, §3.110 (g)(1)(2)Veterinary care (11-6-13 Edition, p. 126)

(http://www.aphis.usda.gov/animal\_welfare/downloads/Animal%20Care%20Blue%20Book%20-%202013%20-%20FINAL.pdf)

**Domain 5**

**133.** What is the etiologic agent of scaly skin disease in athymic nude mice?

1. A gram-positive coccoid bacteria
2. Corynebacterium bovis

c. Corynebacterium kutscheri

d. Staphylococcus epidermidis

**Answer*:* b*.* Corynebacterium bovis**

**References:**

1) Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 1 – Mouse, pp. 72-73.

2) Burr et al. 2012. Corynebacterium bovis:epizootiologic features and environmental contamination in an enzootically infected rodent room. JAALAS 51(2):189-198.

**Domain 1; Primary Species – Mouse (Mus musculus)**

**134.** Standards set by AAALAC International include all of the following **EXCEPT**?

1. All animal care personnel should be suitably qualified by training and experience in the care of laboratory animals
2. The Guide for the Care and Use of Laboratory Animals shall serve as a basic guide to the establishment of specific standards for accreditation
3. Require the accredited to submit an annual report which describes elements of the animal care and use program as specified by AAALAC International
4. Require membership in an association or organization for laboratory animal care and use as a condition for maintaining accreditation

**Answer: d. Require membership in an association or organization for laboratory animal care and use as a condition for maintaining accreditation**

**Reference:** **http://www.aaalac.org/accreditation/rules.cfm#standards**

**Domain 5**

**135.** Regarding the housing and management of aquatic animals, which of the following **IS NOT** a category of ‘life support system’ according to the Guide for the Care and Use of Laboratory Animals?

a. Static system

b. Aerated system

c. Flow-through system

d. Recirculating system

**Answer: b. Aerated system**

**References:**

1) Mason and Matthews. 2012. Aquatic environment, housing, and management in the eighth edition of the Guide for the Care and Use of Laboratory Animals: additional considerations and recommendations. JAALAS 51(3)329-332.

2) National Research Council. 2011. Guide for the Care and Use of Laboratory Animals, 8th ed. National Academies Press, Washington D.C. Chapter 3 – Environment, Housing, and Management, p. 79.

**Domain 4**

**136.** A deficiency or lack of which of the following enzymes is responsible for the requirement for exogenous vitamin C in guinea pigs?

* 1. Glucurokinase
  2. Glucuronate reductase
  3. L-galactose dehydrogenase

d. L-gluonolactone oxidase

e. Lysyl hydroxylase

**Answer: d. L-gulonolactone oxidase**

**References:**

1. Harkness JE and Wagner JE. 1995. The Biology and Medicine of Rabbits and Rodents, 4th Ed.Wilkins and Wilkins: Media, PA. Chapter 5 – Specific Diseases and Conditions, p. 229.
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 5 – Guinea Pig, p. 238.
3. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press, San Diego, CA. Chapter 6 – Biology and Diseases of Guinea Pigs, p. 208, 230-231

**Domain 4; Secondary Species – Guinea pig (Cavia porcellus)**

**137.** When using CO2 exposure for euthanasia of rats, which displacement rate (volume/min) is recommended as it is less likely to cause pain due to nociceptor activation by carbonic acid prior to onset of unconsciousness?

a. 25% to 45%

b. 10% to 30%

c. 30% to 40%

d. 15% to 45%

**Answer: b. 10% to 30%**

**References:**

1. American Veterinary Medical Association. 2013. AVMA Guidelines for the Euthanasia of Animals: 2013 Edition, p. 26 (https://www.avma.org/KB/Policies/Documents/euthanasia.pdf).

# [Burkholder et](http://www.ncbi.nlm.nih.gov/pubmed?term=Burkholder%20TH%5BAuthor%5D&cauthor=true&cauthor_uid=20819391). 2010. Comparison of carbon dioxide and argon euthanasia: effects on behavior, heart rate, and respiratory lesions in rats. JAALAS49(4):448-453.

**Domain 2; Primary Species – Rat (Rattus norvegicus)**

**138.** Which of the following associations is dedicated to balancing animal welfare and excellence in basic and applied scientific inquiry and affirms that the potential benefit to humans and animals from research and the cost to the animal subject(s) must both be considered?

a. SCAW

b. AWI

c. AWA

d. PAWS

**Answer: a. SCAW**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 1 – Laboratory Animal Medicine: Historical Perspective, p. 10.
2. http://www.scaw.com/about-scaw/

**Domain 6**

**139.** All of the following are associated with epilepsy in gerbils **EXCEPT**?

1. Trait inherited as a single autosomal locus with at least 1 dominant allele, with variable penetrance
2. Susceptibility begins at 12 months of age
3. Clinical symptoms include vestibular aberrations
4. Histopathological lesions have not been found in affected animals

**Answer: b. Susceptibility begins at 12 months of age**

**References:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 4 - Gerbil, p. 213
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 7 – Biology and Diseases of Other Rodents, p. 275
3. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section VI – Other Rodents, Chapter 52 – Gerbils, pp. 1144, 1148

**Domain 1; Secondary Species - Gerbil (Meriones spp.)**

**140.** According to FDA’s Good Laboratory Practices, all of the following are required for animal care **EXCEPT**?

1. Newly received animals from outside sources should be isolated and their health status evaluated
2. Regarding morbidities, all diagnoses, treatment authorizations and descriptions, and dates of treatments should be documented
3. Warm blooded animals, including young such as suckling rodents, must be identified
4. Feed and water analyses should be periodically performed to ensure they are not interfering with studies

**Answer: c. Warm blooded animals, including young such as suckling rodents, must be identified**

**Reference:** 21 CFR, Chapter 1 – Food and Drug Administration, Department of Health and Human Services, Subchapter A – General, Part 58 Good Laboratory Practice for Nonclinical Laboratory Studies, Subpart E--Testing Facilities Operation, §58.90 – Animal care. (4-1-13 Edition, p. 433) http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?CFRPart=58&showFR=1

**Domain 5**

**141.** In humans, zoonotic exposure to Newcastle disease virus is characterized by which of the following clinical signs?

1. Conjunctivitis
2. Cutaneous petechial hemorrhages
3. Diarrhea

d. Encephalitis

e. Mucosal hemorrhages

**Answer: a. Conjunctivitis**

**References:**

1. U. S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and National Institutes of Health. 2009. Biosafety in Microbiological and Biomedical Laboratories. 5th ed. U.S. Government Printing Office, Washington, D. C. Appendix D – Agriculture Pathogen Biosafety, p. 367.

(http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5\_appendixD.pdf)

2) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 25 – Selected Zoonoses, p. 1074.

**Domain 3**

**142.** What is the average gestation period in guinea pigs?

1. 31 days
2. 45 days
3. 60 days
4. 68 days

**Answer: d. 68 days**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 6 – Biology and Diseases of Guinea Pigs, p. 210.
2. Harkness JE, Turner PV, VandeWoude S, Wheler CL. 2010. Harkness and Wagner’s Biology and Medicine of Rabbits and Rodents, 5th ed. Wiley-Blackwell: Ames, IA. Chapter 2 – Biology and Husbandry, p. 54.
3. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section III – Guinea Pigs, Chapter 21 – Management, Husbandry, and Colony Health, p. 612

**Domain 4; Secondary Species – Guinea Pig (Cavia porcellus)**

1. According to the Drug Enforcement Agency Controlled Substances Act, which of the following drugs is a Schedule III drug labeled for use in dogs and cats?

a. Apomorphine

b. Butorphanol

c. Carfentanil

d. Diazepam

e. Tiletamine/zolazepam (Telazol)

**Answer: e. Tiletamine/zolazepam (Telazol)**

**Reference:** Drug Enforcement Agency Controlled Substances Act and Scheduling Actions, 2013. http://www.deadiversion.usdoj.gov/schedules/orangebook/a\_sched\_alpha.pdf

**Domain 5; Primary Species – Dog (Canis familiaris), Secondary Species – Cat (Felis domestica)**

**144.** In which of the following species does Streptococcus zooepidemicus cause cervical lymphadenitis?

1. Guinea Pigs
2. Hamsters
3. Mice
4. Rabbits
5. Rats

**Answer: a. Guinea Pigs**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 6 - Biology and Diseases of Guinea Pigs, pp. 213-215.
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 5 - Guinea Pig, pp. 229-230.

**Domain 1; Secondary Species – Guinea Pig (Cavia porcellus)**

**145.** Infections with fur mites (Myocoptes musculinus and Myobia musculi) can negatively affect research results by causing which of the following?

1. Elevations in monocyte skin infiltration
2. Decreases in monocyte skin infiltration

c. Elevations in IgA levels and inflammatory cytokines

d. Elevations in IgE levels and inflammatory cytokines

e. Elevations in IgE levels and decreases in inflammatory cytokines

**Answer: d. Elevations in IgE and inflammatory cytokines**

**References:**

1) Jensen et al. 2013. PCR testing of a ventilated caging system to detect murine fur mites. JAALAS 52(1):28-33

2) Metcalf Pate et al. 2011. Effect of sampling strategy on the detection of fur mites within a naturally infested colony of mice (Mus musculus). JAALAS 50(3):337–343.

