2011 International Mock Board Exam Coalition

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Written Section – 230 Questions

**Referenced Answers - 96 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.***

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**1.** Which of the following is a characteristic of spontaneous atrial thrombosis in hamsters?

1. Increased levels of C reactive protein
2. Males usually affected earlier than females
3. Marked subcutaneous edema
4. Often subclinical
5. Right auricle and atrium most commonly involved

**Answer: c. Marked subcutaneous edema**

**Reference:** Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 3 – Hamster, p. 202.

**Domain 1; Secondary Species – Syrian Hamster (Mesocricetus auratus) and Tertiary Species – Other Rodents**

**2.** Which of the following drug combinations **WOULD NOT** be considered a neuroleptic?

1. Butorphanol + acepromazine
2. Butorphanol + diazepam
3. Fentanyl + alphadolone
4. Fentanyl + droperidol
5. Fentanyl + fluanisone

**Answer: c. Fentanyl + alphadolone**

**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, and Analgesia, 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 2 – Pharmacology of Injectable Anesthetics, Sedatives, and Tranquilizers, pp. 43-44, 64-65; Chapter 10 – Anesthesia and Analgesia for Laboratory Rodents, p. 261; Chapter 11 – Anesthesia and Analgesia in Rabbits, pp. 314-315; Chapter 16 - Anesthesia and Analgesia in Ferrets, pp. 447-448.

**Domain 2**

**3.** Which of the following species is frequently used in stroke research due to its high susceptibility in developing cerebral ischemia following ligation of the common carotid artery?

1. Cotton rat
2. Degu
3. Gerbil
4. Hamster
5. Mouse

**Answer: c. Gerbil**

**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. 275.

2) Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd edition. Blackwell Publishing: Ames, Iowa. Chapter 4 – Gerbil, p. 207.

**Domain 3; Secondary Species – Gerbil (Meriones spp.)**

**4.** What does the acronym CFD stand for?

1. Centrifugal Force Displacement
2. Computational Fluid Dynamics
3. Controlled Flow Direction
4. Central Facility Drawings

**Answer: b. Computational Fluid Dynamics**

**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. 920.
2. Hessler JR, Lehner NDM, eds. 2009. Planning and Designing Research Animal Facilities. Academic Press, San Diego, CA. Chapter 4 – The Planning, Design and Construction Process, p. 41.

**Domain 4**

**5.** Any suspected monkey pox cases in recently imported nonhuman primates must be reported to the Center for Disease Control and Prevention within what time period?

1. 12 hours
2. 24 hrs
3. 48 hours
4. 3 days
5. 7 days

**Answer: b. 24 hrs**

**Reference:** 42 CFR, Part 71 – Foreign Quarantine, Subpart F – Importations, §71.53 Nonhuman Primates. (10-1-03 Edition, p. 433)

**Domain 5**

**6.** Which of the following statements best describes the eligibility requirements needed to qualify for the CMAR certification program?

a. A bachelor’s degree with at least 5 years of work experience in the laboratory animal field and at least 3 years of work experience in a managerial capacity

b. A associate’s degree with at least 5 years of work experience in the laboratory animal field and at least 3 years of work experience in a managerial capacity

c. A bachelor’s degree with at least 3 years of work experience in the laboratory animal field and at least 1 year of work experience in a managerial capacity

d. An associate’s degree with at least 3 years of work experience in the laboratory animal field and at least 1 year of work experience in a managerial capacity

e. At least 3 years of work experience in a managerial capacity

**Answer: a. A bachelor’s degree with at least 5 years of work experience in the laboratory animal field and at least 3 years of work experience in a managerial capacity**

**References:**

1. http://www.aalas.org/pdf/CMAR\_Handbook.pdf (p. 2)
2. http://www.aalas.org/certification/cmar.aspx

**Domain 6**

**7.** Which of the following types of viruses is the etiologic agent for Rabbit Hemorrhagic Disease?

a. Calicivirus

b. Coronavirus

c. Filovirus

d. Herpesvirus

e. Picornavirus

**Answer: a. Calicivirus**

**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. 346.

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

3) Manning PJ, Ringler DH, Newcomer CE, eds. 1994. The Biology of the Laboratory Rabbit, 2nd edition. Academic Press, San Diego, CA. Chapter 9 – Viral Diseases, pp. 193-195

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

**8.** A recent study suggests that tail biopsies less than 5 mm in length are sufficient for genotyping in mice no older than how many days of age, unless anesthesia or topical analgesia is provided?

a. 7

b. 17

c. 21

d. 28

e. 35

**Answer: b. 17**

**Reference:** Hankenson et al. 2008. Evaluation of tail biopsy collection in laboratory mice (Mus musculus): vertebral ossification, DNA quantity, and acute behavioral responses.JAALAS 47(1):10-18.

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

1. Which of the following species has recently been suggested as a nonmammalian model of polycystic kidney disease due to knockdown of bicaudal C gene?
   1. Danio rerio
   2. Trachemys scripta elegans
   3. Xenopus laevis
   4. Xenopus tropicalis

**Answer: a. Danio rerio**

**Reference:** Bouvrette et al. 2010. Knockdown of bicaudal C in zebrafish (Danio rerio) causes cystic kidneys: a nonmammalian model of polycystic kidney disease. Comp Med 60(2):96-106.

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

1. Which of the following temperatures is the maximum recommended storage temperature for natural ingredient feed?
   1. 4oC
   2. 18oC
   3. 21oC
   4. 28oC
   5. 30oC

**Answer: c. 21oC**

**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. 916.
2. Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. National Academy Press: Washington, D.C. Chapter 2 – Animal Environment, Housing, and Management, p. 39.

**Domain 4**

**11.** Which of the following surgical procedures **IS NOT** considered a major surgery according to the Guide for the Care and Use of Laboratory Animals as well as the Animal Welfare Act and its regulations?

1. Cecal abrasion model in a rabbit
2. Ovariohysterectomy in a nonhuman primate
3. Removal of large subcutaneous mammary tumor in an opossum
4. Thoracotomy in a pig

**Answer: c. Removal of a large subcutaneous mammary tumor in an opossum**

**References:**

1. Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. National Academy Press: Washington, D.C. Chapter 1 - Institutional Policies and Responsibilities, pp. 11-12.
2. Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A, Part 1 – Definition of Terms, §1.1, (1-1-00 Edition, p. 10)

**Domain 5**

**12.** Which of the following clinical presentations is most common with Sendai virus in rats?

1. Asymptomatic
2. Death
3. Diarrhea
4. Dyspnea
5. Ulcerative skin lesions

**Answer: a. Asymptomatic**

**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. 143.

2) Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd edition. Blackwell Publishing: Ames, Iowa. Chapter 2 – Rat, p. 135.

3) Suckow MA, Weisbroth SH, Franklin CL, eds. 2006. The Laboratory Rat, 2nd edition. Elsevier Academic Press: San Diego, CA. Chapter 12 – Viral Disease, pp. 442-443.

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

1. Which of the following opioids is considered a mixed agonist-antagonist?

a. Morphine

b. Methadone

c. Butorphanol

d. Naloxone

**Answer: c. Butorphanol**

**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, and Euthanasia, pp. 961, 972.

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.110-114.

**Domain 2**

1. Which of the following avian species has been used extensively to study the relationship between the brain, hormones and social/sexual behavior?

a. Barn owls

b. Japanese quail

c. Pigeon

d. Thick-billed ravens

e. Zebra finch

**Answer: b. Japanese quail**

**Reference:** Ball and Balthazart. 2010. Japanese quail as a model system for studying the neuroendocrine control of reproductive and social behaviors. ILAR J 51(4):310-325.

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

1. What animal biosafety level is required for animal studies using nonhuman primates experimentally or naturally infected with Mycobacterium tuberculosis?
   1. Animal biosafety level 1
   2. Animal biosafety level 2
   3. Animal biosafety level 3
   4. Animal biosafety level 4

**Answer: c. Animal biosafety level 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. 2007. Biosafety in Microbiological and Biomedical Laboratories. 5th ed. U.S. Government Printing Office, Washington, D. C. Section VIIIA – Bacterial Agents. (http http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5\_sect\_VIII\_a.pdf ), p. 146.
2. 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 5 – Zoonoses, p.86.

**Domain 4**

**16.** Which of the following agencies is responsible for periodic, routine surveillance inspections of public, private and government nonclinical laboratories conducting tests on GLP-related products?

1. APHIS
2. CDC
3. EPA
4. FDA
5. USDA

**Answer: d. FDA**

**References:**

1. Good Laboratory Practice Regulations, Code of Federal Regulations, Title 21, Chapter 1, Part 58, Subchapter A, §58.15(a). Inspection of a testing facility
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. 27.

**Domain 5**

**17.** Which of the following agents prevents porcine stress syndrome by decreasing release of calcium from the sarcoplasmic reticulum while allowing calcium uptake to continue and is highly effective in stopping the progression of the syndrome when administered at the onset of signs?

* 1. Dantrolene
  2. Dobutamine
  3. Sodium bicarbonate
  4. Succinylcholine

**Answer: a. Dantrolene**

**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. 662,
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 15 – Anesthesia and Analgesia in Swine, p. 426.

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

**18.** What is the relative ranking of MAC in volatile anesthetics from highest to lowest?

* 1. Desflurane, halothane, isoflurane, sevoflurane
  2. Desflurane, sevoflurane, isoflurane, halothane
  3. Isoflurane, halothane, sevoflurane, desflurane
  4. Isoflurane, sevoflurane, desflurane, halothane

**Answer: b. Desflurane, sevoflurane, isoflurane, halothane**

**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 10 - Anesthesia and Analgesia for Laboratory Rodents, p. 252.

**Domain 2**

**19.** Which of the following designations denotes a mouse that is the offspring of a DBA/2 father and BALB/c mother?

a. F1BcDBA

b. D2CF1

c. DbBcF1

d. CD2F1

e. BcDbF1

**Answer: d. CD2F1**

**References:**

1. International Committee on Standardized Genetic Nomenclature for Mice and Rat Genome and Nomenclature Committee. Guidelines for Nomenclature of Mouse and Rat Strains. January 2009.

<http://www.informatics.jax.org/mgihome/nomen/strains.shtml#congenic>

1. 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 5 – Mouse Strain and Genetic Nomenclature: An Abbreviated Guide, p. 83.

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

1. Which of the following types of lighting has been shown to induce normal circadian pattern with regard to melatonin production and does not cause retinal damage in albino rats?
   1. Broad-band fluorescent white light tubes
   2. Full spectrum lighting
   3. Incandescent lighting
   4. Light-emitting diodes

**Answer: d. Light-emitting diodes**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 21 – Animal Facilities, p. 926.
2. Hessler JR, Lehner NDM, eds. 2009. Planning and Designing Research Animal Facilities. Academic Press, San Diego, CA. Chapter 33 – Electrical: Special Considerations, pp. 457-458

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

**21.** According to the Animal Welfare Act and its regulations, an Institutional Animal Care and Use Committee must be comprised of at least how many members?

a. 3

b. 4

c. 5

d. 7

e. 10

**Answer: a. 3**

**References:**

1. Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A, Part 2 – Regulations, Subpart C – Research Facilities, §2.31(b)(2)(3)(i)(ii) Institutional Animal Care and Use Committee , (1-1-00 Edition, p. 21)
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**

**22.** Which of the following species have a dietary requirement for vitamin D3 and ascorbic acid?

a. Cavia porcellus

b. Meleagris gallopavo

c. Mus musculus – B6-Tg(GLO/D3)Pnu/J

d. Callithrix jacchus

**Answer: d. Callithrix jacchus**

**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. 208; Chapter 16 - Nonhuman Primates, p. 685.
2. Bennett BT, Abee CR, Henrickson R, eds. 1998. Nonhuman Primates in Biomedical Research: Diseases. Academic Press, San Diego, CA. Chapter 11 – Diseases of the Musculoskeletal System, pp. 436-437.
3. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 5 – Guinea Pig, pp. 238-239.

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

**23.** Which of the following is the only anesthetic fully licensed for fish in the United States?

1. Benzocaine
2. Eugenol
3. Metomidate
4. Quinaldine
5. Tricaine methane sulfonate

**Answer: e. Tricaine methane sulfonate**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 20 – Biology and Health of Laboratory Fish, p, 896-897
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 21 – Anesthesia and Restraint of Laboratory Fish, pp. 524-525.
3. Neiffer and Stamper. 2009. Fish sedation, anesthesia, analgesia, and euthanasia: considerations, methods, and types of drugs. ILAR J 50(4): 343-360

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

1. Whenthe drug N-nitroso-N-ethylurea (ENU) is injected into male mice, which of the following changes are created in the germ cells?
2. Single base pair mutations
3. Small chromosome deletions
4. Chromosome rearrangements
5. Robertsonian translocation
6. DNA fragment transposition

**Answer: a. Single base pair mutations**

**Reference:** 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. 1190.

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

**25.** Changes in which of the following characteristics **IS NOT** used to determine if there is genetic contamination of a particular inbred mouse strain?

a. Coat color

b. Behavior

c. Tail skin grafting

d. Tibial measurements

**Answer: d. Tibial measurements**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 27 – Genetic Monitoring, p. 1122-1124.

2) <http://jaxmice.jax.org/genetichealth/GQCprogram.html>

3) 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 8 – Genetic Monitoring, p. 140

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

**26.** 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. Bennett BT, Abee CR, Henrickson R, eds. 1995. Nonhuman Primates in Biomedical Research: Biology and Management. Academic Press, San Diego, CA. Chapter 2 – Laws, Regulations, and Policies, pp. 21-22.
3. http://www.cites.org/common/disc/sec/CITES-USFWS.pdf

**Domain 5**

**27.** Natural infection with CAR bacillus has been described in all of the following laboratory animal species **EXCEPT**?

1. Hamsters
2. Mice
3. Rabbits
4. Rats

**Answer: a. Hamsters**

**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 18 – Mycoplasma spp and CAR Bacillus, p. 458.
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 2 – Rat, p. 142; and Chapter 6 – Rabbit, p. 268.
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. 83; Chapter 4 – Biology and Diseases of Rats, p. 140.
4. 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. 366-369.

**Domain 1; Secondary Species – Syrian Hamster (Mesocricetus auratus) and Tertiary Species – Other Rodents**

**28.** Which of the following volatile anesthetic agents requires a heated, pressurized vaporizer?

1. Desflurane
2. Enflurane
3. Halothane
4. Isoflurane
5. Sevoflurane

**Answer: a. Desflurane**

**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 3 – Pharmacology of Inhalation Anesthetics, p. 88.

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, p. 959.

**Domain 2**

**29.** Which of the following species has been used extensively in the study of renal physiology and water conservation?

1. Cynomys ludovicianus
2. Dipodymys spectabilis
3. Geomys bursarius
4. Marmota monax
5. Sigmodon hispidus

**Answer: b. Dipodymys spectabilis**

**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, pp. 254-255, 258-260, 270-271.
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 8 – Woodchucks as Laboratory Animals, p. 310.

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

1. In mice, the corpus luteum secretes progesterone for approximately how many days following physical stimulation of the cervix and vagina during estrus?
2. 19-21 days
3. 4-5 days
4. 13 days
5. 11 days
6. 9 days

**Answer: c. 13 days**

**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. 51.

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

1. According to the 2007 AVMA Guidelines on Euthanasia, manual cervical dislocation **IS NOT** considered a humane technique for euthanasia for which of the following animals?
   1. 25 g mouse
   2. 100 g rat
   3. 1.5 kg rabbit
   4. 50 g zebra finch

**Answer: c. 1.5 kg rabbit**

**References:**

1. American Veterinary Medical Association. 2007. AVMA Guidelines on Euthanasia (Formerly Report of the AVMA Panel on Euthanasia), p. 14 (http://www.avma.org/issues/animal\_welfare/euthanasia.pdf).
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. 191.

