NAME___________________________

FINAL EXAM

Total points = 150

Matching (30 points)

Choose the chemical that best fits the description. (1 point each)

A. Quaternary ammonia   F. Bleach
B. Phenolic compounds   G. Chlorhexidine
C. Alcohol     H. Peroxygen compounds
D. Iodine compounds   I. Aldehydes
E. Boric Acid    J. Pyrethrum spray

_____1. This chemical is not a sterilant, but is a useful disinfectant for skin and gloves. It evaporates quickly and doesn't need to be rinsed off.

_____2. This is a desiccant used to kill roaches and other pests.

_____3. This chemical is a cheap and effective disinfectant, but often misused. It is easily inactivated by organic matter so surfaces must be washed before using it. It is also inactivated by heat and UV light and must be replaced with fresh chemical frequently.

_____4. This chemical is often used in a 3% solution called DSN on moist lesions to prevent infection.

_____5. This is the most common disinfectant for animal room surfaces (floors, etc.) because it has an excellent cleaning ability and allows the technician to clean and disinfect in one step.

Identify the biosecurity and biosafety levels. (1 point each)

A. Gnotobiotic       C. Axenic       E. SPF
B. Conventional       D. VAF          F. ABSL3

_____6. Free of a defined list of pathogenic microorganisms.

_____7. Having only symbiotic or beneficial microorganisms

_____8. Having no microorganisms.

_____9. Having specifically no viruses.

_____10. Having a microorganism that is lethal to humans.

12/4/2015
Match the following acronyms with their description

A. AAALAC    C. ALAT    E. HRE    G. IIPP    I. LATg
B. AALAS    D. AWA    F. IACUC    H. ILAR    J. SOP

____11. The organization that writes the “Guide;” the rules, regulations, and suggestions for caring for lab animals.

____12. The organization within an institution charged with overseeing animal care, including the oversight of all programs and facilities.

____13. The organization external to an institution charged with assessing animal programs and granting accreditation.

____14. A document that discusses the safety program in an institution, covering issues such as allergies, PPE, and hazardous waste disposal

____15. The organization you should belong to if you plan to make lab animal management a career.

Choose the correct definition of the following causes of a pathogenic state

A. Husbandry related    C. Opportunistic    E. Inherited
B. Contagious    D. Congenital    F. Metabolic

____16. A disease caused by a virus passed from one animal to another by contact with feces.

____17. A pathology caused by low humidity.

____18. A disease caused by a bacteria that isn’t harmful unless other conditions allow proliferation.


Bonus Question to try when you are done with the rest of the test (5 points extra credit). Place one letter in each box. The numbers below the boxes refer to the answers on the Matching Questions. Find the appropriately numbered question in the test and fill in the box with the letter that you answered. Fill in the boxes over the question marks to complete the phrase that answers the clue. I will give partial credit.

Clue: What do you call a line of rabbits walking backwards?

<table>
<thead>
<tr>
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</table>
From the clinical signs described below, choose the disease or condition described. Each may be used more than once. (1 points each)

A. Clostridium ssp.      H. Barbering      O. Ringtail
B. Ectoparasites          I. Broken back    P. Scurvy
C. Mammary tumor          J. Dermatitis     Q. SDAV
D. Mycoplasma pulmonis    K. Hair balls    R. Sore hocks
E. Pasteurella multocida  L. Malocclusion   S. Wet tail
F. Pasteurella pneumotropica  M. MHV
G. Pregnancy toxemia      N. MOBS

21. This pathology is malignant in mice and benign in rats.
22. You open the cage top and wonder who replaced your mice with raccoons. On closer examination you realize that all but one mouse in the cage has fur missing from around the eyes.
23. Your newly weaned hamsters have diarrhea. Your vet tells you it may be proliferative ileitis. What is the layman’s term for this disease?
24. A power outage caused your HVAC system to fail and now your rats are sneezing. What is the most probably disease agent?
25. Also called snuffles, this can be a serious disease in a rabbit colony.
26. When your guinea pig looks sick, you check the milling date on the guinea pig chow. What is your concern?
27. Your vet tells you that your rabbit has trichobezoars. What on earth does he mean?
28. You find several litters of baby mice with a peculiar dome-shaped head. You are not overly concerned until the necropsies show multifocal necrosis. What might they have?
29. A new technician is allowing rabbits to jump from her arms into the cage. You kindly but firmly explain that this can lead to . . . what?
30. It has been a tough winter for you as a facility manager. The weather is cold and dry and your air handlers are not keeping up with the low temperature and low humidity. On top of that, someone must be putting rubber bands on the rat’s tails. You haven’t caught them yet, but when you do . . .!
Multiple choice (80 points)

Please circle each correct answer; there may be more than one correct answer for each question. (5 points each)

31. The following are characteristics of Meriones unguiculatus
   a) This species prefers a monogamous pairing in the lab and requires a nest box for appropriate maternal instinct.
   b) The females are the aggressor and may kill the male when they are not in estrus.
   c) They drink little water and produce only a few drops of urine per day.
   d) They are strict herbivores, eating primarily grasses and hay.
   e) The females are induced ovulators.