**Domain 3; Primary Species – Mouse (Mus musculus)**

1. Excessive noise appears to have which of the following effects on mice and growing chickens?
   1. Decreased reproductive efficiency in mice, but no effect on growing chickens
   2. No effect on reproductive efficiency in mice but increased morbidity and mortality in growing chickens
   3. Decreased reproductive efficiency in mice and increased morbidity and mortality in growing chickens
   4. No effect on either mice or growing chickens

**Answer: c. Decreased reproductive efficiency in mice and increased morbidity and mortality in growing chickens**

**References:**

1. Rasmussen et al. 2009. Construction noise decreases reproductive efficiency in mice. JAALAS 48(4):363-370.
2. Pavek et al.2010. Operation of an air filtration device results in morbidity and mortality in growing chickens (Gallus gallus domesticus). JAALAS 49(5):578–582.

**Domain 4; Primary Species - Mouse (Mus musculus) and Tertiary Species – Chicken (Gallus domesticus)**

**147.** According to the most recent version of the Guide for the Care and Use of Laboratory Animals, what is the recommended minimum floor area for a female rat with a litter?

1. 51 in2
2. 70 in2
3. 101 in2
4. 124 in2
5. 150 in2

**Answer: d. 124 in2**

## Reference: Institute for Laboratory Animal Resources. 2011. Guide for the Care and Use of Laboratory Animals. National Academy Press, Washington, D.C. Chapter 3 – Environment, Housing, and Management, p. 57.

**Domain 5; Primary Species – Rat (Rattus norvegicus)**

**148.** Dubbing refers to which of the following standard agricultural practices?

a. Beak trimming of birds

b. Partial removal of the comb of chickens

c. Removal of supernumerary teats of cattle

d. Tail-docking in lambs

**Answer: b. Partial removal of the comb of chickens**

**Reference:** Committees to Revise the Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching. 2010. GUIDE For the Care and Use of Agricultural Animals in Research and Teaching. 3rd Edition. Federation of Animal Science Societies, Savoy, IL. Chapter 7 – Dairy Cattle, p. 80; Chapter 9 – Poultry, pp. 117, 119; Chapter 10 – Sheep and Goats, p. 135 (http://www.fass.org/docs/agguide3rd/Ag\_Guide\_3rd\_ed.pdf)

**Domain 4; Tertiary Species – Chicken (Gallus domestica)**

**149.** Which of the following statements best describes the use of the nonsteroidal anti-inflammatory drug, meloxicam, in mice?

1. Preferential COX-2 inhibitor with analgesic effects
2. Preferential COX-1 inhibitor with analgesic effects
3. Preferential COX-2 inhibitor with little or no analgesic effects in mice
4. Mixed COX-1/COX-2 inhibitor associated with a narrow therapeutic margin and low margin of efficacy in mice

**Answer: a. Preferential COX-2 inhibitor with analgesic effects**

**Reference:** Ratsep et al. 2013. Hemodynamic and behavioral differences after administration of meloxicam, buprenorphine, or tramadol as analgesics for telemeter implantation in mice. JAALAS 52(5):560-566

**Domain 2; Primary Species – Mouse (Mus musculus)**

**150.** Corticosterone levels are commonly evaluated in rats to evaluate which of the following?

a. Increases in corticosterone levels are an indirect indicator of a stressful situation

b. Decreases in corticosterone levels are an indirect indicator of a stressful situation

c. Increases in corticosterone levels are a direct indicator of a stressful situation

d. Decreases in corticosterone levels are a direct indicator of a stressful situation

**Answer: a. Increases in corticosterone levels are an indirect indicator of a stressful situation**

**References:**

1. Costa et al. 2012. Handling of adolescent rats improves learning and memory and decreases anxiety. JAALAS 51(5):548-553
2. Turner et al. 2012. Oral gavage in rats: animal welfare evaluation. JAALAS 51(1):25-30

**Domain 3; Primary Species – Rat (Rattus norvegicus)**

**151.** Terrestrial reptile cages should contain what item to assist with molting?

1. Basking platform
2. Climbing branches
3. Heat-treated bark
4. Water bowl

**Answer: d. Water bowl**

**Reference:** Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 18 – Biology and Diseases of Reptiles, p. 831.

**Domain 4; Tertiary Species – Reptiles**

**152.** Animal biosafety level 2 practices **WOULD NOT** be acceptable for which of the following situations?

* 1. Mycobacterium tuberculosiscomplexin guinea pigs
  2. Mycobacterium leprae in armadillos
  3. Cercopithecine herpesvirus 1 in mice
  4. Hepatitis C in macaques

**Answer: c. Cercopithecine herpesvirus I in mice**

**References:** U. S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and National Institutes of Health. 2009. Biosafety in Microbiological and Biomedical Laboratories. 5th ed. U.S. Government Printing Office, Washington, D. C. Section VIII Agent Summary Statements, pp. 144-146, 204-208

(http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5\_sect\_VIII.pdf)

**Domain 5; Primary Species- Mouse (Mus musculus)**

**153.** Which of the following stains can be used to identify Pneumocystis spp.?

1. Acid-fast (Ziehl Neelsen)
2. Gomori methenamine-silver nitrate
3. Gram Stain
4. Masson’s Trichrome
5. Oil Red O

**Answer: b. Gomori methenamine-silver nitrate**

**References:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 2 - Rat, p.157
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002 Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 13 – Biology and Diseases of Ferrets, p. 504
3. Abee CR, Mansfield K, Tardif S, Morris T, eds. 2012. Nonhuman Primates in Biomedical Research, 2nd edition, Volume 2 – Diseases. Academic Press: San Diego, CA. Chapter 2, pp. 147-148

**Domain 1**

1. Which of the following strains can develop mineralization in the tongue and cornea?
2. AKR
3. C57BL/6
4. DBA
5. SJL

**Answer: c. DBA**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, p. 106.

2) Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 1 – Mouse, p. 94.

**Domain 3; Primary Species – Mouse (Mus musculus)**

**155.** Which of the following effects describes an accidental exposure of prepubescent female mice to male urine which accelerates puberty in female mice?

1. Blandau
2. Bruce
3. Lee-Boot
4. Vandenbergh
5. Whitten

**Answer: d. Vandenbergh**

**References:**

1. Bind et al. 2013. The role of pheromonal responses in rodent behavior: future directions for the development of laboratory protocols. JAALAS 52(2):124-129.
2. Kelliher and Wersinger. 2009. Olfactory regulation of the sexual behavior and reproductive physiology of the laboratory mouse: effects and neural mechanisms, ILAR J 50(1):28-42
3. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, p. 50.
4. Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 1 – History, Wild Mice, and Genetics. Academic Press: San Diego, CA. Chapter 4 – Breeding Systems: Considerations, Genetic Fundamentals, Genetic Background and Strain Types p. 54.

**Domain 4; Primary Species – Mouse (Mus musculus)**

**156.** According to the Animal Welfare Act and its regulations, if an animal is shipped, when a primary enclosure containing a dog or cat has arrived at the animal holding area at a terminal facility after transport, the carrier or intermediate handler must attempt to notify the consignee upon arrival and at least once every how many hours thereafter.

1. 4
2. 6
3. 12
4. 24

**Answer: b. 6**

**Reference:** Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 3 – Standards, Subpart A – Research Facilities, §3.13 (f) Consignments to carriers and intermediate handlers (11-6-13 Edition, p.70)

(http://www.aphis.usda.gov/animal\_welfare/downloads/Animal%20Care%20Blue%20Book%20-%202013%20-%20FINAL.pdf)

**Domain 5**

**157.** Which if the following select agricultural viral agents has been reported to cause disease in dogs through consumption of meat of an infected animal?

1. African Horse Sickness
2. Newcastle
3. Rabbit Hemorrhagic Fever
4. Sheep Pox

**Answer: a. African Horse Sickness**

**References:**

1. U. S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and National Institutes of Health. 2009. Biosafety in Microbiological and Biomedical Laboratories. 5th ed. U.S. Government Printing Office, Washington, D. C. Appendix D – Agriculture Pathogen Biosafety, p. 353.

(http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5\_appendixD.pdf)

1. Sittert, S.V. Occurrence of African horse sickness in a domestic dog without apparent ingestion of horse meat.

<http://www.academia.edu/4481447/Occurrence_of_African_horse_sickness_in_a_domestic_dog_without_apparent_ingestion_of_horse_meat>

**Domain 1; Primary Species – Dog (Canis familiaris)**

**158.** Which of the following drugs acts on the descending pain pathway through inhibition of norepinephrine uptake?

1. Butorphanol
2. Hydroxymorphone

c. Naloxone

d. Sertraline

e. Tramadol

**Answer: e. Tramadol**

**References:**

1) Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd ed. Academic Press, San Diego, CA. Chapter 4 – Pharmacology of Analgesics, pp. 114-115.

2) McKeon et al. 2011. Analgesic effects of tramadol, tramadol-gabapentin, and buprenorphine in an incisional model of pain in rats (*Rattus norvegicus*). JAALAS 50(2):192-197.

