2016 International Mock Board Exam Coalition

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| Southeast (GA) | Yerkes National Primate Research CenterAtlanta, GA | 3/18/16 |
| West Coast (Southern CA) | City of Hope/Beckman Research InstituteDuarte, CA | 3/19/15 |
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| Asia | Singapore | 6/25/16 |

Written Section – 230 Questions

**45 Pages**

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

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**1.** Which two subfamilies of new world monkeys possess a prehensile tail with a tactile pad?

1. Cebinae and Pithecinae
2. Aotinae and Callicebinae
3. Alouattinae and Atelinae
4. Cercopithecine and Colobinae

**2.** Which of the following is a drawback to the use of bispectral index (BIS) for anesthetic depth monitoring of laboratory animals?

1. Algorithms used to compare BIS are based on human data
2. It is an invasive procedure

 c. There is no data to support its use in common laboratory animals

 d. It can only be used for injectable anesthetic regimens

**3.** What stock of rats has been reported to have a high incidence of seizures and has been used in investigation of audiogenic seizures?

a. Albany

b. Wistar

c. Sprague-Dawley

d. Holtzman

e. Long-Evans

**4.** Which of the following statements best describes environmental enrichment strategies for adult zebrafish?

1. Environmental enrichment strategies in zebrafish should not include artificial material
2. Environmental enrichment strategies for zebrafish are well established in the literature
3. Environmental enrichment strategies should elicit species specific behavior
4. Environmental enrichment strategies should only be used for group housed zebrafish
5. Environmental enrichment strategies should only be used for juvenile zebrafish

**5.** Puppies under \_\_\_\_\_ months of age may not be housed in the same primary enclosure with adult dogs, other than the dam or foster dam, except when permanently maintained in breeding colonies?

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

**6.** Which of the following organizations has recently used “The Identity Campaign” as a fund raiser which “adopts” animals to donors and provides information to the donor on how to obtain additional information on their “adopted” pet from the institution through an open records request?

a.   Beagle Freedom Project

b.   Beagle Rescue League

c. Humane Society of the United States

d.   National Biomedical Research Association

e. People for the Ethical Treatment of Animals

**7.** Guinea pigs are highly susceptible to an infection associated with high mortality, acute death, reproductive disorders, as well as lung and liver lesions with which of the following bacterial organisms?

1. *Brachyspira hyodysenteriae*
2. *Chlamydophilia caviae*
3. *Leptospira spp.*
4. *Listeria monocytogenes*

**8.** At what temperature will hibernation occur in *Cricetus cricetus*?

1. 3°C
2. 5°C
3. 8°C
4. 10°C
5. All other things being equal, which of the following caging conditions for mice would have the highest ammonia level?
	1. Static microisolator, 70% relative humidity, corncob bedding
	2. Static microisolator, 70% relative humidity, wood pulp bedding
	3. Static microisolator, 30% relative humidity, corncob bedding
	4. Individually ventilated microisolator, 70% relative humidity, wood pulp bedding
	5. Individually ventilated microisolator,30% relative humidity, corncob bedding

**10.** Theft or “significant loss” of controlled substances requires immediate reporting to the DEA upon discovery of the loss or theft within how many hours?

a. 24 hours

b. 48 hours

c. 1 business day

d. 1 week

**11.** Your facility supports an antibody producing herd of goats. Every winter the care staff notice alopecia and flaking of the lower limbs and tails of several animals. They also show signs of pruritus. What is the most likely diagnosis?

a. *Demodex*

b. *Chorioptes*

c. *Sarcoptes*

d. *Psoroptes*

**12.** Which of the following statements best describes porcine stress 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

**13.** Which of the following is another name for the Ommaya reservoir?

1. Cardiovascular reserve capacity
2. Cisternal pressure decompressor
3. Hepatocellular regeneration capacity
4. Lateral port model
5. Ventricular perfusion catheter

**14.** Which term best describes the measures taken to detect, prevent, contain, and eradicate adventitious infections?

1. Barrier
2. Biosecurity
3. Quarantine
4. Sentinel Program
5. Stabilization

**15.** According to the Animal Welfare Act and its regulations, how often must dogs less than 16 weeks of age be offered potable water, starting from the time the dog was last offered potable water before transportation was begun?

1. At least once every 6 hours
2. At least once every 12 hours
3. At least once every 24 hours
4. Ad libitum

**16.** Which of the following viruses has been shown to naturally infect African green monkeys but when transmitted to rhesus macaques can cause a fulminant and fatal infection?

1. African green monkey polyomavirus
2. Macacine herpesvirus 1
3. Simian hemorrhagic fever virus
4. Yaba monkey tumor virus

**17.** In a recent study, chimpanzees were trained to urinate into a collection device. Trainers offered a food reward to chimpanzees that showed a fear response to the collection device. What of the following terms best describes this type of training?

a. Classical conditioning

b. Counter-conditioning

c. Negative-reinforcement training

d. Operant conditioning

e. Positive-reinforcement training

**18.** Which of the following best describes peracetic acid?

a. High temperature sterilant

b. Created with a mechanical generator

c. Sporicidal in both liquid and vapor phase

d. Ineffective at killing organisms suspended in the air

**19.** According to the Animal Welfare Act and its regulations, which of the following statements best describes housing requirements for *Oryctolagus cuniculus*?

* 1. Primary enclosures for rabbits must be sanitized once every 14 days
	2. Litter pans or troughs underneath wire/mesh floored enclosures must be cleaned twice per week
	3. Minimum height of all enclosures is at least 16 inches
	4. Indoor housing facilities need not be heated
	5. Shelter be provided in outdoor housing facilities when ambient temperature is less than 45ºF

**20.** Which of the following statements best describes basophils in murine peripheral blood?

* 1. Most common leukocyte, contain lobulated nuclei and easily differentiated from mast cells
	2. Most common leukocyte, contain ovoid nuclei and are difficult to differentiate from mast cells
	3. Least common leukocyte, contain lobulated nuclei and are difficult to differentiate from mast cells
	4. Least common leukocyte, contain lobulated nuclei are easily differentiated from mast cells
	5. Least common leukocyte, contain ovoid nuclei and are difficult to differentiate from mast cells
1. Which of the following euthanasia agents is commonly used by neuroscientists to fix brain chemicals and metabolites *in vivo* while maintaining the brain’s anatomic integrity?

* 1. Argon
	2. CO2
	3. Decapitation
	4. Inhalant anesthesia
	5. Microwave irradiation

**22.** Which of the following sections is no longer required for the Vertebrate Animal Section of an NIH application?

a. Description of animals and how they will be used

b. Justifications for using animals

c. Veterinary care

d. Provisions to minimization of pain and distress

e. Euthanasia

**23.** Which identification method has been associated with fibrosarcomas in various animal species?

1. Ear tagging
2. Ear punching
3. Fur coloring
4. Microchipping
5. Toe clipping

**24.** All of the following applies to importation of nonhuman primates into the United States **EXCEPT**?

1. Importer must quarantine all NHPs for at least 31 days after arrival at a U.S. quarantine facility
2. Three tuberculin tests are required for all imported NHPs
3. Importers must notify CDC within 24 hours of any illness or death of NHPs in quarantine facilities
4. Importers must notify CDC at least 7 days before importing a shipment of NHPs
5. Importers must contact CDC within 72 hours to report any suspected zoonotic illness in an employee

**25.** For the “Experience Option” path to ACLAM board eligibility, a candidate may qualify to take the certifying examination after how many years of relevant, full-time experience in laboratory animal medicine following receipt of a veterinary medical degree?

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

**26.** What is the primary target for K virus in affected tissue of mice?

a. Adipocyte

b. Alveolar epithelium

c. Mesenchymal cell

d. Smooth muscle cell

e. Vascular endothelium

**27.** Which of the following imaging modalities is the leading noninvasive technique for characterizing the structure and function of the irregularly shaped right ventricle in mice?

1. Magnetic resonance imaging
2. Micro-computed tomography
3. Positron emission tomography
4. Ultrasound

**28.** All of the following are a commonly recommended identification methods for *Xenopus laevis* maintained in the laboratory **EXCEPT**?

1. Elastomere implants
2. Group identification by cage card
3. Photographs of skin patterns
4. Sterile transponder implants
5. Toe cutting

**29.** Tramadol is classified as which of the following controlled substance schedules?

1. I
2. II
3. III
4. IV

e. Non-controlled substance

**30.** In macaques, retroperitoneal fibromatosis is associated with infection with which virus?

a. Simian virus 40

b. Simian cytomegalovirus

c. Simian retrovirus type 2

d. Simian varicella virus

e. Simian immunodeficiency virus

**31.** Which of the following **IS NOT** considered a safe and effective anesthetic in the Syrian hamster (*Mesocricetus auratus*) due to its significant side effects and development of intra-abdominal adhesions?

1. Chloral hydrate
2. Ketamine
3. Xylazine
4. Telazol

**32.** Euthanasia by rapid chilling (hypothermic shock) may be performed in all of the following adult species **EXCEPT**?