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

**32.** Spontaneous microphthalmia occurs commonly in which of the following strains?

1. BN rat, 127SJ mouse
2. F344 rat, C57BL/6 mouse
3. Lewis rat, C3H mouse

d. SD rat, CD mouse

**Answer: b. F344 rat, C57BL/6 mouse**

**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 3 – Clinical Procedures, p. 140.
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 1 – Mouse, p. 102

**Domain 1; Primary Species – Rat (Rattus norvegicus) and Mouse (Mus musculus)**

**33.** Ethyl carbamate is commonly known as which of the following anesthetic agents?

1. Avertin
2. Etomidate
3. Metomidate
4. Saffan
5. Urethane

**Answer: e. Urethane**

**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 – Pharmacology of Injectable Anesthetics, Sedatives, and Tranquilizers p. 56.

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, p. 959.

**Domain 2**

**34.** Which of the following statements best describes the collection of blood by the tail vein in mice?

1. Decreased glucose values are seen with repeat sampling
2. Greater hemolysis compared with saphenous venipuncture
3. Increased corticosterone release compared with orbital sinus
4. Problems with long term hemostasis

**Answer: b. Greater hemolysis compared with saphenous venipuncture**

**References:**

1) Aasland et al. 2010. Quality of blood samples from the saphenous vein compared with the tail vein during multiple blood sampling of mice. Laboratory Animals 44(1):25-29.

2) Christensen et al. 2009. Quality of plasma sampled by different methods for multiple blood sampling in mice. Laboratory Animals 43(1):65–71.

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

**35.** When evaluating the micro- (cage) vs. macroenvironment (room) of mice housed in individually ventilated cages, which of the following statements is true?

1. Humidity was lower in the micro- vs. macroenvironment but temperature was unchanged
2. Temperature and humidity were higher in the micro- vs. macroenvironment
3. Temperature and humidity were identical in the micro- and microenvironment
4. Temperature and humidity were lower in the micro- vs. macroenvironment
5. Temperature was lower in the micro- vs. macroenvironment but humidity was unchanged

**Answer: b. Temperature and humidity were higher in the micro- vs. macroenvironment**

**Reference:** Rosenbaum et al. 2010. Disparities in ammonia, temperature, humidity, and airborne particulate matter between the micro-and macroenvironments of mice in individually ventilated caging. JAALAS. 49(2):177–183

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

**36.** Which of the following regulatory documents or guidelines includes coverage of any live or dead warm-blooded animal intended for research use?

1. Animal Welfare Act
2. Guide for the Care and Use of Agricultural Animals in Research and Teaching
3. Guide for the Care and Use of Laboratory Animals
4. Public Health Service Policy on Humane Care and Use of Laboratory Animals

**Answer: a. Animal Welfare Act**

**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. 8.
2. Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. Introduction, pp. 1-2.
3. Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A, Part 1 – Definition of Terms, §1.1, (1-1-00 Edition, p. 7)
4. Committees to Revise the Guide for the Care and Use of Agricultural Animals in 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; Chapter 1 – Institutional Policies, pp. 1-3; and Chapter 2 – Agricultural Animal Health Care, p. 8.

**Domain 5**

**37.** Which of the following NIH Institutes or Centers is the major source of public support for research in laboratory animal medicine, comparative medicine, or comparative pathology?

1. National Cancer Institute
2. National Center for Research Resources
3. National Center for Comparative Medicine
4. NIH Clinical Center
5. National Institute of General Medical Sciences

**Answer: b. National Center for Research Resources**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 33 - Research in Laboratory Animal and Comparative Medicine, p. 1236.
2. http://www.ncrr.nih.gov/comparative\_medicine/

**Domain 6**

**38.** Which of the following statements best defines tidal volume?

* 1. Amount of gas entering the respiratory tract with each respiratory cycle
  2. Amount of gas leaving the respiratory tract with each respiratory cycle
  3. PaO2 measured by a respirometer
  4. Respiratory rate per minute
  5. Respiratory volume per minute

**Answer: a. Amount of gas entering the respiratory tract with each respiratory cycle**

**References:**

1. Paul Flecknell, eds. 2009. Laboratory Animal Anaesthesia, 3rd edition. Academic Press, London, UK. Chapter 2 – Tidal Volume and Minute Volume, p.29
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 6 - Monitoring of Anesthesia, p.177

**Domain 3**

**39.** Which analgesic, buprenorphine or indomethacin, was deemed more effective for pain management, post-surgically, in mice that had received radiotelemetry implants?

* 1. Buprenophine
  2. Indomethacin
  3. Both were equally effective
  4. Neither was effective

**Answer: b. Indomethacin**

**Reference:** Blaha and Leon. 2008. Effects of indomethacin and buprenorphine analgesia on the postoperative recovery of mice. JAALAS, 47(4):8-19.

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

**40.** Which of the following factors **IS NOT** required to calculate the sample size necessary to detect a statistically significant effect?

1. Desired power of the experiment to detect the effect
2. Population mean
3. Population standard deviation of the effect
4. Significance level
5. Size of the effect under study (difference between experimental groups)

**Answer: b. Population mean**

**References:**

1. Committee on Guidelines for the Use of Animals in Neuroscience and Behavioral Research, Institute for Laboratory Animal Research, Division on Earth and Life Studies. 2003. Guidelines for the Care and Use of Mammals in Neuroscience and Behavioral Research. National Academies Press: Washington, D.C. Chapter 2 – Protocol-Development Strategies, p.15.
2. Festing et al. 2002. Guidelines for the design and statistical analysis of experiments using laboratory animals. ILAR J 43(4):244-258.
3. Moore DS, McCabe GP. 1999. Introduction to the Practice of Statistics. W. H. Freeman and Company, New York, NY, p. 425.

**Domain 3**

**41.** The ASHRAE Handbook would be useful for designing and managing what specific aspect of a laboratory animal facility?

1. Heating, ventilation, and air conditioning
2. Plumbing and drainage
3. Power and lighting
4. Security and controlled access
5. Vermin control

**Answer: a. Heating, ventilation, and air conditioning**

**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. 919.
2. Hessler JR and Lehner NDM, eds. 2009. Planning and Designing Research Animal Facilities. Academic Press: San Diego, CA. Chapter Heating, Ventilation and Air Conditioning (HVAC): Special Considerations, p. 462.

**Domain 4**

**42.** According to the Guide for the Care and Use of Laboratory Animals, is the use of expired bags of saline and clean (not sterilized) instruments to perform an acute minor non-survival surgical procedure in a clean treatment/prep room (not the operating room) acceptable in pigs if approved by the Institutional Animal Care and Use Committee and the Attending Veterinarian?

a. Yes

b. No, because non-survival surgeries in this species require aseptic technique

c. No, because all supplies must be used before its expiration date

d. No, because in this species, all surgical procedures must be performed in an operating room

**Answer: a. Yes**

**References:**

1. USDA Animal and Plant Health Inspection Service Animal Care Policy Manual. Policy # 3: Veterinary Care. July 17, 2007 (http://www.aphis.usda.gov/animal\_welfare/downloads/policy/policy3.pdf).
2. Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. National Academy Press: Washington, D.C. Chapter 3 - Veterinary Medical Care, pp. 60-63.

**Domain 5; Primary Species - Pig (Sus scrofa)**

**43.** Which of the following rodents has been shown to develop an infection with monkeypox virus and may prove to be a valuable animal model for research on orthopoxviruses?

1. Graphiurus kelleni
2. Pachyuromys duprasi
3. Sigmodon hispidus
4. Zygodontomys brevicauda

**Answer: a. Graphiurus kelleni**

**References:**

1. Kastenmayer et al. 2010. Management and care of African dormice (Graphiurus kelleni). JAALAS 49(2):173-176.
2. http://edocket.access.gpo.gov/2003/03-27557.htm

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

**44.** Which of the following is a diet in which the ingredients are listed but the quantitative ingredient formulation is not publicly available?

a. Open-formula diet

b. Closed-formula diet

c. Semi-closed formula diet

d. Fixed-formula diet

e. Constant nutrition diet

**Answer: b. Closed-formula diet**

**References:**

1. Barnard et al. 2009. Open- and closed-formula laboratory animal diets and their importance to research. JAALAS 48(6):709-713.
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**

**45.** According to the Animal Welfare Act and its Regulations, which of the following **IS NOT** described as a responsibility of the Attending Veterinarian?

a. Act as a voting member of the IACUC

b. Ensure provision of adequate veterinary care

c. Provide guidance to principal investigators and other personnel regarding handling, anesthesia and analgesia

d. Provide training for animal husbandry staff

e. Provide pre- and post-procedural care in accordance with current established veterinary medical and nursing procedures

**Answer: d. Provide training for animal husbandry staff**

**Reference:**

1. Animal Welfare Act, 9 CFR Part 2 – Regulations, Subpart C – Research Facilities, §2.33 Attending veterinarian and adequate veterinary care. (1-1-01 Edition, pp. 24-25).
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. Section B.3. Role of the Veterinarian, pp. 53-57.

**Domain 5**

**46.** Which of the following inbred mouse strains is prone to audiogenic seizures?

1. C3H
2. C57BL/6
3. DBA/2
4. BALB/c

**Answer: c. DBA/2**

**References:**

1. Lindler. 2006. Phenotyping of genetically engineered mice, ILAR J 47(2):132-140
2. Hedrich HJ, Bullock G, eds. 2004. The Laboratory Mouse. Elsevier Academic Press: San Diego, CA. Chapter 3 – Strains, Stocks and Mutant Mice, p. 28.
3. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 1 – Mouse, p. 101.
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 17 – Convulsive Disorders, pp. 578-579.

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

**47.** As an alternative, less stressful operant condition technique to foot-shock, guinea pigs can acquire the desired response using \_\_\_\_\_\_ as an unconditioned stimulus.

* 1. Air stream
  2. Food
  3. Light
  4. Social cohorts
  5. Water

**Answer: a. Air stream**

**Reference:** Agterberg et al. 2010. A less stressful animal model: a conditioned avoidance behavior task for guinea pigs. Laboratory Animals 44(3):206-210.

**Domain 2; Secondary Species – Guinea Pigs (Cavia porcellus)**

1. Which of the following outcomes was found to be significantly affected by mouse norovirus infection in a C57BL/6 mouse model of diet induced obesity and insulin resistance?

a. Fasting blood glucose

b. Histopathological changes in lymphoid tissue

c. Insulin resistance

d. Liver lipid accumulation

e. Weight gain

**Answer: b. Histopathological changes in lymphoid tissue**

**Reference:** Paik et al. 2010. Effects of murine norovirus infection on a mouse model of diet induced obesity and insulin resistance. Comp Med 60(3):189-195

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

**49.** Which of the following terms describe random-source dogs that have been vaccinated and treated in preparation for use in research?

1. Adapted
2. Certified
3. Conditioned
4. Nonconditioned
5. Purpose-bred

**Answer: c. Conditioned**

**Reference:** 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, pp. 396-397.

**Domain 4; Primary Species – Dog (Canis familiaris)**

**50.** According to the Guide for the Care and Use of Laboratory Animals, what is the recommended floor space for a 90 g adult hamster?

a. 10 in2

b. 13 in2

c. 16 in2

d. >19 in2

**Answer: c. 16 in2**

**Reference:** Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. National Academy Press: Washington, D.C. Chapter 2 - Animal Environment, Housing, and Management, p. 27.

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

**51.** Which anatomical structure is most frequently colonized by Streptococcus pneumoniae in asymptomatic rats?

* 1. Lungs
  2. Nasopharynx
  3. Oral cavity
  4. Small intestine
  5. Salivary glands

**Answer: b. Nasopharynx**

**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. 134.
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 2 – Rat, p. 149.
3. 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, p. 347.

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

**52.** 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**

1. How many SNPs are necessary to distinguish the most common 100 inbred mouse strains?
   1. 28
   2. 96
   3. 384
   4. 768
   5. 3072

**Answer: a. 28**

**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 8 - Genetic Monitoring. – 3. Other Assays, p.142

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

1. Which of the following terms best describes the diet of a wild rhesus macaque?

a. Carnivorous

b. Frugivorous

c. Herbivorous

d. Insectivorous

**Answer: b. Frugivorous**

**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, p. 701.

**Domain 4; Primary Species - Macaque (Macaca spp.)**

1. 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**

**References:**

1) Animal Welfare Act, 9 CFR Part 2 – Regulations, Subpart C – Research Facilities, §2.36(a) Annual report. (1-1-01 Edition, p. 26).

2) USDA Animal and Plant Health Inspection Service Animal Care Policy Manual. Policy # 17: Annual Report for Research Facilities. August 25, 2006 (http://www.aphis.usda.gov/animal\_welfare/downloads/policy/policy17.pdf).

3) <http://www.aphis.usda.gov/animal_welfare/downloads/awr/awr.pdf> (p. 31)

**Domain 5**

**56.** A colony of guinea pigs is experiencing an outbreak of respiratory disease. On necropsy, cranial lung lobes are consolidated. Microscopic exam reveals basophilic intranuclear inclusion bodies within bronchiolar epithelial cell lining. These findings are most consistent with which of the following etiological agents?

1. Adenovirus
2. Coronavirus
3. Cytomegalovirus
4. Parainfluenza 3 virus
5. Paramyxovirus

**Answer: a. Adenovirus**

**References:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 5 – Guinea Pig, pp. 221-224.
2. 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. 222-223.
3. Hankenson et al. 2010. Guinea pig adenovirus infection does not inhibit cochlear transfection with human adenoviral vectors in a model of hearing loss. Comp Med 60(2): 130-135.

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

**57.** According to the 2007 AVMA Guidelines on Euthanasia,which of the following agents or methods **IS NOT** approved as a sole means of euthanasia for Xenopus laevis?

1. Benzocaine
2. Decapitation
3. Immersion in buffered MS-222
4. Intracoelemic injection of MS-222

e. Sodium pentobarbital

**Answer: b. Decapitation**

**References:**

1) Torreilles et al. 2009. Evaluation and refinement of euthanasia methods of Xenopus laevis. JAALAS 48(5):512-516.

2) American Veterinary Medical Association. 2007. AVMA Guidelines on Euthanasia (Formerly Report of the AVMA Panel on Euthanasia), pp. 12, 17-18, 20-21, 28 (http://www.avma.org/issues/animal\_welfare/euthanasia.pdf).

**Domain 2; Secondary Species - African Clawed Frog (Xenopus spp.)**

**58.** Which of the following rat strains is used as a model for juvenile insulin dependent diabetes mellitus?

1. ACI
2. BB/Wor
3. Brattleboro
4. LOU/C
5. Lewis

**Answer: b. BB/Wor**

**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 Rat, p. 122 (Table 1).
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. 714-715

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

**59.** What is the recommended illumination level for goats in laboratory setting?

a. 220 lux

b. 325 lux

c. 1050 lux

d. There are currently no recommendations

**Answer: a. 220 lux**

**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. 524.

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 10 – Sheep and Goats, p. 131.

**Domain 4; Secondary Species - Goat (Capra hircus)**

**60.** According to the Animal Welfare Act and its regulations, which of the following statements describes exercise requirements for dogs?