3) Committee on Recognition and Alleviation of Pain in Laboratory Animals, National Research Council. 2009. Recognition and Alleviation of Pain in Laboratory Animals. National Academies Press. Washington D.C. Chapter 4, p. 84

**Domain 2**

**159.** Which of the following statements is **TRUE** regarding tail biopsies of mice?

1. Hair biopsy provides an acceptable alternative to caudal tail biopsy in most instances
2. Procedure is best performed in animals greater than one month of age
3. Isoflurane anesthesia does not appreciably enhance wellbeing of mice undergoing tail biopsies up to 31 days of age

d. Tail biopsy is commonly performed for tissue phenotyping.

**Answer: c. Isoflurane anesthesia does not appreciably enhance wellbeing of mice undergoing tail biopsies up to 31 days of age**

**References:**

1. Hankenson et al. 2011. Behavioral and activity assessment of laboratory mice (Mus musculus) after tail biopsy under isoflurane anesthesia. JAALAS 50(5):686-694
2. Hankenson et al. 2008. Evaluation of tail biopsy collection in laboratory mice (Mus musculus): vertebral ossification, DNA quantity, and acute behavioral responses. JAALAS 47(6):10-18

**Domain 2; Primary Species – Mouse (Mus musculus)**

**160.** According to theCost Analysis and Rate Setting Manual for Animal Research Facilities, which of the following space costs **CANNOT** be included in an institution’s facilities and administrative rate?

1. Animal procedure rooms
2. Cage wash rooms
3. Mouse quarantine rooms
4. Operating rooms
5. Rodent animal biosafety level 2 housing room

**Answer: b. Cage wash rooms**

**Reference:** National Center for Research Resources (NCRR). 2000. Cost Analysis and Rate Setting Manual for Animal Research Facilities. NCRR Office of Science Policy and Public Liaison: Bethesda, MD. Chapter 2, p. 10 (http://grants.nih.gov/grants/policy/air/rate\_setting\_manual\_2000.pdf)

**Domain 4**

**161.** Which of the following statements would apply to a research institution that is PHS-Assured and USDA-registered, but is not AAALAC, International accredited?

1. Institution has a “category 1” assurance status and is required to submit their most recent IACUC semi-annual report with their Assurance for review
2. Institution has a “category 2” assurance status and is required to submit their most recent IACUC semi-annual report with their Assurance for review
3. Institution has a “category 2” assurance status and is not required to submit their most recent IACUC semi-annual report with their Assurance for review
4. Assurance status is irrelevant since all PHS-Assurance renewals require submission of the institution’s most recent IACUC semi-annual with their Assurance for review.

**Answer: b. Institution has a “category 2” assurance status and is required to submit their most recent IACUC semi-annual report with their Assurance for review**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 2 – Laws, Regulations, and Policies affecting the Use of Laboratory Animals, pp. 25-26.
2. Office of Laboratory Animal Welfare. 2002. Public Health Service Policy on Humane Care and Use of Laboratory Animals. National Institutes of Health, Bethesda, MD, pp. 10-11.

**Domain 5**

**162.** All of the following animals have a bicornuate uterus with two cervices **EXCEPT**?

1. Chinchilla
2. Mouse
3. Rabbit
4. Rat

**Answer: b. Mouse**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002 Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 1 – Biology and Diseases of Rats, p. 125 and Chapter 9 – Biology and Diseases of Rabbits, p. 333
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 6 – Rabbit, p. 254
3. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section V – Chinchillas, Chapter 39 – Anatomy, Physiology, and Behavior, p. 958
4. Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 3 – Normative Biology, Husbandry, and Models. Academic Press: San Diego, CA. Chapter 3 – Reproductive Biology of the Laboratory Mouse, pp. 98-99

**Domain 1; Primary Species – Mouse (Mus musculus)**

**163.** Which of the following parasites is most likely to be found at necropsy in the lumen and mucosa of the urinary bladder and renal pelvis of a wild-caught rat?

1. Aspiculuris tetraptera
2. Heligmosomoides polygyrus
3. Heterakis spumosa
4. Moniliformis moniliformis
5. Trichosomoides crassicauda

**Answer: e. Trichosomoides crassicauda**

**References:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 2 – Rat, pp. 159-160.
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 4 – Biology and Diseases of Rats, pp. 149-150.
3. Suckow MA, Weisbroth SH, Franklin CL, eds. 2006. The Laboratory Rat, 2nd edition. Elsevier Academic Press: San Diego, CA. Chapter 13 – Parasitic Diseases, pp. 462-463

**Domain 1; Primary Species – Rat (Rattus norvegicus)**

**164.** Which of the following strains of rats is a model for obesity?

1. BB
2. Dahl
3. Fawn-hooded
4. SHR
5. Zucker

**Answer: e. Zucker**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002 Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 4 – Biology and Diseases of Rats, pp. 122, 152.

2) Suckow MA, Weisbroth SH, Franklin CL, eds. 2006. The Laboratory Rat, 2nd edition. Elsevier Academic Press: San Diego, CA. Chapter 23 – Spontaneous, Surgically and Chemically Induced Models of Disease, pp. 713-715, 717-719

**Domain 3; Primary Species – Rat (Rattus novergicus)**

1. Care must be taken to eliminate light sources in spaces to be decontaminated with which of the following agents?
2. Chlorine dioxide
3. Formaldehyde
4. Glutaraldehyde
5. Peracetic acid

**Answer: a. Chlorine dioxide**

**Reference:** U. S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and National Institutes of Health. 2009. Biosafety in Microbiological and Biomedical Laboratories. 5th ed. U.S. Government Printing Office, Washington, D. C. Appendix B – Decontamination and Disinfection, p. 332

(http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5\_appendixB.pdf)

**Domain 4**

**166.** According to the Guide for the Care and Use of Laboratory Animals, what is the recommended dry bulb temperature for poultry?

1. 16 – 22° C
2. 16 – 27° C
3. 18 – 29° C
4. 20 – 26° C

**Answer: b. 16 – 27° C**

**Reference:** National Research Council. 2011. Guide for the Care and Use of Laboratory Animals, 8th ed. National Academies Press, Washington D.C. Chapter 3 – Environment, Housing, and Management, p. 44.

**Domain 5; Tertiary Species – Chicken (Gallus domestica)**

**167.** An African green monkey presents with mucohemorrhagic diarrhea and severe depression. At necropsy, multifocal hepatic and splenic necrosis, mesenteric lymphadenopathy and ulcerative enterocolitis were found. An impression smear from foci showed Gram-negative rods with bipolar staining. What is the most likely etiologic agent?

a. Bordatella bronchiseptica

b. Helicobacter spp.

c. Lawsonia intracellularis

d. Yersinia enterocolitica

**Answer: d. Yersinia enterocolitica**

**References:**

1)Soto et al. 2013. An outbreak of Yersinia enterocolitica in a captive colony of African green monkeys (Chlorocebus aethiops sabaeus*)* in the Caribbean.Comparative Medicine 63(5):439-444

2)Abee CR, Mansfield K, Tardif S, Morris T, eds. 2012. Nonhuman Primates in Biomedical Research, 2nd edition, Volume 2 – Diseases. Academic Press: San Diego, CA. Chapter 2, pp.138-141.

3) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 16 – Nonhuman Primates, pp. 733-734

**Domain 1, Tertiary Species – Other Nonhuman Primates**

**168.** Which of the following is a side effect reported in rabbits administered buprenorphine?

a. Increased food intake in comparison to baseline

b. Increased blood pressure

c. Pica

d. Respiratory depression

**Answer: d. Respiratory depression**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 22 – Preanesthesia, Anesthesia, Analgesia, and Euthanasia, p. 972.

2) [Goldschlager et](http://www.ncbi.nlm.nih.gov/pubmed?term=Goldschlager%20GB%5BAuthor%5D&cauthor=true&cauthor_uid=24041213) al. 2013. Effects of multimodal analgesia with low dose buprenorphine and meloxicam on fecal glucocorticoid metabolites after surgery in New Zealand white rabbits (Oryctolagus cuniculus). [JAALAS](http://www.ncbi.nlm.nih.gov/pubmed/24041213) 52(5):571-576.

**Domain 2; Primary Species – Rabbits (Oryctolagus cuniculus)**

**169.** Which of the following species is frequently used in pulmonary research studies due to relatively large lungs, a high degree of bronchiolar branching, and extensive bronchial submucosal glands?

* 1. Cat
  2. Ferret
  3. Gerbil
  4. Pigs

**Answer: b. Ferret**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 13 – Biology and Diseases of Ferrets, p. 485.

2) Mitchell MA, Tully TN. 2009. Manual of Exotic Pet Practice. Saunders Elsevier: St. Louis, MO. Chapter 13 – Ferrets, p. 346.

**Domain 3; Secondary Species – Ferret (Mustela putorius furo)**

**170.**  According to the Guide for the Care and Use of Laboratory Animals, what is the recommended dry-bulb temperature range for gerbils?

a. Not stated

b. 18-29°C

c. 16-22°C

d. 20-26°C

e. 16-27°C

**Answer: d. 20-26°C**

**Reference:** National Research Council. 2011. Guide for the Care and Use of Laboratory Animals, 8th ed. National Academies Press, Washington D.C. Chapter 3 – Environment, Housing, and Management, pp. 44.