1. *Danio rerio*
2. *Oncorhynchus mykiss*
3. *Nematolosa erebi*
4. *Oryzias latipes*

**33.** Which of the following is most resistant to germicidal chemicals or disinfectants?

1. *Pseudomonas aeruginosa*
2. Herpes simplex virus
3. Enterococci
4. Poliovirus
5. *Bacillus subtillis* endospores

**34.** Which institutions are required to appoint a biological safety officer?

1. Every institution that works with biological hazards requires a biological safety officer
2. Institutions that engage in large-scale research or production activities involving viable organisms containing recombinant DNA molecules
3. Institutions that engage in recombinant DNA research at BSL 2 or higher regardless of program scale
4. Any institution utilizing recombinant DNA molecules in research

**35.** Polycystic disease in aged Syrian hamsters most commonly presents in which organ?

1. Kidney
2. Liver
3. Lung
4. Spleen
5. Testes

**36.** Imaging with PET and SPECT involves the use of which of the following?

a. Radioactive tracers such as F-2-deoxy-2-fluoro-D-glucose

b. Para magnetic agents such as gadolinium

c. High frequency ultrasonic vibrations

d. Bioluminescent proteins such as luciferase

**37.** Which of the following is a recommended characteristic of diets fed to ferrets in the laboratory?

1. High in complex carbohydrates
2. High in fiber and dietary fat
3. High in fish products
4. High in protein and dietary fat

**38.** Which of the following amendments to the Animal Welfare Act mandated institutional environmental enhancement plans for nonhuman primates?

1. 1970: Expands the list of animals covered by the Act
2. 1985: Improved Standards for Laboratory Animals Act
3. 1976: Traveling, carrier and animal fighting amendments
4. 1990: Protection of Pets

**39.** Which of the following statements best describes hyperacute rejection in xenotransplantation from animal to human partially driven by natural antibodies that recognize the sugar moiety α-1,3 Gal?

1. α-1,3 Gal is present in pigs, humans and NHP only
2. α-1,3 Gal is present in most mammals but not in humans and old world monkeys
3. The development of the Gal-knockout pig has completely resolved rejection associated with pig to NHP xenografts
4. α-1,3 Gal is not associated with rejection in xenotransplantation
5. α-1,3 Gal is the major factor involved in chronic rejection of NHP to human xenografts

**40.** What standard is recommended by ILAR to minimize animal distress in the production of monoclonal antibody when using the ascites method in mice?

a. Limit pristane priming to less than or equal to 0.2 ml IP

b. The animal must be observed twice daily

c. Anesthesia must be used during needle harvest of ascites fluid

d. Saline must be administered post-harvest of ascites fluid

e. The animal should be euthanized if hunched posture and roughened coat is observed

**41.** Cerebrospinal fluid collection in rabbits is performed by which of the following approaches?

1. CSF obtained following surgical exposure of the atlanto-occipital region of the spine
2. Catheterization of the subdural space in the T1-T4 location
3. Needle inserted ~2 mm caudal to the external occipital protuberance
4. Catheters percutaneously inserted into the subdural space in the L7-S1 location
5. None of the above

**42.** Which of the following species require a dietary source of vitamin D3 and ascorbic acid?

1. *Callithrix jacchus*
2. *Colobus angolensis*

c. *Hylobates lar*

d. *Macaca mulatta*

e. *Presbytis cristata*

**43.** According to the 8th Edition of the Guide for the Care and Use of Laboratory Animals and the Animal Welfare Act and its regulations, the floor space requirement for guinea pigs in the United States is \_\_\_\_\_\_ in2 for animals weighing 350 g or less and \_\_\_\_\_\_ in2 for animals weighing more than 350 g?

1. 50 and 100
2. 75 and 151
3. 60 and 101
4. 71 and 111

**44.** Which of the following viruses causes clinical disease in preweanling rats?

a. Pneumonia virus of mice

b. Rat parvovirus

c. Rat respiratory virus

d. Rat theilovirus

**45.** Which of the following mouse strains exhibit accumulation of *Coxiella burnetti* in the placenta, abortion, stillbirth, perinatal death, and endocarditis when infected with organism?

1. AKR/J
2. DBA/2J
3. BALB/c
4. SEC/ReJ
5. C3H/HeN

**46.** Which of the following best describes husbandry for the gerbil (*Meriones unguiculatus*)?

a. Gerbils produce large amounts of urine and feces and therefore need more frequent cleaning than other laboratory rodents

b. Gerbils thrive on commercial rodent diets but develop high blood cholesterol on diets containing more than 4% fat

c. Gerbils are desert dwelling rodents; therefore *The Guide* recommends housing them at a dry- bulb temperature of 79-85ºF

d. Gerbils develop nasal dermatitis if the relative humidity is maintained below 50%

**47.** According tothe Public Health Service Policy on Humane Care and Use of Laboratory Animals, which of the following applies to an IACUC?

* 1. There can be no more than 3 members from the same administrative unit of the institution
	2. A suspension can only be approved by a majority vote of the quorum present at a convened meeting
	3. The CEO and IO cannot be the same individual
	4. Significant deficiencies remaining uncorrected beyond the scheduled correction date shall be reported in writing within 15 business days to OLAW

**48.** Which statement best describes differences between mouse and human hematological characteristics?

1. Mice have significantly larger neutrophils than humans
2. Mice have significantly larger erythrocytes than humans
3. Mice have physiologic splenic hematopoiesis and iron storage
4. Mice do not have physiologic splenic hematopoiesis and iron storage
5. Mice have the ability to perform renal erythropoiesis

**49.** According to Good Laboratory Practice for conducting nonclinical laboratory studies, which of the following best describes what a sponsor is?

1. Any person or organizational element, except the study director, designated by testing facility management to perform the duties relating to quality assurance of nonclinical laboratory studies.
2. Individual responsible for the overall conduct of a nonclinical laboratory study
3. Person who submits a nonclinical study to the Food and Drug Administration in support of an application for a research or marketing permit
4. Test site manager who supports the study by provision of financial or other resources

**50.** IL-10-/- mice are a commonly used as a model for which of the following diseases?

1. Alzheimer’s
2. Arthritis
3. Autoimmune cardiomyopathy
4. Diabetes
5. Inflammatory bowel disease

**51.** Which of the following nonhuman primate species is monogamous?

1. *Aotus lemurinus*
2. *Callithrix jacchus*
3. *Pan paniscus*
4. *Papio anubis*
5. *Saimiri boliviensis*

**52.** All of the following practices are required when working with a laboratory adapted LCMV strain being used in a rodent model **EXCEPT**?

1. Availability of an autoclave
2. Biohazard warning signs posted
3. Decontamination of clothing before laundering
4. Decontamination of infected wastes before cage wash
5. Hand washing sink available in room

**53.** Drugs metabolized by the kidney and liver should be injected into the epaxial muscles of the cranial half of the body in \_\_\_\_\_\_\_\_\_\_ or the muscles of the front legs in \_\_\_\_\_\_\_\_\_\_.

1. Chelonians; snakes
2. Crocodilians; lizards
3. Lizards; chelonians
4. Snakes; lizards

**54.** The following are advantages of using isoflurane anesthesia in imaging pregnant mice **EXCEPT**?

1. Reduced risk of intrauterine trauma associated with injections
2. Readily adjustable dosage
3. Precise control of the duration of anesthesia
4. No effect on embryonic growth rate during first gestational week or following chronic exposure

**55.** Which of the following meet general recommendations for lighting in zebrafish facilities?

1. Between 10 and 40 ft candles (107-430 lux) at tank level
2. Between 5 and 30 ft candles (54-354 lux) at tank level
3. Between 10 and 40 ft candles (107-430 lux) at ceiling level
4. Between 10 and 30 ft candles (107-354 lux) at ceiling level
5. Between 5 and 30 ft candles (54-354 lux) at ceiling level

**56.** When breeding rabbits, which of the following behaviors should lead to separation of the animals?

* 1. Male tail-flagging
	2. Female tail-raising
	3. No interaction after 15 minutes
	4. First attempt at copulation

**57.** What are the expected clinical signs from a young beagle with juvenile polyarteritis syndrome?

1. Exercise intolerance
2. Joint pain
3. Petechiae, purpura, or ecchymosis
4. Reluctance to move the head and neck

**58.** Which of the following is the reversal drug for pancuronium?

1. Atipamezole
2. Doxapram
3. Neostigmine
4. Yohimbine

**59.** The altered Shaedler flora consists of all of the following bacteria **EXCEPT**?

1. *Lactobacillus murinus*
2. *Clostridium spp.*
3. *Escherichia spp.*
4. *Eubacterium plexicaudatum*
5. *Lactobacillus intestinalis*

**60.** Which one of the following methods would be most effective in eliminating all bacteria from rodent rack water lines and watering valves?