1. Dogs over the age of 16 weeks must be given the opportunity for exercise
2. Exemptions must be documented and reviewed by the IACUC every 30 days
3. Dogs housed in runs that provide more than 2 times the required floor space for that animal are exempt from exercise requirements
4. Group housed dogs are exempt as long as they are in compatible groups
5. There is no exercise requirement for dogs

**Answer: c.** **Dogs housed in runs that provide more than 2 times the required floor space for that animal are exempt from exercise requirements**

**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. 24.

2) Animal Welfare Act, 9 CFR Part 3 – Standards, Subpart A – Specifications for the humane handling, care, treatment, and transportation of dogs and cats, §3.8(a) Exercise for dogs. (1-1-00 Edition, pp. 50-51).

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

**61.** The Animal Care Panel was founded in 1950 and is presently known as what laboratory animal medicine organization?

1. American Association for Laboratory Animal Science
2. American College of Laboratory Animal Medicine
3. Institute of Laboratory Animal Resources
4. National Association for Biomedical Research

**Answer: a. American Association for Laboratory Animal Science**

**Reference:** 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.

**Domain 6**

**62.** According to the Public Health Service Policy on Humane Care and Use of Laboratory Animals, the primary responsibility for meeting applicable federal and state rules lies with whom?

* 1. Attending veterinarian
  2. IACUC
  3. PHS awardee institution
  4. Principal investigator
  5. Principal investigator and attending veterinarian

**Answer: c. PHS awardee institution**

**References:**

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.5. Legal Concerns, p 32.

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, p. 7.

**Domain 5**

**63.** Which of the following drugs is classified as a depolarizing neuromuscular blocking agent?

* 1. Atracurium
  2. Pancuronium
  3. Succinylcholine
  4. Vecuronium

**Answer: c. Succinylcholine**

**Reference:** Kohn DF, Wixson SK, White WJ, Benson JG, eds. 1997. Anesthesia and Analgesia in Laboratory Animals, 1st edition. Academic Press: San Diego, CA. Chapter 16 – Anesthesia and Analgesia in Ferrets, p. 449.

**Domain 2**

**64.** Which of the following nonhuman primates is an endangered species used as a model in chronic colitis and colon cancer research?

1. Aotus lemurinus
2. Pan troglodytes
3. Papio anubis
4. Saguinus oedipus
5. Saimiri boliviensis

**Answer: d. Saguinus oedipus**

**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. 685-686, 692, 697-698, 711, 714-715.
2. Johnson et al. 2001. Campylobacter-induced enteritis and diarrhea in captive cotton-top tamarins (Saguinus oedipus) during the first year of life. Comp Med 51(3):257-261

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

**65.** All of the following statements describe distinguishing features of Platyrrhine primates **EXCEPT**?

* 1. Are arboreal
  2. Require Vitamin D3 in their diet
  3. Possess cheek pouches
  4. Do not possess ischial callosities

**Answer: c. Possess cheek pouches**

**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. 680.
2. Bennett BT, Abee CR, Henrickson R, eds. 1995. Nonhuman Primates in Biomedical Research: Biology and Management. Academic Press, San Diego, CA. Chapter 3 – Taxonomy, p. 35.

**Domain 4; Tertiary Species - Other Nonhuman Primates**

**66.** Facilities where work is performed with indigenous or exotic agents that may cause serious or potentially lethal disease through aerosol transmission should, at a minimum, operate at what biosafety level (BSL)?

a. BSL 1

b. BSL 2

c. BSL 3

d. BSL 4

**Answer: c. BSL 3**

**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. 1048-1049.
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 IV – Laboratory Biosafety Level Criteria (<http://www.cdc.gov/biosafety/publications/bmbl5/index.htm>)

**Domain 5**

**67.** Which of the following opportunistic agents may be carried subclinically in the oropharynx of rats?

1. Arcanobacterium pyogenes
2. Clostridium piliforme
3. Corynebacterium kutscheri
4. Fusobacterium necrophorum
5. Pneumocystis carinii

**Answer: c. Corynebacterium kutscheri**

**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 4 – Clinical Signs and Differential Diagnoses, p. 283 and Chapter 5 – Specific Diseases and Conditions, pp. 363, 386-387.

2) Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd edition. Blackwell Publishing: Ames, Iowa. Chapter 2 – Rat, pp. 138, 147, 157.

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, pp. 135-136, 152.

4) 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. 357-359, 363, 384-385.

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

**68.** In the United States, which of the following anesthetics is currently approved by the Food and Drug Administration for use in food fish?

a. Metomidate

b. Carbon dioxide

c. Tricaine methane sulfonate

d. Quinaldine

e. Pentobarbital

**Answer: c. Tricaine methane sulfonate**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 20 – Biology and Health of Laboratory Fishes, p. 896.

2) Coyle et al. 2004. Anesthetics in Aquaculture, Southern Regional Aquaculture Center Fact Sheet, SRAC Publication No. 3900 (<http://www.aces.edu/dept/fisheries/aquaculture/documents/5864154-3900fs.pdf>)

## Domain 2; Tertiary Species – Other Fish

**69.** Reyes-like syndrome, although relatively rare, has been principally associated with which of the following mouse strains?

1. B6C3F1
2. BALB/cByJ
3. C3H/HeNCr
4. C57BL/6
5. DBA/2

**Answer: b. BALB/cByJ**

**References:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 1 – Mouse, p. 96.
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. 106.

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

**70.** According to theCost Analysis and Rate Setting Manual for Animal Research Facilities, all internal Animal Research Facility costs must be assigned to which of the following cost center categories?

1. Administrative and non-administrative
2. Centralized and decentralized
3. Clinical and non-clinical
4. Direct or support

**Answer: d. Direct or support**

**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 - Preparation for Cost Analysis, p 9.

**http://www.ncrr.nih.gov/publications/comparative\_medicine/CARS.pdf**

**Domain 4**

**71.** If not called for by an APHIS official, an official tag identifying a dog that has been euthanized or died must be retained by a research facility for how long?

1. 1 year
2. 2 years
3. 3 years
4. 4 years
5. 5 years

**Answer: a. 1 year**

**Reference:** Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A, Part 2 – Regulations, Subpart C – Research Facilities, §2.38(10-11) Miscellaneous, (1-1-00 Edition, p. 29)

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

**72.** What kind of information does a pulse oximeter give?

1. Hemoglobin concentration
2. Oxygen saturation of hemoglobin
3. Pulse Pressure
4. Respirations per minute

**Answer: b. Oxygen saturation of hemoglobin**

**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 6 - Monitoring of Anesthesia, p.178

**Domain 3**

**73.** According to the 2007 AVMA Guidelines on Euthanasia, which of the following methods is conditionally acceptable to use for laboratory rabbits?

a. Blow to the head

b. Electrocution

c. Penetrating captive bolt

d. Potassium chloride in conjunction with general anesthesia

**Answer: c. Penetrating captive bolt**

**Reference:** American Veterinary Medical Association. 2007. AVMA Guidelines on Euthanasia (Formerly Report of the AVMA Panel on Euthanasia), pp. 13, 28 (http://www.avma.org/issues/animal\_welfare/euthanasia.pdf).

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

**74.** What is the accepted strain abbreviation for BALB/c?

* 1. BC
  2. B/c
  3. B/C
  4. C
  5. CB

**Answer: d. C**

**References:**

1. 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 5 - Mouse Strain and Genetic Nomenclature: An Abbreviated Guide, p. 83
2. International Committee on Standardized Genetic Nomenclature for Mice and Rat Genome and Nomenclature Committee. Guidelines for Nomenclature of Mouse and Rat Strains. September 2010.

http://www.informatics.jax.org/mgihome/nomen/strains.shtml#hybrids

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

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

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

**Answer: c. Glutaraldehyde**

**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. 370.

**Domain 4**

**76.** According to the Animal Welfare Act and its regulations, which facilities housing USDA covered species must have a written program of veterinary care?

1. All dealers, exhibitors and research facilities
2. All research facilities
3. Dealers, exhibitors and research facilities that employ a part-time veterinarian
4. Dealers, exhibitors and research facilities that house only USDA covered species
5. Only research facilities that employ a part-time veterinarian

**Answer: c. Dealers, exhibitors and research facilities that employ a part-time veterinarian**

**References:**

1. USDA Animal and Plant Health Inspection Service Animal Care Policy Manual. Policy # 3: Veterinary Care. July 17, 2007 (<http://www.aphis.usda.gov/animal_welfare/downloads/policy/policy3.pdf> ).

2) Animal Welfare Act, 9 CFR Part 2 – Regulations, Subpart C – Research Facilities, §2.33 Attending veterinarian and adequate veterinary care (1-1-01 Edition, p. 24).

3) Animal Welfare Act, 9 CFR Part 2 – Regulations, Subpart D – Attending Veterinarian and Adequate Veterinary Care, §2.40 Attending veterinarian and adequate veterinary care (dealers and exhibitors) (1-1-01 Edition, p. 30).

**Domain 5**

1. Which of the following diseases in ruminants is caused by an Orbivirus and must be differentiated from foot-and-mouth disease?
2. Blue Tongue
3. Malignant Catarrhal Fever
4. Rinderpest
5. Vesicular Stomatitis

**Answer: a. Blue Tongue**

**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, pp. 565-566, 575-576, 581-582.
2. Pugh DG, ed. 2002. Sheep and Goat Medicine. Saunders: Philadelphia, PA. Chapter 3 - Oral-Esophageal Diseases, p. 66.

**Domain 1; Secondary Species – Goat (Capra hircus) and Sheep (Ovis aries) and Tertiary Species – Other Ruminants**

**78.** Pain initiated or caused by a primary lesion, dysfunction, or transitory perturbation in the peripheral or central nervous system is defined by which of the following terms?

1. Allodynia
2. Hyperalgesia
3. Neurogenic pain
4. Neuropathic pain
5. Pain threshold

**Answer: c. Neurogenic pain**

**References:**

1. Kohn et al. 2007. Guidelines for the assessment and management of pain in rodents and rabbits. JAALAS 46(2):97-108.
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 3 – Anatomy, Physiology, and Effects of Pain, pp. 4-5, 16.

**Domain 2**

**79.** Which of the following is commonly used to test spatial learning and memory in rodents?

1. Elevated plus maze
2. Morris water maze
3. Open field test
4. Operant conditioning chamber
5. Rotarod test

**Answer: b. Morris water maze**

**References:**

1) Committee on Guidelines for the Use of Animals in Neuroscience and Behavioral Research, Institute for Laboratory Animal Research, Division on Earth and Life Studies. 2003. Guidelines for the Care and Use of Mammals in Neuroscience and Behavioral Research. National Academies Press: Washington, D.C. Chapter 9 – Behavioral Studies, pp. 134-136.

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 18 – Behavioral Testing, p. 518.

3) Mulder and Pritchett. 2003. The Morris water maze. Contemp Top Lab Anim Sci 42(2):49-50.

4) Mulder and Pritchett. 2004. The elevated plus maze. Contemp Top Lab Anim Sci 43(2):39-40.

5) Pritchett and Mulder. 2003. Open-field assessment of spontaneous activity. Contemp Top Lab Anim Sci 42(1):57

6) Pritchett and Mulder. 2003. The rotarod. Contemp Top Lab Anim Sci 42(6):49

7) Pritchett and Mulder. 2004. Operant conditioning. Contemp Top Lab Anim Sci 43(4):35-36

**Domain 3**

1. In male rats, female-oriented sexual behavior is reported to decrease after how many days of age?
2. 45
3. 100
4. 150
5. 300
6. 600

**Answer: c. 150**

**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.130.

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

1. According to the Animal Welfare Act and its regulations, the ambient temperature in the sheltered part of the facility for nonhuman primates must not fall below 45ºF or must not rise above 85ºF for more than \_\_\_\_\_\_ consecutive hours?
2. 2
3. 3
4. 4
5. 5
6. 6

**Answer: c. 4**

**Reference:** Animal Welfare Act, 9 CFR Part 3 – Standards, Subpart D – Specifications for the Human Handling, Care, Treatment and Transportation of Nonhuman Primates, §3.77 (a) Sheltered housing facilities. (1-1-00 Edition, p. 78)

**Domain 5**

**82.** Which of the following mites is most commonly found in cases of intensely pruritic, generalized dermatitis in pet and laboratory guinea pigs?

1. Chirodiscoides caviae
2. Demodex caviae
3. Notoedres muris
4. Trixacarus caviae

**Answer: d. Trixacarus caviae**

**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. 225-227.

2) Baker DG, ed. 2007. Flynn’s Parasites of Laboratory Animals, 2nd edition. Blackwell Publishing, Iowa, USA. Chapter 14 – Parasites of Guinea Pigs. pp. 438-440.

3) Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 5 – Guinea Pig, pp. 234-235.

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

**83.** Propofol has been shown to produce an adequate plane of surgical anesthesia in frogs when administered by which of the following routes?

1. Intracoelomic
2. Immersion
3. Intravenous
4. Oral
5. Perivascular

**Answer: a. Intracoelomic**

**References:**

1) Guenette et al. 2008. Anesthetic properties of propofol in African clawed frogs (Xenopus laevis). JAALAS 47(5):35-38.

2) Fish RE, Brown MJ, Danneman PJ, Karas AZ. Anesthesia and Analgesia in Laboratory Animals 2nd Edition. 2008. Boston: Academic Press. Chapter 20 – Anesthesia and Analgesia in Amphibians, p. 516.

**Domain 2; Secondary Species – African Clawed Frog (Xenopus laevis) and Tertiary Species – Other Amphibians**

1. Which of the following strains of mice is the most frequent source of embryonic stem cells from which most gene-targeted mice are derived?
   1. BALB/c
   2. C57BL/6
   3. FVB/N
   4. 129

**Answer: d. 129**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 28 - Transgenic and Knockout Mice, pp: 1130-1131.
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter1 - Mouse, pp. 5-6.

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

**85.** 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, p. 923.
2. http://www.triatek.com/products/Venturi-Valve.html
3. http://www.tsi.com/en-1033/products/2266/venturi\_valves.aspx

**Domain 4**

**86.** According to the NIH Guidelines for Research Involving Recombinant DNA Molecules, which of the following statements applies to experiments involving introduction of recombinant DNA into a cytomegalovirus vector which is then transferred into nonhuman vertebrates?

1. Are exempt from registration with the Institutional Biosafety Committee
2. Must be approved before initiation by the Institutional Biosafety Committee
3. Require Institutional Biosafety Committee notification simultaneous with initiation of the experiment
4. Require NIH approval simultaneous with initiation

**Answer: b. Must be approved before initiation by the Institutional Biosafety Committee**

**References:**

1. NIH Guidelines For Research Involving Recombinant DNA Molecules. 2011. Section III-C to III-E, Appendix B-II-D, pp. 16-22, 40-42 (http://oba.od.nih.gov/oba/rac/Guidelines/NIH\_Guidelines.pdf)
2. National Institutes of Health, Office of Biotechnology Activities. 2010. Transgenic Animals and the Use of Recombinant DNA in Animals: FAQs for Research Subject to the NIH Guidelines, Question 12a. http://oba.od.nih.gov/oba/ibc/FAQs/FAQs\_about\_Transgenic\_Animals\_and\_the\_Use\_of\_Recombinant\_DNA\_in\_Animals.pdf
3. 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**

1. Which of the following organizations has a mission to advance the humane care and responsible use of laboratory animals through certification of veterinary specialists, professional development, education and research?
2. AALAS
3. ASLAP
4. AAALAC
5. ACLAM
6. ILAR

**Answer: d. ACLAM**

**References:**

1. <http://www.aclam.org/>
2. Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. National Academy Press: Washington, D.C. Appendix B - Animal Selected Organizations, pp. 102-104, 109.

