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Practical Section– 120 Questions

**Referenced Answers with Photos – 125 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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Question 1: Peripheral blood smear from a guinea pig. What is the nucleated cell in the center of the image and when would you expect to see an increased number of these cells in circulation?

1. Heterophil, bacterial infection
2. Foa-Kurloff cell, pregnancy
3. Moon cell, estrus
4. Pseudoeosinophil, drug reaction
5. Dobson cell, juvenile/active growth

**Answer: b. Foa-Kurloff cell, pregnancy**

**References:**

1. Fox JG, Anderson LC, Otto GM, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 6 – Biology and Diseases of Guinea Pigs, p. 251.
2. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster and Other Rodents. Academic Press: San Diego, CA. Part III – Guinea Pigs, Chapter 20 – Anatomy, Physiology and Behavior, pp. 584-585.

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

Question 2: Newborns of which of these animals are attached firmly to the nipples of the dams and are dragged around for about 3 weeks.

1. A
2. B
3. C
4. D

**Answer: a. White-Tailed Rats (*Mystromys albicaudatus*)**

**References:**

1. Fox JG, Anderson LC, Otto Glen, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 7 – Biology and Diseases of Other Rodents, p. 315.
2. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Part VI –Other Rodents, Chapter 51 - p. 1126.

**Domain 4; Tertiary Species –Other Rodents (*Mystromys albicaudatus*)**

Question 3: Which of the following behaviors or physiologic parameters of mice and rats are **not** determined/validated by this instrument?

1. Normal behaviors such as climbing, locomotion, immobility and rearing
2. Normal behaviors such as drinking, grooming and eating
3. Special behaviors such as seizures, startle response and head twitches
4. Measures body temperatures, blood pressures and metabolic rate

**Answer: d. Measures body temperatures, blood pressures and metabolic rate**

**References:**

1. <http://www.metris.nl/en/products/laboras>
2. Castagne V et al. Differential behavioral profiling of stimulant substances in the rat using the LABORAS™ system Pharmacology Biochemistry and Behavior. 2012; 101(4)-553-63

**Domain 3**

Question 4: What set of results do the horizontal lines on this diagram represent assuming the dotted parabolic line is known negatives and the solid parabolic line is known positives?

* 1. False negative results
	2. Equivocal results
	3. False positive results
	4. True negative results
	5. True positive results

**Answer: a. False negative results**

**Reference:**

1. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT. 2015. Laboratory Animal Medicine, 3rd Ed. Academic Press: San Diego, CA. Chapter 11 – Microbiological Quality Control for Laboratory Rodents and Lagomorphs, p. 489.

**Domain 3**

Question 5: According to the 2013 AVMA Guidelines on Euthanasia, which is the preferred method for euthanizing the species depicted:

a. penetrating captive bolt

b. immersion in buffered tricaine methansulfonate

c. CO2 inhalation

d. immersion in an isoflurane water bath

e. decapitation

**Answer: b) buffered tricaine methansulfonate**

**References:**

1) 2013 AVMA Guidelines on Euthanasia. AVMA. Pg: 77-78.

2) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd ed. Academic Press: San Diego, CA. Chapter 17 – Biology and Diseases of Amphibians, p. 815.

**Domain 2 – tertiary species, Xenopus laevis**

Question 6: A ferret presents with chronic diarrhea and weight loss. Necropsy and histopathology indicates the ferret was suffering from eosinophilic gastroenteritis. What histopathologic feature in the slide is most supportive of this diagnosis?

1. Eosinophilic infiltrate
2. Intralesional helminthes
3. Interstitial edema and fibrosis
4. Splendore Hoeppli bodies

**Answer: d. Splendore Hoeppli bodies**

**References:**

1. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd ed. Academic Press: Oxford, UK. Chapter – 14 Biology and Diseases of Ferrets p. 611.
2. Fox & Marini eds. 2014. Biology and Diseases of the Ferret, 3rd ed. Wiley-Blackwell, Chapter 16 – Diseases of the Gastrointestinal System, p. 373.

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

Question 7: The agent which causes this condition must be differentiated from which environmental condition in glabrous mice:

a. Low temperature

b. Low humidity

c. High temperature

d. High humidity

**Answer: b. Low humidity**

**References:**

1) Fox JG, Anderson LC, Otto G, Pritchett-Corning K, Whary M, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, p. 113.

2) Percy DH, Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits. 3rd edition. Ames, Iowa: Blackwell Pub. Chapter 1 – Mouse. p73.

**Domain 4; Primary Species – Mus musculus**

Question 8: The packaging shown here is used for shipping what material?

a. Infectious substance

b. Biological specimen

c. Clinical specimen

d. Diagnostic specimen

**Answer: b. Biological specimen**

**References:**

1. U. S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and National Institutes of Health. 2009. Biosafety in Microbiological and Biomedical Laboratories. 5th ed. U.S. Government Printing Office, Washington, D. C. Appendix C – Transportation of Infectious Substances, pp. 336-342. **(**<http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5_sect_IV.pdf>)
2. http://www.phmsa.dot.gov/pv\_obj\_cache/pv\_obj\_id\_54AC1BCBF0DFBE298024C4C700569893C2582700/filename/Transporting\_Infectious\_Substances\_brochure.pdf

**Domain 5**

Question 9: The items shown are most commonly used for laboratory rabbits for what purpose?

* 1. Enrichment
	2. Weight-training
	3. Optical-testing
	4. Color differentiation testing

**Answer: a. Enrichment**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. Chapter 32 – Laboratory Animal Behavior, p. 1245.
2. Harriss LD, Custer LB, Soranaka ET, Burge JR & Ruble GR. 2001. “Evaluation of Objects and Food for Environmental Enrichment of NZW Rabbits” *JAALAS,* 40(1): pp. 27-30.

3) [**http://www.bio-serv.com/product/Bunny\_Blocks.html**](http://www.bio-serv.com/product/Bunny_Blocks.html)

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

Question 10: The equipment in this image is used to perform which one of the following tests:

1. Bacteriology testing
2. Environmental testing
3. PCR testing
4. Serology testing
5. Parasite testing

**Answer: d**. **Serology testing**

**References:**

1) Qualification of EZ-Spot® dried-blood-spot (DBS) samples for rodent serology. [Internet]. Charles River Laboratories International, Inc; 2013. [Cited 2014 June 9]. Available from:<http://www.criver.com/files/pdfs/research-models/rm_ld_r_ez_spot.aspx>

2) Opti-Spot: Revolutionizing serology testing by simplifying rodent blood collection. [Internet]. IDEXX Laboratories, Inc; 2013. [Cited 2014 July 25]. Available from:<http://www.idexxbioresearch.com/radil/userfiles/download_files/OptiSpot_SellSheet_072013_US.pdf>.

**Domain 4**

Question 11: Which of the following is true regarding the use of the apparatus pictured above in rodents?

1. It is primarily used to study depression.
2. It is primarily used to evaluate neuromuscular function by testing swimming ability.
3. Mice typically require less training to perform this test than tests that involve lever-pressing and/or food restriction.
4. Animals must be removed immediately if they become immobile to prevent drowning.
5. It is primarily used to induce stress.

**Answer: c. Mice typically require less training to perform this test than tests that involve lever-pressing and/or food restriction.**

**References:**

1. Guidelines for the Use of Mammals in Neuroscience and Behavior Research, 2003, National Research Council, National Academy of Sciences, Washington, DC. p118-119.
2. Vorhees, CV and Williams, MT. 2014. Assessing Spatial Learning and Memory in Rodents. *ILAR* 55 (2) p 310-328.

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

Question 12: This personal protective equipment is required for all of the following hazardous agents except?

1. B virus injected macaques
2. B virus in mice
3. 1918 flu virus in any animal
4. Hantavirus in Sigmodon spp.
5. Filovirus in *Papio* spp.

**Answer: c) 1918 flu virus in any animal**

**References**:

1. Biosafety in Microbiological and Biomedical Laboratories (BMBL), 2009. Centers for Disease Control and Prevention and National Institutes of Health. 5th ed., p. 213.
2. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd ed. Academic Press: Oxford, UK Chapter 2, p. 1301.

**Domain 5**

Question 13: What is the most likely etiology of the pictured guinea pig disease?

1. Inability to produce the hepatic enzyme L-gulonolactone oxidase
2. Metastatic calcification due to inability to metabolize excess dietary calcium
3. Vitamin C toxicity secondary to consuming a diet formulated for mice
4. Rhabdomyomatosis secondary to environmental stressors

**Answer: a. Inability to produce the hepatic enzyme L-gulonolactone oxidase**

**References:**

1. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press. Ch 6 – Biology and Diseases of Guinea Pigs. p. 268
2. Percy DH, Barthold SW. 2007. Pathology of laboratory rodents and rabbits, 3rd ed. Ames, Iowa: Blackwell Pub. Ch 5 – Guinea Pig p. 238.

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

Question 14: The following condition was found in numerous mice in an institution. Choose the **LESS** likely etiological agent that may cause this condition:

a. *Citrobacter rodentium*

b. Coronavirus

c. Rotavirus

d. Reovirus

e. Polyoma virus

**Answer: e. Polyoma virus**

**References**

1) Miller CL, et. Al. “Isolation of Helicobacter spp. from Mice with Rectal Prolapses”. 2014. [*Comp*](http://www.ingentaconnect.com.ezproxy.library.wisc.edu/content/aalas/cm) *Med*. 64(3):171-178

2) Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press: San Diego, CA. p. 85, 95,-97,108

3) Percy and Barthold. 2007. Pathology of Laboratory rodents and rabbits. 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 2- Rats, p. Pg. 8, 55-90

**Domain 1- Primary species – Mouse (*Mus musculus*)**

Question 15: Which statement best describes the procedure being performed below:

1. Jugular blood sampling
2. Carotid arterial blood sampling from right carotid artery
3. Vena caval blood sampling from right side to prevent damage to recurrent laryngeal nerve
4. Subclavian arterial blood sampling from right side to prevent damage to recurrent laryngeal nerve
5. Azygous vein blood sampling from the right side

**Answer: c. Vena caval blood sampling from right side to prevent damage to recurrent laryngeal nerve**

**References:**

1. 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, p. 700.
2. Swindle MM and Smith AC, eds. 2016. Swine in the Laboratory: Surgery, Anesthesia, Imaging and Experimental Techniques. 3rd Edition. CRC Press: Boca Raton, FL. Chapter 1: Biology, Handling, Husbandry and Anatomy, p. 26

**Domain 1; Primary species pig (Sus scrofa)**

Question 16: The equipment pictured here is:

a. A rodent euthanasia chamber

b. A rodent metabolic chamber

c. An open field chamber

d. A rodent anesthesia induction chamber

**Answer: d. A rodent anesthesia induction chamber**

**References:**

1) Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd edition. Academic Press: San Diego, CA. Chapter 5 – Anesthesia Delivery Systems, p. 156.

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

**Domain 2; Primary Species – Mus musculus**

Question 17: How would you evaluate the following picture of a rat using the rat grimace scale?