**Domain 4; Secondary Species – Gerbil (Meriones spp.)**

**171.** Which of the following agencies regulates the importation of nonhuman primates into the United States?

1. Centers for Disease Control and Prevention
2. Environmental Protection Agency
3. U.S. Department of Agriculture
4. U.S. Fish and Wildlife Services
5. U.S. Public Health Services

**Answer: a. Centers for Disease Control and Prevention**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 2 – Laws, Regulations, and Policies Affecting the Use of Laboratory Animals, p. 30
2. Roberts and Andrews. 2008. Nonhuman primate quarantine: its evolution and practice. ILAR J 49(2):145–156
3. <http://www.cdc.gov/animalimportation/>

**Domain 5**

1. Which of the following rodents has an X zone composed of basophilic cells in adrenal cortex?
   1. Gerbil
   2. Guinea pigs
   3. Hamsters
   4. Mice
   5. Rats

**Answer: d. Mice**

**Reference:** Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 1- Mouse, p. 14

**Domain 1; Primary Species - Mouse (Mus musculus)**

**173.** Which of the following is **TRUE** regarding the “altered Schaedler flora” used in gnotobiotic rodents?

a. Contains all aerobic bacteria

b. Does not contain any lactobacilli

c. Consists of eight "normal" or autochthonous (naturally occurring) bacteria

d. Consists of some bacteria which are so-called Extremely Oxygen Resistant (EOR)

e. Contains all anaerobic bacteria

**Answer: c. Consisted of eight "normal" or autochthonous (naturally occurring) bacteria**

**References:**

1. http://www.taconic.com/wmspage.cfm%3Fparm1=288
2. http://www.taconic.com/wmspage.cfm?parm1=325
3. Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 3 – Normative Biology, Husbandry, and Models. Academic Press: San Diego, CA. Chapter 7 - Gnotobiotics, pp. 228-229

**Domain 3**

**174.** In a recently described immunosuppressed rabbit model of pulmonary aspergillosis, which of the following was considered to pose a significant risk requiring ABSL2 containment?

1. Preparation of conidial forms for inoculation
2. Intra-tracheal administration of inoculum
3. Housing of infected rabbits
4. Collection and culturing of blood after inoculation
5. Handling of infected lung tissue at necropsy

**Answer: a. Preparation of conidial forms for inoculation**

**References:**

1. Such et al. 2013. Environmental monitoring for Aspergillus fumigatus in association with an immunosuppressed rabbit model of pulmonary aspergillosis. JAALAS 52(5):541-544
2. U. S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and National Institutes of Health. 2007. Biosafety in Microbiological and Biomedical Laboratories. 5th ed. U.S. Government Printing Office, Washington, D. C. Section V – Vertebrate Animal Biosafety Level Criteria For Vivarium Research Facilities, p. 103

(http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5\_sect\_V.pdf).

**Domain 4; Primary Species- Rabbit (Oryctolagus cuniculus)**

**175.** Which of the following organizations is responsible for revisions and publication of the previous (1999) and current (2010) editions of Guide for the Care and Use of Agricultural Animals in Research and Teaching?

1. AAALAC International
2. APHIS
3. FASS
4. ILAR
5. USDA

**Answer: c. FASS (Federation of Animal Science Societies)**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002 Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 2 – Laws, Regulations and Policies Affecting the Use of Laboratory Animals, p. 28.
2. Committees to Revise the Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching. 2010. GUIDE For the Care and Use of Agricultural Animals in Research and Teaching. 3rd Edition. Federation of Animal Science Societies, Savoy, IL. Preface, p. vi (http://www.fass.org/docs/agguide3rd/Ag\_Guide\_3rd\_ed.pdf)

**Domain 5**

**176.** Which of the following is a vector of Mycoplasma haemomuris (formerly Hemobartonella muris) in rats?

a. Nosopsyllus fasciatus

b. Polyplax serrata

c. Polyplax spinulosa

d. Phlebotomus dubosci

e. Xenopsylla cheopis

**Answer: c. Polyplax spinulosa**

**References:**

1) Baker DG, ed. 2007. Flynn’s Parasites of Laboratory Animals, 2nd edition. Blackwell Publishing, Iowa, USA. Chapter 11 – Parasites of Rats and Mice, p. 353.

2) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 4 – Biology and Diseases of Rats, p. 151.

**Domain 1; Primary Species – Rat (Rattus norvegicus)**

**177.** Which of the following is associated with the transmission of dull, burning, longer-lasting pain sensations from the periphery to the spinal cord?

1. Aβ fibers
2. Aδ fibers
3. B-type fibers
4. C-type fibers

**Answer: d. C-type fibers**

**References:**

1. Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd ed. Academic Press, San Diego, CA. Chapter 1 – Anatomy, Physiology and Effects of Pain, p. 6.
2. Flecknell P, Waterman-Pearson A. 2000. Pain Management in Animals. WB Saunders, London, UK. Chapter 2 – The Physiology of Pain, p.12.

**Domain 2**

**178.** Elevations in corticosterone levels in mice during gavage can be mitigated by dipping the gavage needle in what solution?

1. Citrate
2. Sodium chloride

c. Sucrose

d. Water

**Answer: c. Sucrose**

**References:**

1. Hoggatt et al. 2010. A spoonful of sugar helps the medicine go down: a novel technique to improve oral gavage in mice. JAALAS 49(3):329–334.
2. [Turner et](http://www.ncbi.nlm.nih.gov/pubmed/?term=Turner%20PV%5Bauth%5D) al. 2011. Administration of substances to laboratory animals: routes of administration and factors to consider. JAALAS50(5):600–613.

**Domain 3; Primary Species – Mouse (Mus musculus)**

**179.** Which of the following types of biosafety cabinets **DOES NOT** provide product protection?

1. I
2. IIA1
3. IIA2
4. IIB1
5. IIB2

**Answer: a. I**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 24 - Control of Biohazards Associated with the Use of Experimental Animals, pp. 1048-1051

2) U. S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and National Institutes of Health. 2009. Biosafety in Microbiological and Biomedical Laboratories. 5th ed. U.S. Government Printing Office, Washington, D. C. Appendix A – Primary Containment for Biohazards: Selection, Installation, and Use of Biological Safety Cabinets, pp. 292-293

(http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5\_appendixA.pdf)

**Domain 4**

**180.** According to the Guide for the Care and Use of Agricultural Animals in Research and Testing, which of the following statements is **TRUE** regarding the role of the Attending Veterinarian (AV)?

1. It is not necessary to use a veterinarian with farm animal experience
2. The AV may not delegate authority to other qualified veterinarians
3. The AV must be full-time
4. The AV is responsible for the animal health care program and adequacy of animal husbandry and nutrition, sanitation practices, zoonosis control and hazard containment
5. AVs are only required at agricultural research stations

**Answer: d. The AV is the person responsible for the animal health care program and adequacy of animal husbandry and nutrition, sanitation practices, zoonosis control and hazard containment**

**References:**

1) Vaughn. 2012. Review of the third edition of the Guide for the Care and Use of Agricultural Animals in Research and Teaching. JAALAS 51(3):298-300.

2) Committees to Revise the Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching. 2010. GUIDE For the Care and Use of Agricultural Animals in Research and Teaching. 3rd Edition. Federation of Animal Science Societies, Savoy, IL. Chapter 2: Agricultural Animal Health Care, p. 9

(http://www.fass.org/docs/agguide3rd/Ag\_Guide\_3rd\_ed.pdf)

**Domain 5**

**181.** Which of the following best describes the cerebral blood supply in the pig?

1. It is almost exclusively derived from the vertebral arteries
2. It is distributed evenly between left and right coronary arteries
3. There is significant collateral circulation making complete occlusion difficult
4. It is mostly from the internal carotid artery and does not have preexisting collateral circulation

**Answer: d. It is mostly from the internal carotid artery and does not have preexisting collateral circulation**

1. Swindle MM. 2007. Swine in the Laboratory: Surgery, Anesthesia, Imaging, and Experimental Techniques. CRC Press: Boca Raton, FL. Chapter 10 – Head and Neck Surgery/Central Nervous System, p. 272.
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 15 – Biology and Disease of Swine, p. 618.

**Domain 1; Primary Species - Pig (Sus scrofa)**

**182.** Which of the following describes the progeny of female progenitor C57BL/6J and male progenitor 129S1/SvlmJ?

1. B6129S1SvlmJF1/J
2. B6129SF1/J
3. C57BL129SF1/J
4. C57BL/129S1
5. C57BL/SvlmJ

**Answer: b. B6129SF1/J**

**References:**

1. http://jaxmice.jax.org/support/nomenclature/tutorial.html
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, pp. 36-38.
3. International Committee on Standardized Genetic Nomenclature for Mice and Rat Genome and Nomenclature Committee. Guidelines for Nomenclature of Mouse and Rat Strains. October 2013.

http://www.informatics.jax.org/mgihome/nomen/strains.shtml#hybrids

**Domain 3; Primary Species – Mouse (Mus musculus)**

**183.** Newly hatched young of which of the following species are often fed an exclusive diet of Paramecium spp. grown in culture within the laboratory?