* 1. Rack-washer sanitation alone
	2. Flush lines and valves during sanitation through rack washer
	3. Removal of biofilm
	4. Rack washer-sanitation followed by autoclave sterilization
	5. Treatment of waterlines and valves with ultraviolet light

**61.** According to the Animal Welfare Act and its regulations, perimeter fencing around outdoor housing facilities for nonhuman primates must be constructed so that it protects nonhuman primates by restricting unauthorized humans, and animals the size of \_\_\_\_\_\_\_\_\_\_, from going through it or under it and having contact with the nonhuman primates?

a. Cats, dogs, skunks, and opossums

b. Dogs, cats, raccoons, and skunks

c. Raccoon, skunks, and dogs

d. Raptors, cats, and dogs

1. Obesity in most mammalian species causes disruption of the hypothalamic-pituitary-gonadal axis predominantly via feedback from which hormone(s)?
2. Luteinizing hormone and estrogen
3. Follicle stimulating hormone and insulin
4. Grehlin and luteinizing hormone
5. Insulin and leptin
6. Gonadotropin releasing hormone

**63.** In sheep and goats, infection with *Dichelobacter nodosus* most commonly causes which of the following conditions?

1. Blue bag
2. Foot rot
3. Lumpy jaw
4. Sore mouth
5. Wooden tongue

**64.** When performing longitudinal cardiovascular phenotyping with conscious mice, electrocardiography **IS NOT** useful for detecting which of the following conditions?

* 1. Atrial fibrillation
	2. Cardiac hypertrophy
	3. Heart block
	4. Low ejection fraction
1. Which of the following best describes the reproductive physiology of the female dog?
	1. Polyestrous, nonseasonal spontaneous ovulator
	2. Monoestrus, nonseasonal, spontaneous ovulator
	3. Polyestrous, seasonal, induced ovulator
	4. Monoestrous, non-seasonal, induced ovulator
	5. Monoestrous, seasonal, spontaneous ovulator

**66.** What office within the NIH is responsible for overseeing the Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules, and how many voting members are required?

1. Office of Biotechnology Activities, 15 voting members
2. Office of Biosafety Activities, 5 voting members
3. Office of Biotechnology Activities, 5 voting members
4. Office of Biosafety Activities, 15 voting members
5. None of the above

**67.** Alteration of the light cycle in a zebrafish facility has been documented to alter all of the following **EXCEPT**?

1. Fin length
2. Gene expression
3. Locomotion
4. Reproductive cycle

**68.** All of the following drugs are partial mu agonists **EXCEPT**?

a. Buprenorphine

b. Butorphanol

c. Etorphine

d. Pentazocine

1. What is the preferred blood collection site in anesthetized *Xenopus tropicalis*?
	1. Heart
	2. Ventral abdominal vein
	3. Lingual venous plexus
	4. Ventral caudal vein
	5. Femoral vein

**70.** What is the relationship between relative humidity and ammonia levels in an animal’s microenvironment?

1. As relative humidity increases, ammonia levels decrease
2. As relative humidity increases, ammonia levels increase
3. Ammonia levels are not influenced by relative humidity
4. Relative humidity is decreased by increasing ammonia levels

**71.** According to the most recent version of the Guide for the Care and Use of Laboratory Animals, all of the following meet the criteria for public member(s) of an IACUC **EXCEPT**?

1. Must not receive any form of compensation to avoid compromising the member’s association with the community and public at large
2. Should not be laboratory animal users
3. Should not be affiliated in any way with the institution
4. Should not be affiliated with the immediate family of a person who is affiliated with the institution

**72.** Which of the following statements best describes malignant hyperthermia in swine?

1. Condition is most commonly reported in miniature swine
2. No known genetic basis for the condition
3. Clinical signs include decreasing end-tidal CO2, bradycardia, and metabolic alkalosis
4. Pathophysiology involves elevated levels of intracellular calcium

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

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

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

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

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

**74.** Which of the following is the single most expensive component of a modern vivarium, both in initial acquisition and life cycle costs?

1. Caging/housing system
2. Heating, ventilation, and air conditioning system
3. Humidifying, ventilation, and air conditioning system
4. Records management system
5. All of the following are classified by APHIS and the CDC as select agents **EXCEPT**?
6. *Bacillus anthracis*
7. *Burkholderia mallei*
8. Nipah virus
9. SARS
10. Venezuelan equine encephalitis virus

**76.** *Pasteurella multocida* infection in rabbits can be associated with a wide variety of symptoms including all of the following **EXCEPT**?

1. Abortion
2. Arthritis
3. Conjunctivitis
4. Otitis
5. Paracarditis

**77.** According to the AVMA Guidelines for the Euthanasia of Animals: 2013 Edition, which of the following statements best describes euthanasia methods for small laboratory rodents?

1. Nitrogen and argon gas are acceptable with conditions
2. CO2, with or with­out premedication with inhaled anesthetics, is acceptable with conditions
3. Decapitation is an acceptable method for mice and rats
4. IP (intraperitoneal) injection of 70% ethanol is an unacceptable method
5. Focused beam microwave irradiation, using a machine profes­sionally designed for animal euthanasia, is acceptable for euthaniz­ing mice and rats

**78.** Which of the following statements best describes what is involved with CRISPR/Cas9 technology for genome editing?

1. Synthetic proteins whose [DNA-binding domains](https://en.wikipedia.org/wiki/DNA-binding_domains) enable them to create double-stranded breaks in DNA at specific spots
2. Synthetic nucleases to target a double-strand break to a specific location on the DNA strand
3. Creation of a custom protein for each targeted DNA sequence
4. Simplistic design of a short RNA guide sequence that is paired to the targeted DNA sequence, using a modified bacterial immune system
5. Direct insertion of cloned genetic material into the pronucleus of a fertilized mouse egg

**79.** Which of the following statements best describes breeding of rhesus macaques in the U.S.A.?

1. Replacement breeders are readily available for import from India
2. There is no need for practical genetic management protocols for this species
3. Reduced genetic diversity can change the means and variability of biomedical traits
4. Accurate pedigree information can be obtained by observing breeding habits in a multi-male, multi-female colony

**80.** Who bears ultimate responsibility for the Animal Care and Use Program of an institution and is responsible for resource planning and ensuring alignment of Program goals with the institution mission?

 a. Attending veterinarian

 b. Institutional Animal Care and Use Committee

 c. Institutional Official

 d. Biosafety officer

 e. Institutional Biosafety Committee

**81.** In order to maintain CMAR certification, one must do which of the following?

1. Successfully pass 4 exams and obtain 24 continuing education units every 2 years
2. Successfully pass 4 exams and obtain 24 continuing education units every 3 years
3. Successfully pass 4 exams and obtain 48 continuing education units every 2 years
4. Successfully pass 4 exams and obtain 48 continuing education units every 3 years

**82.** A rhesus macaque has severe anaplastic anemia following a recent organ transplantation. Bone marrow biopsy revealed numerous intranuclear inclusions in the erythroid precursor cells and marked erythroid hypoplasia. Which of the following viruses is the most likely etiologic agent?

a. Adenovirus

b. Arenavirus

c. Filovirus

d. Flavavirus

e. Parvovirus

1. All of the following are examples of a gnotobiote **EXCEPT**?
2. Associated animal
3. Defined microbiota
4. Monoxenic animal
5. Restricted flora
6. Specific pathogen free

**84.** According to the 8th Edition of the Guide for the Care and Use of Laboratory Animals, which of the following statements best describes relative humidity in animal rooms?

1. Is maintained by humidification of the air via condensers that fluctuate the temperature of the air
2. Is maintained by humidification of air entering the animal spaces utilizing steam injectors or atomizing water into the air stream
3. Utilizes dehumidification mechanisms via increasing the air temperature until the moisture is removed and then decreasing the temperature to that appropriate for each room
4. Should be maintained between 50 and 70 % according to The Guide for the Care and Use of Laboratory Animals, 8th edition

**85.** Acute allograft rejection is mediated by cells expressing which of the following?

a. CD20 and CD79a

b. CD68 and CD20

c. CD4 and CD8

d. CD79a and CD68

**86.** What diagnostic parameters can best be used to differentiate microsporidiosis in zebrafish caused by *Pseudoloma neurophila* or *Pleistophora hypessobryconis*?

1. Wet mount of *P.* *neurophila* spores can be made from opaque lesions in skeletal muscle
2. Microsporidian spores from *P. neurophilia* are gram negative
3. *P. hyphessobryconis* spores are pyriform-shaped and measure 2.7 x 5.4 microns
4. Spores from *P. hyphessobryconis* have a more prominent posterior vacuole
5. Real time and conventional PCR techniques are used to detect *P. hyphessobryconis* infection

**87.** Which of the following are classified by APHIS and CDC as select agents category A, B, C respectively?

a. *Francisella tularensis*, *Burkholderia pseudomallei*, Hantavirus

b. Hantavirus, *Burkholderia pseudomallei*, *Francisella tularensis*

c. Machupo, Lassa, *Francisella tularensis*

d. Ricin toxin, *Burkholderia pseudomallei*, *Francisella tularensis*

e. *Yersinia pestis*, *Burkholderia pseudomallei*, *Clostridium perfringens* (epsilon toxin).

**88.** According to the Guide for the Care and Use of Laboratory Animals, most HVAC systems are designed for average high and low temperatures and humidities experienced in a geographical area within what percentage variation?

1. +/- 3%
2. +/- 5%
3. +/- 7%
4. +/- 10%

**89.** According to the Animal Welfare Act and its regulations, the ambient temperature shall not be allowed to fall below 60°F, nor to exceed 85°F for indoor facilities housing what species?