1. Moderate orbital tightening and moderate nose/cheek flattening.
2. No orbital tightening and no nose/cheek flattening.
3. Obvious orbital tightening and moderate nose/cheek flattening
4. Moderate orbital tightening and no nose/cheek flattening

**Answer: a. Moderate orbital tightening and moderate nose/cheek flattening**

**References:**

1. [Matsumiya LC](http://www.ncbi.nlm.nih.gov/pubmed?term=Matsumiya%20LC%5BAuthor%5D&cauthor=true&cauthor_uid=22330867), [Sorge RE](http://www.ncbi.nlm.nih.gov/pubmed?term=Sorge%20RE%5BAuthor%5D&cauthor=true&cauthor_uid=22330867), [Sotocinal SG](http://www.ncbi.nlm.nih.gov/pubmed?term=Sotocinal%20SG%5BAuthor%5D&cauthor=true&cauthor_uid=22330867), [Tabaka JM](http://www.ncbi.nlm.nih.gov/pubmed?term=Tabaka%20JM%5BAuthor%5D&cauthor=true&cauthor_uid=22330867), [Wieskopf JS](http://www.ncbi.nlm.nih.gov/pubmed?term=Wieskopf%20JS%5BAuthor%5D&cauthor=true&cauthor_uid=22330867), [Zaloum A](http://www.ncbi.nlm.nih.gov/pubmed?term=Zaloum%20A%5BAuthor%5D&cauthor=true&cauthor_uid=22330867), [King OD](http://www.ncbi.nlm.nih.gov/pubmed?term=King%20OD%5BAuthor%5D&cauthor=true&cauthor_uid=22330867), [Mogil JS](http://www.ncbi.nlm.nih.gov/pubmed?term=Mogil%20JS%5BAuthor%5D&cauthor=true&cauthor_uid=22330867). 2012. Using the Mouse Grimace Scale to reevaluate the efficacy of postoperative analgesics in laboratory mice. *JAALAS,* 51(1):42-9.
2. Sotocinal SG, Sorge RE, et al. 2011. The Rat Grimace Scale: A partially automated method for quantifying pain in the laboratory rat via facial expressions. Molecular Pain 7, 55-65.

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

Question 18: Infections with these pathogens can negatively affect research results by causing which of the following?

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

c. Elevations in IgA levels and inflammatory cytokines

d. Elevations in IgE levels and inflammatory cytokines

e. Elevations in IgE levels and decreases in inflammatory cytokines

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

**References:**

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

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

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

Question 19: Which of the following imaging modalities will an investigator most likely use after giving an intraperitoneal injection of this compound to mice?

* 1. Bioluminescence
	2. High-frequency Ultrasound
	3. MicroCT
	4. MRI

**Answer: a. Bioluminescence**

**References:**

1. Zinnet al. 2008. Non-invasive bioluminescence imaging in small animals. ILAR J 49(1):103-115.
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 14 – In-Vivo Whole-Body Imaging of the Laboratory Mouse. pp. 506-507.

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

Question 20: With regard to the husbandry and care of the animal shown below, what is the largest concern?

* 1. The animal will need to be sedated frequently for procedures, so dietary supplementation will be needed.
	2. The animal may develop skin lesions that will need to be treated clinically.
	3. The animal will need to be exempted for social housing, which means that extra enrichment will need to be provided.
	4. The study will need to be halted if the jacket becomes damaged or soiled.
	5. Caging change will be need to be coordinated with the study schedule, because the animal will need to be moved into the tether cage the same day the study is started.

**Answer: b. The animal may develop skin lesions that will need to be treated clinically.**

**References:**

1. Kelly R et al. 2014. Evaluation of the use of primate undershirts as a refinement practice for jacketed rhesus macaques (*Macaca mulatta*). *JAALAS 53*:267-272
2. Association of Primate Veterinarians. [Internet]. 2013. Guidelines for jacket use for nonhuman primates. Available at: http://www.primatevets.org/Content/files/Public/education/NHP\_Jacket\_Use\_Guidelines.pdf

**Domain 4; Primary Species – Macaques (*Macaca species*)**

Question 21: The interior height for any primary enclosure used to confine this species shall be at least \_\_\_\_\_\_ inches?

* 1. 5
	2. 5.5
	3. 6
	4. 6.5
	5. 7

**Answer: c. 6**

**Reference:**

1. Guide for the Care and Use of Laboratory Animals 8th edition Institute of Laboratory Animal Resources, National Research Council, National Academy of Sciences. National Academy Press, Washington, DC, 2011. Page 57
2. Animal Welfare Act, 7 U.S.C., Sections 2131-2159. Animal Welfare Standards, 9 CFR Chapter 1, Subchapter B, 3.28. Page 62.

**Domain 5; Secondary Species – Syrian hamster (Mesocricetus auratus)**

Question 22: The CDC and NIH recommend what biosafety level facility for animal studies using nonhuman primates experimentally or naturally infected with the disease above.

a. Animal Biosafety Level 1

b. Animal Biosafety Level 2

c. Animal Biosafety Level 3

d. Animal Biosafety Level 4

e. Animal Biosafety Level 5

**Answer: c. Animal Biosafety Level 3**

**References:**

1) Occupational Health and Safety in the Care and Use of Research Animals. Institute of Laboratory Animal Resources, National Research Council. National Academy Press, Washington, DC, 1997. Chapter 5: Zoonoses. Page 86.

2) Biosafety in Microbiological and Biomedical Laboratories 5th Edition. Centers for Disease Control and Prevention and National Institutes of Health. December 2009. Section VIII-Agent Summary Statements. Section VIII-A: Bacterial Agents. Page 146.

**Domain 5; Primary species- Macaques (*Macaca mulatta*)**

Question 23: Which of the following is true about this assay?

* 1. Measures mechanical hypersensitivity (grams force)
	2. Repeat testing affects the latency for paw withdrawal
	3. A cut-off point to prevent tissue damage is not needed
	4. Allows for independent testing of both sides of the body
	5. Increases the number of animals required for a given experiment

**Answer: d. Allows for independent testing of both sides of the body**

**References:**

1. Chum HH, Jampachairsri K, McKeon GP, Yeomans DC, Pacharinsak C, Felt SA. *Antinociceptive effects of sustained-release buprenorphine in a model of incisional pain in rats (Rattus norvegicus)*. J Am Assoc Lab Anim Sci. 2014 Mar;53(2):193-7.
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 23- Pain Testing in the Laboratory Mouse, p. 552

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

Question 24: Identify the following instrument and its most likely use:

1. Stylet; To aide in intubation of the neonatal trachea
2. Acupuncture needle; to enhance analgesia by stimulating the release of endogenous opioids
3. Trochar; to implant small pellets subcutaneously
4. Peripheral nerve stimulator; to measure the degree of neuromuscular blockade

**Answer: b. Acupuncture needle; to enhance analgesia by stimulating the release of endogenous opioids**

**References:**

1. Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nd ed. Academic Press, San Diego, CA. Chapter 10 – Anesthesia and Analgesia for Laboratory Rodents, p. 275; Chapter 29- Nonpharmacologic Pain Control, p. 626
2. Magden ER, Haller RL, Thiele EJ, Buchl SJ, Lambeth SP, Schapiro SJ. *Acupuncture as an adjunct therapy for osteoarthritis in chimpanzees (Pan troglodytes).* J Am Assoc Lab Anim Sci. 2013 Jul;52(4):475-80.

**Domain 2**

Question 25: Which of the following virus types is most likely attributable to the lesion shown?

a. Alphaherpesvirus

b. Betaherpesvirus

c. Gammaherpesvirus

d. Retrovirus

e. Polyomavirus

**Answer: a. Alphaherpesvirus**

**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. 746.
2. Rogers, DL; McClure, GB; Ruiz, JC; Abee, CR; Vanchiere, JA. 2015. *Endemic Viruses of Squirrel Monkeys (Saimiri spp.)*. Comp Med 65(3):232-240.

**Domain 1; Secondary Species – Squirrel monkey (Saimiri spp.)**

Question 26: This clinical sign in a NZB x NZW F1 hybrid mouse (NZBWF1/J) is a potential sequela of its genetic manipulation to model what human disease?

1. Multiple sclerosis
2. Rheumatoid arthritis
3. Hodgkin’s lymphoma
4. Muscular dystrophy
5. Systemic lupus erythematosus

**Answer: e. Systemic lupus erythematosus**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quinby FW, eds. 2002. Laboratory Animal Medicine, 2nd edition. Academic Press:San Diego, CA. Chapter 3 – Biology and Diseases of Mice, pp. 109; Chapter 24 – Animal Models in Biomedical Research, p. 672-673.
2. Perry D, Sang A, Yin Y, Zheng YY, Morel L. 2011. Murine models of systemic lupus erythematosus. *J Biomed Biotechnol* 2011:271694.

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

Question 27: What agent is appropriate for a surgical skin preparation in this species?

a. Sterile saline

b. 80% benzalkonium choride

c. Betadine surgical scrub

d. 70% Isopropyl alcohol

**Answer: a. Sterile saline**

**References:**

1) Fox JG, Anderson LC, Otto G, Pritchett-Corning K, Whary M, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 18 – Biology and Diseases of Amphibians, p. 947.

2) Tuttle, Allison D; Law, Mac J; Harms, Craig A; Lewbart, Gregory A; Harvey, Stephen B. 2009. Effects of Helicobacter Infection on Research: The Case for Eradication of Helicobacter from Rodent Research Colonies. *JAALAS*. 59: 10-17.

**Domain 3; Secondary Species – Xenopus laevis**

Question 28: Which of the following helps prevent complications in the spinal procedure in rats shown below?

1. Widening the exposure of the lumbar spine
2. Withholding post-operative fluid therapy
3. Cooling the body temperature to 18 degrees C during surgery
4. Avoiding extracorporeal reflection of the small intestine during the exposure

**Answer: d.** Avoiding extracorporeal reflection of the small intestine during the surgical exposure

**Resources:**

1. Damle SR, Krzyzanowska A, Frawley RJ, and Cunningham ME.2013. Surgical Anatomy, Transperitoneal Approach, and Early Postoperative Complications of a Ventral Lumbar Spine Surgical Model in Lewis Rats. Comp Med 63(5) p. 409–415.
2. Rousseau MA, Bass EC, Lotz JC. 2004. Ventral Approach to the Lumbar Spine of the Sprague–Dawley Rat. Lab Anim (NY). 33: p. 43–45.

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

Question 29: Which of the following pathologic findings is commonly seen in mice that have recovered from the disease shown in the above picture?

1. Bone marrow necrosis
2. Lymphocytic choriomeningitis
3. Chronic hyperplastic typhlocolitis
4. Splenic fibrosis

**Answer: d. Splenic fibrosis**

**References:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd edition. Blackwell Publishing: Ames, IA. Chapter 1- Mouse, page 27.
2. Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research: Diseases, 2nd edition. Academic Press: San Diego, CA. Chapter 3- Mousepox, page 79.

**Domain 1, primary species (mouse)**

Question 30: The organization pictured below was the precursor to what current organization?