1. Danio rerio
2. Iguana iguana
3. Trachemys scripta elegans
4. Xenopus laevis

**Answer: a. Danio rerio**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 18 – Biology and Diseases of Reptiles, pp. 841-843 and Chapter 19 – Biology and Diseases of Zebrafish, p. 874.
2. http://zebrafish.org/zirc/documents/protocols/pdf/Fish\_Nursery/Nursery/Basic\_Nursery\_Instructions.pdf

**Domain 4; Secondary Species - Zebrafish (Danio rerio)**

**184.** According to the Animal Welfare Act and its regulations, the ambient temperature in the sheltered part of the facility for dogs and cats must not rise above what temperature for more than 4 consecutive hours?

a. 72°F

b. 79°F

c. 81°F

d. 85°F

e. 89°F

**Answer: d. 85°F**

**Reference:** Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 3 – Standards, Subpart A – Specifications for the Humane Handling, Care, Treatment, and Transportation of Dogs and Cats, §3.2 (a) Indoor housing facilities (11-6-13 Edition, p. 61)

(http://www.aphis.usda.gov/animal\_welfare/downloads/Animal%20Care%20Blue%20Book%20-%202013%20-%20FINAL.pdf)

**Domain 5; Primary Species – Dog (Canis familiaris); Secondary Species – Cat (Felis domestica)**

**185.** All of the following are characteristics of Pelger-Huët anomaly in the rabbit **EXCEPT**?

a. Affected animals exhibit granulocytic nuclear hyposegmentation

b. Disorder is caused by a mutation in the lamin A receptor on the nuclear membrane

c. Disorder is inherited as a partial dominant trait

d. Homozygous plegers have granulocytes with round to oval nuclei and severe skeletal deformities

**Answer: b. Disorder is caused by a mutation in the lamin A receptor on the nuclear membrane**

**References:**

1) Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section II - Rabbits, Chapter 17 - Mycosis and Non-Infectious Diseases, pp. 515-516.

2) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002 Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 9 – Biology and Diseases of Rabbits, p. 334

**Domain 1; Primary Species – Rabbit (Oryctolagus cuniculus)**

**186.** According to the AVMA Guidelines for the Euthanasia of Animals: 2013 Edition, which of the following methods of euthanasia is considered to be unacceptable for a suckling pig?

1. Carbon dioxide
2. Purpose-built pneumatic nonpenetrating captive bolt guns
3. Manually applied blunt force trauma to the head
4. Injected barbiturates
5. All of the above are acceptable or acceptable with conditions

**Answer: e. All** **of the above are acceptable or acceptable with conditions**

**Reference:** American Veterinary Medical Association. 2013. AVMA Guidelines for the Euthanasia of Animals: 2013 Edition, pp. 35-36, 58, 61-62, 102

(https://www.avma.org/KB/Policies/Documents/euthanasia.pdf).

**Domain 2; Primary Species - Pig (Sus scrofa)**

1. The WHHL rabbit is a model for which of the following human diseases?
2. Achromatosis
3. Familial hypercholesterolemia
4. Idiopathic leptomeningiosis
5. Lymphoblastic leukemia

**Answer: b. Familial Hypercholesterolemia**

**References:**

1. Kobayashi et al. 2012. Electrocardiograms corresponding to the development of myocardial infarction in anesthetized WHHLMI rabbits (*Oryctolagus cuniculus*), an animal model for familial hypercholesterolemia. Comparative Medicine 62(5):409-418.
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 9 – Biology and Diseases of Rabbits, p. 331.
3. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section II – Rabbits, Chapter 7 – Rabbit Genetics and Transgenic Models, pp, 173, 176 and Chapter 18 – The Rabbit as an Experimental Model, pp. 533-535

**Domain 3 -** **Primary Species – Rabbit (Oryctolagus cuniculus)**

**188.** Which of the following is **FALSE** regarding lighting conditions for reptiles?

1. Many reptilian species require ultraviolet light in the appropriate UVB spectrum (290-320 nm) in order to endogenously manufacture vitamin D3
2. Several species will develop metabolic bone disease if deprived of UV light
3. UV light source should be placed 18-24” above the reptile and separated by a glass or plastic barrier
4. Prolonged exposure to black light can result in ocular problems

**Answer: c. UV light source should be placed 18-24” above the reptile and separated by a glass or plastic barrier**

**Reference:** Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 18 – Biology and Diseases of Reptiles, pp.832-833.

**Domain 4; Tertiary Species – Reptiles**

**189.** Which of the following was established in 1974 by NIH to alleviate public anxiety over the possible ethical and scientific consequences of manipulating DNA in the lab?

1. Animal Welfare Act
2. DNA Transfer Authority
3. FDA USDA Partnership Act
4. Recombinant DNA Advisory Committee

**Answer: d. Recombinant DNA Advisory Committee**

**Reference:** http://oba.od.nih.gov/rdna\_rac/rac\_about.html

**Domain 5**

**190.** Rat bite fever can be caused by either of which two microorganisms?

1. Streptobacillus moniliformis and Spirillum minus
2. Streptobacillus moniliformis and Spirillum muris
3. Staphylococcus epidermidis and Spirillum minus
4. Staphylococcus epidermidis and Spirillum muris

**Answer: a. Streptobacillus moniliformis and Spirillum minus**

1. Suckow MA, Weisbroth SH, Franklin CL, eds. 2006. The Laboratory Rat, 2nd edition. Elsevier Academic Press: San Diego, CA. Chapter 11 – Bacterial, Mycoplasmal and Mycotic Infections, pp. 340 – 346 and Chapter 17 – Occupational Health and Safety, pp. 568-569, 572
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, p. 91; Chapter 4 – Biology and Diseases of Rats, p. 139; and Chapter 25 – Selected Zoonoses, pp. 1078-1079.
3. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 2 – Rat, p. 153.

**Domain 1; Primary Species – Rat (Rattus norvegicus)**

**191.** According to the AVMA Guidelines for the Euthanasia of Animals: 2013 Edition, which of the following is considered an acceptable method of euthanasia without any conditions for rats?

* 1. Barbiturates
  2. Carbon dioxide
  3. Cervical dislocation
  4. Focused beam microwave irradiation

**Answer: a. Barbiturates**

**References:** American Veterinary Medical Association. 2013. AVMA Guidelines for the Euthanasia of Animals: 2013 Edition, pp. 48-51, 99 (https://www.avma.org/KB/Policies/Documents/euthanasia.pdf).

**Domain 2; Primary Species– Rat (Rattus norvegicus)**

**192.** According to the Guide for the Care and Use of Laboratory Animals, what is the recommended dry bulb macroenvironmental temperature range for rabbits?

1. 61-72°F
2. 61-81°F
3. 64-84°F
4. 68-79°F

**Answer: a. 61-72°F**

**Reference:** National Research Council. 2011. Guide for the Care and Use of Laboratory Animals, 8th ed. National Academies Press, Washington D.C. Chapter 3 – Environment, Housing, and Management, p. 44.

**Domain 4; Primary Species – Rabbit (Oryctolagus cuniculus)**

**193.** When working with recombinant DNA in a biomedical institution, which of the following **IS NOT** required when establishing a committee to review such work?

1. Committee must have no fewer than 5 members
2. Committee members must have experience and expertise in recombinant DNA technology
3. At least two members must not be affiliated with the institution and must represent the interest of the surrounding community
4. At least one member with expertise in animal containment principles is required if experiments with animal cells or tissues are done

**Answer: d. At least one member with expertise in animal containment principles is required if experiments with animal cells or tissues are done**

**Reference:** Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 24 - Control of Biohazards Associated with the Use of Experimental Animals, pp. 1053-1054.

**Domain 5**

**194.** Which of the following **IS NOT** seen as a result of simian varicella virus infection in macaques?

1. Fever
2. Vesicular dermatitis
3. Pneumonia
4. Hepatitis
5. Hemorrhagic necrosis of the proximal duodenum

**Answer: e. Hemorrhagic necrosis of the proximal duodenum**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 16 – Nonhuman Primates, pp. 747-749.
2. Abee CR, Mansfield K, Tardif S, Morris T, eds. 2012. Nonhuman Primates in Biomedical Research, 2nd edition, Volume 2 – Diseases. Academic Press: San Diego, CA. Chapter 1 – Viral Disease of Nonhuman Primates, pp. 17-18.
3. Halliday and Fortman. 2011. Severe thrombocytopenia in aged rhesus macaques (Macaca mulatta) infected with simian varicella virus. JAALAS50(1):109-113.

**Domain 1; Primary Species - Macaques (Macaca spp.)**

**195.** Which if the following is **TRUE** as it relates to the use of flunixin meglumine?

* 1. Flunixin meglumine is a more potent inhibitor of COX2 than COX1 and therefore more likely to have adverse effects
  2. Flunixin meglumine is a more potent inhibitor of COX1 than COX2 and is therefore less likely to have adverse effects
  3. Flunixin meglumine is a more potent inhibitor of COX2 than COX1 and therefore less likely to have adverse effects
  4. Flunixin meglumine is a more potent inhibitor of COX1 than COX2 and is therefore more likely to have adverse effects

**Answer: d. Flunixin meglumine is a more potent inhibitor of COX1 than COX2 and is therefore more likely to have adverse effects**

**References:**

1. DiVincenti. 2012. Analgesic use in nonhuman primates undergoing neurosurgical procedures. JAALAS 52(1):10-16
2. Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd ed. Academic Press, San Diego, CA. Chapter 4 – Pharmacology of Analgesics, pp. 107-108

**Domain 2**

**196.** Which of the following are the most important predictors for mortality in aging mice and in infectious disease research and longevity studies?