1. Cats
2. Dogs
3. Guinea pigs
4. Rabbits
5. Rhesus macaques

**90.** Coated (red-tint) glass is commonly used on animal holding room doors in rodent vivaria, since it is assumed that mice and rats cannot see light at what part of the visible spectrum?

1. 450 nm
2. 650 nm
3. 750 nm
4. 950 nm

**91.** Which of the following best describes the research complications caused by murine parvovirus?

1. It causes extensive mortality in weanlings from infected dam
2. It causes chronic diarrhea and retarded growth in affected mice
3. It causes colonic hyperplasia and increases the sensitivity of colonic mucosa to chemical carcinogens
4. It affects the immune function and causes augmentation or suppression of humoral and cellular immune responses
5. Infected animals have an increased sensitivity to irradiation
6. Which of the following instruments is most commonly used to test a gnotobiotic isolator for leakage prior to use?
	1. Balometer
	2. Gas detector
	3. Geiger counter
	4. Hygrometer
	5. Particle detector

**93.** Which of the following cleaning agents **IS NOT** safe to use on cages housing *Dendrobates spp*?

a. 1% Virkon

b. Iodine-based cleanser

c. 2% bleach

d. 70% ethanol

**94.** According to the Animal Welfare Act and its regulations, **f**or how long must records of IACUC-approved activities be kept?

1. As long as the protocol is active
2. For the duration of the activity and for 3 years following
3. For 3 years, or for as long as the activity is ongoing
4. For 7 years
5. There is no requirement for the number of years records must be maintained

**95.** Atrophic rhinitis is a multifactorial disease in pigs which can be caused by all of the following toxigenic bacterial strains EXCEPT?

1. *Bordetella bronchiseptica*
2. *Hemophilus parasuis*
3. *Pasteurella multocida*
4. *Streptococcus suis*

**96.** How often does Public Health Service Policy on Humane Care and Use of Laboratory Animals require an IACUC to conduct a complete review of ongoing activities?

1. At least once every 3 years
2. At least once every year
3. At least once every 5 years
4. At least once every 6 months

**97.** Cynomolgus macaques **DO NOT** have which of the following antigens?

 a. Anti-A and Anti-B agglutinin in their sera

 b. AB cell surface antigens on the surface of erythrocytes

 c. ABO antigens in the epithelium of the gastrointestinal tract

 d. ABO antigens in the saliva

**98.** Which of the following best describes appropriate housing conditions for a research colony of *Heterocephalus glaber*?

1. Climbing enrichment should be provided
2. Animals should be singly housed due to their solitary lifestyle in the wild
3. Water should be provided through a continual supply of vegetables
4. Compared to mice relatively cool temperatures and low humidity are recommended

e. A low fat diet should be provided to minimize adenocarcinoma risk

**99.** OSHA recently standardized the content and formatting of the Material Safety Data Sheets. What is the title of the new revised replacement document?

a. Material Safety Information Sheet

b. Material Information Form

c. Chemical Substance Information Sheet

d. Safety Data Sheet

e. Substance Data Form

**100.** Which of the following **IS NOT** recommended as a flooring substrate for swine?

a. Fiberglass slatted flooring

b. Plastic coated metal grids

c. Rubber mats

d. Seamless epoxy

e. Straw bedding

**101.** What is the mode of transmission of Theiler’s mouse encephalitis virus and where does the virus replicate after infection?

1. Horizontal transmission through mouse-to-mouse contact; brain
2. Oronasal transmission; lungs
3. Fecal-oral transmission; gastrointestinal tract
4. Vector-borne transmission; spleen
5. Vertical transmission via an infected dam; brain

**102.** All of thefollowing statement are applicable to the dried blood spot technique in mice **EXCEPT**?

a. It is used as an alternative to serum for serology

b. Requires approximately 100 to 200 μL blood

c. It enhances the ability to identify and streamline better drug candidates during drug discovery.

d. It is consistent with 3Rs principles by achieving reductions in the number of animals used

**103.** What minimal contact time is considered adequate for sanitation using mechanical washers and water at a temperature of 61.7oC (143oF)?

a. 15 seconds

b. 30 seconds

c. 5 minutes

d. 15 minutes

e. 30 minutes

**104.** Which of the following pathogens in zebrafish would be analogous to *Encephalitozoon cuniculi* in rabbits?

1. *Mycobacterium marinum*
2. *Myxidium spp.*
3. *Pseudocapillaria tomentosa*

 d. *Pseudoloma neurophila*

**105.** Which of the following is the most appropriate combination of floor space and environmental temperature to house Japanese quail?

1. 1 ft2/animal; 29°C
2. 0.75 ft2/animal; 27°C
3. 0.5 ft2/animal; 20°C
4. 0.25 ft2/animal; 23°C

**106.** Both injectable and transdermal preparations of which of the following sustained-released drugs have been associated with self-limiting skin reactions?

1. Bupivacaine
2. Buprenorphine
3. Carprofen
4. Fentanyl
5. Lidocaine

**107.** Up to how many mice are required to map a single gene with recessive inheritance and full penetrance, and have adequate numbers of progeny for developmental studies, phenotyping and linkage analysis?

a. 80-100

b. 750

c. 1100

d. 1200

**108.** How does housing density affect the frequency and intensity of territorial behaviors in zebrafish?

1. No correlation
2. Directly proportional (aggression increases as density increases)
3. Directly proportional, but only in female zebrafish
4. They are inversely proportional (aggression decreases as density increases)

**109.** Allof the following are requirements of the Animal Welfare Act for transportation and handling of warm-blooded animals other than dogs, cats, rabbits, hamsters, guinea pigs, nonhuman primates, and marine mammals **EXCEPT**?

1. Cages must have either wire floors or adequate bedding to keep the animals clean from waste
2. Animals must be offered water at least every 12 hours and food at least every 24 hours during transport
3. Animals must be observed at least every 6 hours during surface transportation
4. Temperature should not be allowed to be colder than 45**°**F or to exceed 75**°**F

**110.** Which of the following laboratory animal species is the reservoir for the Powassan virus, a flavivirus which can cause a fatal encephalitis in humans?

1. *Cynomys ludovicianus*
2. *Marmota monax*
3. *Mus musculus*
4. *Rattus norvegicus*
5. *Sigmodon hispidus*
6. Which of the following in rabbits is a model of colibacillosis?
	1. Ileal loop ligation
	2. Injection of either *E. coli* organisms or LPS into the marginal ear vein
	3. Removable intestinal tie-adult rabbit diarrhea
	4. Thiry fistula
	5. Thiry-Vella loop fistula

**112.** Which of the following water quality parameters would pose the greatest health risk to a zebrafish colony?

1. pH of 7.5
2. Nitrite level of 4 mg/L
3. Temperature of 80°F (27°C)
4. Nitrate level of 110 mg/dl

**113.** All of the following are responsibilities of the Quality Assurance Unit under GLP Regulations **EXCEPT**?

a. Maintain a copy of the master schedule sheet of all nonclinical laboratory studies conducted at the testing facility

b. Maintain copies of all protocols pertaining to all nonclinical laboratory studies for which the unit is responsible

c. Periodically submit to management and the study director written status reports on each study

d. Maintain a current summary of training and experience and job description for each individual engaged in or supervising the conduct of a nonclinical laboratory study

**114.** Which of the following is an enveloped DNA virus that has been detected in nonhuman primates?

1. Poliovirus
2. Simian Retrovirus type 1
3. Measles virus
4. Cytomegalovirus
5. Dengue virus

**115.** Which of the following drugs may be ineffective in rabbits?

1. Atropine
2. Dexmedetomidine
3. Diazepam
4. Glycopyrrolate
5. Pentobarbital
6. Which of the following animals is least likely to develop clinical hypercholesterolemia over time?
7. Beagle dog
8. Brattleboro rat
9. Kurosowa and Kusanagi rabbit
10. Rapacz FH swine
11. WHHL rabbit

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

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

**118.** According to the Guide for the Care and Use of Laboratory Animals and the Animal Welfare Act and its Recommendations, all of the following are regulatory requirements for cats **EXCEPT**?

* 1. Cats up to and including 4 kg must be provided with at least 3.0 ft²
	2. Cats over 4 kg must be provided with at least 4.0 ft²
	3. Vertical space with perches is required and may require additional cage height
	4. Primary enclosures housing cats must be at least 24 inches high

**119.** Which of the following organizations has a mission “to educate people about the essential role humans and responsible animal research plays in the quest for medical advancements, treatments and cures for both people and animals?”

1. Americans for Medical Progress
2. Foundation for Biomedical Research

c. National Association for Biomedical Research

d. Speaking of Research

**120.** What etiologic agents are most commonly implicated in feline upper respiratory infections?

1. *Chlamydophila felis* and *Mycoplasma felis*
2. Feline calicivirus (FCV) and feline herpesvirus-1 (FHV-1)
3. FCV and *Mycoplasma felis*
4. FHV-1 and *Mycoplasma felis*
5. FCV and *Chlamydophila felis*

**121.** What is the recommended maximal amount of total blood volume that can be safely collected weekly in healthy adult male and female cynomolgus macaques for 4 consecutive weeks with minimal effect on animal wellbeing?