**Domain 6**

**88.** Some rabbit kits present with severe yellow diarrhea, dehydration, and high mortality. Histologic sections of the intestines reveal bacteria adhered to the intestinal epithelium, resulting in effacement of the enterocytes. Which of the following is the most likely etiologic agent?

1. Clostridium piliforme
2. Clostridium spiriforme
3. Enteropathogenic E. coli
4. Enterotoxic E. coli

e. Salmonella typhimurium

**Answer: c. Enteropathogenic E. coli**

**References:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 6 - Rabbit, pp. 269, 272-274, 277.
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, pp. 340-343
3. Manning PJ, Ringler DH, Newcomer CE, eds. 1994. The Biology of the Laboratory Rabbit, 2nd edition. Academic Press, San Diego, CA. Chapter 8 – Bacterial Diseases, pp. 143-150.

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

**89.** What is the term for an inbred mouse or rat strain that is produced by backcrossing a whole chromosome from a donor strain onto a recipient background?

1. Coisogenic
2. Congenic
3. Consomic
4. Conplastic

**Answer: c. Consomic**

**References:**

1. Suckow MA, Weisbroth SH, Franklin CL, eds. 2006. The Laboratory Rat, 2nd edition. Elsevier Academic Press: San Diego, CA. Chapter 3 – Taxonomy Stocks and Strains, p. 90.
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 5 – Mouse Strain and Genetic Nomenclature: An Abbreviated Guide, pp. 87-88.
3. http://www.informatics.jax.org/mgihome/nomen/strains.shtml#ccasis

**Domain 3; Primary Species – Mouse (Mus musculus) and Rat (Rattus norvegicus)**

1. Which of the following effects describes when pheromones from a strange male mouse prevent implantation in recently bred females?

a. Blandau

b. Bruce

c. Coolidge

d. Lee-Boot

e. Whitten

**Answer: b. Bruce effect**

**References:**

1. 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
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. 50.
3. 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)**

1. Which of the following provides the statutory mandate for the Public Health Service Policy on Humane Care and Use of Laboratory Animals?
   1. Animal Welfare Act
   2. Health Research Extension Act
   3. Food, Drug, and Cosmetic Act
   4. Public Health Service Act
   5. Guide for the Care and Use of Laboratory Animals

**Answer: b. Health Research Extension Act**

**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, preface.
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. 25.

**Domain 5**

**92.** The use of moxidectin for the treatment of Myocoptes musculinus has been shown to produce considerable morbidity and mortality in which of the following strains of mice?

1. AKR/J
2. BALB/c
3. C57BL/6
4. CF1
5. SAMP8

**Answer: e. SAMP8**

**References:**

1) Lee et al. 2009. Moxidectin toxicity in senescence-accelerated prone and resistant mice. Comp Med 59(3):227-233.

2) Mook and Benjami. 2008. Use of selamectin and moxidectin in the treatment of mouse fur mites. JAALAS 47(3):20-24.

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

**93.** Which of the following drugs is an alpha-2 adrenergic antagonist?

1. Atipamezole
2. Butorphanol
3. Flumazenil
4. Medetomidine

**Answer: a. Atipamezole**

**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, pp. 958-959, 961, 974.
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 2 – Pharmacology of Injectable Anesthetics, Sedatives, and Tranquilizers, pp. 47, 52-53; Chapter 4 – Pharmacology of Analgesics, p. 114.

**Domain 2**

**94.** 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. Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. National Academy Press: Washington, D.C. Chapter 2 – Animal Environment, Housing, and Management, p. 35.
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)**

**95.** According to the Animal Welfare Act and its regulations,failure to correct any significant deficiency within an animal care and use program or the animal research facilities within established deadlines must be reported in writing by the Institutional Animal Care and Use Committee within how many days?

1. As soon as possible
2. 5-7 business days
3. 15 business days
4. 30 business days
5. 60 business days

**Answer: c. 15 business days**

**Reference:** Animal Welfare Act, 9 CFR Part 2 – Regulations, Subpart C – Research Facilities, §2.31(c)(3) Institutional Animal Care and Use Committee (IACUC). (1-1-01 Edition, p. 21).

**Domain 5**

1. STLV has a high rate of infection in which of the following nonhuman primates?
2. Owl monkeys
3. Squirrel monkeys
4. Tamarins
5. Baboons
6. Chimpanzees

**Answer: d.** **Baboons**

**References:**

1. Bennett BT, Abee CR, Henrickson R, eds. 1998. Nonhuman Primates in Biomedical Research: Diseases. Academic Press, San Diego, CA. Chapter 1 – Viral Diseases, pp. 35-36.
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, p. 753.

**Domain 1; Secondary Species – Baboons (Papio spp.)**

**97.** α-2 agonists are associated with which of the following pharmacodynamic effects in mice?

1. Hyperthermia, hyperglycemia and bradycardia
2. Hyperthermia, hypoglycemia and tachycardia
3. Hypothermia, hyperglycemia and bradycardia
4. Hypothermia, hypoglycemia and tachycardia

**Answer: c. Hypothermia, hyperglycemia and bradycardia**

**References:**

1. Alves et al. 2010. Anesthesia with intraperitoneal propofol, medetomidine, and fentanyl in rats. JAALAS 49(4):454–459
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. 958-959

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

**98.** Ligation of the left circumflex coronary artery of rabbits simulates which of the following pathological condition in humans?

a. Dilated cardiomyopathy

b. Right ventricular ischemia

c. Right ventricular hypertrophy

d. Left ventricular ischemia

e. Left ventricular hypertrophy

**Answer: d. Left ventricular ischemia**

**Reference:** Hu et al. 2010. Ligation of the left circumflex coronary artery with subsequent MRI and histopathology in rabbits. JAALAS 49(6):838-844.

**Domain 3; Primary Species – Rabbit (Oryctolagus cuniculus)**

**99.** According to the 2007 AVMA Guidelines on Euthanasia, which of the following agents or methods is a conditionally acceptable method of euthanasia for fish?

1. Decapitation and pithing
2. Formalin immersion
3. Inhalant anesthetics
4. Tricaine methane sulfonate.
5. Rapid freezing

**Answer: a. Decapitation and pithing**

**References:**

1. American Veterinary Medical Association. 2007. AVMA Guidelines on Euthanasia (Formerly Report of the AVMA Panel on Euthanasia), pp. 20, 28, (<http://www.avma.org/issues/animal_welfare/euthanasia.pdf>).
2. Fish RE, Brown MJ, Danneman PJ, Karas AZ. Anesthesia and Analgesia in Laboratory Animals 2nd Edition. 2008. Boston: Academic Press. Chapter 21 – Anesthesia and Restraint of Laboratory Fish, pp.532-533.

**Domain 5; Secondary Species – Zebrafish (Danio rerio) and Tertiary Species – Other Fish**

1. Which of the following is the most common tumor observed in Oryctolagus cuniculus?
   1. Basal cell tumors
   2. Bile duct adenomas
   3. Lymphosarcoma
   4. Osteosarcoma
   5. Uterine adenocarcinoma

**Answer: e. Uterine adenocarcinoma**

**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, pp. 355-357.
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 6 – Rabbit, pp. 304-307.
3. 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, Iowa. Chapter 5 – Specific Diseases and Conditions, p.341-342.

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

**101.** Which of the following reflexes is the most useful and accurate for determination of depth of anesthesia in the rabbit?

1. Corneal
2. Palpebral
3. Pedal withdrawal
4. Pinna

**Answer: d. Pinna**

**References:**

1. Paul Flecknell, eds. 2009. Laboratory Animal Anaesthesia, 3rd edition. Academic Press, London, UK. Chapter 3 – Responses to Painful Stimuli, p.82
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 11 - Anesthesia and Analgesia in Rabbits, p.322
3. 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. 971.

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

**102.** Which of the following species has been advocated as a species suitable for use in pediatric intubation training due to its tracheal size and laryngeal anatomy?

1. Canis familiaris
2. Mustela putorius furo
3. Oryctolagus cuniculus
4. Rattus norvegicus

**Answer: b. Mustela putorius furo**

**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. Fox JG, ed. 1998. Biology and Diseases of the Ferret, 2nd ed. Wiley-Blackwell. Chapter 19 - Anesthesia, Surgery, and Biomethodology, p. 461

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

1. Performance certification criteria for biological safety cabinets were established by which of the following organizations?
   1. American National Standards Institute
   2. Environmental Protection Agency
   3. National Sanitation Foundation
   4. Occupational Safety and Health Administration

**Answer: c. National Sanitation Foundation**

**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 6 – Principal Elements of an Occupational Health and Safety Program, p. 117
2. http://www.nsf.org/business/biosafety\_cabinetry/index.asp

**Domain 4**

**104.** Which of the following viruses demonstrates both intranuclear and intracytoplasmic inclusions on histopathology in nonhuman primates?

1. Herpesvirus
2. Morbillivirus
3. Papillomavirus
4. Poxvirus

**Answer: b. Morbillivirus**

**Reference:** Bennett BT, Abee CR, Henrickson R, eds. 1998. Nonhuman Primates in Biomedical Research: Diseases. Academic Press, San Diego, CA. Chapter 1 - Viral Diseases, pp. 3, 6, 8, 10-12, 14, 21, 27-29.

**Domain 1**

**105.** Which of the following rodent strains is an example of an induced animal model?

* 1. Gunn rat
  2. BB Wistar rat
  3. Watanabe rabbit
  4. SHR rat
  5. hu-SCID mouse

**Answer: e. hu-SCID mouse**

**Reference:** Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 30 – Animal Models, pp. 1186-1187.

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

**106.** Rabbits depend on cecotrophy to fulfill dietary requirements for protein and B vitamins. What dietary manipulation can result in greater cecotroph ingestion?

1. Low fiber
2. Low protein
3. High fiber
4. High protein

**Answer:** **c. High fiber**

**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. 335.
2. Manning PJ, Ringler DH, Newcomer CE, eds. 1994. The Biology of the Laboratory Rabbit, 2nd edition. Academic Press, San Diego, CA. Chapter 14 – Nutrition and Nutritional Diseases, pp. 322-323.

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

**107.** Which of the following **IS NOT** the responsibility of the Institutional Official?

a. In consultation with the IACUC, determine whether deficiencies are significant or minor

b. Pre-approve an activity prior to IACUC approval

c. Receives biannual inspection reports and recommendations from the IACUC

d. Sign an institution’s Assurance

**Answer: b. Pre-approve an activity prior to IACUC approval**

**References:**

1) Silverman J, Murthy S, Suckow MA, eds. 2007. The IACUC Handbook, 2nd ed. CRC Press, Boca Raton, FL. Chapter 4 – Reporting Lines of the IACUC, pp. 32-33.

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. 8-9, 12, 17-18.

3) Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A, Part 1 – Definition of Terms, §1.1 Definitions (1-1-00 Edition, p. 10)

4) Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A, Part 2 – Regulations, Subpart C – Research Facilities, §2.31 Institutional Animal Care and Use Committee (IACUC) (1-1-00 Edition, pp. 20-24)

5) 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. Section E.1 Recordkeeping and Reporting, p. 169-178

**Domain 5**

**108.** What application type is a grant with ID number 2 R01 AI183723 01 A1?

1. ID number does not provide that information
2. New application
3. Noncompeting continuation
4. Renewal
5. Supplement

**Answer: d. Renewal**

**Reference:** http://www.niaid.nih.gov/ncn/glossary/default.htm#apptype

**Domain 3**

**109.** What is the mechanism of action ofmeloxicam?

1. α2-adrenergic agonist
2. Cyclooxygenase-2 inhibitor
3. Mu opioid receptor partial agonist
4. NMDA receptor antagonist

**Answer: b. Cyclooxygenase-2 inhibitor**

**References:**

1. Cooper et al. 2009. [Comparison of side effects between buprenorphine and meloxicam used postoperatively in Dutch belted rabbits (Oryctolagus cuniculus)](http://aalas.publisher.ingentaconnect.com/search/article?title=MELOXICAM&title_type=tka&year_from=1998&year_to=2009&database=1&pageSize=20&index=2). JAALAS 48(3):279-285.
2. Turner et al. 2006. [Pharmacokinetics of meloxicam in rabbits after single and repeat oral dosing](http://aalas.publisher.ingentaconnect.com/search/article?title=MELOXICAM&title_type=tka&year_from=1998&year_to=2009&database=1&pageSize=20&index=3). [Comp Med](http://aalas.publisher.ingentaconnect.com/content/aalas/cm) 56(1):63-67.
3. 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, p. 99

**Domain 2**

1. In zebrafish, a change in water temperature should be limited to how many degrees per day in order to avoid an internal shock reaction?
   1. ± 0.5ºC/day
   2. ± 1.0ºC/day
   3. ± 1.5ºC/day
   4. ± 2.0ºC/day
   5. ± 2.5ºC/day

**Answer: c. ± 1.5ºC/day**

**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. 867.

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

1. According tothe Public Health Service Policy on Humane Care and Use of Laboratory Animals, the Institutional Animal Care and Use Committee shall consist of not less than how many members?

a. 3

b. 4

c. 5

d. 6

e. 7

**Answer: c. 5**

**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. 11
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, pp. 25-26.

**Domain 5**

**112.** Which of the following organisms is the most common cause of cervical lymphadenitis in guinea pigs?

* 1. Bordetella bronchiseptica
  2. Klebsiella pneumoniae
  3. Streptobacillus moniliformis
  4. Streptococcus zooepidemicus

**Answer: d. Streptococcus zooepidemicus**

**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, pp. 212-214, 218-220.
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd edition. Blackwell Publishing: Ames, Iowa. Chapter 5 – Guinea Pig, pp. 227-230

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

**113.** In the United States, what is the withdrawal time for tricaine methane sulfonate for fish intended for food?

* 1. 7 days
  2. 14 days
  3. 21 days
  4. 28 days
  5. There is no required withdrawal period

**Answer: c. 21 days**

**References:**

1. American Veterinary Medical Association. 2007. AVMA Guidelines on Euthanasia (Formerly Report of the AVMA Panel on Euthanasia), p. 12 (http://www.avma.org/issues/animal\_welfare/euthanasia.pdf).
2. Food and Drug Administration – Freedom of Information Summary – NADA 200-226 (<http://www.fda.gov/cvm/FOI/1635.htm>)
3. 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; Tertiary Species – Other Fish**

**114.** Which of the following breeds of pigs has recently been described as a promising model to study metabolic syndrome?

a. Hanford

b. Ossabaw

c. Sinclair

d. Yorkshire

**Answer: b. Ossabaw**

**References:**

1. Conn, PM, ed. 2008. Sourcebook of Models for Biomedical Research. Humana Press, Inc: Totowa, NJ. Chapter 26 - Swine in Biomedical Research, p. 234.
2. Neeb et al. 2010. Metabolic syndrome and coronary artery disease in Ossabaw compared with Yucatan swine. Comp Med 60(4):300-315.

**Domain 3; Primary Species - Pig (Sus scrofa)**

**115.** Which of the following statements applies to proper functioning of a Class II type B1 biological safety cabinet?

1. Volatile toxic chemicals and radionuclides may be used in minute amounts
2. Minimum measured inflow velocity is 75 linear feet per minute.
3. Normal airflow is 70% recirculated, 30% exhausted
4. Personnel are protected, but product is not protected
5. Must be tested at three-year intervals for airflow, leaks, and electrical safety

**Answer: a. Volatile toxic chemicals and radionuclides may be used in minute amounts**

**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. 945.
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. Appendix A – Primary Containment for Biohazards, pp. 295-296, 311. (http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5\_appendixA.pdf)

**Domain 4**

**116.** According to the Guide for the Care and Use of Laboratory Animals, all of the following information should be included on an animal’s identification card **EXCEPT**?