* 1. AALAS
	2. ACLAM
	3. AAVP
	4. OLAW
	5. USDA

**Answer: a. AALAS**

**References:**

1. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 1 – The Organizations of Laboratory Animal Science. p. 14.
2. <https://www.aalas.org/about-aalas/history#.VosWmvkrIuU>

**Domain 6**

Question 31: Why would the following device be placed in an animal in the manner shown below?

1. To facilitate frequent collection of cecal contents.
2. To allow visualization of the gastric mucosa
3. To minimize the forced handling of macaques otherwise needed for oral dosing
4. To prevent gastric bloat

**Answer: c. To minimizes the forced handling of macaques otherwise needed for oral dosing**

**Resources:**

1. Fante et al. 2012. Subcutaneous implanted port in the macaque. Lab Anim. 46: p. 114–121.
2. Gades NM and Mandrell TD. 2001. Nonendoscopic Placement and Use of Percutaneous Gastrostomy Tubes in Pigs (*Sus scrofa domestica*). Contemporary Topics 40(2) pp. 37-39.

**Domain 3; Primary Species – Macaque (*Macaca spp.)* and Pig (*Sus scrofa*)**

Question 32: What procedure is being performed in this photo?

1. Tattooing
2. Microchip identification placement
3. Placement of a tail vein catheter
4. Endotracheal intubation

**Answer: d. Endotracheal intubation of the mouse**

**References:**

1. Rivera, B., Miller, S., Brown, E., Price, R. A Novel Method for Endotracheal Intubation of Mice and Rats Used in Imaging Studies. 2005. Contemporary Topics in Laboratory Animal Science / American Association for Laboratory Animal Science. 44(2), pp. 52-55.
2. Fish RE, Brown MJ, Danneman PJ, Karas AZ, eds. 2008. Anesthesia and Analgesia in Laboratory Animals, 2nded. Academic Press, San Diego, CA. Chapter 5 – Anesthesia Delivery Systems, p. 161.

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

Question 33: A group of rhesus involved in an organ transplantation study has severe aplastic anemia. The following sample was obtained from one of the affected individuals. Please select the most likely etiological agent.

a. Adenovirus

b. Filovirus

c. Arenavirus

d. Flavavirus

e. Parvovirus

**Answer: e. parvovirus.**

**References:**

1) Christian Abee, Keith Mansfield, Suzette Tardiff, and Timothy Morris. 2012. Nonhuman Primates in Biomedical Research, two-volume set, 2nd edition. Elsevier. pg. 36

2)Simon MA. [Simian parvoviruses: biology and implications for research.](http://www.ncbi.nlm.nih.gov/pubmed/19793456) *Comp Med*. 2008 Feb;58(1):47-50.

3)[Bailey C](http://www.ncbi.nlm.nih.gov/pubmed/?term=Bailey%20C%5BAuthor%5D&cauthor=true&cauthor_uid=20472806)1, [Mansfield K](http://www.ncbi.nlm.nih.gov/pubmed/?term=Mansfield%20K%5BAuthor%5D&cauthor=true&cauthor_uid=20472806). Emerging and reemerging infectious diseases of nonhuman primates in the laboratory setting. [*Vet Pathol*.](http://www.ncbi.nlm.nih.gov/pubmed/?term=bailey+mansfiled++nonhuman+primates) 2010 May;47(3):462-81.

**Domain 1. Primary species, Rhesus macaque (*Macaca mulatta*).**

Question 34: What does the equipment depicted measure?

a. Depression

b. Memory

c. Avoidance

d. Mechanical allodynia

e. Rotational behavior

**Answer: e. Rotational behavior**

**References:**

1) <http://www.harvardapparatus.com/hapdfs/HAI_DOCCAT_3/BH1_18.pdf>

2) <http://www.panlab.com/panlabWeb/Hardware/ROTAMETER/ROTAMETER.pdf>

**Domain 3**

Question 35: What is the benefit of this housing set up for *Danio rario*?

1. Decreased cortisol production for singly housed animals
2. Increased breeding
3. Increased growth rate
4. Increased shoaling behavior
5. Decreased aggression

**Answer b. Increased breeding**

**References:**

1. Fox, J., et al. (2015). Laboratory Animal Medicine. San Diego, CA, Elsevier: 1023.
2. Wilkes, L., et al. (2012). "Does structural enrichment for toxicology studies improve zebrafish welfare?" *Applied Animal Behaviour Science* 139(1-2): 143-150.
3. Collymore, C., et al. (2015). "The Behavioral Effects of Single Housing and Environmental Enrichment on Adult Zebrafish (Danio rerio)." *J Am Assoc Lab Anim Sci* 54(3): 280-285.

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

Question 36: What hazard does this symbol indicate is present?

1. Ionizing radiation
2. Explosive
3. Laser
4. High voltage
5. Oxidizing

**Answer c. Laser**

**References:**

1. Institute of Laboratory Animal Resources, National Research Council. 1997. Occupational Health and Safety in the Care and Use of Research Animals. National Academy Press:Washington, D.C. Chapter 3 – Physical, Chemical, and Protocol-Related Hazards, pp.37-8

**Domain 5**

Question 37: What initiative is represented by this logo supported by animal research? Note the name has been removed from the logo.

1. Americans for Medical Progress
2. Doctors Without Borders
3. Institute for Laboratory Animal Research
4. One Health
5. Association for Assessment and Accreditation of Laboratory Animal Care

**Answer: d. One Health**

**Reference:**

1. One Health Initiative website: <http://onehealthinitiative.com/>

**Domain 6**

Question 38: What is the name of the device shown in the photo?

a. Elevated plus maze

b. Grip strength bar

c. Balance beam

d. Rotarod

**Answer: d. Rotarod**

**References:**

1) Fox JG, Anderson LC, Otto G, Pritchett-Corning K, Whary M, eds. 2002. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, p. 69.

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

Question 39: The spores of which pathogen are seen in these histological sections of ovarian, intestinal, and kidney from zebrafish?

1. *Pseudocapillaria tomentosa*
2. *Piscinoodinium pillulare*
3. *Ichthyophthirius multiliis*
4. *Edwardsiella ictaluri*
5. *Pseudoloma neurophilia*

**Answer: e. *Pseudoloma neurophilia***

**Reference:**

1. Murray KN, Dreska M, Nasiadka A, Rinne M, Matthews JL, Carmichael C, Bauer J, Varga ZM, Westerfield M. 2011. Transmission, Diagnosis and Recommendations for control of Pseudeoloma neurophilia Infections in Laboratory Zebrafish (Danio rerio) Facilities. Comparative Medicine 61(4): 322-329.
2. Sanders JL, Watral V, and Kent ML. 2012. Microsporidiosis in Zebrafish Research Facilities. *ILAR* 53(2): pp. 106-113.

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

Question 40: For data with this frequency distribution, what percentage of the area under the curve is located within one standard deviation of the mean?

a. 33%

b. 50%

c. 68%

d. 95%

e. It varies with the magnitude of the standard deviation

**Answer: c. 68%**

**References:**

1) Hennekers CH, Buring JE. 1987. Epidemiology in Medicine, Little Brown and Co: Boston, MA. Chapter 9 – Presentation and Summarization of Data, p. 238.

2) https://www.mathsisfun.com/data/standard-normal-distribution.html

**Domain 3**

Question 41: What is the condition shown here, which may be seen during ocular development in Wistar Hannover (WH) rats?

a. Diffuse retinal detachment

b. Spontaneous intraocular hemorrhage and retina pigment deposition

c. Optic nerve degeneration

d. Corneal opacity and lenticular cataractous change

e. Asteroid hyalosis

**Answer: b. Spontaneous intraocular hemorrhage and retina pigment deposition**

**References:**

1. Inagaki K, Koga H, Inoue K, Suzuki K, Suzuki H. Spontaneous intraocular hemorrhage in rats during postnatal ocular development. Comp Med. 2014 Feb;64(1):34-43.
2. Hojman AS, Otzen LW, Schrøder-Hansen LM, Wegener KM. Pigment Deposition in the Rat Retina. Toxicol Pathol. 2015 Aug;43(6):890-2.

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

Question 42: The diagram below depicts a method to evaluate what in respect to mice?

a. vibration

b. G-forces

c. despair (forced swimming test)

d. memory (Morris maze)

e. coordination (rotorod)

**Answer: a. vibration**

**References:**

1. Li, Y et al. 2015. Characteristics of vibration that alter cardiovascular parameters in mice. *J Am Assoc Lab Anim Sci* 54(4): 372-377.

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

Question 43: What required information is NOT STATED on this signage on the door of a mouse housing room in which an ABSL2 agent is in use?

a. The name of the animal species in use

b. After hours (home or cell) contact information for the investigator

c. Historical information of infectious agents used previously in this colony

d. Soiled cage and waste disposal procedures

e. Procedures necessary when exiting the room

**Answer: e. Procedures necessary when exiting the room**

**Reference:** Biosafety in Microbiological and Biomedical Laboratories, 5th ed. Centers for Disease Control and Prevention, National Institutes of Health. U.S. Government Printing Office, Washington, DC, 2009. Section V – Vertebrate Animal Biosafety Level Criteria for Vivarium Research Facilities. p. 68.

**Domain 5**

Question 44: According to the 8th Edition of the Guide for the Care and Use of Laboratory Animals, what is the recommended minimum space for this animal?

1. 23 in2
2. 40 in2
3. 51 in2
4. 60 in2
5. >70 in2

**Answer: c. 51 in2**

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

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

Question 45: Which of the following statements best describes this drug?

a. Have currently accepted medical use and a high potential for abuse which may lead to severe psychological or physical dependence.

b. Have no currently accepted medical use in the United States, a lack of accepted safety for use under medical supervision, and a high potential for abuse

c. Have currently accepted medical use, have a potential for abuse and abuse may lead to moderate or low physical dependence or high psychological dependence.

d. Have currently accepted medical use, have a low potential for abuse and consist primarily of preparations containing limited quantities of certain narcotics

**Answer: a. Have currently accepted medical use and a high potential for abuse which may lead to severe psychological or physical dependence.**

**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 25 – Regulatory Issues, p. 573-575 (Table 25-1)
2. Controlled Substances Act, USC Title 21, Chapter 13, Subchapter I – Control and Enforcement, Part B – Authority to Control; Standards and Schedules, §812 Schedules of controlled substances (b) (1) Schedule I. (http://www.deadiversion.usdoj.gov/21cfr/21usc/index.html)
3. http://www.deadiversion.usdoj.gov/schedules/index.html

**Domain 5**

Question 46: Which of the following images of Syphacia spp. shows a nonviable egg?

1. A
2. B
3. C
4. D

**Answer: a. Nonviable egg**

**Reference:**

1) Czarra JA, et. Al. “Exposure to chlorine dioxide gas for 4 hours renders *Syphacia* ova nonviable”. 2014. *JAALAS*. 53(4):364-367.

2) Dix J, et. Al. “Assessment of methods of destruction of *Syphacia muris* eggs”. 2004. *Lab Animal* 38:11-16.