* 1. 7.5 %
	2. 10%
	3. 12.5%
	4. 15%
	5. 17.5%

**122.** Which of the following species is used as a model for the evaluation of human oral cancer development because of its “immunologically privileged” cheek pouches?

1. *Cavia porcellus*
2. *Heterocephalus glaber*
3. *Marmota monax*
4. *Meriones unguiculatus*
5. *Mesocricetus auratus*

**123.** According to the Animal Welfare Act and its regulations, what five considerations must be a part of an environment enhancement plan for a nonhuman primate?

1. Restraint devices, exemptions, social grouping, special considerations, and environmental enrichment
2. Behavior management, social grouping, food enrichment, psychological well-being, and health management
3. Behavior management, restraint devices, exemptions, social grouping, and special considerations
4. Exemptions, behavior management, social grouping, environmental enrichment, and special considerations

**124.** Which of the following mouse strains has a lymphoproliferation mutation and is used as an animal model for rheumatoid arthritis and system lupus erythematosus?

* 1. BALB/c
	2. C57BL/6
	3. FVB
	4. MRL/MpJ
	5. SJL/J

**125.** According to the AVMA Guidelines for the Euthanasia of Animals: 2013 Edition, all of the following statements describe euthanasia methods in zebra finches and other avian species **EXCEPT**?

a. Intracoelomic barbiturates and their congeners are acceptable

b. Inhaled anesthetics and carbon dioxide asphyxiation are acceptable

c. Unwanted embryos that have undergone over 50% of incubation can be euthanized by decapitation

d. Thoracic compression used solely is an unacceptable method

**126.** The B6.129P2-*Apoetm1Unc*/J mouse is which of the following?

1. A congenic strain, where the locus of interest (*Apoetm1Unc*) of the 129P2 donor strain has been backcrossed to recipient strain C57BL/6J at least 5 times.
2. A congenic strain, where the locus of interest (*Apoetm1Unc*) of the 129P2 donor strain has been backcrossed to recipient strain C57BL/6J less than 5 times.
3. A congenic strain, where the locus of interest (*Apoetm1Unc*) of the C57BL/6J donor strain has been backcrossed to recipient strain 129P2 at least 5 times.
4. A congenic strain, where the locus of interest (*Apoetm1Unc*) of the C57BL/6J donor strain has been backcrossed to recipient strain 129P2 less than 5 times.

**127.** Which of the following statements best describes allergies to laboratory animals as an important occupational disease?

a. Reducing allergens is the primary method for reducing the incidence and relieving symptoms of animal allergies; the type of rodent caging used has no impact on mouse allergens

b. Reducing allergens is the primary method for reducing the incidence and relieving symptoms of animal allergies; allergens can be removed by switching from open cages to filter-top cages and further reduced with IVC systems

c. Increasing allergens is the primary method for reducing the incidence and relieving symptoms of animal allergies; allergens can be increased by switching from open cages to filter-top cages and further reduced with IVC systems

d. Reducing allergens is the primary method for reducing the incidence and relieving symptoms of animal allergies; allergens can be removed by switching from IVC systems to filter-top cages

**128.** Work with which of the following requires Animal Biosafety Level 3 containment?

1. Animal models of swine influenza
2. Bats infected with Hendra virus
3. Dogs known to be infected with rabies
4. LCMV-infected hamsters

**129.** What are the main concerns in terms of viral disease transmission between species when mixing African nonhuman primate species with Asian or new world nonhuman primate species?

1. Dengue Fever and Tanapox
2. SIV and SHFV
3. SRV/D and Hepatitis A
4. Yellow Fever and Monkey Pox

**130.** Gamma-irradiated diets for gnotobiotic mouse colonies are subjected to what irradiation dose to reduce the number of total viable count to 1 organism per 10*25* g.

a. 10 kGy

b. 20 kGy

c. 25 kGy

d. 40 kGy

**131.** Which of the following types of enrichment is the least effective in macaques?

1. Forage boards
2. Olfactory stimulation
3. Play cages
4. Tactile enrichment

**132.** Which of the following statements applies to the Health Research Extension Act of 1985?

1. Governs the use of all animals (invertebrate and vertebrate) in research, research training, or testing that is funded by the Public Health Service
2. Governs the use of all vertebrate animals in research, research training, or testing that is funded by the Public Health Service
3. Governs the use of all animals (invertebrate and vertebrate) in research, research training, or testing regardless of funding source
4. Governs the use of all vertebrate animals in research, research training, or testing regardless of funding source

**133.** Which of the following mouse strains is hepatitis-resistant when infected with *Helicobacter hepaticus*?

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

e. SJL/NCr

**134.** Which of the following is considered a minimum necessary standard for extra-label drug use?

1. Valid veterinary, client, patient relationship
2. Only FDA-approved drugs for the species in question may be utilized
3. Any extra-label drug usage is permissible as long as it is prescribed by a licensed veterinarian
4. The route and dose of the drug must be consistent with the product label

**135.** When designing housing for *poikilothermic* animals, which of the following considerations is of **LEAST** concern for animal health?

1. Ambient lighting conditions
2. Conditioned fresh air
3. Habitat water temperature / quality
4. Humidity
5. Noise and vibration

**136.** Xenopus laevis adults may be housed at how many liters of water per frog?

1. 0.5
2. 1
3. 2
4. 3
5. 5

**137.** When giving gentamicin as a post-operative antibiotic in mice, why is it recommended to wait until the animal fully recovers from anesthesia?

1. Calcium blocking action of gentamicin could cause hypotension and prolonged anesthesia
2. Gentamicin is only effective in fully awake mice
3. Gentamicin can potentially induce hypothermia in anesthetized mice
4. Gentamicin is less nephrotoxic in awake mice

**138.** Which of the following laboratory animal organizations has representation within the AVMA’s House of Delegates?

1. AAALAC
2. AALAS
3. ACLAM
4. ASLAP
5. FBR

**139.** Which of the following malarial parasites is indigenous to new world monkeys?

a. *P. knowlesi*

b. *P. pitheci*

c. *P. reichenowi*

d. *P. schwetzi*

e. *P. simium*

**140.** According to the AVMA Guidelines for the Euthanasia of Animals: 2013 Edition,, if euthanizing zebrafish by rapid chilling, adult zebrafish must be exposed to 2-4° C ice-chilled water for at least \_\_\_ minutes, and fry 4 to 7 days post-fertilization must be exposed for at least \_\_\_ minutes.

1. 5; 7
2. 5; 10
3. 7; 5
4. 10; 20
5. Which of the following drugs has been associated with dose-dependent pulmonary edema and hypoxemia in sheep?
6. Acepromazine
7. Midazolam
8. Morphine
9. Telazol
10. Xylazine

**142.** An investigator is proposing a project that involves experimental infections of *Coxiella burnetii* in sheep. All of the following are recommendations you would make based on current accepted safety practices **EXCEPT**?

1. BSL-3 facilities are required for handling of infected tissues
2. Animals that die as part of the experimental design may be necropsied in BSL-2 facilities
3. Animals should be housed in BSL-3 facilities for the project
4. Respiratory PPE is necessary due to the low inhaled infective dose of this agent
5. The lab should register with the CDC prior to experimental protocols, as *C. burnetii* is a select agent

**143.** According to the Animal Welfare Act and its regulation, which of the following statements best describe the requirement for transporting a rabbit by surface vehicle?

1. Rabbits being transported more than 6 hours should have access to food and water and they are required to be observed no less than once every 4 hours
2. Rabbits being transported more than 8 hours should have access to food and water and they are required to be visually observed no less than once every 4 hours
3. Rabbits being transported more than 6 hours should have access to food and water and they are required to be observed no less than once every 8 hours
4. Rabbits being transported more than 8 hours should have access to food and water and they are required to be observed no less than once every 6 hours

**144.** All of the following statements describe pancreatic islet cell tumors in ferrets **EXCEPT**?

* 1. If the patient is stable, surgical debulking is the treatment of choice
	2. Clinical signs are intermittent and may include ptyalism
	3. Metastasis rates are high, usually greater than 50%.
	4. Disease is usually later onset, with most cases occurring in 4-5 year old animals

**145.** Which animal model is prone to developing immune complex glomerulonephritis as an autoimmune disease resembling human lupus erythematosus?

1. CX8B/EiJ
2. CX8D/EiJ
3. B6DBF1
4. NZB x NZW F1
5. C57BL/6

**146.** Which of the following species **WILL NOT** eat in low light or darkness, thus requiring a restriction on these time periods due to welfare concerns?

* 1. *Chinchilla lanigera*
	2. *Gallus domesticus*
	3. *Meriones unguiculatus*
	4. *Mesocricetus auratus*
	5. *Taeniopygia guttata*

**147.** An investigator with NIH funding has an IACUC protocol that is about to expire in the next 3 days. He will need his IACUC approved period extended so that he can complete a very important experiment planned in a pig model of cardiac insufficiency that includes a surgeon flying in from out of state 5 days from now. After the procedure, he plans to submit his 3-year renewal. Which of the following statements best describes what action the IACUC can take in this situation?