1. Names of responsible investigators
2. Protocol number
3. Sex and age of the animal
4. Source of the animal
5. Strain or stock

**Answer: c. Sex and age of the animal**

**Reference:**  Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. National Academy Press: Washington, D.C. Chapter 2 – Animal Environment, Housing and Management, p. 46.

**Domain 5**

**117.** Mouse thymic virus infects which of the following tissues as its primary target?

1. Cervical lymph nodes
2. Peyer’s patches
3. Salivary glands
4. Thymus
5. Thyroid

**Answer: c. Salivary glands**

**References:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 1 – Mouse, p. 21.
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. 60-61.

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

**118.** Which of the following stains would differentiate Encephalitozoon cuniculi from Toxoplasma organisms in diagnostic tissue sections?

* 1. Carbol fuchsin
  2. Masson Trichrome
  3. Periodic acid Schiff
  4. Warthin-Starry

**Answer: a. Carbol fuchsin**

**References**:

1. Baker DG, ed. 2007. Flynn’s Parasites of Laboratory Animals, 2nd edition. Blackwell Publishing, Iowa, USA. Chapter 15 – Parasites of Rabbits, p. 462.
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 6 – Rabbit, p. 293.

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

1. Which of the following terms best describes the CcS1 mouse?
2. Coisogenic
3. Congenic
4. F1 hybrid
5. Recombinant inbred
6. Recombinant congenic

**Answer: e. Recombinant congenic**

**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. 37-40.
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 5 - Mouse Strain and Genetic Nomenclature. An Abbreviated Guide, p.81 (Table 5.2).
3. International Committee on Standardized Genetic Nomenclature for Mice and Rat Genome and Nomenclature Committee. Guidelines for Nomenclature of Mouse and Rat Strains. September 2010.

<http://www.informatics.jax.org/mgihome/nomen/strains.shtml#rcs>

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

1. All of the following statements apply to mouse allergens **EXCEPT**?
   1. Female mice produce four times more Mus M1 than male mice
   2. Mus M1 is the primary mouse allergen excreted in urine
   3. Mus M1 is produced in liver cells
   4. Mus M2 is found in hair and dander but not in urine

**Answer: a. Female mice excrete four times as much Mus M1 as male mice**

**References:**

1. Wood. 2001. Laboratory animal allergens. ILAR J 42(1):12-16.
2. 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. 55-56.

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

**121.** Which of the following organizations is responsible for establishing regulations to govern the transportation of hazardous materials in the United States?

1. Environmental Protection Agency
2. Food and Drug Administration
3. Public Health Service
4. U.S. Department of Transportation

**Answer: d. U.S. Department of Transportation**

**References:**

1. Committee on Guidelines for Humane Transport of Research Animals, Institute of Laboratory Resources. 2006. Guidelines for the Humane Transportation of Research Animals. National Academies Press, Washington, D.C., p. 20.
2. <http://www.phmsa.dot.gov/portal/site/PHMSA/menuitem.ebdc7a8a7e39f2e55cf2031050248a0c/?vgnextoid=348ae4fca0380110VgnVCM100000762c7798RCRD&vgnextchannel=8938143389d8c010VgnVCM1000008049a8c0RCRD&vgnextfmt=print>
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. 31.

**Domain 5**

**122.** A biohazard sign must be posted on the entrance of any room in which there are biohazardous agents. All of the following information should be included on the sign **EXCEPT**?

a. Identify the agent(s)

b. Provide name of principle investigator and room supervisor

c. Provide the names of all personnel authorized to enter area

d. List emergency phone numbers

e. Identify any special requirements for entry

**Answer: c. Provide the names of all personnel authorized to enter area**

**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, p. 1053.

**Domain 4**

**123.** Mice generally remain viremic for how long following an infection with lactate dehydrogenase-elevating virus?

a. 7 days

b. 14 days

c. 4 weeks

d. 8 weeks

e. Lifelong

**Answer: e. Lifelong**

**References:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 1 – Mouse, pp. 30-31.
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)**

1. Clostridium piliforme is transmitted in rats through which of the following routes?
   1. Fomite
   2. Aerosol
   3. Direct contact
   4. Fecal-oral

**Answer: d. Fecal-oral**

**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 – c. Tyzzer's Disease, p.136
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 2 – Rats, p. 138
3. 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, p. 358.

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

**125.** What would be the phenotypic coat color of a mouse that is wild type at the Tyrc and p coat color loci but has Tyrp1b, a, and Myo5ad alleles?

1. Agouti
2. Albino
3. Dilute brown
4. Non-agouti (black)

**Answer: c. Dilute brown**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 27 – Genetic Monitoring, p. 1123 (Table I).

2) <http://jaxmice.jax.org/strain/000671.html>

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

**126.** What is the estimated number of loci that remain unfixed at the F20 generation of an inbred rodent strain?

1. 20
2. 273
3. 565
4. 3512
5. None

**Answer: b. 273**

**Reference:** Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press, San Diego, CA. Chapter 27 - Genetic Monitoring, p.1120

**Domain 4**

1. According to the Animal Welfare Act and its regulations, the Institutional Animal Care and Use Committee can have no more than how many members from the same administrative unit of the facility (Departmental level)?

a. 1

b. 2

c. 3

d. 4

e. There is no limit

**Answer: c. 3**

**References:**

1. Animal Welfare Act, 9 CFR Part 2 – Regulations, Subpart C – Research Facilities, §2.31(b)(4) Institutional animal care and use committee (IACUC). (1-1-01 Edition, p. 21).
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. Section A.2. Authority, Composition and Functions, p. 14.

**Domain 5**

1. Which of the following types of viruses is the etiological agent of mousepox?
   1. Nidovirus
   2. Orthomyxovirus
   3. Orthopoxvirus
   4. Parapoxvirus
   5. Reovirus

**Answer: c. Orthopoxvirus**

**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 – 1. Viral Diseases, p.55.
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 1 – Mouse, pp. 25-26.
3. 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 3 - Mousepox, pp. 67-92.

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

**129.** In which of the following species is the use of fenbendazole associated with hemorrhagic enteritis, hepatitis, renal tubular necrosis and death?

1. Carassius auratus
2. Columba livia
3. Mastomys natalensis
4. Saimiri sciureus

**Answer: b. Columba livia**

**Reference:** Gozalo et al. 2006. Mortality associated with fenbendazole administration in pigeons (Columba livia).JAALAS 45(6):63-66.

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

**130.** Which of the following terms describes an inbred mouse strain that is produced by repeated backcrosses to an inbred (background) strain, with selection for a particular marker from the donor strain?

1. Coisogenic
2. Congenic
3. Conplastic
4. Consomic

**Answer: b. Congenic**

**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.

1. International Committee on Standardized Genetic Nomenclature for Mice and Rat Genome and Nomenclature Committee. Guidelines for Nomenclature of Mouse and Rat Strains. September 2010.

<http://www.informatics.jax.org/mgihome/nomen/strains.shtml#congenic>

1. Hedrich HJ, Bullock G, eds. 2004. The Laboratory Mouse. Elsevier Academic Press: San Diego, CA. Chapter 3 – Strains, Stocks and Mutant Mice, p. 30.

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

1. Which species of laboratory animal possesses the following dental formula:

2(I 1/1, C 0/0, PM 1/1, M 3/3) = 20?

* 1. Cavia porcellus
  2. Meriones unguiculatus
  3. Mus musculus
  4. Oryctolagus cuniculus

**Answer: a. Cavia porcellus**

**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. 207, 331.
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, pp. 25, 46, 96.

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

**132.** According to the Public Health Service Policy on Humane Care and Use of Laboratory Animals, which of the following situations must be reported promptly to Office of Laboratory Animal Welfare by the IACUC through the Institutional Official?

1. Any change in contact information for the PI of a PHS funded activity
2. Any changes in the IACUC membership
3. Any suspension of an activity by the IACUC

d. Two consecutive IACUC meetings in which a quorum is not met

**Answer: c. Any suspension of any activity by the IACUC**

**References:**

1. Office of Laboratory Animal Welfare (OLAW), Office of Extramural Research. 2005. Guidance on Prompt Reporting to OLAW under the PHS Policy on Humane Care and Use of Laboratory Animals. http://grants.nih.gov/grants/guide/notice-files/NOT-OD-05-034.html
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. 817, 18 (<http://grants.nih.gov/grants/olaw/references/PHSPolicyLabAnimals.pdf>)
3. 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, p. 18

**Domain 5**

**133.** Which of the following mouse strains is resistant to lethal infection with ectromelia virus?

1. BALB/c
2. C57BL/6
3. C3H
4. DBA/1
5. DBA/2

**Answer: b. C57BL/6**

**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 Disease of Mice, p. 56.

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 3 – Mousepox, p. 81.

3) Labelle et al. 2009. Mousepox detected in a research facility: case report and failure of mouse antibody production testing to identify Ectromelia virus in contaminated mouse serum. Comp Med 59(2):180-186.

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

**134.** An owl monkey housed in the same corridor as squirrel monkeys presents with conjunctivitis and oral ulcerations that progress to generalized pruritis, anorexia, depression and death. Histologically, the lesions are characterized by multifocal to coalescing areas of necrosis with syncytia and intranuclear viral inclusions. What is the most likely etiology?

1. Ateline herpesvirus 2
2. Cercopithecine herpesvirus 1
3. Saimirine herpesvirus 1
4. Saimirine herpesvirus 2

**Answer: c. Saimirine herpesvirus 1**

**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. Gozalo et al. 2008. Dyscoria associated with herpesvirus infection in owl monkeys (Aotus nancymae). JAALAS 47(4):68-71.
3. Bennett BT, Abee CR, Henrickson R, eds. 1998. Nonhuman Primates in Biomedical Research: Diseases. Academic Press, San Diego, CA. Chapter 1 – Viral Diseases, pp. 9-10

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

1. A mutation in which of the following genes is responsible for the mouse neurologic mutants *tottering* and *leaner*, resulting in different types of seizures and cerebellar ataxia?
   1. *Cacna1a*
   2. *Coll1A2*
   3. *VeGFa*
   4. *SHH*

**Answer: a. *Cacna1a***

**References:**

1. Marques et al. 2009. The spatial learning phenotype of heterozygous leaner mice is robust to systematic variation of the housing environment. Comp Med 59(2):129-138.
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 21 - Mouse Models of Inherited Human Neurodegenerative Disease, p. 676.

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

**136.** All of the following can lead to termination of estrus in a ferret **EXCEPT**?

1. Administration of human chorionic gonadotrophin
2. Coitus induced ovulation
3. Increased photoperiod
4. Infertile mating

**Answer: c. Increased photoperiod**

**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. 488.

2) Quesenberry, KE, Carpenter, JW, eds. Ferrets, Rabbits, and Rodents – Clinical Medicine and Surgery, 2nd edition. Saunders, St. Louis, MO. Chapter 1 – Basic Anatomy, Physiology, and Husbandry, p. 10.

3) Fox JG, ed. 1998. Biology and Diseases of the Ferret, 2nd ed. Wiley-Blackwell. Chapter 8 – Growth, Reproduction, and Breeding, pp. 214, 217-218

**Domain 4; Secondary Species – Ferret (Mustela putorius furo)**

**137.** What does the acronym CITES mean?

1. Committee for the International Trade in Endangered Species of Fauna and Flora
2. Convention on International Trade in Endangered Species of Wild Fauna and Flora
3. Committee for the Internal Transport of Endangered Species of Wild Fauna and Flora
4. Constitution of the International Treaty for Endangered Species of Fauna and Flora

**Answer: b. Convention on International Trade in Endangered Species of Wild Fauna and Flora**

**References:**

1. Committee on Guidelines for Humane Transport of Research Animals, Institute of Laboratory Resources. 2006. Guidelines for the Humane Transportation of Research Animals. National Academies Press, Washington, D.C., p. 20.
2. <http://www.cites.org>
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. 30

**Domain 5**

**138.** Pain can elicit increases in any of these physiologic parameters **EXCEPT**?

1. Blood pressure
2. Catecholamines
3. Heart rate
4. Tidal volume

**Answer: d. Tidal volume**

**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 1 – Anatomy, Physiology, and Effects of Pain, p. 11.

**Domain 2**

**139.** A squirrel monkey with a history of diarrhea, abdominal distention, and weight loss was euthanized. At necropsy, an accumulation of adult worms are found attached to the terminal ileum. What is the most likely diagnosis?

1. Anatrichosoma cynomolgi
2. Dipetalonema marmosetae
3. Prosthenorchis elegans
4. Trichospirura leptosome
5. Trichuris trichiura

**Answer: c. Prosthenorchis elegans**

**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. 762, 765-766.

2) Baker DG, ed. 2007. Flynn’s Parasites of Laboratory Animals, 2nd edition. Blackwell Publishing, Iowa, USA. Chapter 21 – Parasites of Non-human Primates, pp. 715-716.

3) Bennett BT, Abee CR, Henrickson R, eds. 1998. Nonhuman Primates in Biomedical Research: Diseases. Academic Press, San Diego, CA. Chapter 3 – Parasitic Diseases, pp. 166-168

**Domain 1; Secondary Species – Squirrel Monkey (Saimiri sciureus)**

**140.** Which of the following components are used to make copies of target DNA in a standard PCR assay?

1. DNA template, primers, [DNA polymerase](http://en.wikipedia.org/wiki/DNA_polymerase), [deoxynucleoside triphosphates](http://en.wikipedia.org/wiki/Nucleoside), buffers and ions
2. DNA template, specific antibody, fluorescent probe
3. RNA template, Taq polymerase, primers, buffers and ions, deoxynucleoside triphosphates
4. Taq polymerase, RNA template, primers, buffers and ions

**Answer: a.** **DNA template, primers,** [**DNA polymerase**](http://en.wikipedia.org/wiki/DNA_polymerase)**,** [**deoxynucleoside triphosphates**](http://en.wikipedia.org/wiki/Nucleoside)**, buffers and ions**

**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. 379.
2. Kendall and Riley. 1999. The polymerase chain reaction (PCR). Contemp Top Lab Anim Sci 38(6):50**.**

**Domain 3**

**141.** The 99.97% rating given HEPA filters is based on the efficiency with which they retain particles of what size?

1. 0.1 μm
2. 0.3 μm
3. 0.5 μm
4. 1.0 μm
5. 1.5 μm

**Answer: b. 0.3 μm**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter10 – Microbiological Quality Control for Laboratory Rodents and Lagomorphs, p. 369.
2. Hessler JR, Lehner NDM, eds. 2009. Planning and Designing Research Animal Facilities. Academic Press, San Diego, CA. Chapter 5 – Pre-Occupancy Planning, Commission, Qualification and Validation Testing, pp. 47-48.

**Domain 4**

**142.** According to the Guide for the Care and Use of Laboratory Animals, the institutional animal care and use committee should review the animal care program and inspect the animal facilities and activity areas at least once every how many months?

1. 2 months
2. 4 months
3. 6 months
4. 12 months
5. 18 months

**Answer: c. 6 months**

**Reference:** Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. National Academy Press: Washington, D.C. Chapter 1 - Institutional Policies and Responsibilities, p. 9.