Domain 4-Animal Care

Question 47: The "rhino" mutation is allelic with "hairless" and is a more sever manifestation of the "hairless mutation" as seen in this image. Which of the following is **NOT** a feature of the skin of these mutants?

a. Nail aplasia

b. Comedone formation

c. Ruptured follicles with associated dermal inflammation

d. Generalized acanthosis and orthokeratosis

e. Skin Ulceration

**Answer: a. Nail aplasia**

**These animals have loss of hair after growth of the first pelage, rudimentary mammary gland development, abnormal growth of the nails (overgrowth) and a high incidence of thymic lymphomas.**

**References:**

1) Liu Y, Sundberg JP, Das S, Carpenter D, Cain KT, Michaud EJ, Voy BH: Molecular Basis for Hair Loss in Mice Carrying a Novel Nonsense Mutation (*Hrrh-R* ) in the Hairless Gene (*Hr*). Veterinary PathologyJanuary 2010 vol. *47 no. 1 167-176*

 2) <http://jaxmice.jax.org/jaxnotes/archive/436c.html>

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

Question 48: How will the presence of the tissue indicated by the red arrow affect reproductive performance in female mice?

1. Decrease copulatory plugs and pregnancy rates
2. Decrease copulatory plugs but no effects on pregnancy rates
3. Increase rates of dystocia and fetal death
4. No effect on reproductive performance
5. Increase rates of pseudo hermaphrodites

**Answer: a. Decrease copulatory plugs and pregnancy rates**

**References:**

1. Chang *et al*. 2013. Effects of Vaginal Septa on the Reproductive Performance of BALB/cByJNarl Mice. *JAALAS* 52(5): pp. 520-523.
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: Boston, MA. Chapter 3 – Reproductive Biology of the Laboratory Mouse, p. 110.

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

Question 49: This disinfectant is considered to be a:

1. Denaturant
2. Reactant
3. Oxidant
4. Reductant

**Answer: c. Oxidant**

**Reference:**

1) Fox JG, Anderson LC, Otto G, Pritchett-Corning K, Whary M, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 11 – Microbiological Quality Control for Laboratory Rodents and Lagomorphs, p. 474

**Domain 4**

Question 50: A new researcher in your institution wishes to use this animal for translational research pertaining to paramyxoviral respiratory diseases. Which is correct regarding the care and handling of this species?

1. Continual water availability may lead to a diabetes insipidus like syndrome
2. Intraspecific aggression is rare even if males are introduced to social groups as adults
3. Feeding a standard rodent diet is likely to lead to hypovitaminosis C
4. Tail restraint is not recommended due to the risk of injury to the animal or the handler
5. Typical gestation length is 21-22 days

**Answer: d. Tail restraint is not recommended due to the risk of injury to the animal or the handler**

**References:**

1. Fox JG, Anderson LC, Otto GM, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 7- Biology and Diseases of Other Rodents, p 312.
2. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster and Other Rodents. Academic Press: San Diego, CA. Chapter 49- Cotton Rat, p 1105-1107.

**Domain 4; Tertiary species- Other rodent (Cotton Rat, *Sigmodon hispidus*)**

Question 51: The organisms pictured below were found on the dorsal fin of a goldfish in quarantine. Which of the following would be an appropriate course of action?

1. Isolate the fish and the infection will be self-limiting
2. Treat all water in the facility with chlorine
3. Physically examine each fish and remove organisms
4. Perform skin scrape and euthanize infected fish

**Answer: c. Physically examine each fish and remove organisms**

**References:**

1. Baker DG, ed. 2007. Flynn’s Parasites of Laboratory Animals, 2nd edition. Blackwell Publishing: Ames, IA. Chapter 7 – Parasites of Fishes, pp. 91-92
2. Wafer LN, Whitney JC, Jensen VB. 2015. Fish Lice (*Argulus japonicas*) in Goldfish (*Carassius auratus*). *Comp Med.* 65(2): 93-95

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

Question 52: Which method of sanitation is the most important means of preventing the spread of this organism throughout a fish facility?

1. Using an acid wash in a tunnel washer
2. Using an alkaline wash in a tunnel washer
3. Soaking tanks in 3.175 g/L sodium thiosulfate
4. Soaking tanks in 0.7% bleach
5. Maintaining UV sterilization in filtration system

**Answer: e. Maintaining UV sterilization in filtration system**

**Reference:**

1) Murray KN, Dreska M, Nasiadka A, Rinne M, Matthews JL, Carmichael C, Bauer J, Varga ZM, Westerfield M. 2011. Transmission, diagnosis, and recommendations for control of Pseudoloma neurophilia infections in laboratory zebrafish (Danio rerio) facilities. *Comp Med*. 61:322-329.

2) Sanders JL, Watral V, Kent ML. 2012. Microsporidiosis in zebrafish research facilities. *ILAR J*. 53:106-113.

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

Question 53: The condition shown in this H & E section of a mouse stomach can be seen in all of the following sites, **EXCEPT**, which one?

a. Intestinal epithelium

b. Gallbladder epithelium

c. Trachea epithelium

d. Bile and pancreatic duct epithelium

e. Nasal respiratory epithelium

**Answer: a. Intestinal epithelium (epithelial hyalinosis/adenomatous hyperplasia)**

**Resources:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 1 – Mouse, p. 95.
2. James G. Fox et al. The Mouse in Biomedical Research, 2nd ed. Chapter 25 - Spontaneous Diseases in commonly used mouse strains, p. 680.
3. Picture source: <http://www.askjpc.org/wsco/wsc_showconference.php?id=238>

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

Question 54: Name the genus and species and a common use in research:

a. *Columba livia domestica*; memory

b. *Coturnix japonica*; birth defects

c. *Columba livia domestica*; birth defects

d. *Coturnix japonica*; memory

**Answer: b. *Coturnix japonica*; birth defects**

**References:**

1. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd ed. Academic Press: San Diego, CA. Chapter 22 – Japanese Quail as a Laboratory Model, p. 1088
2. Ball GF and Balthazart J. 2010. Japanese quail as a model system for studying the neuroendocrine control of reproductive and social behaviors. *ILAR* 51(4):310-325.

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

Question 55: One of the pigs in your facility began breathing hard and developed red and blotchy skin. It died relatively quickly after. The provided photo is from the necropsy of this pig. Which of the following statements best describes this syndrome?

1. Only identified in miniature pig breeds
2. Triggered by dantrolene administration
3. Associated with a mutation in the calcium-release channel protein (ryanodine receptor)
4. Caused by excess dietary selenium

**Answer: c. Associated with a mutation in the calcium-release channel protein (ryanodine receptor)**

**References:**

1. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 16 – Biology and Diseases of Swine, pp. 752-753
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 – Amesthesia and Analgesia in Swine. p. 425

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

Question 56: Which federal agency has primary jurisdiction over the importation of this species?

a. Treasury

b. Defense

c. Education

d. Health and Human Services

e. Interior

**Answer: e. Interior**

**References:**

1) Abee CR, Mansfield K, Tardif S, Morris T, eds. 2012. Nonhuman Primates in Biomedical Research, 2nd edition, Volume 1 - Biology and Management, Academic Press: San Diego, CA. Chapter 2 – Laws, Regulations and Policies Relating to the Care and Use of Nonhuman Primates, pp. 51-52

2) Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 2 – Laws, Regulations, and Policies Affecting the Use of Laboratory Animals, pp. 36-39.

**Domain 5**

Question 57: During routine husbandry procedures an animal caretaker noted these abnormal findings in a swine room. What is the most likely etiology?

a. Gastric ulceration

b. *Ascaris suum*

c. *Trichuris suis*

d. *Strongyloides ransomi*

e. *Oesophetostomum* spp.

**Answer: b. *Ascaris suum***

**References:**

1) Fox JG, Anderson LC, Otto G, Pritchett-Corning K, Whary M, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 16 – Biology and Diseases of Swine, p. 728-9, 740.

2) Straw BE, JJ Zimmerman ,S D’Allaire, DJ Taylor. 2006. Diseases of Swine 9th edition. Ames, Iowa: Blackwell Pub. Chapter 55 – Internal Parasites, p 904-905.

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

Question 58: Which of the following methods of euthanasia is considered “acceptable with conditions” in the species pictured?

* 1. Injectable ethanol
	2. Injectable ketamine/xylazine combination
	3. Inhaled nitrogen
	4. Injectable opioids

**Answer:** a. Injectable ethanol

**References:**

1. Allen-Worthington KH, Brice AK, Marx JO, and Hankenson FK. 2015. Intraperitoneal injection of ethanol for the euthanasia of laboratory mice (*Mus musculus*) and rats (*Rattus norvegicus*). JAALAS 54 (6):769-778.
2. American Veterinary Medical Association. 2013. AVMA guidelines for the euthanasia of animals, 8th ed. Schaumburg (IL): American Veterinary Medical Association.

**Domain 2; Primary species- Mus musculus.**

Question 59: The experimental technique depicted below is useful for which of the following?

1. measurement of precise food and water intake
2. fiberoptic tracing of neurons
3. intermittent whole blood sampling from cerebral (dural) venous sinuses
4. continuous collection of extracellular fluid samples
5. locomotor inhibition evaluation

**Answer: d. continuous collection of extracellular fluid samples**

**References:**

1. Jacus MO et al. 2015. Observational evaluations of mice during cerebral microdialysis for pediatric brain tumor research. *J Am Assoc Lab Anim Sci* 54(3): 304-310.
2. McCully CM et al. 2013. Model for concomitant microdialysis sampling of the pons and the cerebral cortex in rhesus macaques (*Macaca mulatta*). *Comp Med* 63(4): 355-360.

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

Question 60: Which of the following is true regarding the rat pictured below?

1. Filament test for whisker response is being performed
2. Von Frey filament tests mechanical stimuli
3. A hotplate test would be less reliable as it tests for thermal stimuli
4. Tail clip test would be more reliable as it tests for thermal stimuli
5. The investigator is assessing the rat grimace scale

**Answer: b.** **Von Frey filament tests mechanical stimuli**

**References:**

* 1. Chum, HH, et al. 2014. Antinociceptive effects of sustained-release buprenorphine in a model of incisional pain in rats (*Rattus norvegicus*). *JAALAS* 53(2): 193.
	2. Mert, T, and Y Gunes. 2012. Antinociceptive activities of lidocaine and the Nav2.8 blocker A803467 in diabetic rats. *JAALAS* 51(5): 579.
	3. Kolstad, AM, et al. 2012. Effect of pain management on immunization efficacy in mice. *JAALAS* 51(4): 448.
	4. Fish RE, Brown MJ, Danneman PJ, Karas AZ eds. 2008. Anesthesia and analgesia in laboratory animals. 2nd edition. Academic Press: San Diego, CA. Chapter 23 – Pain Testing in the Laboratory Mouse, p 550 and 552.