1. Decreased appetite and hypothermia
2. Decreased appetite and hyperthermia
3. Body weight loss and hypothermia
4. Decreased activity and hypothermia
5. Decreased appetite and body weight loss

**Answer: c. Body weight loss and hypothermia**

**References:**

1. Hankenson et al. 2013. Weight loss and reduced body temperature determine humane endpoints in a mouse model of ocular herpesvirus infection. JAALAS 52(3):277-285
2. Trammell et al. 2012. Markers for heightened monitoring, imminent death, and euthanasia in aged inbred mice. Comparative Medicine 62(3):172-178.
3. Trammell and Toth. 2011. Markers for predicting death as an outcome for mice used in infectious disease research. Comp Med (61)6:492–498.
4. Ray et al. 2010. [Identification of markers for imminent death in mice used in longevity and aging research](http://aalas.publisher.ingentaconnect.com/content/aalas/jaalas/2010/00000049/00000003/art00006). JAALAS 49(3):282-288.

**Domain 3; Primary Species – Mouse (Mus musculus)**

**197.** According to the Animal Welfare Act and its regulations,which of the following expired materials **WOULD NOT** be acceptable for use in a 3 hour nonsurvival surgery involving Saguinus oedipus?

a. Latex examination gloves by the surgeon

b. Surgical instruments after immersion in isopropyl alcohol followed by a saline rinse

c. Expired epinephrine for emergency treatment of asystole

d. Expired 0.45% sodium chloride and 5% dextrose solution administered intravenously

e. Expired polyglactin suture for anchoring a chest tube to skin

**Answer: c. Expired epinephrine for emergency treatment of asystole**

**Reference:** USDA Animal and Plant Health Inspection Service Animal Care Policy Manual. Policy # 3: Veterinary Care. March 25, 2011. (http://www.aphis.usda.gov/animal\_welfare/policy.php?policy=3)

**Domain 5; Secondary Species – Marmoset/Tamarins (Callitrichidae)**

**198.** Which of the following statements best describes the reason forthe rat’s ability to concentrate urine to an osmotic ratio (urine/plasma) that is about twice that of humans?

1. Rat kidney contains glutamine synthetase while the human kidney does not
2. Rat kidney has a thicker medulla and a greater percentage of long-looped nephrons when compared to the human kidney
3. Rat kidney has a thinner medulla and a smaller percentage of long-looped nephrons when compared to the human kidney
4. Rat kidney has a greater percentage of superficial nephrons in the cortex when compared to the human kidney

**Answer: b. Rat kidney has a thicker medulla and a greater percentage of long-looped nephrons when compared to the human kidney**

**References:**

1. Suckow MA, Weisbroth SH, Franklin CL, eds. 2006.The Laboratory Rat, 2nd edition. Academic Press: San Diego, CA. Chapter 4 – Morphopysiology, p. 112.
2. O'Malley B. 2005. Clinical Anatomy and Physiology of Exotic Species: Structure and Function of Mammals, Birds, Reptiles and Amphibians. Elsevier: St. Louis, MO. Chapter 10 – Rats, p. 219.

**Domain 1; Primary Species- Rat (Rattus norvegicus)**

**199.** Which of the following best defines a congenic inbred mouse strain?

1. Created when mutation of interest occurred in that strain
2. Developed by single-pair random matings of mice from an F2 generation created by crossing mice of two inbred strains
3. Produced by 20 brother-sister matings for more than 20 generations
4. Occurs when mutation or gene of interest was transferred from another strain or stock by repeated backcrossing

**Answer: d. Occurs when mutation or gene of interest was transferred from another strain or stock by repeated backcrossing**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, p. 37.
2. Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 1 – History, Wild Mice, and Genetics. Academic Press: San Diego, CA. Chapter 4 – Breeding Systems: Considerations, Genetic Fundamentals, Genetic Background and Strain Types pp. 66-71; Chapter 5 – Mouse Strain and Genetic Nomenclature: An Abbreviated Guide, pp. 5 – Mouse Strain and Genetic Nomenclature: An Abbreviated Guide, pp. 81, 87-88.
3. International Committee on Standardized Genetic Nomenclature for Mice and Rat Genome and Nomenclature Committee. Guidelines for Nomenclature of Mouse and Rat Strains. October 2013. http://www.informatics.jax.org/mgihome/nomen/strains.shtml#congenic

**Domain 3; Primary Species – Mouse (Mus musculus)**

**200.** Which of the following methods used to decontaminate diets can lead to the formation of breakdown products with potential toxicities, such as free radicals and peroxides?

a. Autoclaving

b. Ethylene oxide

c. Extrusion

d. Irradiation

e. Pasteurization

**Answer: d. Irradiation**

**References:**

1. Suckow MA, Weisbroth SH, Franklin CL, eds. 2006. The Laboratory Rat, 2nd edition. Elsevier Academic Press: San Diego, CA. Chapter 9 – Nutrition, pp. 271-273.
2. Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 3 – Normative Biology, Husbandry, and Models. Academic Press: San Diego, CA. Chapter 10 – Nutrition, p.365.

**Domain 4**

**201.** According to the Animal Welfare Act and its regulations, a health certificate issued within how many days of shipment must accompany any cat that is transported in commerce by a licensee or registrant?

1. 1
2. 3
3. 5
4. 10
5. 30

**Answer: d.** **10**

**References:**

1. Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 2 – Regulations, Subpart G – Records, §2.78 (a)(1) Health certification and identification (11-6-13 Edition, p. 48)

(http://www.aphis.usda.gov/animal\_welfare/downloads/Animal%20Care%20Blue%20Book%20-%202013%20-%20FINAL.pdf)

1. USDA Animal and Plant Health Inspection Service Animal Care Policy Manual. Policy # 18: Health Certificate for Dogs, Cats, and Nonhuman Primates. March 25, 2011. (http://www.aphis.usda.gov/animal\_welfare/policy.php?policy=18)

**Domain 5; Secondary Species – Cat (Felis domesticus)**

**202.** Please indicate which statement is **TRUE** with respect to Spironucleus muris?

1. S. muris is considered to be a primary pathogen in normal adult mice
2. S. muris is an opportunistic pathogenic nematode that inhabits the cecum and colon of several rodent species including mice, hamsters and rats
3. S. muris infection is usually asymptomatic in normal adult mice
4. S. muris is normally detected using serological analysis in mice > 6 weeks of age

**Answer: c. S. muris infection is usually asymptomatic in normal adult mice**

**References:**

1) Jackson et al. 2013. Development of a PCR assay for the detection of Spironucleus muris. JAALAS 52(2):165-170

2) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 13 – Biology and Diseases of Mice, pp. 98-99.

**Domain 1; Primary Species – Mouse (Mus musculus)**

**203.** All of the following parameters are useful for monitoring post-operative pain in rabbits **EXCEPT**?

a. Body temperature

b. Fecal output

c. Food intake

d. Rearing

**Answer: a. Body temperature**

**References:**

1) Weaver et al. A model for clinical evaluation of perioperative analgesia in rabbits (Oryctolagus cuniculus). JAALAS 49(6):845-851.

2) Cooper et al. Comparison of side effects between buprenorphine and meloxicam used postoperatively in Dutch Belted rabbits (Oryctolagus cuniculus). JAALAS 48(3):279-285.

**Domain 2; Primary Species – Rabbit (Oryctolagus cuniculus)**

**204.** When breeding rabbits, how should the mating pair should be introduced?

a. Both the buck and doe should be placed in a new cage.

b. Buck should be brought to the doe’s cage.

c. Doe should be brought to the buck’s cage.

d. Buck should be placed in an open enclosure with multiple does.

e. One doe and multiple bucks should be placed in an open enclosure.

**Answer: c. Doe should be brought to the buck’s cage**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 9 – Biology and Diseases of Rabbits, p. 337.
2. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section II – Rabbits, Chapter 9 - Rabbit Colony Management and Related Health Concerns, p.230.

**Domain 4; Primary Species – Rabbit (Orytolagus cuniculus)**

1. Portable class II type A biosafety cabinets are mostly used for which of the following purposes?

a. Protecting research materials

b. Containing infectious agents

c. Containing radionuclides

d. Rodent cage changing

e. Containing volatile anesthetics

**Answer: d. Rodent cage changing**

**Reference:** Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 21 - Design and Management of Animal Facilities, 945.

**Domain 5**

**206.** Elimination of cefovecin in cynomolgus monkeys occurs primarily through excretion in \_\_\_\_\_\_?

1. Feces
2. Saliva

c. Sweat

d. Urine

**Answer: d. Urine**

**References:**

1) Raabe et al. 2011. Pharmacokinetics of cefovecin in cynomolgus macaques (Macaca fascicularis), olive baboons (Papio anubis), and rhesus macaques (Macaca mulatta). JAALAS 50(3):389–395.