**Domain 5**

1. Most pituitary tumors in rats are classified as which of the following?
2. Acidophil carcinoma
3. Chromophobe adenoma
4. Corticotroph adenoma
5. Craniopharyngioma

**Answer: b. Chromophobe adenoma**

**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 14 – Neoplastic Disease, pp. 493-494.
3. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 2 – Rat, p. 173.

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

**144.** Retroperitoneal fibromatosis in macaques is most frequently associated with which of the following viruses?

* 1. Polyomavirus macacae
  2. SIVMAC
  3. SRV/D-2
  4. STLV-1

**Answer: c. SRV/D-2**

**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: 751, 753-756.
2. Bennett BT, Abee CR, Henrickson R, eds. 1998. Nonhuman Primates in Biomedical Research: Diseases. Academic Press, San Diego, CA. Chapter 1 – Viral Diseases, pp. 19-20, 36-39.

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

**145.** Which of the following mice has the least genetic uniformity between littermates?

1. AEJ/GnJ-ae/Aw-J
2. B6129SF1/J
3. DBA2/J
4. Hsd:ICR

**Answer: d. Hsd:ICR**

**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) International Committee on Standardized Genetic Nomenclature for Mice and Rat Genome and Nomenclature Committee. Guidelines for Nomenclature of Mouse and Rat Strains. September 2010. <http://www.informatics.jax.org/mgihome/nomen/strains.shtml>

3) 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 5 – Mouse Strain and Genetic Nomenclature: An Abbreviated Guide, pp. 81-87.

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

**146.** Which of the following statements applies to gamma radiation as a physical process of disinfection?

1. Causes a greater reduction in the nutritional value of food compared to autoclaving
2. Damages but does not break DNA
3. Is a type of nonionizing radiation
4. Passes through solid objects

**Answer: d. Passes through solid objects**

**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. 369.
2. Suckow MA, Weisbroth SH, Franklin CL, eds. 2006. The Laboratory Rat, 2nd edition. Elsevier Academic Press: San Diego, CA. Chapter 17 – Occupational Health and Safety, pp. 570-571

**Domain 4**

**147.** An accredited institution has two months to correct a mandatory item following a recent AAALAC site visit. Which of the following categories of accreditation would apply to this institution under these circumstances?

1. Continued full accreditation
2. Conditional accreditation
3. Deferred accreditation
4. Probation
5. Provisional status

**Answer: c. Deferred accreditation**

**Reference:** http://www.aaalac.org/accreditation/categories.cfm

**Domain 5**

**148.** Which of the following best represents the hearing range of the mouse?

a. 1 to 100 kHz

b. 10 to 1000 Hz

c. 100 to 1000 kHz

d. 1 to 100 Hz

**Answer: a. 1 to 100 kHz**

**References:**

1) Reynolds et al. 2010. Noise in a laboratory animal facility from the human and mouse perspectives. JAALAS 49(5): 592-597.

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 Research, p. 1150

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

**149.** Which of the following **IS NOT** applicable to mycobacteriosis in zebrafish?

a. Clinical signs can include emaciation, poor growth rate, and chronic wasting

b. Histologic exam often yields acid fast, rod-shaped bacteria in affected tissues

c. PCR-based assays with mycobacteria species-specific primers are available

d. Various antibiotic therapies have been shown to be effective in eliminating infection

e. It is a zoonotic disease

**Answer: d. Various antibiotic therapies have been shown to be effective in eliminating infection**

**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, pp. 876-877.

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

**150.** Which of the following inbred mouse strains is a model of Type 1 diabetes?

* 1. AKR
  2. NOD
  3. NZB
  4. SJL

**Answer: b. NOD**

**References:**

1. Lindler. 2006. Phenotyping of genetically engineered mice, ILAR J 47(2):132-140
2. Hedrich HJ, Bullock G, eds. 2004. The Laboratory Mouse. Elsevier Academic Press: San Diego, CA. Chapter 3 – Strains, Stocks and Mutant Mice, p. 28.

3) 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.

4) 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 25 – Spontaneous Diseases in Commonly Used Mouse Strains, pp. 638-639, 654-655

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

1. Minerals and organic compounds in the urine from which of the following animals often adhere to cage surfaces and necessitate treatment with acid solution before washing?
2. Axolotls
3. Cats
4. Ferrets
5. Rabbits
6. Sheep

**Answer: d. Rabbits**

**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. 338.
2. Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. National Academy Press: Washington, D.C. Chapter 2 – Animal Environment, Housing, and Management, p.43.

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

**152.** According to the Animal Welfare Act and its regulations, at what age must dogs be provided the opportunity to exercise, if they are singly housed and provided less than two times the required floor space for that dog?

a. 6 weeks of age

b. 8 weeks of age

c. 12 weeks of age

d. 36 weeks of age

e. 1 year of age

**Answer: c. 12 weeks of age**

**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. 24.

2) Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A, Part 3 – Standards, Subpart A – Specifications for the Humane Handling, Care, Treatment and Transportation of Dogs and Cats, §3.8 Exercise for dogs (a) (1-1-00 Edition, p. 50)

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

**153.** Mammary tumors are most commonly seen in which of the following types of rats?

1. Brown Norway
2. Fischer 344
3. Long-Evans
4. Sprague-Dawley

**Answer: d. Sprague-Dawley**

**References:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 2 – Rat, p. 171.
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. 154.

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

**154.** A cynomolgus macaque presents with clinical signs of sneezing, eyelid swelling, epistaxis, and mucohemorrhagic nasal discharge. What is the most likely etiology associated with these clinical signs?

a. High humidity

b. Moraxella catarrhalis

c. Mycobacterium tuberculosis

d. Pterygodermatites nycticebi

e. Shigella boydii

**Answer: b. Moraxella catarrhalis**

**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. 738.
2. Bennett BT, Abee CR, Henrickson R, eds. 1998. Nonhuman Primates in Biomedical Research: Diseases. Academic Press, San Diego, CA. Chapter 7 - Respiratory Diseases, pp. 276-277.
3. VandeWoude and Luzarraga. 1991. The role of Branhamella catarrhalis in the “bloody-nose syndrome” of cynomolgus macaques. Lab Anim Sci 41(5)**:** 401-406.

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

1. Which of the following mouse models of immunodeficiency is characterized by a decreased natural killer cell activity?
   * + 1. Beige mouse
       2. Nude mouse
       3. SCID mouse
       4. Rag-1 mouse
       5. XID mouse

**Answer: a. Beige mouse**

**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)**

**156.** According to the Animal Welfare Act and its regulations, which of the following species may be fed pelleted feed on the floor of a primary enclosure?

1. Cats
2. Ferrets
3. Guinea pigs
4. Hamsters
5. Rabbits

**Answer:** **d. Hamsters**

**Reference:** Animal Welfare Act, 9 CFR Part 3 – Standards, Subpart B – Specifications for the humane handling, care, treatment, and transportation of guinea pigs and hamsters, §3.29 Feeding. (1-1-01 Edition, p. 62).

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

**157.** According to the Guide for the Care and Use of Laboratory Animals, dead animals and animal tissue waste should be stored below what temperature to reduce putrefaction?

1. 1°C
2. 2°C
3. 5°C
4. 7°C
5. 9°C

**Answer: d. 7oC**

**Reference:** Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. National Academy Press: Washington, D.C. Chapter 4 – Physical Plant, p. 77.

**Domain 5**

**158.** Which of the following organizations offers a certification program for IACUC administrators?

a. American Association for Laboratory Animal Science

b. American College of Laboratory Animal Medicine

c. Foundation for Biomedical Research

d. Institute of Laboratory Animal Resources

e. Public Responsibility in Medicine and Research

**Answer: e. Public Responsibility in Medicine and Research**

**References:**

1. Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. Appendix B – Selected Organizations, pp. 103-104, 108-109
2. http://www.primr.org/Education.aspx?id=994

**Domain 6**

**159.** A 7-day-old mouse presents with fecal soiling of the perineum, dirty pelage and weight loss. Necropsy reveals milk in the stomach and a flaccid bowel distended with fluid and gas. Histologic exam shows marked vacuolation of villar epithelial cells. Which of the following is the most likely etiology?

1. Clostridium piliforme
2. Cryptosporidium muris
3. Mouse Reovirus 3
4. Mouse Rotavirus
5. Salmonella cholerasuis

**Answer: d. Mouse rotavirus**

**References:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 1 – Mouse, pp.41-43, 58, 62, 88.
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. 72-74, 83-84, 90-91, 99.

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

**160.** Which of the following is an important and normal clinical chemistry finding in gerbils maintained on a normal fat diet?

1. Atherosclerosis
2. Hypercholesteroluria
3. Hypotriglyceridemia

d. Lipemia

**Answer: d. Lipemia**

**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. 76

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. 276

3) Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd edition. Blackwell Publishing: Ames, Iowa. Chapter 4 – Gerbil, p. 207.

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

**161.** In adult mice, which of the following is the maximum recommended volume for an intramuscular injection using a needle size of < 23 gauge (i.e. smaller diameter than that of a 23 gauge needle)?

* 1. 0.01 ml
  2. 0.02 ml
  3. 0.05 ml
  4. 0.1 ml
  5. 0.2 ml

**Answer: c. 0.05 ml**

**References:**

1) Hedrich HJ, Bullock G, eds. 2004. The Laboratory Mouse. Elsevier Academic Press: San Diego, CA. Chapter 32 – Routes of Administration, p. 531.

2) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 23 – Techniques of Experimentation, p. 1008.

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

1. Which of the following methods **DOES NOT** dechlorinate water sufficiently for use by amphibians?
2. Passing water through activated charcoal filters
3. Aging open containers of water for 12 hours
4. Aerating water
5. Adding sodium thiosulfate

**Answer: b. Aging the water for 12 hours**

**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. 797.
2. Browne et al. 2007. Facility design and associated services for the study of amphibians. ILAR J 48(3):188-202.

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

**163.** According to the Guide for the Care and Use of Laboratory Animals, which of the following areas should be kept under relative negative air pressure?

1. Clean equipment storage
2. Housing for pathogen-free animals
3. Housing for nonhuman primates
4. Surgery

**Answer: c. Housing for nonhuman primates**

**Reference:**  Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. National Academy Press: Washington, D.C. Chapter 4 - Physical Plant, p. 76.

**Domain 5**

**164.** All of the following factors have been associated with a greater incidence of chronic progressive nephropathy in rats **EXCEPT**?

* 1. Dietary restriction
  2. Fisher 344 strain
  3. Increased age
  4. Male sex

**Answer: a. Dietary 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. 157.
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 2 – Rat, p. 161.
3. 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, pp. 525-526.

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

**165.** A 17 year old female macaque is found to have adhesions in the caudal abdomen on abdominal palpation. Ultrasound examination finds multiple hypoechoic cysts that contain chocolate-colored fluid on aspiration. Which of the following is the most likely diagnosis?

* 1. Carcinomatosis
  2. Endometriosis
  3. Diverticulosis
  4. Pneumonyssus simicola infection

**Answer: b. Endometriosis**

**References:**

1. Marr-Belvin et al. 2010. Ovarian pathology in rhesus macaques: A 12-year retrospective. J Med Primatol 39(3):170–176.
2. Bennett BT, Abee CR, Henrickson R, eds. 1998. Nonhuman Primates in Biomedical Research: Diseases. Academic Press, San Diego, CA. Chapter 4 – Neoplasia/Proliferative Disorders, p. 220 and Chapter 7 – Respiratory Diseases, pp. 302-303

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

1. The use of which of the following agents to induce ovarian failure in rats and mice provides an ovary-intact model for studying the menopausal transition of women and postmenopausal diseases?
2. Diepoxide 4-vinylhexene
3. Diepoxide cyclohexane
4. 4-diepoxide vinylcyclohexene
5. 4-Vinylcyclohexene diepoxide

**Answer: d. 4-Vinylcyclohexene diepoxide**

**References:**

1. [Muhammad](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Muhammad%20FS%22%5BAuthor%5D) et al. 2009. Effects of 4-vinylcyclohexene diepoxide on peri pubertal and adult Sprague-Dawley rats: ovarian, clinical, and pathologic outcomes. Comp Med 59(1):46-59.
2. Haas et al. 2007. Effects of impending ovarian failure induced by 4-vinylcyclohexene diepoxide on fertility in C57BL/6 female mice. Comp Med 57(5):443-449.

**Domain 3; Primary Species - Mouse (Mus musculus) and Rat (Rattus norvegicus)**

**167.** Hibernation can occur in which of the following species?

1. Chinchilla
2. Guinea pig
3. Mouse
4. Rat
5. Syrian hamster

**Answer: e. Sryian hamster**

**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; Chapter 5 – Biology and Diseases of Hamsters, p.170; Chapter 6 – Biology and Diseases of Guinea Pigs, p. 204; and Chapter 7 – Biology and Diseases of Other Rodents, p. 286

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

**168.** According to the Animal Welfare Act and its regulations, a licensee is required to notify the AC Regional Director by certified mail within how many days of any change in the name, address, management, or substantial control or ownership of his business or operation, or of any additional sites?

a. 5

b. 10

c. 15

d. 30

**Answer: b. 10**

**Reference:** Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A, Part 2 – Regulations, Subpart C – Research Facilities, §2.8 Notification of change of name, address, control, or ownership of business, (1-1-00 Edition, p. 18)

**Domain 5**

**169.** Which of the following background lesions **HAVE NOT** been identified in C57BL/6 mice?

a. Age related cochlear degeneration and hearing loss

b. Hippocampal neurodegeneration

c. Hydrocephalus

d. Hypocallosity

e. Microphthalmia and anophthalmia

**Answer: d. Hypocallosity**

**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. Brayton et al. 2001. Evaluating mutant mice: anatomic pathology. Vet Pathol 38(1):1–19.

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

1. An elevation of the gammaglobulins to generally greater than 20% of the total proteins can be observed in which of the following diseases in ferrets?
2. Aleutian disease
3. Canine distemper
4. Influenza
5. Rabies

**Answer: a. Aleutian Disease**

**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. 498-500
2. Fox JG, ed. 1998. Biology and Diseases of the Ferret, 2nd ed. Wiley-Blackwell. Chapter 15 - Viral Disease, pp. 361-362.

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

**171.** Blue Smoke Persian cats and beige mice are an animal model for which of the following human diseases?

1. Chediak-Higashi syndrome
2. Ehlers-Danlos syndrome
3. Hemophilia B
4. Hurler Syndrome
5. Maroteaux-Lamy syndrome

**Answer: a. Chediak-Higashi syndrome**

**References:**

1. Bauer et al. 2009.Potential large animal models for gene therapy of human genetic diseases of immune and blood cell systems. ILAR J 50(2):168–186.
2. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 12 – Domestic Cats as Laboratory Animals, p. 461.
3. http://jaxmice.jax.org/strain/000269.html

**Domain 3; Primary Species – Mouse (Mus musculus) and Secondary Species – Cat (Felis domestica)**

**172.** ATP in organic material on solid surfaces is best detected using which of the following methods?

1. Bioluminescence
2. Mass spectrometer
3. RODAC plate
4. Western blot

**Answer: a. Bioluminescence**

**References:**

1) Turner et al. 2010. Efficacy and limitations of an ATP-based monitoring system. JAALAS 49(2):190-195.

2) Schondelmeyer et al. 2006. Investigation of appropriate sanitation frequency for rodent caging accessories: evidence supporting less-frequent cleaning. JAALAS 45(6):40-43.