**Domain 3; Primary species -- *Rattus norvegicus***

Question 61: The organism shown below in liver tissue of a mouse is unlikely to be found in the heart of which of the following species?

a. Mouse

b. Rat

c. Hamster

d. Gerbil

e. Guinea pig

**Answer: e. Guinea pig**

**Resources:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 1 – Mouse, p. 58. Chapter 2 – Rat, p. 139. Chapter 3 – Hamster, p. 187. Chapter 4 – Gerbil, p. 208. Chapter 5 – Guinea pig, p. 225.
2. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents. Academic Press: San Diego, CA. Section III – Guinea Pigs, Chapter 23 – Infectious Diseases, p.655.

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

Question 62: This image depicts:

1. HEPA filter for a biocontainment facility
2. Quencher exhaust for an MRI
3. Emergency generator for an animal facility
4. Incinerator for a biocontainment facility

**Answer: a. HEPA filter for a biocontainment facility**

**References:**

1. Hassler JR, Lehner ND, eds. 2009. Planning and Designing Research Animal Facilities. Elsevier: London. Chapter 34 – Heating, Ventilation and Air conditioning (HVAC): Special Consideration, p. 466-467.
2. Fox JG, Anderson LC, Otto G, Prichett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd edition. Elsevier: London. Chapter 36 - Facility Planning and Design, p. 1554.

**Domain 4**

Question 63: The most likely cause for the behavior displayed by the zebrafish is:

1. Temperature higher than their thermal tolerance (28◦C)
2. Low dissolved oxygen levels within the water
3. Salinity higher than their tolerance level of 2 g/L
4. Insufficient feeding amount of 5-10% of body weight daily

**Answer: b. Low dissolved oxygen levels within the water**

**References:**

1. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd ed. Academic Press: Oxford, UK.. Chapter 20 – Biology and Management of the Zebrafish, p. 1024.
2. Harper C & Lawrence C. 2010. The Laboratory Zebrafish, 1st ed, CRC Press: Boca Raton, FL. Chapter 1- Biology. Chapter 3 – Life Support, p. 115.

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

Question 64: Which anesthetic combination causes the fewest deleterious cardiovascular effects for the species shown?

1. Ketamine and xylazine
2. Ketamine and medetomidine
3. Telazol and xylazine
4. Telazol and dexmedetomidine
5. Ketamine and romifidine

**Answer: b. Ketamine and medetomidine**

**References:**

1. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd ed. Academic Press: Oxford, UK. Chapter 16 – Biology and Diseases of Swine, pp. 1163-1165.
2. Fish R, Danneman P, Brown M, & Karas A. eds. 2008. Anesthesia and Analgesia in Laboratory Animals. 2nd ed. American College of Laboratory Animal Medicine, Academic Press, pp. 420.

**Domain 3; Primary species – Pig (*Sus scrofa domestica*)**

Question 65: Which of the following must be considered when collecting a urine sample from rats using the technique depicted?

1. Intraluminal ureteral bleeding may occur resulting in occlusion of the catheter with blood clots.
2. Male rats ejaculate after urethral catheterization resulting in plugging of the catheter with coagulum.
3. The female rat has distinct vaginal and urethral openings.
4. Due to curves in the male rat urethra, a curved-tip catheter is recommended.
5. The urethra of the female rat is essentially impossible to catheterize.

**Answer: c. The female rat has distinct vaginal and urethral openings.**

**References:**

1)Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, and Fox JG, eds. 2015**.** Laboratory Animal Medicine, 3rd Edition. Academic Press: San Diego, CA. Chapter 25-Techniques of Experimentation, p.1222

 2) Suckow MA, Weisbroth SH, and Franklin CL, eds. 2006. The Laboratory Rat, 2nd Edition. Academic Press: San Diego, CA. Chapter 4 – Morphophysiology, p. 115

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

Question 66: This device is used in rabbits. What is this device used for?

1. Intramuscular injection
2. Environmental enrichment
3. Physical euthanasia
4. Otoscopic examination

**Answer: c. Physical euthanasia**

**Reference: 1)** [**http://www.bunnyrancher.com/uploads/8/0/4/3/8043582/s575940860307007594\_p42\_i2\_w1240.jpeg**](http://www.bunnyrancher.com/uploads/8/0/4/3/8043582/s575940860307007594_p42_i2_w1240.jpeg)

**2)** [**www.avma.org/resources/euthanasia.pdf**](http://www.avma.org/resources/euthanasia.pdf)

**Domain 2 – Primary Species (Rabbit)**

Question 67: The primary purpose of this system is to:

a. Acidify drinking water

b. Filter drinking water via biofiltration

c. Sterilize drinking water

d. Filter drinking water via reverse osmosis

e. Hyperchlorinate drinking water

**Answer: d. Filter drinking water via reverse osmosis**

**References:**

1) Fox JG, Anderson LC, Otto G, Pritchett-Corning K, Whary M, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 11 – Microbiological Quality Control for Laboratory Rodents and Lagomorphs, p. 474.

2) Hessler JR, Lehner NDM, eds. 2009. Planning and Designing Research Animal Facilities. Academic Press: San Diego, CA. Chapter 32 – Plumbing: Special Considerations, p. 428-433

**Domain 4**

Question 68: A Yorkshire pig showed clinical signs of anorexia, coughing, depression, swollen joints, and neurological signs prior to death. This photo is from the necropsy. What is the etiologic agent for this condition?

1. *Erysiplelothrix rhusiopathiae*
2. Porcine circovirus-2
3. *Haemophilus parasuis*
4. *Pasteurella multocida*
5. *Streptococcus suis*

**Answer: c. *Haemophilus parasuis* (necropsy showed fibrinous pleuritis, pericarditis and peritonitis.)**

**References:**

* 1. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT eds. 2015. Laboratory Animal Medicine, 3nd edition. Academic Press: San Diego, CA. Chapter 12 – Biology and diseases of Swine, p. 715 – 716.
	2. Aragon V, Segales J, Oliveira S. 2012. Glasser’s disease. In: Zimmerman JJ, Karriker, LA, Ramirez A, Schwartz KJ, Stevenson, GW (Eds) Diseases of swine, Tenth ed. Wiley Blackwell, Chichester, West Sussex.

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

1. Question 69: This example of an indoor marmoset cage provides an increase in what beneficial parameter for the marmosets?
2. sanitation
3. UV light
4. microorganisms
5. environmental enrichment

**Answer: d. environmental enrichment**

**References:**

1. Fox JG, Anderson LC, Otto GM, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 17- Nonhuman Primates, p. 781.
2. Bakker *et al.* 2015. Advantages and risks of husbandry and housing changes to improve animal wellbeing in a breeding colony of common marmosets. *JAALAS* 54(3): 273-279.

**Domain 4; Secondary Species – Marmoset (*Callithrix jacchus*)**

Question 70: What is the name of the following piece of equipment and what is it used for?

a. Hygrometer; Humidity

b. Thermometer; Temperature

c. VOC Meter; Volatile Organic Compounds

d. Balometer; Air Volume

e. Anemometer; Air Speed

**Answer d. Balometer; Air Volume**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW. eds. 2002. Laboratory Animal Medicine 2nd Ed. Academic Press: San Diego, CA.

**Domain 5;**

Question 71: The ectoparasite depicted in this image can cause intense pruritus and may lead to excoriation, self- mutilation, and secondary bacterial infections in rabbits. What is the etiologic agent?

1. *Sarcoptes scabies*
2. *Psoroptes cuniculi*
3. *Haemodipsus ventricosus*
4. *Spilopsyllus cuniculi*
5. *Linguatula serrata*

**Answer: b. *Psoroptes cuniculi***

**References:**

1. Suckow MA, Stevens KA, Wilson RP. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents, 1st edition. Elsevier: London. Chapter 15 - Parasitic diseases, p. 428.
2. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd edition. Elsevier: London. Chapter 10 - Biology and Diseases of Rabbits, p. 440.

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

Question 72: What is the minimum cage height this animal should be provided?

1. 20 inches
2. 30 inches
3. 40 inches
4. 50 inches
5. 60 inches

**Answer: b. 30 inches; Owl monkeys weigh approximately 1kg and the shortest cage height required by the Guide is 30 inches**

**References:**

1. National Research Council. 2011. Guide for the Care and Use of Laboratory Animals, 8th edition. The National Academies Press: Washington, DC. Chapter 3 – Environment, Housing, and Management, p. 61.
2. Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 2 – Regulations, Subpart D – Specifications for the Humane Handling, Care, Treatment, and Transportation of Nonhuman Primates, §3.80 Primary enclosures, (b) Minimum space requirements. (August 2002 Edition, p. 94)

**Domain 4 & 5; Tertiary Species – Other nonhuman primates**

Question 73: What is the purpose of this equipment?

* 1. Vacuuming up hair after preparing for surgery
	2. Active scavenging of halogenated anesthetics
	3. Ultrasound to confirm swine pregnancy
	4. Bedding disposal

**Answer: b) Active scavenging of halogenated anesthetics**

**Reference:** [**http://www.colmedsupply.com/waste\_gas.html**](http://www.colmedsupply.com/waste_gas.html)

**Domain 2**

Question 74: An older rat in your facility is showing signs of snuffling and chattering. Upon necropsy and histopathology you find the following. What is your most likely diagnosis?

* 1. CAR bacillus
	2. *Mycoplasma pulmonis*
	3. Sendai virus
	4. *Streptococcus pneumoniae*
	5. *Pneumocystis carinii*

**Answer: b. *Mycoplasma pulmonis***

**References:**

1. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd edition. Blackwell Publishing: Ames, Iowa. Chapter 2 – Rat, p. 143-146.
2. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd ed. Academic Press: San Diego, CA. Chapter 4 – Biology and Diseases of Rats, p. 175.

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

Question 75: What is the landmark denoted by the asterisk (\*) that may be used as a coordinate during stereotaxic electrode implantation?

1. Coronal
2. Lambda
3. Bregma
4. Sagittal
5. Horizontal

**Answer: b. Lambda**

**References:**

1. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd ed. Academic Press: Oxford, UK Chapter 25 – Techniques of Experimentation, p. 1238.
2. Abbe C, Mansfield K, Tardiff S, Morris T. eds. 2012. Nonhuman Primates in Biomedical Research, Volume II, 2nd edition, Elsevier; Chapter 14 – Surgery in Nonhuman Primates, p.352.

**Domain 3; Primary Species – Rat (Rattus novegicus) and Macaques (Macaca spp.)**

Question 76: A male animal, like the one pictured, is found to have a cranial abdominal mass during physical exam. What is the most likely diagnosis?

* 1. Gastric adenocarcinoma
	2. Hemangiosarcoma
	3. Bloat
	4. Lymphoma
	5. Lipoma

**Answer: a. Gastric Adenocarcinoma of the cotton rat**

**References**

1. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd ed. Academic Press: Oxford, UK Chapter 7: biology and diseases of other rodents. p. 313.
2. Suckow, Weisbroth, & Franklin eds. 2006. The Laboratory Rat, 2nd ed, American College of Laboratory Animal Medicine. Elsevier, 2006. Chapter 49: Cotton rat. p. 1109.

**Domain 1; Tertiary – Cotton rat (*Sigmodon hispidus*)**

Question 77: What is the device used for?