1. The IACUC is able to administratively extend the approved protocol by only 30 days
2. The IACUC is able to administratively extend the approved protocol by only 14 days
3. The IACUC is able to extend the approved protocol if the attending veterinarian approves
4. The IACUC is able to extend the approved protocol if the attending veterinarian and IACUC chair approve
5. The IACUC does not have the authority to administratively extend the approved protocol period beyond 3 years

**148.** All of the following has been shown to be advantageous to have in quail habitats **EXCEPT**?

1. Elevated perches
2. Material such as sand or cat litter for dust baths
3. Nest boxes
4. Solid flooring with seed scattered in bedding

**149.** Which of the following statements best describes the physiological and behavioral changes caused by the immobility response of rabbits?

1. Analgesia, increased depth of respiration, miosis, reduced respiratory rate, reduced heart rate, reduced blood pressure
2. Analgesia, increased depth of respiration, mydriasis, reduced respiratory rate, reduced heart rate, reduced blood pressure
3. Anesthesia, increased depth of respiration, mydriasis, reduced respiratory rate, reduced heart rate, reduced blood pressure
4. Increased depth of respiration, mydriasis, reduced respiratory rate, reduced heart rate, reduced blood pressure
5. Decreased depth of respiration, miosis, reduced respiratory rate, reduced heart rate, reduced blood pressure

**150.** A strain of transgenic mice was originally created in FVB stem cells and then back crossing was performed for 10 generations to get the Myh6-cre transgene onto a C57B/6 background. Which of the following names best describes this mouse strain?

1. FVB.B6-Tg(Myh6-cre)
2. B6.FVB-Tg(Myh6-cre)
3. B6:FVB-Tg(Myh6-cre)
4. FVB:B6-Tg(Myh6-cre)

**151.** Which of the following is the most important physical enrichment for laying hens?

1. Overhead cover
2. Nestbox
3. Foraging materials
4. Hanging strings
5. Dustbaths

**152.** Which of the following rat urine proteins is responsible for the allergic reactions of many research and animal care personnel?

1. Alpha 2u-globulin, Rat n 1
2. Alpha 2u-globulin, Rat m 1
3. P53 protein, Rat r 1
4. P53 protein, Rat m 3
5. P53 protein, Rat n 1

**153.** All of the following strains of mice are susceptible to Helicobacter-associated gastrointestinal disease and may develop chronic enterohepatic disease **EXCEPT**?

a. A/JCr

b. B6C3F1

c. BALB/cAnNCr

d. C3H/HeNCr

e. SJL/NCr

**154.** Colony managers must consider which of the following when determining how to decontaminate diets fed to SPF or gnotobiotic rodents?

1. Autoclavable diets must be fortified as autoclaving reduces the nutritional value of diets
2. Gamma or UV irradiation are both equally effective in eliminating pathogens from food
3. Pelleted feed is exposed to sufficient heat as part of the pelleting process to eliminate all important rodent pathogens.
4. Gamma irradiation is effective in eliminating pathogens from food via denaturing of proteins found in contaminating microorganisms

**155.** Unless the primary enclosure used to transport dogs is permanently affixed to the conveyance, the total combined surface area of the ventilation openings must be at least what percent of the total combined surface area of all the walls of the primary enclosure?

* 1. 8
	2. 14
	3. 16
	4. 50

**156.** According to NIH Guidelines for Research Involving Recombinant DNA Molecules, membership of the Institutional Biosafety Committee must include a minimum of:

a. 3 individuals, with no requirement for unaffiliated members

b. 3 individuals, including 1 unaffiliated community member

c. 5 individuals, with no requirement for unaffiliated members

d. 5 individuals, including 1 unaffiliated community member

e. 5 individuals, including 2 unaffiliated community members

**157.** Which of the following best describes simian hemorrhagic fever in nonhuman primates?

1. Highly contagious, fatal viral disease of macaques caused by a flavivirus
2. Causes fatal hemorrhagic fever in a number of African primates, principally the Patas monkey
3. Causes hemorrhage and necrosis of the proximal duodenum in macaques
4. Lesions differ from those seen in Ebola due to the involvement of the spleen and kidney

**158.** Which of the following agents **IS NOT** suitable as a sole anesthetic agent for surgical procedures in zebrafish (*Danio rerio*)?

1. Eugenol
2. Gradual cooling
3. Isoflurane
4. Metomidate hydrochloride
5. Tricaine methanesulfonate

**159.** An investigator would like to use sustained release buprenorphine (Bup-SR) in his C57BL/6J mice to decrease the number of times they need to be handled post operatively. As the overseeing veterinarian, what recommendations should you provide?

1. Bup-SR has the potential to cause skin lesions
2. Bup-SR provides extended analgesia for 5 days, and this method would be sufficient for his model
3. Using Bup-SR would be considered part of the Three R’s as a reduction due to the reduced stress in the animals from handling
4. Bup-SR has been shown to cause significant respiratory depression; therefore, it should not be used.

**160.** Which of the following must be considered during the design of animal room ventilation systems?

1. Room air change rates of 4 to 6 air changes per hour are recommended in the Guide for the Care and Use of Laboratory Animals
2. Room air change rates vary depending on numerous factors including the heat load of the room
3. Positive pressure differentials as low as 0.02 inches of water column may be associated with difficulties in opening doors.
4. Positive pressure differentials from rooms to corridors are required for spaces housing volatile chemicals or biohazards

**161.** Which of the following statements best describes regulations regarding hazardous substances?

a. The National Institute for Occupational Safety and Health regulates the Occupational Safety and Health Administration

b. The Occupational Safety and Health Administration regulates the protection of workers against illness or injury resulting from unsafe working conditions

c. The United States Department of Agriculture plans, directs and coordinates national programs to develop occupational safety and health standards.

d. The Center for Disease Control and Prevention provides recommendations to the National Institute for Occupational Safety and Health regarding safe work practices

**162.** Which antibiotic has been reported to eradicate *Pasteurella pneumotropica* in mice?

1. Ampicillin
2. Enrofloxacin
3. Tetracycline
4. Tylosin tartarate
5. All of the following statements apply to ulcerative dermatitis (UD) in mice **EXCEPT**?
	1. High-fat, western-style diet may potentiate UD
	2. UD is more prevalent in females
	3. Supplementing a high-fat, western-style diet with mineralized red-algae may ameliorate UD
	4. Increasing dietary fat content decreases incidence of UD
	5. Deficient or excess dietary vitamins A or E might predispose mice to UD

**164.** Which of the following is an example of a recombinant inbred strain?

1. DBA/2J
2. BXD-1/Ty
3. CcS1
4. B6C3F1
5. Hsd:ICR

**165.** All of the following statements applies to the use of autoclaves in animal facilities **EXCEPT**?

1. Autoclaving of food can significantly affect concentrations of essential nutrients such as thiamine, vitamin A, and vitamin K
2. Gravity displacement cycles are preferred for feed and bedding
3. Water sterilization can be effectively monitored using *Geobacillus stearothermophilus* biological indicators
4. Autoclaving is not recommended for polystyrene materials

**166.** According to Good Laboratory Practice for conducting nonclinical laboratory studies, which of the following best describes the *in vivo* and *in vitro* experiments(s) which are part of a nonclinical laboratory study?

1. Utilize human subjects
2. Include field trials conducted in animals
3. Include a basic exploratory study carried out to determine whether a test article has any potential utility
4. Study test articles prospectively in test systems under laboratory conditions to determine safety
5. Determine physical or chemical characteristics of a test article
6. Which of the following best describes a male *Coturnix japonica*?
7. Are slightly larger than females
8. Have black speckling on the chest and are slightly larger than females
9. Has ZW sex chromosomes
10. Secretes a white foamy material from the cloacal gland that prolongs sperm motility

**168.** According to the AVMA Guidelines for the Euthanasia of Animals: 2013 Edition, intraperitoneal injection of ethanol in mice as a primary method of euthanasia is considered which of the following?

a. Acceptable with conditions

b. Acceptable

c. Unacceptable

d. None of the above

**169.** Which of the following would be a mid-diaphyseal tibial critical size defect in aged ewes?

1. 1 cm
2. 2 cm
3. 3 cm
4. 4 cm
5. 5 cm

**170.** Which of the following may give rise to a false-negative reaction to an intradermal tuberculin test in nonhuman primates?

1. Animals exposed to Freund’s Complete Adjuvant
2. Concomitant measles infection or a recent history of measles vaccination
3. Infection with atypical mycobacterium
4. Nonspecific reactivity to the vehicle
5. Trauma due to improper administration of the test

**171.** According tothe Public Health Service Policy on Humane Care and Use of Laboratory Animals, funding from a PHS awarding unit can only be provided once which of the following has occurred?

1. Assurance is approved by USDA for the awardee institution
2. Assurance is approved for the awardee institution and the IACUC has approved for the animal activities
3. Only after IACUC approval for animal activities
4. Institution has obtained AAALAC accreditation
5. Institution has obtained AAALAC accreditation and IACUC approval for animal activities

**172.** Of the following treatment options for ectoparasitism by gyrodactylids in fish, which is most likely to result in resistant organisms when used for an extended period of time?