**Domain 4**

**173.** According to the Public Health Service Policy on Humane Care and Use of Laboratory Animals, the Institutional Animal Care and Use Committee (IACUC) may suspend an activity only after review of the matter under which of the following conditions?

a. At least 50% of the IACUC members are present at a convened meeting

b. A majority (>50%) of the IACUC members are present at a convened meeting

c. If the majority (>50%) of the quorum of the IACUC present at a convened meeting votes in favor of suspension

d. If all IACUC members with no conflicts of interest are present at a convened meeting

**Answer: c. If the majority (>50%) of the quorum of the IACUC present at a convened meeting votes in favor of suspension**

**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, pp. 8, 15 (http://grants.nih.gov/grants/olaw/references/PHSPolicyLabAnimals.pdf)
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. A.2. Authority, Composition and Functions, pp. 15-16.

**Domain 5**

**174.** Which of the following etiologic agents would most likely cause ulceration and crusting of the muzzle as well as of the periorbital and anal regions in rabbits?

1. Clostridium piliforme
2. Herpes sylvilagus
3. Pasteurella multocida
4. Treponema paraluis cuniculi

**Answer: d. Treponema paraluis cuniculi**

**References:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 6 – Rabbit, pp. 264-267, 271-, 273, 282-283
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, pp. 339-345.

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

**175.** A common marmoset presented with mild serous nasal discharge, but was otherwise clinically normal. Microscopic examination of slides prepared from nasal swabs revealed large, barrel-shaped ova with bipolar opercula. What is the most likely etiology?

1. Anatrichosoma cynomolgi
2. Ascaris lumbricoides

c. Athesmia foxi

d. Gongylonema spp.

e. Pterygodermatites alphi

**Answer: a. Anatrichosoma cynomolgi**

**References:**

1. Bennett BT, Abee CR, Henrickson R, eds. 1998. Nonhuman Primates in Biomedical Research: Diseases. Academic Press, San Diego, CA. Chapter 3 - Parasitic Diseases, pp. 146-148, 154-155, 159-160.
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. 766, 771.

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

**176.** Which of the following represents the major histocompatability complex of the mouse?

1. H2
2. H-Y
3. MLA
4. MT1
5. RT1

**Answer: a. H2**

**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. 36.

2) Silver. 1995. Mouse Genetics – Concepts and Applications. Oxford University Press: New York, NY. Chapter 3 – Laboratory Mice, p. 45.

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

**177.** The temperature control system for an animal room should be capable of maintaining temperature how many degrees around any set point selected from the designed temperature range?

1. ± 0.5°F
2. ± 1.0°F
3. ± 1.5°F
4. ± 2.0°F
5. ± 2.5°F

**Answer: d. ± 2**°**F**

**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. 925.
2. Hessler JR, Lehner NDM, eds. 2009. Planning and Designing Research Animal Facilities. Academic Press, San Diego, CA. Chapter 7 – Environmental Considerations for Research Animals, p. 62 and Chapter 34 – Heating, Ventilation and Air Conditioning (HVAC): Special Considerations, pp. 471-472.

**Domain 4**

**178.** According to the Animal Welfare Act and its regulations, all of the following is required for the annual report filed by each reporting facility **EXCEPT**?

a. Must be filed by December 1st of each calendar year with the AC regional director

b. Must be signed and certified by the Institutional Official and the attending veterinarian

c. Must assure that each principal investigator has considered alternatives to painful procedures

d. Must state the location of all facilities where animals are housed or used in research

e. Must state the numbers of animals held for, but not yet used, in research

**Answer: b. Must be signed and certified by the Institutional Official and the attending veterinarian**

**References:**

1. USDA Animal and Plant Health Inspection Service Animal Care Policy Manual. USDA Animal and Plant Health Inspection Service Animal Care Policy Manual. Policy #17 – Annual Report for Research Facilities. August 25, 2006. http://www.aphis.usda.gov/animal\_welfare/downloads/policy/policy17.pdf
2. Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A, Part 2 – Regulations, Subpart C – Research Facilities, §2.36 Annual report, (1-1-00 Edition, pp. 26-27)

**Domain 5**

1. Which of the following best describes the mode of inheritance of congenital glaucoma (buphthalmia) in rabbits?

a. Autosomal dominant with incomplete penetrance

b. Sex-linked recessive with complete penetrance

c. Autosomal recessive with incomplete penetrance

d. Autosomal dominant with complete penetrance

e. Sex-linked dominant with incomplete penetrance

**Answer: c. Autosomal recessive with incomplete penetrance**

**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, Iowa. Chapter 5 – Specific Diseases and Conditions, p. 265.

2) Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 6 – Rabbit, p.303.

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. 353-354.

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

**180.** Which of the following is the organism most commonly isolated from amphibians with Redleg?

* 1. Aeromonas hydrophila
  2. Entamoeba ranarum
  3. Flavobacteriums spp.
  4. Pseudocapillariodes xenopi

**Answer: a. Aeromonas hydrophila**

**Reference:** 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, pp. 814-815.

**Domain 1; Tertiary Species – Other Amphibians**

**181.** Which of the following strains of rabbits has a marked deficiency of low-density lipoprotein (LDL) receptors in the liver and other tissues?

1. Caldwell
2. St. Thomas Hospital
3. Conaway
4. Watanabe heritable hyperlipidemic

**Answer: d. Watanabe heritable hyperlipidemic**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter9 - Biology and Diseases of Rabbits, p. 331.
2. Manning PJ, Ringler DH, Newcomer CE, eds. 1994. The Biology of the Laboratory Rabbit, 2nd ed. Academic Press, San Diego, CA. Chapter 17 - Atherosclerosis Research, p. 369.

**Domain 3; Primary Species - Rabbit (Oryctolagus cuniculus)**

**182.** What do PCR-amplified SSLP markers detect in genomic DNA?

1. Differences in MHC haplotypes
2. Erythrocytic antigens that are strain-specific
3. Various biochemical markers that are polymorphic between strains
4. Length variation in dinucleotide repeat regions
5. Differences in the G, Q, C, and R bands of chromosomes

**Answer: d. Length variation in dinucleotide repeat regions**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 27 – Genetic Monitoring, pp. 1122-1124.
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 7 – Gene Mapping, pp. 117-120.

**Domain 4**

**183.** 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.

**Domain 5**

**184.** Which of the following best describes the blood supply from the coronary artery in pigs?

1. Left side dominant with no preexisting collateral circulation
2. Left side dominant with pre-existing collateral circulation
3. Right side dominant with no preexisting collateral circulation
4. Right side dominant with pre-existing collateral circulation

**Answer: c. Right side dominant with no preexisting collateral circulation**

**Reference:** 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)**

**185.** Porcine dermatitis and nephropathy syndrome has been associated with which of the following infectious agents?

1. Haemophilus parasuis
2. Mycoplasma hyorhinis
3. Porcine circovirus 2
4. Stephanurus dentatus
5. Salmonella typhimurium

**Answer: c. Porcine circovirus 2**

**References:**

1) Straw BE, Zimmerman JJ, D’Allaire SD, Taylor BJ. 2006. Diseases of Swine, 9th edition. Blackwell: Ames, IA. Chapter 14 – Porcine Circovirus Diseases, p. 302.

2) Phaneuf et al. 2007. Porcine dermatitis and nephropathy syndrome associated with porcine circovirus 2 infection in a Yorkshire pig. JAALAS 46(3):68-72.

3) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press, San Diego, CA. Chapter 16 – Biology and Diseases of Swine, pp.629-631, 639

**Domain 1; Primary Species – Swine (Sus scrofa)**

**186.** A mutation in which of the following genes is responsible for the immunodeficiency in SCID mice?

1. Recombinant Activating Gene
2. Forkhead Box N1 Gene
3. Immunoglobulin Heavy Chain
4. Protein Kinase, DNA-Activated, Catalytic Polypeptide
5. Simple Coagulopathy-Inducing Gene

**Answer: d. Protein Kinase, DNA-Activated, Catalytic Polypeptide**

**References:**

1. [Blunt](http://www.pnas.org/search?author1=T+Blunt&sortspec=date&submit=Submit) et al. 1996. Identification of a nonsense mutation in the carboxyl-terminal region of DNA-dependent protein kinase catalytic subunit in the scid mouse. PNAS 93(19):10285-10290
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. Chapter 13 – Mouse Models of Immunodeficiency, pp. 276-279.

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

**187.** **Which of the following secondary barriers is required for an ABSL-2 facility?**

1. Hand washing sink available in animal room
2. Negative airflow into laboratory
3. Self-closing, double-door access
4. Separate building or isolated zone

**Answer: a. Hand washing sink available in animal room**

**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. Section IV – Laboratory Biosafety Level Criteria, p. 59. (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**

**188.** According to the Animal Welfare Act and its regulations, when should principal investigators reconsider alternatives or alternative methods?

a. Only during the initial planning phase of the protocol

b. Only when significant changes are made to the proposal

c. At the time of each annual review of the protocol

d. At least once every three years, consistent with the triennial review of the protocol

**Answer: d. At least once every three years, consistent with the triennial review of the protocol**.

**References:**

1. USDA Animal Care Policy #12, Consideration of Alternatives to Painful/Distressful Procedures. June 2000.

http://www.aphis.usda.gov/animal\_welfare/downloads/policy/policy12.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. Section C.2.a. Alternatives – Replacement, Reduction and Refinement, p. 101

**Domain 5**

**189.** Which of the following best describes the Whitten effect in mice?

1. Induction of pseudopregnancy or diestrus in group-housed female mice
2. Spontaneous abortion, or prevention of implantation, in a female mouse when exposed to a male mouse that was not the original mate or to his odor
3. The synchronization of the female mouse estrus cycle after introduction of a male mouse or his odor
4. Cannibalization of pups by a male mouse that was not the original mate

**Answer: c. The synchronization of the female mouse estrus cycle after introduction of a male mouse or his odor**

**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. 50.
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 p. 54.

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

**190.** Which of the following organs is most commonly affected in Syrian hamsters suffering from polycystic disease?

a. Epididymis and liver

b. Kidneys and liver

c. Kidneys and pancreas

d. Kidneys and ovaries

e. Ovaries and uterus

**Answer: a. Epididymis and liver**

**References:**

1) 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, pp. 188-189.

2) Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 3 – Hamster, p. 203.

**Domain 1; Secondary Species – Syrian Hamster (Mesocricetus auratus)**

1. Which of the following ruminants has been used as a model for Dubin-Johnson syndrome in humans?
2. Nubian goats
3. Ayrshire cattle
4. Corriedale sheep
5. Southdown sheep

**Answer: c. Corriedale sheep**

**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. 521-522.
2. Pugh DG, ed. 2002. Sheep and Goat Medicine. Saunders: Philadelphia, PA. Chapter 4 - Diseases of the Gastrointestinal System, p. 103.

**Domain 3; Secondary Species - Sheep (Ovis aries)**

**192.** Which of the following are proven welfare benefits of tail docking in dairy cattle?

a. Fewer fly strikes

b. Fewer incidences of self-trauma

c. Minimizes bacterial contamination of the udder and milk

d. There are no proven welfare benefits

**Answer: d. There are no proven welfare benefits**

**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 7 – Dairy Cattle, p. 81.

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. 535.

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

**193.** According tothe Public Health Service Policy on Humane Care and Use of Laboratory Animals, an institution’s written Assurance must be signed by which of the following individuals before it can be submitted and reviewed by the Office of Laboratory Animal Welfare?

1. Attending veterinarian
2. Chief executive officer
3. IACUC chairperson

d. Institutional Official

**Answer: d. Institutional Official**

**Reference:**  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. 8-9.

**Domain 5**

1. Which of the following proteins form the basis for serological differentiation of minute virus of mice from mouse parvovirus?
2. CG1 and CG2
3. LP1 and LP2
4. NS1 and NS2
5. VP1 and VP2

**Answer: d. VP1 and VP2**

**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. 61.
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter - Mouse, p. 24.

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

**195.** Which organism is the primary cause of enterotoxemia in rabbits and may be precipitated by antibiotic administration?

* 1. Clostridium difficile
  2. Clostridium piliforme
  3. Clostridium spiroforme
  4. Clostridium tetani

**Answer: c. Clostridium spiroforme**

**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, pp. 340-342.
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 5—Specific Disease and Conditions, pp. 297-299.
3. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 6 – Rabbit, pp. 268-272
4. Manning PJ, Ringler DH, Newcomer CE, eds. 1994. The Biology of the Laboratory Rabbit, 2nd edition. Academic Press, San Diego, CA. Chapter 8 – Bacterial Diseases, pp. 140-146.

**Domain1; Primary Species - Rabbit (Oryctolagus cuniculus)**

**196.** Which of the following tests is commonly used to assess fear and anxiety in mice?

1. Elevated plus maze
2. Hot plate
3. Morris water maze
4. Tail flick

**Answer: a. Elevated plus maze**

**References:**

1. Mulder and Pritchett. 2004. The Elevated Plus-Maze. Contemp Top Lab Anim Sci 43(2):39-40
2. Mulder and Pritchett. 2003. The Morris water maze. Contemp Top Lab Anim Sci 42(2):49-50
3. Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd ed. Academic Press, San Diego, CA. Chapter23 – Pain Testing in Laboratory Mice, pp. 550-552

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

**197.** Under which of the following conditions may a tuberculin skin test give a false negative result?

1. Concomitant infection with measles
2. Nonspecific reactivity to the vehicle
3. Previous exposure to Freund’s complete adjuvant
4. Trauma due to improper administration of the test

**Answer: a. Concomitant infection with measles**

**References:**

1. Panarella and Bimes. 2010. A naturally occurring outbreak of tuberculosis in a group of imported cynomolgus monkeys (Macaca fascicularis). JAALAS 49(2):221-225
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, p. 740
3. Bennett BT, Abee CR, Henrickson R, eds. 1998. Nonhuman Primates in Biomedical Research: Diseases. Academic Press, San Diego, CA. Chapter 2 – Bacterial and Mycotic Diseases, pp. 85-86.

**Domain 4**

**198.** Which of the following organization developed the US Government Principles for the Utilization and Care of Vertebrate Animals Used in Testing, Research, and Training?

a. Institute of Laboratory Animal Resources

b. Interagency Research Animal Committee

c. Office of Laboratory Animal Welfare

d. Public Health Service

e. National Research Council

**Answer: b. Interagency Research Animal Committee**

**References:**

1. Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. National Academy Press: Washington, D.C. Appendix D: Public Health Service Policy and Government Principles Regarding the Care and Use of Animals, pp. 116-117.
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, p. 7
3. Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd ed. Academic Press, San Diego, CA. Chapter 25 – Regulatory Issues, p. 571.
4. 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. 25.

**Domain 5**

**199.** Which of the following organizations was established by the 1985 amendments to the Animal Welfare Act and provides information on improved methods of animal experimentation including alternatives?

1. Animal Welfare Information Center
2. Animal Welfare Institute
3. Center for Alternatives to Animal Testing
4. Institute of Laboratory Animal Resources
5. Scientists Center for Animal Welfare

**Answer: a. Animal Welfare Information Center**

**Reference:** Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. Appendix B – Selected Organizations, pp. 105, 107, 109, 112.

**Domain 6**

**200.** Which mouse strain is most resistant to hepatic and large intestinal pathology due to Helicobacter hepaticus?

1. A/JCr
2. BALB/cANCr
3. C3H/HeNCr
4. C57BL/6

e. SCID/NCr

**Answer: d. C57BL/6**

**References:**

1) Freebersyser et al. 2010. Evaluation of a commercial colorimetric fecal dipstick assay for the detection of Helicobacter hepaticus infections in laboratory mice. JAALAS 49(3):312-315.

2) Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 1 – Mouse, p. 59.