1. Skin scrape for the detection of parasites
2. Inoculation of bacteria subcutaneously
3. Lancing a blood vessel for blood collection
4. Cutting off a skin tag for biopsy

**Answer: c. Lancing a blood vessel for blood collection**

**References:**

1. Ayers *et al*. 2012. Alternatives to Retroorbital Blood Collection in Hispid Cotton Rats (*Sigmodon hispidus*). *JAALAS* 51(2): 239-245.
2. Golde *et al*. 2005. A Rapid, Simple, and Humane Method for Submandibular Bleeding of Mice using a Lancet. *Lab Animal* 34: 39-43.

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

Question 78: Which of the following statements is TRUE regarding the use of this unit in animal facilities?

* 1. It provides product protection but no personnel protection
	2. It provides personnel protection but no product protection
	3. It provides both product and personnel protection
	4. It provides neither product nor personnel protection

**Answer: a. It provides product protection but no personnel protection**

**References:**

1) Biosafety in Microbiological and Biomedical Laboratories, 5th ed. Centers for Disease Control and Prevention, National Institutes of Health. U. S. Government Printing Office, Washington, DC. 2009. Appendix A – Primary Containment for Biohazards: Selection, Installation and Use of Biological Safety Cabinets, p 290.

2) Fox JG, Anderson LC, Otto G, Pritchett-Corning K, Whary M, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 36 – Design and Management of Research Facilities, p. 1575-6.

**Domain 4**

Question 79: When using the device pictured below, which of the following considerations is correct?

1. Habituation is never required as there is minimal impact on the animal’s normal behavior
2. Animals may be individually housed with IACUC approval
3. When used for more than 12 consecutive hours, the device must be removed and the animal allowed at least one continuous hour of unrestrained activity daily
4. Animals will always have increased urinary cortisol when the device is being used
5. Behavioral assessments are not a reliable method of assessing that an animal has adapted to the device

**Answer: b. Animals may be individually housed with IACUC approval**

**References:**

1. Institute for Laboratory Animal Research. Guidelines for the Care and Use of Mammals in Neuroscience and Behavioural Research, Committee on Guidelines for the Use of Animals in Neuroscience and Behavioural Research, National Research Council, Division on Earth and Life Studies,. 2003. p.49.
2. Institute for Laboratory Animal Research**.** 2011. Guide for the Care and Use of Laboratory Animals, 8th ed. Washington (DC): National Academies Press. p.29.
3. <http://www.sai-infusion.com/pages/tethered-primate-system>

**Domain 5; Primary Species – Macaques (Macaca spp)**

Question 80: What imaging modality does the following image represent?

* 1. Representative 3D guided A-Mode echocardiograph
	2. Representative 2D guided A-Mode echocardiograph
	3. Representative 2D guided doppler echocardiograph
	4. Representative 3D guided M-Mode echocardiograph
	5. Representative 2D guided M-Mode echocardiograph

**Answer: e. Representative 2D guided M-Mode echocardiograph**

**References:**

1. Huss MK, Ikeno F, Buckmaster CL, Albertelli MA. 2015. Echocardiographic and Electrocardiographic Characteristics of Male and Female Squirrel Monkeys (*Saimiri spp.*). *Journal of the American Association of Laboratory Animal Science*;54(1)25-28

**Domain 3;**

Question 81: Which of the following statements is true with regards to the mice pictured?

1. The mouse on the left has a facial expression consistent with fear or distress
2. The mouse on the right is exhibiting behaviors indicating a need for analgesics
3. None of the mice above are showing signs that indicate a need for analgesics
4. The mouse in the center has muzzle alopecia consistent with an external parasite infection

**Answer: b. The mouse on the right is exhibiting behaviors indicating a need for analgesics**

**References:**

1) Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 24 – Preanesthesia, Anesthesia, Analgesia, and Euthanasia p. 1145-1146.

2) Matsumiya *et al*. 2012. Using the Mouse Grimace Scale to Reevaluate the Efficacy of Postoperative Analgesics in Laboratory Mice. *JAALAS* 51(1): 42-49.

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

Question 82: According to the Animal Welfare Act, which of the following is **TRUE** regarding the primary enclosure for a female of the species pictured, weighing 9.5 kg, and her 5-month-old infant weighing 1.5 kg?

1. An exemption from the caging standards does not need approval by the IACUC if it has already been reviewed and approved by the attending veterinarian.
2. After the infant is weaned and the female becomes pregnant again, she will need a group 4 cage if she gains more than 0.5 kg.
3. Since this is a brachiating species, they require a group 6 cage.
4. The female and infant described require a group 3 cage while they are housed together.
5. A low perch in the cage, even if it does not allow the animals to comfortably sit underneath, is added to the floor space of the cage.

**Answer: d. The female and infant described require a group 3 cage while they are housed together.**

**Reference:** 9 CFR, Part 3 – Standards, Subpart D – Specifications for the Humane Handling, Care, Treatment, and Transportation of Nonhuman Primates, §3.80 Primary enclosures. (1-1-05 Edition, pp. 94-95)

**Domain 5; Primary Species – Macaques (Macaca spp)**

Question 83: What is an indication for use of this equipment in the rodent housing facility?

1. Measuring ATP
2. Measuring ultrasound
3. Measuring ammonia
4. Measuring hydration

**Answer: b. Measuring ultrasound**

**References**:

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. Laboratory Animal Medicine, 2nd edition. American College of Laboratory Animal Medicine, Quimby. Academic Press, 2002. Chapter 29 p. 1150.
2. Fox JG, Barthold SW, Davisson MT, Newcomer CE, Quimby FW, Smith AL, eds. 2007. The Mouse in Biomedical Research, 2nd edition. Chapter 3, p.106.

**Domain 4**

Question 84: Your zebra finch colony was recently exposed to 24 hours of continuous light over several days and has increased morbidity and mortality. Histopathology of the ventriculus of one of the animals is shown above. In addition to correcting the light cycle, what is the treatment of choice for these animals?

1. Amoxicillin
2. Amphotericin B
3. Metronidazole
4. Depopulate colony
5. Test and cull

**Answer: b) Amphotericin B.**

**References:**

1. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd ed. Academic Press: Oxford, UK. Chapter 23: Zebra Finches in Biomedical Research. pg. 1127.
2. Snyder JM, Molk DM, Treuting PM. 2013. Increased mortality in a colony of zebra finches exposed to continuous light. *JAALAS*, *52*(3), 301.

**Domain 1; Tertiary species – Zebra Finch (*Taenopygia guttata*)**

Question 85: What is the minimum floor area requirement for this singly housed male weighing 15.5 kg, according to Animal Welfare Regulations?

1. 4.3 ft2
2. 6.0 ft2
3. 8.0 ft2
4. 25.1 ft2

**Answer: c. 8.0 ft2**

**Reference:** Animal Welfare Regulations, CFR Title 9, Chapter 1, Subchapter A – Animal Welfare, Part 3 – Standards, Subpart D – Specifications for the Human Handling, Care, Treatment and Transportation of Nonhuman Primates, §3.80 Primary enclosures (January 1, 2012 p. 84)

**Domain 5; Primary Species – Macaques (Macaca spp)**

Question 86: This device is used to measure which of the levels listed below, which is an important consideration in the cage microenvironment?

1. humidity
2. ammonia
3. temperature
4. carbon dioxide

**Answer: b. ammonia**

**References:**

1) Fox JG, Anderson LC, Otto GM, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 36- Design and Management of Research Facilities, p. 1569.

2) Mexas *et al*. 2015. Nasal histopathology and intracage ammonia levels in female groups and breeding mice housed in static isolation cages. *JAALAS* 54(5): 478-486.

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

Question 87: This is a histologic section from the adrenal gland of a mouse. What is the etiologic agent?

a. MAV

b. MHV

c. MCMV

d. MTV

e. MVM

**Answer: a. MAV**

**References:**

1) Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd edition. Blackwell Publishing: Ames, Iowa. Chapter 1 – Mouse, pp. 17-18

2) Fox JG, Anderson LC, Otto G, Pritchett-Corning K, Whary M, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, p. 81-2

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

Question 88: Moving this animal to a new environment is associated with a **decrease** in which of the following parameters?

* 1. C-reactive protein (CRP)
	2. Pig major acute-phase protein (PMAP)
	3. Haptoglobin
	4. Porcine α-1 acid glycoprotein (PAGP)
	5. Albumin

**Answer: e. Albumin**

**Resources:**

1. Christoffersen BØ, Jensen SJ, Ludvigsen TP, Nilsson SK, Grossi AB, Heegaard PM. Age- and Sex-Associated Effects on Acute-Phase Proteins in Göttingen Minipigs. Comp Med. 2015 Aug;65(4):333-41.
2. Picture source: <http://www.sdsdiets.com/products_and_data_sheets/mini_pig/>

**Domain 4; Primary Species – Pig (*Sus scrofa*)**

Question 89: Occlusion of these ports found on ventilated racks can cause which of the following?

1. dehydrated animals
2. increased nest building behavior
3. rhinitis, otitis, tracheitis, and pneumonia
4. none of the above, the ports are supposed to be occluded for normal operation of the rack

**Answer: c. rhinitis, otitis, tracheitis, and pneumonia from elevated ammonia in the cage (these are ventilation ports)**

**References:**

1. Creamer MA et al. 2014. Implications of natural occlusion of ventilated racks on ammonia and sanitation practices. *J Am Assoc Lab Anim Sci* 53(2): 174-179.

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

Question 90: The pictured animal displays which of the following captive breeding behaviors?

1. Eusocial, one breeding queen with several non-reproductive workers participating in cooperative brood care
2. Harem breeding, one male for every 4-6 females
3. Monogamous, one male, one female pairings
4. Promiscuous, females and males mate multiple times with multiple mates with no cooperative brood care

**Answer: a. Eusocial, one breeding queen with several non-reproductive workers participating in cooperative brood care**

**References:**

1. Suckow MA, Stevens KA, Wilson RP. 2012. The laboratory rabbit, guinea pig, hamster, and other rodents, 1st ed. London ; Waltham, MA: Academic Press/Elsevier. p.1059 and 1069
2. Ke, Z., et al., *Novel husbandry techniques support survival of naked mole rat (Heterocephalus glaber) pups.* J Am Assoc Lab Anim Sci, 2014. 53(1): p. 89-91.

**Domain 4; Tertiary Species- Naked Mole Rat (Heterocephalus glaber)**

Question 91: Use of this method of euthanasia can result in:

* 1. Prolonged time to loss of consciousness
	2. No change in GABA concentrations in the brain
	3. Hemorrhage in the lungs
	4. No change in serum corticosterone

**Answer: c) Hemorrhange in the lungs**

**Reference: “Public Statements: Report of the ACLAM Task Force on Rodent Euthanasia” (**[**https://www.aclam.org/Content/files/files/Public/Active/report\_rodent\_euth.pdf**](https://www.aclam.org/Content/files/files/Public/Active/report_rodent_euth.pdf)**)**

**Domain 2 – Primary Species (Rat and Mouse)**

Question 92: According to the AWA, what is **false** with regards to the correct use of this piece of equipment by a research institution?