1. Freshwater baths for marine fish
2. Saltwater baths for freshwater fish
3. Formalin (prolonged immersion)
4. Organophosphates (prolonged immersion)
5. Praziquantel (prolonged immersion or PO)

**173.** Which of the following is the most frequently used song bird in the laboratory?

 a. *Columba livia domestica*

 b. *Gallus gallus domestica*

c. *Serinus canaries*

 d. *Sturnus vulgaris*

 e. *Taenopygia guttata*

**174.** When breeding mice, using what in combination with plug checks can reduce the false positive rate for pregnancy detection significantly versus relying on plug checks alone?

 a. Body temperature

 b. Body weight

 c. Cortisol levels

 d. Corticosterone levels

 e. Progesterone levels

**175.** According to the most recent edition of the Guide for the Care and Use of Laboratory Animals, which of the following applies to physical restraint?

* 1. Restraint devices should be used simply as a convenience in handling or managing animals
	2. Animals that fail to adapt to necessary restraint systems should be removed from the study
	3. Alternatives to physical restraint do not need to be considered
	4. Provision should be made for observation of the animal at appropriate intervals, as determined by the PI

**176.** Which of the following is the typical presentation of *Streptococcus azizii* infection in mice?

1. Morbidity and mortality among neonatal mice P1-3
2. Morbidity and mortality among weanlings
3. Subclinical infection in immunocompetent mice of all ages
4. General ill thrift in adult mice

**177.** Bispectral index scores of what value indicate a surgical plane of anesthesia?

1. 15-20
2. 20-25
3. 25-35
4. 30-40
5. 40-60

**178.** All of the following statements describeswine models of hematopoietic cell transplantation (HCT) **EXCEPT**?

* 1. Control for acute GVHD is important within the first 100 days after bone marrow suppression and HCT
	2. The potential of adverse reactions from cytokine-mediated donor cell mobilization has no bearing on the post-transplantation outcomes in the recipient
	3. Animals undergoing myeloablative doses of radiation as a conditioning regiment prior to HCT have a higher risk of GVHD
	4. A scoring system for GVHD in swine involves the presence or absence of skin rashes, gastrointestinal signs and elevated liver enzymes

**179.** Which of the following types of valves, when placed within an automatic watering system for rodents, provides a means of computer controlled, higher-pressure water flushing to reduce microbial biofilm production?

1. Flutter
2. Lixit
3. Schrader
4. Solenoid
5. Venturi

**180.** A DEA Form 222 is used to order which schedules of controlled substances?

1. I
2. II
3. III through V
4. I and II

**181.** Which of the following species produces abundant cervical mucus that is visible on ultrasound?

1. *Macaca arctoides*
2. *Macaca fascicularis*
3. *Macaca mulatta*
4. *Macaca nemestrina*
5. *Macaca radiata*

**182.** Which of the following terms best describes injection of glioma cells of human origin intracranially in a nude mouse?

1. Allograft
2. Autograft
3. Heterotopic
4. Orthotopic

**183.**  According to the Guide for the Care and Use of Laboratory Animals, all of the following are components of the contingency plan that should/must be addressed **EXCEPT**?

a. Criminal activities (trespassing, arson, vandalism)

b. Preservation of animals

c. Communication of disaster to appropriate regulatory agencies

d. Training of personnel in advance of a catastrophe

e. Actions necessary to prevent animal pain, distress, and deaths due to loss of systems

**184.** According to the Guide for the Care and Use of Laboratory Animals and the Animal Welfare Act and its Recommendations, what is the minimum cage height for a 4.5 kg cat?

1. 18 inches
2. 20 inches
3. 24 inches
4. 32 inches
5. 40 inches

**185.** Which of the following statements best describes ulcerative dermatitis in mice?

1. An idiopathic disease of C3H/HeJ mice associated with a variety of environmental factors
2. Occurs at a greater incidence in C57BL/6 mice fed a high fat diet
3. Characterized by intense pruritis and lesion formation concentrated on the rear limbs and tail
4. Occurs most common in outbred rats and responds to dietary vitamin E supplementation

**186.** Pica in rats has been reported in association with administration of which drug?

1. Aspirin
2. Buprenorphine
3. Carprofen
4. Gabapentin
5. Lidocaine

**187.** Which of the following statements best describes findings from a recent study evaluating the pharmacokinetics of several formulations of meloxicam in cynomolgus macaques?

a. Sustained released formulations generated the lowest plasma concentrations for the shortest period of time

b. Oral formulation had low circulating levels of the drug

c. Intramuscular formulation, both over 3 d and as a single dose, provided higher plasma levels and a shorter duration than did a sustained-release subcutaneous formulation

d. All of the above are correct

**188. Which of the following statements best describes the development of asthma and related respiratory disease in laboratory animal workers?**

1. **Was reported by NIOSH to be as high as 50% of the workforce**
2. **Is associated with things other than allergens such as airborne endotoxin and dust**
3. **Is only associated with lab animal exposure and not other more traditional risk factors such as smoking, age and atopy**
4. **Has no genetic component**

**189.** Which of the following best describes parasitic infections in rats?

1. *Rodentolepis nana* always has an indirect life cycle
2. *Trichosomoides crassicauda* infestation is diagnosed in live rats by fecal flotation for eggs
3. *Hymenolepis diminuta* always has an indirect life-cycle
4. *Entamoeba muris* is a highly pathogenic amoeba of rats
5. *Syphacia muris* are readily recognized by the four alae present at the anterior end of the body

**190.** Which region of the rhesus macaque genome has been associated with phenotypic protection from simian AIDS following SIV infection?

* 1. ABO region
	2. Major histocompatibility region
	3. MAM-domain containing region
	4. Toll-like receptor region

**191.** According to the AVMA Guidelines for the Euthanasia of Animals: 2013 Edition, cooling or freezing is an appropriate method for euthanasia of bird embryos that have attained what percentage incubation?

1. < 25% incubation
2. < 50% incubation
3. < 75% incubation
4. < 100% incubation

**192.** Which of the following chemicals can be safely used to effectively decontaminate electronic and electrical devices in mouse housing rooms not currently housing animals?

1. Chlorine dioxide
2. Ethanol
3. Quaternary ammonium compounds
4. Phenols
5. Vaporized hydrogen peroxide

**193.** Which of the following statements best describes cat allergens?

1. *Fel d 1-* the major cat allergen –is produced in sebaceous glands, urine and saliva
2. *Fel d 1* is the major cat allergen, produced in sebaceous glands and saliva, and is found in all cats
3. *Fel b 1* is the major cat allergen, produced in sebaceous glands, urine and saliva
4. *Fel b 1* is the major cat allergen, produced in sebaceous glands and saliva, and is found in all cats

**194.** A diagnosis of *Gyrodactylus* infestation has been made in a colony of commercially purchased rainbow trout. In a closed colony, how many treatments with praziquantel would be required to clear the infestation?

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

**195.** Which of the following **IS NOT** anacceptable method for semen collection in the respective laboratory animal species?

1. Artificial vagina in trained bovid, canine, lagomorphs, and feline
2. Rectal probe ejaculation (RPE) in bovid, ovine, canine, equine, non-human primates
3. Electrical stimulation of the penis in bovid, ovine, equine, non-human primates
4. Post coital uterine flush in an anesthetized mouse
5. Collection of rete testis fluid in non-human primates
6. Because of their cheek pouches, hamsters can be a good model to study which of the following?
7. Primary lung tumors
8. Pancreatic adenocarcinoma
9. SV 40 tumor induction
10. Oral carcinogenesis

**197.** All of the following activities are regulated by the United States Department of Agriculture **EXCEPT**?

1. A rhesus macaque that is part of a breeding colony at a large research institution
2. A euthanized dog used in an anatomy lab
3. A horse on a study investigating MRI as an equine diagnostic modality to improve racing performance
4. Wild-caught ducks used as part of a waterfowl handling lab for a biology class

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**198.** Which statement best describes the effects of murine norovirus in Ldlr-/- mice?

1. Tropism of MNV for macrophages results in deceased atherosclerotic lesion size in Ldlr-/- mice
2. Tropism of MNV for macrophages results in increased atherosclerotic lesion size in Ldlr-/- mice
3. MNV infection does not change the disease phenotype of Ldlr-/- mice
4. MNV infection causes significant mortality via respiratory infection in Ldlr-/- mice
5. MNV infection causes significant mortality via immunosuppression in Ldlr-/- mice

**199.** Which of the following statements best describes irradiation of mice for bone marrow ablation?

1. X-ray irradiators utilize radioisotopes such as Cs-137
2. A lower dose of radiation should be used for X-ray irradiation
3. A lower dose of radiation should be used for gamma-ray irradiation
4. Two common types of irradiators are cesium-irradiators and gamma-ray irradiators
5. BALB/c mice are highly resistant to irradiation

**200.** Which of the following types of wood bedding can emit aromatic hydrocarbons that induce hepatic microsomal enzymes and cytotoxicity and have been reported to increase the incidence of cancer in rodents?

1. Aspen
2. Birch
3. Cedar
4. Maple

**201.** According to the Guide for the Care and Use of Laboratory Animals and the Animal Welfare Act and its regulations, nonhuman primate food receptacles must be sanitized at least how often?

1. Once daily
2. Once a week
3. Once every 2 weeks
4. Once a month

**202.** A young female rabbit presented with torticollis, paresis, uveitis and kidney failure from a breeding colony. Which of the following statements **DOES NOT** apply to the disease most consistent with these clinical signs?