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

**201.** Which of the following etiological agents would most likely be the cause of conjunctivitis with serous to purulent exudate in a guinea pig?

a. Herpesvirus

b. Calicivirus

c. Chlamydophila caviae

d. Streptococcus zooepidemicus

**Answer: c. Chlamydophila caviae**

**References:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter4 - Guinea Pig, p. 228.
2. 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, 220-223.

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

1. Myocardial infarction can be induced by balloon catheterization and occlusion of which of the following vessels in a closed-chest model of myocardial infarction in swine?
2. Common coronary artery
3. Left anterior descending coronary artery
4. Left circumflex coronary artery
5. Right circumflex coronary artery

**Answer: b. Left anterior descending coronary artery**

**References:**

1. Schuleri et al. 2008. The adult Gottingen minipig as a model of chronic heart failure after myocardial infarction: focus on cardiovascular imaging and regenerative therapies. Comp Med 58(6):568-579.
2. Angeli et al. 2009. Left Ventricular Remodeling after Myocardial Infarction: Characterization of a Swine Model on β-Blocker Therapy. Comp Med 59(3):272-279.

**Domain 3; Primary Species - Pig (Sus scrofa)**

**203.** Alcohols are classified as which of the following chemical disinfectant categories?

1. Denaturant
2. High level disinfectant
3. Oxidant
4. Reactant
5. Sterilant

**Answer: a. Denaturant**

**References:**

1) Keen et al. 2010. [Efficacy of soaking in 70% isopropyl alcohol on aerobic bacterial decontamination of surgical instruments and gloves for serial mouse laparotomies](http://aalas.publisher.ingentaconnect.com/content/aalas/jaalas/2010/00000049/00000006/art00008). JAALAS 49(6):832-837.

2) 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. 370.

3) Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. National Academy Press: Washington, D.C. Chapter 3 – Veterinary Medical Care, p. 62.

**Domain 4**

**204.** Which of the following drugs or anesthetic agents can cause excitement and clonic convulsions when administered as the sole agent to dogs?

1. Morphine
2. Fentanyl
3. Etomidate
4. α-Chloralose
5. Propofol

**Answer: d. α-Chloralose**

**Reference:** 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. 975-976.

**Domain 2; Primary Species – Dog (Canis familiaris)**

**205.** Particularly high levels of allergen exposure can occur during which of the following activities involving rodents?

1. Health checks in rodent rooms
2. Necropsy of sentinel rodents
3. Rodent cage emptying and cleaning

d. Weighing rodents daily

**Answer: c. Rodent cage emptying and cleaning**

**Reference:** 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. 62-63.

**Domain 4**

**206.** Fecal corticosterone metabolites are commonly used for measuring which of the following in mice?

1. Sexual maturity
2. Stress
3. Diabetic status
4. Analgesic efficacy

**Answer: b. Stress**

**References:**

1. Nicholson et al. 2009. The response of C57BL/6J and BALB/cJ mice to increased housing density. JAALAS 48(6):740–753
2. Jensen et al. 2010. Vacuum-cleaner noise and acute stress responses in female C57BL/6 mice (Mus musculus). JAALAS 49(3):300-306

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

**207.** Which of the following organizations is composed of research professionals with a mission dedicated to balancing animal welfare and excellence in basic and applied scientific inquiry?

a. National Association for Biomedical Research

b. Scientists Center for Animal Welfare

c. Laboratory Animal Management Association

d. Federation for Biomedical Research

**Answer: b. Scientists Centre for Animal Welfare**

**References:**

1. Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. National Academy Press: Washington, D.C. Appendix B: Selected Organizations, pp. 108, 110-112
2. <http://www.scaw.com/>
3. <http://www.aalas.org/resources/branches-affil.aspx>

**Domain 6**

**208.** Which of the following **IS NOT** a potential side effect of cyclosporine administration in rabbits?

1. Diarrhea
2. Facial dermatitis
3. Gingival overgrowth
4. Inappetence
5. Ptyalism

**Answer: a. Diarrhea**

**References:**

1. Jean et al. 2009. Cyclosporine-induced gingival overgrowth in New Zealand white rabbits (Oryctolagus cuniculus). Comp Med 59(4):357-362.
2. Gratwohl et al. 1986. Cyclosporine toxicity in rabbits. Lab Anim 20(3):213-220.

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

**209.** The National Fire Protection Association classifies fires into four types according to the character of the combustible materials involved. Which of the following combustible materials would be found in a Class B fire?

a. Magnesium, sodium, potassium

b. Animal bedding, paper gowns, paper towels

c. Lighting, automatic cage-washers, wet vacuums

d. Cleaning solutions, volatile anesthetics, paint

**Answer: d. Cleaning solutions, volatile anesthetics, paint**

**Reference:** 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, p. 35.

**Domain 4**

1. Which of the following etiological agents is the most likely cause of a maculopapular lesion on the hand of a technician taking care of sheep?
   1. Bacillus anthracis
   2. Brucella spp.
   3. Coxiella burnetii
   4. Leptospira spp.
   5. Orf virus

**Answer: e. Orf virus**

**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. 538-540, 553, 574 and Chapter 25 - Selected Zoonoses, pp.1062, 1076, 1083
2. 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 5 – Zoonoses, pp. 74-75, 81-83, 90-92

**Domain 1; Secondary Species - Sheep (Ovis aries)**

1. For knockout mouse studies, blastocysts from which of the following inbred mouse strains have been used almost exclusively as recipients of genetically engineered embryonic stem cells?

a. FVB/N

b. C57BL/6

c. 129/SvEv

d. SJL/J

e. C3H

**Answer: b. C57BL/6**

**References:**

1) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 28 – Transgenic and Knockout Mice, pp. 1130-1131.

2) Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 1 - Mouse, p. 6.

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

**212.** For Animal Care to grant approval for a microchip implantation identification system in breeding stock or research animals, which of the following requirements must be met?

1. The microchip may be placed in any anatomical location as long as the microchip location is included in the animal identification record
2. Animals with microchips that transfer to another licensee/registrant must always be given a tag/tattoo during transit even if a compatible scanner is available at the receiving facility
3. The animal identification records must include the name of the microchip manufacturer and the microchip number
4. The microchip scanner device must be readily available to the APHIS inspector and/or facility employee accompanying the APHIS representative

**Answer: d. The microchip scanner device must be readily available to the APHIS inspector and/or facility employee accompanying the APHIS representative**

**Reference:** USDA Animal and Plant Health Inspection Service Animal Care Policy Manual. Policy # 13: Microchip Implants. July 17, 2000 (http://www.aphis.usda.gov/animal\_welfare/downloads/policy/policy13.pdf).

**Domain 4**

**213.** Which of the following is the best method for detecting Giardia spp. in sheep?

a. Detection of motile trophozoites in fresh fecal mounts

b. Direct fluorescent antibody assay

c. Enzyme immunoassay

d. Immunofluorescent antibody assay

**Answer: a. Detection of motile trophozoites in fresh fecal mounts**

**References:**

1) Wilson and Hankenson. 2010. Evaluation of an inhouse rapid ELISA test for detection of Giardia in domestic sheep (Ovis aries). JAALAS 49(6):809-813.

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. 588.

**Domain 1; Secondary Species - Sheep (Ovis aries)**

**214.** Which of the following tests or models has been widely used to evaluate analgesic compounds for use in amphibians?

1. Abdominal constriction
2. Acetic acid wiping response

c. Formalin

d. Hot-plate

e. von Frey filament

**Answer: b. Acetic acid wiping response**

**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 20 -Anesthesia and Analgesia in Amphibians, p. 517 and Chapter 23 – Pain Testing in the Laboratory Mouse, pp. 551-553

**Domain 3**

**215.** Which of the following organizations provides a unified voice for the scientific community on legislative and regulatory matters affecting laboratory animal research?

1. American Association for Laboratory Animal Science
2. Americans for Medical Progress

c. American Society of Laboratory Animal Practitioners

d. Institute of Laboratory Animal Resources

e. National Association for Biomedical Research

**Answer: e. National Association for Biomedical Research**

**References:**

1. Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. National Academy Press: Washington, D.C. Appendix B: Selected Organizations, pp. 103-104, 109, 111
2. <http://www.nabr.org/About_NABR.aspx>
3. <http://www.amprogress.org/>

**Domain 6**

**216.** In zebrafish, infections of the spinal cord that may disseminate to somatic muscle and that are associated with severe emaciation and scoliotic changes have been attributed to which of the following organisms?

* 1. Mycobacterium fortuitum
  2. Pseudoloma neurophilia
  3. Pseudocapillaria tomentosa
  4. Piscinoodinium pillulare

**Answer: b. Pseudoloma neurophilia**

**References:**

1. Whipps and Kent. 2006. Polymerase chain reaction detection of pseudoloma neurophilia, a common microsporidian of zebrafish (Danio rerio) reared in research laboratories. JAALAS 45(1):36-39.
2. 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 Zebrafish, pp. 876-879.

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

**217.** When a database search is the primary means used by a principal investigator of meeting the Animal Welfare Act and its regulations’ requirements to consider alternatives to painful/distressful procedures, the written narrative must, at a minimum, include all of the following **EXCEPT?**

1. Date the search was performed
2. Key words and/or the search strategy used
3. Names of the databases searched
4. Number of “hits” for each key word
5. Period covered by the search

**Answer: d. Number of “hits” for each key word**

**References:**

1) Animal Welfare Act, 9 CFR Part 2 – Regulations, Subpart C – Research Facilities, §2.31(d)(1)(ii) Institutional animal care and use committee (IACUC). (1-1-01 Edition, p. 22).

2) USDA Animal and Plant Health Inspection Service Animal Care Policy Manual. Policy # 12: Written Narratives for Alternatives to Painful Procedures. June 21, 2000 (http://www.aphis.usda.gov/animal\_welfare/downloads/policy/policy12.pdf).

**Domain 5**

**218.** Which of the following grants is an NIH career development grant?

1. K08
2. P30
3. R21
4. U01

**Answer: a. K08**

**References:**

1. http://grants.nih.gov/grants/funding/funding\_program.htm#RSeries
2. http://grants.nih.gov/training/careerdevelopmentawards.htm
3. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 31 - Research in Laboratory Animal and Comparative Medicine, p. 1234.

**Domain 3**

**219.** The Occupational Safety and Health Administration limits employee exposure to noise to how many decibels measured on the A scale of a standard sound-level meter at slow response (dBA) averaged over an 8 hour work shift?

a. 100 decibels

b. 90 decibels

c. 85 decibels

d. 50 decibels

e. 45 decibels

## Answer: b. 90 decibels

**Reference:** 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, p. 41.

**Domain 4**

**220.**  Which of the following types of walls is the most effective in containing noise because their density reduces sound transmission?

1. Masonry walls
2. Metal walls
3. Plaster walls
4. All of these types of walls are equally effective in containing noise

**Answer: a. Masonry walls**

**Reference:** Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. Chapter 4 – Physical Plant, p. 77 (Noise Control).

**Domain 4**

**221.** Which of the following laboratory animals has been utilized as a model for biliary physiology and the pathophysiology of gallstone formation?

* 1. Cynomys ludovicianus
  2. Dipodomys spectabilis
  3. Marmota monax
  4. Spermophilus richardsonii

**Answer: a. Cynomys ludovicianus**

**Reference:** 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. 252, 254, 259-260 and Chapter 8 – Woodchucks as Laboratory Animals, p. 310.

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

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

1. 61-72°F
2. 64-79°F
3. 64-84°F
4. 61-81°F
5. 68-72°F

**Answer: b. 64-79°F**

**Reference:** Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council. 1996. Guide for the Care and Use of Laboratory Animals. National Academy Press: Washington, D.C. Chapter 2 – Animal Environment, Housing, and Management, p. 32 (Table 2.4).

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

**223.** Which of the following volatile anesthetics has been shown to cause proximal tubular necrosis in nonhuman primates through high doses of its degradation product, compound A?

* 1. Desflurane
  2. Enflurane
  3. Halothane
  4. Isoflurane
  5. Sevoflurane

**Answer: e. Sevoflurane**

**Reference:** 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. 994.

**Domain 2**

**224.** According to the Animal Welfare Act and its regulations, research facilities which obtain cats from sources other than dealers, exhibitors, and exempt persons must hold animals for \_\_\_\_ full days, not including day of acquisition, after acquiring the animal, excluding time in transit, before these animals can be used by the facility.

1. 1
2. 3
3. 5
4. 7
5. 10

**Answer: c. 5**

**References:**

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. B.3. Role of the Veterinarian, p. 54.
2. Animal Welfare Act, 9 CFR Part 2 – Regulations, Subpart C – Research Facilities, §2.38(j) Miscellaneous. (1-1-01 Edition, p. 30)

**Domain 4; Secondary Species – Cat (Felis domestica)**

**225.** Hamster parvovirus infections in hamsters may occur due to interspecies transmission of which of the following strains of mouse parvovirus from mice?

1. Minute virus of mice
2. Mouse parvovirus 1
3. Mouse parvovirus 2
4. Mouse parvovirus 3

**Answer: d. Mouse parvovirus 3**

**References:**

1. Christie et al. 2010. Experimental infection of mice with hamster parvovirus: evidence for interspecies transmission of mouse parvovirus 3. Comp Med 60(2):123-129.
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 3 – Hamsters, p.181.

**Domain 1; Primary Species – Mice (Mus musculus), Secondary Species – Syrian Hamster (Mesocricetus auratus), and Tertiary Species – Other Rodents**

**226.** Which of the following statistical tests is used as a nonparametric test when it is not possible to normalize badly skewed data and when the aim is to compare groups?

a. ANOVA

1. Mann-Whitney test
2. Chi Square
3. T test
4. Pearson’s correlation coefficient

**Answer: b. Mann-Whitney test**

**Reference:** Festing. 2006. Design and statistical methods in studies using animal models of development. ILAR J 47(1):5-14.

**Domain 3**

**227.** Which of the following types of rodent pathogens is least susceptible to disinfectants?

1. Enveloped viruses
2. Hydrophilic, nonenveloped viruses
3. Non-spore-forming bacteria
4. Parasite ova and cysts
5. Partially lipophilic, nonenveloped viruses

**Answer: d. Parasite ova and cysts**

**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 B – Decontamination and Cleaning, pp. 327, 330 (http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5\_appendixB.pdf)

2) 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.

**Domain 4**

**228.** All of the following reasons could account for the occurrence of false-positive or false-negative results in a diagnostic test **EXCEPT**?

1. Incomplete sensitivity of tests
2. Incomplete specificity of tests
3. Laboratory errors
4. High disease prevalence
5. Sample selection errors

**Answer: d. High disease prevalence**

**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, pp. 385-387.

**Domain 1**

**229.** All of the following parameters can influence sensitivity in bioluminescence imaging in small animals **EXCEPT**?

a. Animal position

1. Contrast agent
2. Depth in tissue
3. Diet
4. Hair

**Answer: b. Contrast agent**

**Reference:** Zinn et al. 2008. Noninvasive bioluminescence imaging in small animals. ILAR J 49:(1):103-115.

**Domain 3**

**230.** According to the Animal Welfare Act and its regulations, which of the following animal species must be housed separately when nursing young?

1. Hamsters
2. Guinea pigs
3. Rabbits
4. Nonhuman primates

**Answer: a. Hamsters**

**Reference:** Animal Welfare Act, 9 CFR Part 3 – Standards, Subpart B – Specifications for the humane handling, care, treatment, and transportation of guinea pigs and hamsters, §3.28(b)(3)(ii) Primary Enclosures. (1-1-01 Edition, p. 61).

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

END OF EXAM