1. The tag number shall be correctly listed in the records of purchase, acquisition, disposal, or sale of the dog or cat it identifies and to which it is affixed.
2. Unweaned puppies or kittens do not need tags while they are maintained as a litter with their dam in the same primary enclosure, provided the dam has been individually identified.
3. When an animal dies or is euthanized, this tag shall be retained by a research facility until called for by an APHIS official or for a period of 3 years.
4. No tag number shall be used to identify more than one animal or shall be reused within a 5-year period.
5. This tag is not less than 1-1⁄4 inches in diameter.

**Answer: c. When an animal dies or is euthanized, this tag shall be retained by a research facility until called for by an APHIS official or for a period of 3 years.**

**References:**

1. Title 9, Chapter 1, Subchapter A, Part 2, Subpart C, Part 2.38 (g)(11)
2. ) US Code, Title 7: Chapter 54, Animal Welfare Act

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

Question 93: The disease depicted in the slide can be chemically induced in *Mesocricetus auratus* by subcutaneous injection of which substance?

1. Collagen
2. Ethanolamine
3. Casein
4. Dioctyl sodium sulfosuccinate

**Answer: c. Casein.**

**References:**

1. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd ed. Academic Press: Oxford, UK, p. 228.
2. Suckow, M. A., Stevens, K. A. & Wilson, R. P. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents, 1st ed. Academic Press: San Diego, CA p. 895.

**Domain 3; Secondary Species – Syrian hamster (Mesocricetus auratus)**

Question 94: What color is the tail of this animal?

1. nude
2. white
3. black
4. white with a black tip

**Answer: b. white**

**References:**

1. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd ed. Academic Press: San Diego, CA. Chapter 7 – Biology and Diseases of Other Rodents, p. 314.
2. Hall A et al. 1967. *Mystromys albicaudatus* (the African white-tailed rat) as a laboratory species. *Lab Anim*  17: 180-188.

**Domain 3;** **Tertiary Species – Other rodents (Mystromys albicaudatus)**

Question 95: The pictured was found as an incidental finding at necropsy of a New Zealand White rabbit. What is your diagnosis?

1. *Eimeria stiedae*
2. *Cryptosporidium cuniculus*
3. *Encephalitozoon cuniculi*
4. *Treponema paraluiscuniculi*
5. *Lawsonia intracellularis*

**Answer: a. *Eimeria stiedae***

**References:**

1. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd ed. Academic Press: San Diego, CA. Chapter 7 – Biology and Diseases of Other Rabbits, p. 437.
2. Suckow MA, Stevens KA, Wilson RP, eds. 2012. The Laboratory Rabbit, Guinea Pig, Hamster, and other Rodents. Academic Press: San Diego, CA. Chapter 15 – Parasitic Diseases, p. 418.

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

Question 96: Which is **NOT** an acceptable method of euthanasia for these animals?

1. Hypothermia, as long as the animal is <7 days of age and does not come into direct contact with ice or pre-cooled surfaces
2. Injectable barbiturates alone
3. CO2 exposure for 5 minutes
4. Leaving the animal in utero after euthanizing the dam

**Answer: c. CO2 exposure for 5 minutes**

**References:**

1. American Veterinary Medical Association. “AVMA Guidelines for the Euthanasia of Animals: 2013 Edition,” Part III – Methods of Euthanasia by Species and Environment, S2. Laboratory Animals, p. 50.
2. Hedrich HJ, ed. 2012. The Laboratory Mouse, 2nd edition. Academic Press: Boston, MA. Chapter 5.4 – Anaesthesia, Analgesia and Euthanasia, p. 739-759.

**Domain 2; Primary Species – Mouse (Mus musculus) and Tertiary Species – Other Rodents**

Question 97: The fish depicted on the right has a mutation in what gene?

1. BRAF
2. MYCN
3. APC
4. B-myb
5. TP53

**Answer: a. BRAF**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 20 – Biology and Management of the Zebrafish, p. 1019.
2. Davies H, Bignell GR, Cox C, et al. 2002. Mutations of the BRAF gene in human cancer. *Nature* 417(6892): 949–954.

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

Question 98: What is the purpose of the horizontal wire cable in the image?

1. Emergency door release
2. Emergency shut off cable
3. Trip wire to alert operator that equipment is contacting sprayer arms
4. Cable to turn on interior light

**Answer: b. Emergency shut off cable**

**References:**

1. Fox JG, Anderson LC, Otto G, Prichett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd edition. Elsevier: London. Chapter 30 – Occupational Health of Laboratory Animal Workers, p. 1388
2. Institute for Laboratory Animal Research, Division on Earth and Life Studies, The National Research Council. 2011. Guide for the Care and Use of Laboratory The National Academies Press: Washington, D.C. Chapter 5 – Physical Plant, p 143.

**Domain 4**

Question 99: Which of the below have been identified as the likely underlying cause of this condition affecting *Meriones unguiculatus*?

1. Chemical irritation from porphyrin continuing lacrimal secretions
2. Demodex infestation
3. B12 deficiency
4. Infection with Cilia-Associated Respiratory Bacillus

**Answer: a. Chemical irritation from porphyrin containing lacrimal secretions.**

**References:**

1. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd ed. Academic Press: Oxford, UK, p. 318.
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd edition. Blackwell Publishing: Ames, Iowa. pp. 210-211.

**Domain 1; Secondary Species – Mongolian gerbil (Meriones unguiculatus)**

Question 100: This gross photograph shows tissues from a Long-Evans rat that died within days after arriving at an animal facility from a commercial breeder. What condition did the rat have and what is depicted in the picture?

* 1. Urolithiasis; kidney with calculi in the renal pelvis
	2. Urolithiasis; urinary bladder with multiple variable sized calculi in the lumen
	3. Spontaneous progressive glomerulonephropathy; kidney with granular surface
	4. Pulmonary pneumocystosis; lung with focal cellular infiltrates
	5. Spontaneous diplococcal (*Streptococcus pneumoniae*) infection; fibrinous pleuritis

**Answer: a. urolithiasis; kidney with calculi in the renal pelvis**

**References:**

1. Pang J, Borjeson TM, Parry NM, Fox JG. 2015. Struvite Urolithiasis in Long-Evans Rats. *Comp Med* 65(6): 486-91.
2. Percy DH and Barthold SW. 2007. Pathology of Laboratory Rodents and Rabbits, 3rd ed. Blackwell Publishing: Ames, Iowa. Chapter 2 – Rat, p. 163.

**Domain 1, Primary species- rats**

Question 101: This behavior is seen most often in animals who were:

1. Reared in isolation
2. Born in the wild
3. Parent reared
4. Reared with con-specifics

**Answer: a. Reared in isolation**

**References:**

1. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rdedition. Academic Press:San Diego, CA. Chapter 17 Nonhuman Primates.
2. Latham and Mason, “Maternal deprivation and the development of stereotypic behavior.” *Appl. Anim. Behav. Sci*., 110 (2008), pp. 84–108

**Domain 1; Primary Species- Rhesus Macaque *(Macaca mulatta)***

Question 102: The causative agent of this disease is **not** known to do which of the following?

1. Cause focal hepatitis
2. Present with only skin “lumps” as the only clinical sign
3. Present with torticollis, nasal or ocular discharge
4. Metastasize to the brain

**Answer: d. Metastasize to the brain - streptococcus equi zooepidemicus**

**References:**

1. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rdedition. Academic Press:San Diego, CA. Chapter 6 - Biology and Diseases of Guinea Pigs

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

Question 103: The minimum space requirements for this animal and her infant are:

1. Floor area/animal = 6.0 ft2 and height = 32 inches
2. Floor area/animal = 6.0 ft2 and height = 36 inches
3. Floor area/animal = 8.0 ft2 and height = 36 inches
4. Floor area/animal = 9.6 ft2 and height = 36 inches

**Answer: c.** **Floor area/animal = 8.0 ft2 and height = 36 inches**

**References:**

1. Animal Welfare Act, 7 U.S.C., Sections 2131-2159. Animal Welfare Regulations, 9 CFR Chapter 1, Subchapter A, Parts 1-4, pp. 99-100.
2. Guide for the Care and Use of Laboratory Animals 8th edition, Institute of Laboratory Animal Resources, National Research Council, National Academy of Sciences. National Academy Press, Washington, DC, 2011, p. 61

**Domain 5; Secondary Species – Baboon (*Papio* spp.)**

Question 104: Biological safety cabinets (BSC) are the primary containment devices that protect the worker, product, and environment from exposure to microbiological agents. Identify the BSC type depicted below.

1. Class II, Type A2
2. Class II, Type B1
3. Class II, Type B2
4. Class III

**Answer: c. Class II, Type B2**

**References:**

1. Centers for Disease Control and Prevention, National Institutes of Health. 2009. Biosafety in Microbiological and Biomedical Laboratories, 5th edition. US Government Printing Office: Washington, DC. Appendix A: Biological Safety Cabinets, p. 318.

**Domain 5**

Question 105: An investigator calls you about necropsy findings in some of the control animals in her work. She has just started working with gnotobiotic mice and on necropsy, there was a large swollen section of the gut. The picture on the left is one of the gnotobiotic animals and the picture on the right is typical for her conventionally housed control animals. What can you tell the investigator about her gnotobiotic mice?

1. The swollen area is an enlargement of the colon, indicating a helicobacter infection
2. The swollen cecum indicates bacterial contamination of the gnotobiotic colony
3. The substantial enlargement of the cecum is typical for gnotobiotic mice
4. The enlarged structure is the spleen and the investigator should submit an animal for you to examine
5. The enlarged colon is secondary to torsion of the intestine

**Answer: c. The substantial enlargement of the cecum is typical for gnotobiotic mice**

**References:**

1. Fox JG, Anderson LC, Otto GM, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 7 – Derivation of Germfree Mice, p. 1287.
2. Overstreet AC, Ramer-Tait AE, Jergens AE, Wannemuehler MJ. 2012. The Role of the Microbiota in Gastrointestinal Health and Disease, Inflammatory Bowel Disease. Chapter 3 – The Role of the Microbiota in Gastrointestinal Health and Disease. Available from: http://www.intechopen.com/books/inflammatory-bowel-disease/the-role-of-the-microbiota-in-gastrointestinal-health-and-disease

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

Question 106: Which metabolic or physiologic metrics are altered in rats housed in these cages?

1. Body growth rates
2. Dietary and water intake
3. Total fatty acids
4. Daily melatonin levels

**Answer: d. Daily melatonin levels**

**References:**

1. Wren MA, Dauchy RT, Hanifin JP, et al. 2014. Effect of Different Spectral Transmittances through Tinted Animal Cages on Circadian Metabolism and Physiology in Sprague–Dawley Rats*.* *JAALAS* 53(1): 44–51.
2. Dauchy RT, Wren MA, Dauchy EM, et al. 2013. Effect of Spectral Transmittance through Red-Tinted Rodent Cages on Circadian Metabolism and Physiology in Nude Rats.  *JAALAS* 52(6): 745–755.