2) Papp et al. 2010. Pharmacokinetics of cefovecin in squirrel monkey (Saimiri sciureus), rhesus macaques (Macaca mulatta), and cynomolgus macaques (Macaca fascicularis). JAALAS 49(6):805–808.

**Domain 1; Primary Species – Macaques (Macaca spp.)**

1. Which of the following best describes butyrophenone derivatives like droperidol and azaperone?
2. Potent analgesics when used alone
3. Alpha2 adrenoceptor antagonists
4. Antipsychotic effects based on antidopaminergic actions in basal ganglia and limbic portions of the forebrain
5. Imidazole derivatives

**Answer: c. Antipsychotic effects based on antidopaminergic actions in basal ganglia and limbic portions of the forebrain**

**Reference:** Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd ed. Academic Press, San Diego, CA. Chapter 2 - Pharmacology of Injectable Anesthetics, Sedatives, and Tranquilizers, p. 55

**Domain 2**

**208.** Which of the following anatomical differences is unique to the pig compared to humans?

1. Coronary circulation has few subepicardial collateral anastomoses
2. Myocardial blood supply from the coronary artery is right-side dominant
3. Left azygous vein drains into the coronary sinus
4. Aorta has a true vaso vasorum

**Answer: c. Left azygous vein drains into the coronary sinus**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 15 - Biology and Diseases of Swine, p. 618
2. Harig et al. 2010. Refinement of pig retroperfusion technique: global retroperfusion with ligation of the azygos connection preserves hemodynamic function in an acute infarction model in pigs (Sus scrofa domestica). Comparative Medicine 60(1):38-44

**Domain 3; Primary Species – Swine (Sus scrofa)**

**209.** Which of the following is **TRUE** regarding the thermoneutral zone (TNZ) of an animal?

a. Ambient temperature must fall within the TNZ of the species housed in order to be within regulatory compliance

b. Temperatures outside of the TNZ result in physiologic and behavior adjustments to ensure homeostasis

c. Temperatures below the TNZ result in reduced basal metabolic rate due to reduced energy expenditure

d. TNZ of mice includes the temperature range 20-260C

e. An animal’s basal metabolism is greatest within (rather than outside) its TNZ due to promotion of natural behaviors such as nest building and huddling

**Answer: b. Temperatures outside of the TNZ result in physiologic and behavior adjustments to ensure homeostasis**

**References:**

1) National Research Council. 2011. Guide for the Care and Use of Laboratory Animals, 8th ed. National Academies Press, Washington D.C. Chapter 3 – Environment, Housing, and Management, p. 43.

2) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 29 – Factors that may Influence Animal Research, p. 1147

**Domain 4**

**210.** Which of the following best describes the function of the USDA Animal and Plant Health Inspection Service Animal Care Policy Manual?

a. Clarifies how to create research protocols

b. Describes an individual institution’s IACUC policies

c. Describes the treatments that should be administered for specific diseases

d. Dictates specific medical treatment protocols for animals

e. Further clarifies the intent of the Animal Welfare Act

**Answer: e. Further clarifies the intent of the Animal Welfare Act**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 2 – Laws, Regulations, and Policies Affecting the Use of Laboratory Animals. pp. 20-21.
2. http://www.aphis.usda.gov/animal\_welfare/downloads/Animal%20Care%20Blue%20Book%20-%202013%20-%20FINAL.pdf
3. http://www.aphis.usda.gov/animal\_welfare/policy.php

**Domain 5**

**211.** A rabbit is found to have an ulcerated and crusted muzzle adjacent to nares at necropsy. Using Warthin-Starry stain, histology sections of affected skin contain spiral-shaped organisms. What is the most likely etiologic agent?

a. Clostridium piliforme

b. Encephalitozoon cuniculi

c. Listeria monocytogenes

d. Pasteurella multocida

e. Treponema paraluiscuniculi

**Answer: e. Treponema paraluiscuniculi**

**References:**

1) Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd edition. Blackwell Publishing: Ames, Iowa. Chapter 6 – Rabbits, pp. 282-283

2) Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section II – Rabbits, Chapter 13 – Bacterial Diseases, pp. 331-334

3) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 9 – Biology and Diseases of Rabbits, pp. 343-344

**Domain 1; Primary Species – Rabbit (Oryctolagus cuniculus)**

**212.** Which of the following natural dietary ingredients is the main source of phytoestrogens in rodent diets?

a. Alfalfa meal

b. Corn meal

c. Oats

d. Soybean meal

e. Wheat

**Answer: d. Soybean meal**

**References:**

1. Thigpen et al. 2013. The estrogenic content of rodent diets, bedding cages, and water bottles and its effect on Bisphenol A studies. JAALAS 52(2):130-141.
2. Suckow MA, Weisbroth SH, Franklin CL, eds. 2006. The Laboratory Rat, 2nd edition. Elsevier Academic Press: San Diego, CA. Chapter 9 – Nutrition, pp. 265-266

**Domain 4**

**213.** Which of the following species of macaques has CITES I status?

1. Macaca fascicularis
2. Macaca radiata
3. Macaca silenus
4. Macaca nemestrina
5. Macaca fuscata

**Answer: c. Macaca silenus**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 16 – Nonhuman Primates, p. 700.

2) http://www.cites.org/eng/app/index.php

**Domain 5; Primary Species – Macaques (Macaca spp.)**

**214.** What is the normal anatomic structure that prevents vomiting in rats?

a. Elongated soft palate

b. Limiting ridge of the fore stomach

c. Esophageal sphincter

d. Laryngeal diverticulum

e. Pyloric sphincter

**Answer: b. Limiting ridge of the fore stomach**

**References:**

1) Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd ed. Academic Press, San Diego, CA. Chapter 10 – Anesthesia and Analgesia for Laboratory Rodents, p. 249.

2) Suckow MA, Weisbroth SH, Franklin CL, eds. 2006. The Laboratory Rat, 2nd edition. Elsevier Academic Press: San Diego, CA. Chapter 4 - Morphophysiology, pp. 101-106.

3)Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 4 – Biology and Diseases of Rats, p. 124

**Domain 1; Primary Species – Rat (Rattus norvegicus)**

**215.** Which of the following is a disadvantage of using tribromoethanol for anesthesia in rodents?

a. It should ideally only be used for long-duration, terminal procedures

b. It is expensive to obtain

c. It is a controlled substance

d. It produces severe cardiodepressive effects compared to other injectable anesthetics

e. If not prepared and stored correctly, toxic byproducts can form

**Answer: e. If not prepared and stored correctly, toxic byproducts can form**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 22 – Preanesthesia, Anesthesia, Analgesia and Euthanasia, p. 958

2) Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd ed. Academic Press, San Diego, CA. Chapter 10 – Anesthesia and Analgesia in Laboratory Rodents, pp. 260-261.

**Domain 2**

1. Which animal biosafety level (ABSL) practices, equipment, and facility design are applicable when utilizing microbiological agents that are indigenous or exotic, have the potential for aerosol transmission, and result in disease that can have serious health effects?
2. ABSL 1
3. ABSL 2
4. ABSL 3
5. ABSL 4
6. ABSL 5

**Answer: c. ABSL 3**

**References:**

1. U. S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and National Institutes of Health. 2009. Biosafety in Microbiological and Biomedical Laboratories. 5th ed. U.S. Government Printing Office, Washington, D. C. SectionV—Vertebrate Animal Biosafety Level Criteria for Vivarium Research Facilities, p. 103 (table 3)

(http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5\_sect\_V.pdf)

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 24 – Control of Biohazards, p.1049

**Domain 4**

**217.** Which of the following clinical signs has been reported in juvenile rabbits with vitamin A toxicity?

a. Paresis

b. Nystagmus

c. Urolithiasis

d. Diarrhea

e. Subcutaneous nodules

**Answer: a. Paresis**

**References:**  Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section II – Rabbits, Chapter 9 – Rabbit Colony Management and Related Health Concerns, p. 238

**Domain 1; Primary Species – Rabbit (Oryctolagus cuniculus)**

**218.** C57BL/6 mice are considered resistant to all of the following viral infections **EXCEPT**?

1. Ectromelia
2. Mouse adenovirus 1
3. Mouse cytomegalovirus
4. Murine polyoma virus

**Answer: b. Mouse adenovirus 1**

**References:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd edition. Blackwell Publishing: Ames, Iowa. Chapter1 – Mouse, pp. 17, 19, 21-22, 25-26.
2. Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 2 – Diseases. Academic Press: San Diego, CA. Chapter 1 – Murine Cytomegalovirus and other Herpesviruses, p. 10; Chapter 2 – Mouse Adenoviruses, p. 56; Chapter 3 – Mousepox, p. 73; and Chapter 5 – Polyoma Viruses, p. 124
3. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, pp. 55-56

**Domain 1; Primary Species - Mouse (Mus musculus)**

**219.** Which of the following statements is **FALSE** with respect to water deprivation in mice?

1. Weight loss can exceed 15% of baseline weight by 48 hours of acute water deprivation
2. Decreased water intake will decrease food consumption
3. There were no differences in dehydration measures between mice housed in conventional static cages or ventilated racks
4. Plasma corticosterone concentration decreased with duration of deprivation
5. Chronic water restriction induced no significant changes compared with ad libitum availability

**Answer: d. Plasma corticosterone concentration decreased with duration of deprivation**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, p. 41.