1. Transmission is primarily via ingestion and transplacental
2. Caesarean hysterectomy rederivation can be used to eliminate the pathogen from a rabbit colony
3. Can infect immunocompromised human patients
4. Histologic diagnosis is possible through examination of brain and kidney samples stained with Giemsa stain

**203.** Rapid freezing may be used as a method of euthanasia for amphibians such as Xenopus if they weigh less than \_\_\_\_\_\_\_\_\_\_?

a. 4 g

b. 5 g

c. 6 g

d. 7 g

e. 8 g

**204.** Which of the following statements applies to both natural ingredient and purified diets?

1. Although nutrient ingredients are fixed bioavailability may be altered due to oxidation and nutrient interactions
2. Bioavailability of nutrients is limited in both diets due to the presence of tannins, lignins and phytates
3. Both are inexpensive to manufacture
4. Potential for contamination with pesticides is higher in natural ingredient diets compared to purified diets
5. Purified diets are prepared using elemental compounds

**205.** According to the 8th Edition of the Guide for the Care and Use of Laboratory Animals, techniques for non-survival surgery should include, at a minimum, which of the following?

a. Surgical site should be clipped and prepped with disinfectant; the surgeon should wear a cap, mask, disposable gown or clean lab coat and sterile gloves; surgery should be performed in a sterile field with sterile instruments

b. Surgical site should be clipped and prepped with disinfectant; the surgeon should wear a cap, mask and gloves; surgery should be performed in a clean area with sterile instruments

c. Surgical site should be clipped; the surgeon should wear gloves; surgery should be performed in a clean area with sterile instruments

d. Surgical site should be clipped; the surgeon should wear gloves; surgery should be performed in a clean area with clean instruments

e. Surgical site should be clipped; the surgeon’s hands should be washed and disinfected; surgery should be performed with clean instruments

**206.** Which of the following naturally occurring conditions is an important cause of morbidity and mortality in owl monkeys?

1. Cardiomyopathy
2. Metabolic syndrome
3. Neoplasia
4. *Plasmodium* spp.
5. Renal disease

**207.** Which of the following euthanasia methods can cause acidosis and decrease the cerebral concentrations of sodium and potassium in zebrafish?

1. Carbon dioxide inhalation
2. Ethyl 3-aminobenzoate methanesulfonic acid
3. Eugenol or clove oil
4. Quinaldine
5. Thermal shock (cooling the water)

**208.** In collagen-induced arthritis rat models, susceptibility to disease, similar to that found in humans, is associated with which of the following factors?

1. Coat color patterns
2. Major histocompatibility complex class II subtypes
3. Neutrophilic infiltration
4. Tolerance to peripheral nervous system antigens

**209. Which of the following lists the hierarchy of controls from the most effective to the least effective in controlling biological hazards?**

1. **Elimination of hazard, substitution, engineering controls, administrative controls, PPE**
2. **Elimination of the hazard, PPE, engineering controls, administrative controls, substitution**
3. **Elimination of the hazard, substitution, PPE, engineering controls, administrative controls.**
4. **Elimination of the hazard, engineering controls, PPE, administrative controls, substitution**

**210.** Which of the following studies would be performed using Good Laboratory Practices for Nonclinical Laboratory Studies?

1. Bench tests, such as chemical or physical testing
2. Studies utilizing human subjects, human specimens, clinical studies
3. Field trials in animals (e.g., wildlife studies)
4. *In vivo* or *in vitro* experiment in which a test article is studied prospectively in a test system under laboratory conditions to determine its safety

**211.** Which of the following swine breeds are susceptible to malignant hyperthermia?

1. Berkshire and Ossabaw
2. Landrace and Pietrain
3. Hanford and Yucatan
4. Sinclair and Göttingen

**212.** Due to alterations in circadian rhythm, 24 hour light in a rodent room can alter physiologic function resulting in \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

1. Stimulation of plasma lactic acid concentration
2. Suppression of corticosterone levels
3. Stimulation of melatonin production
4. Suppression of plasma glucose levels
5. Stimulation of proliferation of tumor xenografts

**213.** Which of the following entities is in charge of the international registry of laboratory registration codes on behalf of the International Committee on Standardized Genetic Nomenclature for Mice?

1. AALAS
2. APA
3. ASLAP

d. ILAR

e. NABR

**214.** Which of the following **IS NOT** a characteristic of myoepitheliomas in mice?

1. Common in BALB/c and BALB/cBy mice
2. Arises exclusively from liver
3. Microscopically, tumors are composed of large, pleomorphic spindle cells with epithelial and mesenchymal features
4. Rare metastasis to lung and bone marrow

**215.** According to the AVMA Guidelines for the Euthanasia of Animals: 2013 Edition, manual cervical dislocation is acceptable with conditions for euthanasia of rats weighing how much when performed by individuals with a demonstrated degree of technical proficiency?

1. < 200 g
2. < 200 g
3. < 250 g
4. < 250 g
5. < 300 g
6. When must antibody testing be done for any Old World primate that exhibit signs consistent with a filovirus infection during quarantine?
7. As soon as clinical signs appear
8. As soon as clinical signs resolve
9. At the end of the quarantine period
10. Two weeks after the animal is released into the colony

**217.** *Corynebactium bovis* is associated with all of the following **EXCEPT**?

1. Aerosolization within a class II biosafety hood spreads bacterium during cage-change procedures
2. Being carried in the nasal pharynx of humans
3. Mild non-suppurative inflammation
4. Successful treatment with topical antibiotics

**218.** Inoculation of mice with mouse parvovirus produces the least serological response in which of the following strains?

a. C3H

b. C57BL/6

c. BALB/c

d. DBA/2

1. Which of the following best describes the primary purpose of barrier facilities?
2. Prevent transmission of pathogenic agents from animals contained within the barrier to other animals in a facility
3. Exclude the introduction of infectious agents to animals with a defined health status
4. Exclude intrusion of specific personnel from working with rodents
5. Isolate zoonotic agents within a barrier from research personnel
6. Prevent the escape of barrier animals from a facility

**220.** What is the short-term exposure limit for carbon dioxide for employees exposed in a 15-min time interval?

a. 500 ppm

b. 5,000 ppm

c. 30,000 ppm

d. 40,000 ppm

**221.** Which of the following clinical pathology analytes has been found to be significantly lower in aged versus young adult Xenopus laevis?

1. Amylase
2. BUN
3. Calcium
4. PCV
5. Total Protein

**222.** To minimize potential adverse effects such as renal toxicity and gastric hemorrhage in cattle, \_\_\_\_\_\_\_\_\_\_ should be given as needed every 12-24 hours not to exceed 4 doses?

a. Carprofen

b. Flunixin meglumine

c. Ketoprofen

d. Meloxicam

e. Phenylbutazone

**223.** According to The Guide for the Care and Use of Laboratory Animals, enrichment for aquatic species should be evaluated for which of the following?

a. Bioload

b. Cost

c. Pathogens

d. Taste

e. Utility

**224.** What is the optimum concentration (in ppm) of chlorine needed to be added in drinking water provided water bottles changed weekly to eliminate *Pseudomonas aeruginosa* and reduce carriage of the organism in infected mice?

a. 0.5 - 1

b. 2.5 - 3

c. 6 - 8

d. 12 - 18

e. 20 – 25

**225.** Which of the following etiological agents found in nonhuman primates requires a rodent vector, has been reported in *Macaca mulatta, Callithrix jacchus,* and *Saimiri sciureus* among others, and is known to interfere with cardiac studies?

1. *Babesia pitheci*
2. Encephalomyocarditis virus
3. Monkeypox virus
4. *Strongyloides fulleborni*
5. *Trypanosoma cruzi*

**226.** According to the Animal Welfare Act and its regulations, a licensed veterinarian must inspect a nonhuman primate on a specified date not more than how many days prior to the delivery of the nonhuman primate for transportation?

1. 3
2. 7
3. 10
4. 15
5. 31

**227.** What is the definition of sanitation?

1. Use an appropriate disinfectant for cleaning of the equipment and environment
2. Maintenance of environmental conditions conducive to the health and well-being of the animal, which involves bedding changes, cleaning, and disinfection
3. Process of inactivating harmful pathogens using various agents, such as chemicals, heat, ultraviolet light, or radiation
4. Procedures intended to protect humans or animals against disease or harmful biological agents
5. Which of the following agents is considered a noncore vaccine in cats?
6. Calicivirus
7. *Chlamydophila*
8. Herpesvirus
9. Parvovirus
10. Rabies

**229.** Pesticides should only be used in animal areas following approval by or consultation with the \_\_\_\_\_?

1. Attending Veterinarian
2. IACUC
3. Institutional Official
4. Investigator
5. Safety Officer

**230.** Which of the following **WOULD NOT** lead to gas supersaturation of tank/system water and consequent gas bubble disease in zebrafish?

1. Pumping water from deep wells for use in recirculating systems
2. A leaky pipe supplying water for use in recirculating systems
3. Rapidly cooling hot water and then utilizing in recirculating systems
4. Injection of air from filters upon water changes in recirculating systems

END OF EXAM