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

Question 107: The following statement is **FALSE** about this device:

1. Is operated by biting or licking
2. Provides adequate airflow through piped systems
3. Has various flow rates dependent on species
4. Has a shield to prevent bedding from entering the system

**Answer: b. Provides adequate airflow through piped systems**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 36 – Design and Management of Research Facilities, p. 1583.
2. Hessler JR, Lehner NDM, eds. 2009. Planning and Designing Research Animal Facilities. Academic Press: San Diego, CA. Chapter 32 – Plumbing: Special Considerations, p. 442-443.

**Domain 4**

Question 108: According to the AWA and Regulations, which of the following **cannot** be used to sanitize primary enclosures for the following species?

1. Soap or detergent and hot water - 180 °F in a mechanical cage washer
2. Detergent solution followed by a safe disinfectant
3. Live steam
4. Flame
5. Wash and rinse water at 143 - 165 °F for 30 minutes

**Answer: e. Wash and rinse water at 143 - 165 °F for 30 minutes**

**References:**

1. Title 9, Chapter 1, Subchapter A, Part 2, Subpart C, Part 3.56 (b)(3)
2. US Code, Title 7: Chapter 54, Animal Welfare Act

**Domain 4**

Question 109: This equipment is required when what environmental parameters exist?

1. Temperatures exceed 72F
2. Carcinogens are in use
3. Noise levels exceed 85 dBA
4. Biological hazards are in use

**Answer: c. Noise levels exceed 85 dBA (**Where levels exceed 85dBA, the exposed employees need to participate in a hearing-conservation program that includes monitoring, audio- metric testing, hearing protection, training, and record-keeping).

**References:**

1. 29 CFR 1910.95
2. Occupational Health and Safety in the Care and Use of Research Animals. Institute of Laboratory Animal Resources, National Research Council. National Academy Press, Washington, DC, 1997, p. 41.

**Domain 5**

Question 110: The following lesion found in a squirrel monkey is caused by

1. Osteosarcoma
2. Hydrocephalus
3. Hypovitaminosis C
4. Hypovitaminosis A
5. Hypocalcemia

**Answer: c. Hypovitaminosis C**

**References:**

* 1. Fox JG, Anderson LC, Otto G, Pritchett-Corning KR, Whary MT eds. 2015. Laboratory Animal Medicine, 3nd edition. Academic Press: San Diego, CA. Chapter 17. Nonhuman Primates, p. 891.
	2. [Ratterree MS](http://www.ncbi.nlm.nih.gov/pubmed/?term=Ratterree%20MS%5BAuthor%5D&cauthor=true&cauthor_uid=2157096)1, [Didier PJ](http://www.ncbi.nlm.nih.gov/pubmed/?term=Didier%20PJ%5BAuthor%5D&cauthor=true&cauthor_uid=2157096), [Blanchard JL](http://www.ncbi.nlm.nih.gov/pubmed/?term=Blanchard%20JL%5BAuthor%5D&cauthor=true&cauthor_uid=2157096), [Clarke MR](http://www.ncbi.nlm.nih.gov/pubmed/?term=Clarke%20MR%5BAuthor%5D&cauthor=true&cauthor_uid=2157096), [Schaeffer D](http://www.ncbi.nlm.nih.gov/pubmed/?term=Schaeffer%20D%5BAuthor%5D&cauthor=true&cauthor_uid=2157096). 1990. Vitamin C deficiency in captive nonhuman primates fed commercial primate diet. [Lab Anim Sci](http://www.ncbi.nlm.nih.gov/pubmed/2157096): 40(2):165-8.

**Domain 1; Secondary species, Squirrel monkey (*Saimiri sciureus*)**

Question 111: Of the depicted animals used in biomedical research, which would be covered by the PHS policy but not the Animal Welfare Act?

a. A

b. B

c. C

d. D

**Answer: d. D** (Zebrafish larvae)

**References:**

1) Public Health Service (PHS) Policy on Humane Care and Use of Laboratory Animals. Office of Laboratory Animal Welfare, National Institutes of Health, August, 2002.

2) Animal Welfare Regulations, Code of Federal Regulations, Title 9, Chapter 1, Subchapter A, §1.1

3) OLAW Frequently Asked Questions – PHS Policy on Humane Care and Use of Laboratory Animals, A. Questions 4&5. <http://grants.nih.gov/grants/olaw/faqs.htm>

**Domain 5; Secondary Species – Zebrafish (Danio rerio) and Tertiary Species – Chicken (Gallus domesticus), Horseshoe crab (Limulus polyphemus), Deer mouse (Peromyscus leucopus)**

Question 112: According to the 2013 AVMA Guidelines for the Euthanasia of Animals, the following are acceptable without conditions methods of euthanasia for the following species **except**?

1. Injected barbiturates
2. Inhaled anesthetics
3. Topical buffered tricaine methanesulfonate
4. Topical buffered benzocaine hydrochloride

**Answer: b. Inhaled anesthetics**

**References**

1. AVMA Guidelines for the Euthanasia of Animals: 2013 edition.
2. DeNardo, D. Amphibians as Laboratory Animals. ILAR J (1995) 37 (4): 173-181.

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

Question 113: In what species would this general cage and feeder design be inappropriate?

1. Mice
2. Rats
3. Syrian hamsters
4. Gerbils

**Answer: c. Syrian hamsters**

**References:**

1. Fox JG, Anderson LC, Loew FM, Quimby FW, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 5 – Biology and Diseases of Hamsters, p. 216.
2. 9 CFR, Part 3 – Standards, Subpart B – Specifications for the Humane Handling, Care, Treatment, and Transportation of Guinea Pigs and Hamsters, §3.29 Feeding. (11-6-13 Edition, p.79)

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

Question 114: The images below depict the gross and histologic lesions associated with a certain pathogen in a rhesus macaque. When working with this pathogen in a laboratory, which activity can be conducted at the BSL-2 level?

1. Preparation of acid-fast smears from clinical specimens
2. Manipulation of cultures of the pathogen
3. Handling of experimentally infected mice
4. Handling of experimentally infected nonhuman primates

**Answer: a. Preparation of acid-fast smears from clinical specimens**

**References:**

1. CDC, NIH. 2009. Biosafety in Microbiological and Biomedical Laboratories, 5th edition. U.S. Dept. of Health and Human Services. Section VIII – Agent Summary Statements, p. 146.
2. Fox JG, Anderson LC, Otto GM, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 17 – Nonhuman Primates, p. 856.

**Domain 5**

Question 115: According to the Guide for the Care and Use of Laboratory Animals, which of the following should **not** be part of a Pest Control Program when possible?

1. A
2. B
3. C
4. D

**Answer: a. A,** D-con, a toxic agent. B is nontoxic amorphous silica. C is nontoxic insect growth regulator. D is a live trap, which is humane, but “requires frequent observation and human euthanasia after capture.”

**References:**

1. National Research Council. 2011. Guide for the Care and Use of Laboratory Animals, 8th edition. The National Academies Press: Washington, DC. Chapter 3 – Environment, Housing, and Management, p. 74.

**Domain 5**

Question 116: Name the equipment pictured.

1. Irradiator
2. Ferret nesting box
3. Micro-CT
4. PET-CT

**Answer: b. Ferret nesting box**

**References:**

1. Fox JG, Anderson LC, Otto GM, Pritchett-Corning KR, Whary MT, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 14 – Biology and Diseases of Ferrets, p. 586.
2. Ball RS. 2006.Issues to Consider for Preparing Ferrets as Research Subjects in the Laboratory. *ILAR* 47(4): 348-357.

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

Question 117: This animal is being imported to the US from its native country and will be transported to your research facility from an adjacent state. Special written approval is needed from which agency or agencies?

1. CDC Division of Global Migration and Quarantine
2. CDC Division of Global Migration and Quarantine and FDA
3. CDC Etiologic Agent Import Permit Program
4. CDC Etiologic Agent Import Permit Program and DoT
5. USDA and FWS only

**Answer: b. CDC Division of Global Migration and Quarantine and FDA**

**References:**

1. 42 CFR, Part 71 – Foreign Quarantine, Subpart F – Importations, §71.56 African rodents and other animals that may carry the monkeypox virus. (10-1-09 Edition)
2. 21 CFR, Part 1240 – Control of Communicable Diseases, Subpart D –Specific Administrative Decisions Regarding Interstate Shipments, §1240.63 – African rodents and other animals that may carry the monkeypox virus. (04-01-08 Edition)
3. Guidelines for the Humane Transport of Research Animals, 2006 NRC pp. 12-13, 19, 22

**Domain 5; Tertiary Species**

Question 118: For what reason is the procedure depicted in the images typically performed?

a. Collection of tissue for genotyping

b. Collection of samples for disease testing

c. Identification of the animal

d. Treatment of a disease

**Answer: d. Treatment of a disease**

**References:**

1) Fox JG, Anderson LC, Otto G, Pritchett-Corning K, Whary M, eds. 2015. Laboratory Animal Medicine, 3rd edition. Academic Press: San Diego, CA. Chapter 3 – Biology and Diseases of Mice, p. 130.

2) Hampton AL, Hish GA, Aslam MN, Rothman ED, Bergin IL, Patterson KA, Naik M, Paruchuri T, Varani J, Rush HG. 2012. Progression of ulcerative dermatitis lesions in C57BL/6Crl mice and the development of a scoring system for dermatitis lesions. *J Am Assoc Lab Anim Sci* 51:586-593.

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

Question 119: The following image depicts what piece of equipment that may be found in an animal facility?

1. Autoclave test strip
2. Radio frequency identification (RFID) tag
3. A sample capture unit to perform environmental PCR testing
4. Device to monitor light levels in animal holding rooms
5. Device to monitor vibration levels in animal holding rooms

**Answer: c. A sample capture unit to perform environmental PCR testing**

**References:**

1. <http://www.criver.com/promo/charles-river-allentown-partnership>
2. Jensen ES, Allen KP, Henderson KS, Szabo A, Thulin JD. 2013. PCR testing of a ventilated caging system to detect murine fur mites. *J Am Assoc Lab Anim Sci.* 52(1):28-33.

**Domain 4**

Question 120: You identify the following organism during routine surveillance of your *Rattus norvegicus* colony. What is it?

1. *Radfordia ensifera*
2. *Myocoptes musculinus*
3. *Radfordia affinis*
4. *Syphacia obvelata*
5. *Lumbricus terrestris*

**Answer: a. *Radfordia ensifera***

**References:**

* 1. Suckow, MA, et al, eds. 2006. The Laboratory Rat, 2nd edition. Elsevier: San Fransisco, CA. Chapter 13 – Parasitic Diseases, p. 472.
	2. Arbona, RJR, et al. 2010. Treatment and eradication of murine fur mites: 1. Toxicologic evaluation of ivermectin-compounded feed. JAALAS49(5): 564.
	3. Rice, KA, et al. 2014. Evaluation of diagnostic methods for *Myocoptes musculinus* according to age and treatment status of mice (*Mus musculus*). JAALAS52(6): 773.

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

**END OF EXAM!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!**