2) Bekkevold et al. 2013. Dehydration parameters and standards for laboratory mice. JAALAS 52(3):233-239

**Domain 4; Primary Species – Mouse (Mus musculus)**

**220.** According to the Animal Welfare Act and its regulations, each reporting research facility shall submit an annual report to the Animal Care Regional Director for the state where the facility is located on or before which calendar day over every year?

* 1. January 1
  2. September 30
  3. October 1
  4. November 1
  5. December 1

**Answer: e. December 1**

**Reference:** Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 2 – Regulations, Subpart C – Research Facilities, §2.36 (a) Annual report (11-6-13 Edition, p. 38) (http://www.aphis.usda.gov/animal\_welfare/downloads/Animal%20Care%20Blue%20Book%20-%202013%20-%20FINAL.pdf)

**Domain 5**

**221.** Helicobacter species can be divided into which of the following two groups?

a. Gastric and enterohepatic

b. Gastrointestinal and hepatic

c. Gram positive and gram negative

d. Inflammatory and non-inflammatory

e. Pathogenic

**Answer: a. Gastric and enterohepatic**

**References:**

1. Cacioppo et al. 2012. Resistance of Sprague-Dawley rats to infection with Helicobacter pullorum. JAALAS 51(6):803-807.
2. Lofgren et al. 2012. Prevalence of murine *Helicobacter* spp. infection is reduced by restocking research colonies with Helicobacter-free mice. JAALAS 51(4):436-442.

**Domain 1**

**222.** During the semi-annual facility site visit of a PHS-funded and AAALAC-accredited facility, IACUC members note mature male rats being housed singly, although this method of housing is not indicated in the study protocol. Would this be considered a problem? Why or why not?

a. Not a problem because rats are commonly housed singly

b. A problem because it is not in line with the protocol

c. A problem because the housing method is not justified and has not been reviewed and approved by the IACUC

d. Not a problem if the veterinarian has provided verbal agreement to the housing method

**Answer: c. A problem because the housing method is not justified and has not been reviewed and approved by the IACUC**

**References:**

1)Institute for Laboratory Animal Research. 2011. Guide for the Care and Use of Laboratory Animals Academies Press: Washington, D.C. Chapter 3 – Environment, Housing, and Management, p. 64.

2)AAALAC, International FAQ on Social Housing.

http://www.aaalac.org/accreditation/faq\_landing.cfm#C6

3) http://www.aaalac.org/accreditation/positionstatements.cfm#social

**Domain 5; Primary Species – Rats (Rattus norvegicus)**

**223.** Which of the following categories of biological agents **IS NOT** particularly resistant to inactivation by commonly used chemical disinfectants?

1. Bacterial endospores
2. Nonenveloped viruses
3. Parasite ova
4. Protozoan cysts
5. Vegetative bacteria

**Answer: e. Vegetative bacteria**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002 Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 10 – Microbiological Quality Control for Laboratory Rodents and Lagomorphs, pp. 369-371.
2. Harkness JE, Turner PV, VandeWoude S, Wheler CL. 2010. Harkness and Wagner’s Biology and Medicine of Rabbits and Rodents, 5th ed. Wiley-Blackwell: Ames, IA. Chapter 1 – Introduction, General Husbandry and Disease Prevention, p. 16.
3. U. S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and National Institutes of Health. 2009. Biosafety in Microbiological and Biomedical Laboratories. 5th ed. U.S. Government Printing Office, Washington, D. C. Appendix B – Decontamination and Disinfection, p. 330 (Table 1)

(http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5\_appendixB.pdf)

**Domain 4**

**224.** Chlorination of water containing organic matter results in formation of which of the following by-products?

* 1. Chlorinated phenols
  2. Trihalomethanes
  3. Aldehydes
  4. Chlorofluorocarbons
  5. Polychlorinated biphenyls

**Answer: b. Trihalomethanes**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 21 – Design and Management of Animal Facilities, pp. 936-937.
2. Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 3 – Normative Biology, Husbandry, and Models. Academic Press: San Diego, CA. Chapter 9 – Design and Management of Research Facilities for Mice, pp. 306-309.

**Domain 4**

**225.** Which of the following statements best describes the characteristics of rabbit urine?

1. Neutral pH
2. Acid pH and rich in phosphate and carbonate precipitates
3. Alkaline pH and rich in struvite crystals
4. Alkaline pH and rich in phosphate and carbonate precipitates

**Answer: d. Alkaline pH and rich in phosphate and carbonate precipitates**

**References:**

1. Harkness JE, Turner PV, VandeWoude S, Wheler CL. 2010. Harkness and Wagner’s Biology and Medicine of Rabbits and Rodents, 5th ed. Wiley-Blackwell: Ames, IA. Chapter 1 – Introduction, General Husbandry and Disease Prevention, p. 17.
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002 Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 9 – Biology and Diseases of Rabbits, p. 333
3. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 6 – Rabbit, p. 254
4. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section 2 – Rabbits, Chapter 3 – Clinical Biochemistry and Hematology, p. 71

**Domain 1; Primary Species - Rabbit** **(Oryctolagus cuniculus)**

**226.** Which of the following is **TRUE** regarding iron requirements in neonatal swine?

1. Neonatal swine receive the necessary 21 mg/kg of growth of iron in the sow’s milk and it does not need to be supplemented
2. Neonatal swine receive the necessary 5 mg/kg of growth of iron in the sow’s milk and it does not need to be supplemented
3. Sow’s milk does not contain adequate iron for neonatal swine and 100-200 mg of iron dextran should be administered IM 24-48 hours post-farrowing
4. Sow’s milk does not contain adequate iron for neonatal swine and collecting the sow’s feces and administering orally to piglets for the first two weeks post-farrowing is necessary
5. Neonatal swine do not have any special iron requirements.

**Answer: c. Sow’s milk does not contain adequate iron for neonatal swine and 100-200 mg of Iron dextran should be administered IM 24-48 hours post-farrowing**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press, San Diego, CA. Chapter 15 – Biology and Diseases of Swine, pp. 620-621.
2. Committees to Revise the Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching. 2010. GUIDE For the Care and Use of Agricultural Animals in Research and Teaching. 3rd Edition. Federation of Animal Science Societies, Savoy, IL. Chapter 11 - Swine, p. 146 (http://www.fass.org/docs/agguide3rd/Ag\_Guide\_3rd\_ed.pdf )

**Domain 4; Primary Species – Pig (Sus scrofa)**

**227.** Which of the following viruses is the most sensitive to chemical disinfection?

a. Mouse Parvovirus

b. Murine Rotavirus (EDIM)

c. Reovirus 3

d. Sendai virus

**Answer: d. Sendai virus**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, pp. 69-71; and Chapter 10 – Microbiological Quality Control for Laboratory Rodents and Lagomorphs, p. 371.
2. Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 2 – Diseases. Academic Press: San Diego, CA. Chapter 4 – Parvoviruses, p. 101; Chapter 9 – Reoviridae, p. 258; Chapter 11 – Sendai Virus and Pneumonia Virus of Mice (PVM), p. 298.

**Domain 4**

1. Saimiri sciureus may be latently infected with herpesvirus saimiri, which could be transmitted to and cause a fatal epizootic disease in \_\_\_\_\_\_\_\_\_?
   1. Aotus trivirgatus
   2. Macaca mulatta
   3. Macaca arctoides
   4. Papio anubis

**Answer: a. Aotus trivirgatus**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 16 – Nonhuman Primates, p. 748.
2. Institute for Laboratory Animal Research. 2011. Guide for the Care and Use of Laboratory Animals The National Academies Press: Washington, D.C. Chapter 4 – Veterinary Care, p. 112.

**Domain 1; Tertiary Species - Other Nonhuman Primates**

**229.** Which of the following statements is **TRUE** as it relates to cortisol measurements?

1. Cortisol measurements of hair evaluate acute stressors as opposed to saliva samples which evaluate chronic stressors
2. Cortisol measurements of saliva evaluate acute stressors as opposed to fecal samples which evaluate chronic stressors
3. Cortisol measurements of hair evaluate acute stressors as opposed to fecal samples which evaluate chronic stressors
4. Cortisol measurements of hair evaluate chronic stressors as opposed to saliva samples which evaluate acute stressors

**Answer: d. Cortisol measurements of hair evaluate chronic stressors as opposed to saliva samples which evaluate acute stressors**

**Reference:** Bryan et al. 2013. Hair as a meaningful measure of baseline cortisol levels over time in dogs. JAALAS 52(2):189-196

**Domain 3**

**230.** In adult mice with acute lymphocytic choriomeningitis virus infection, virus multiplies in \_\_\_\_\_ and macrophages, whereas \_\_\_\_\_\_ are resistant.

1. B cells, T cells
2. B cells, NK cells
3. NK cells, T cells
4. NK cells, B cells
5. T cells, B cells

**Answer: a. B cells, T cells**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 3 - Biology and Diseases of Mice, p. 68.
2. Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition, Volume 2 – Diseases. Academic Press: San Diego, CA. Chapter 7 – Lymphocytic Choriomeningitis Virus, pp. 198-202

**Domain 1; Primary Species – Mice (Mus musculus)**

**END OF EXAM**