32. An investigator is discussing the possibility of using ketamine as a rat anesthesia in a new surgical protocol. He asks for your advice. What should you tell him?
   a) It is important to combine ketamine with a muscle relaxant like xylazine for balanced anesthesia.
   b) Surgical plane can be monitored by looking for the loss of both the pedal withdrawal reflex and the eye blink reflex.
   c) Surgical plan can be monitored by looking for the loss of both the pedal withdrawal reflex and jaw tone.
   d) Rats should be fasted prior to anesthesia to prevent regurgitation and choking.
   e) Common side effects of ketamine are dehydration and hypothermia.

33. You are writing an SOP for your new cabinet washer. Which lines should you include?
   a) Cages should be placed in the washer right-side-up in stacks to save space.
   b) Cages should be placed upside-down and spread out so that water hits all surfaces.
   c) Water temperature should be 100 F in the rinse cycle.
   d) Water temperature should be assured using a temperature indicator.
   e) Overall effectiveness should be monitored using RODAC plates.

34. Your SOP also contains a section on managing feed.
   a) Store feed in a cool, dry, dark environment to prevent oxidation.
   b) Keep feed stacked on the ground close to the wall to allow for safe movement among stacks.
   c) Take only sealed bags of feed into the animal room.
   d) Use all rodent diets within 3 months of mill date.
   e) Once in the animal room, store feed in bins labeled with the type of feed, the mill date, and the date the bin was last disinfected.
35. You are characterizing a new line of mouse. You have bred them to look at their reproductive success, but although they have normal size litters, you don’t see milk spots on the pups. What might be the cause?
   a) The dams' post-partum PRL levels are too low.
   b) The dams' post-partum estradiol levels are too low.
   c) The dams' post-partum oxytocin levels are too low.
   d) The dams were bred during post-partum estrus. They won’t produce milk until after implantation.
   e) Mice nurse at night. You won’t see a milk spot during the day.

36. The nude mouse is a line often used in cancer research.
   a) Nude mice are genetically axenic.
   b) Nude mice must be kept in a sterile environment.
   c) Nude mice have no thymus or spleen and lack both B- and T-cells.
   d) Nude mice have no thymus and lack T-cells.
   e) Nude mice have both a thymus and a spleen but high levels of glucocorticoids cause these organs to atrophy.

37. The following is true about shipping and receiving live animals.
   a) Shipping containers may be 10% smaller than cage size requirements.
   b) It is not necessary to provide feed and water if animals are traveling a short distance.
   c) For short distances, animals may be transported in the trunk of a car.
   d) When animals arrive at their destination, use a spray disinfect on the outside of the boxes before moving the animals into the room but be careful to avoid spraying the filter paper.
   e) When animals arrive at their destination, use a spray disinfect on the outside of the boxes before moving the animals into the room being careful to spray the filter paper as thoroughly as the rest of the box.

38. Your guinea pig is pregnant with her first litter. She was due to give birth today, but instead you find her dead in her cage. Which of the following might have been the reason?
   a) The sow is 9 months old.
   b) The boar is 9 months old.
   c) The food you are feeding her is 9 months old.
   d) You failed to give her a nest box.
   e) She was pseudopregnant.

39. Which of the following helps to prevent cross-contamination between “clean” and “dirty” animals?
   a) Have dedicated brooms, dust pans, and/or mops in each animal room.
   b) Maintain a traffic flow pattern of clean to dirty for equipment and personnel.
   c) Keep “clean” animals in a room where the air pressure is positive to the hallway.
   d) Keep “dirty” animals in a room where the air pressure is positive to the hallway.
   e) Use environmental screens to assure that the cage wash procedures are effective and that cages used in both rooms are truly sanitized.
40. An investigator has asked you to provide him with 50 mice every 3 weeks.
   a) You will need to set up 5 breeding females every 3 weeks to supply these animals.
   b) You will need to set up 10 breeding females once and then depend on post-partum estrus to provide these animals.
   c) A hand mating scheme with plug checking is the best system.
   d) A monogamous scheme with 5 breeding females is best.
   e) A harem mating system with 5 breeding females is best.

41. Your rabbits have been diagnosed with hair balls? What might be the reason?
   a) The temperature in the room is 70 ± 2°F.
   b) The humidity in the room is 40 – 60%.
   c) Ammonia levels in the room are < 25 ppm.
   d) The technician has been feeding the rabbits Pineapple Stix
   e) The rabbits are on a study that causes pruritus (itchy skin).

42. Which of the following is true about rodent vision?
   a) Vision is the most important sense in rodents.
   b) Rodents are able to see movement more than details of an object.
   c) Rodents have 3 cone photo pigments.
   d) Rodents are able to see into the ultraviolet wavelength.
   e) Rodents cannot see red light wavelengths which allows us to see them using red light without disturbing their photoperiod.

43. When an immunocompetent animal (one that is not immunocompromised) is first exposed to a pathogenic cell, which of the following happen.
   a) The B-lymphocyte is converted to an antibody producing plasma cell.
   b) The T-lymphocyte regulates antibody production.
   c) Antibodies may bind to the pathogenic cell blocking it from entering host cells.
   d) Antibodies may bind to the pathogenic cell marking it for destruction by phagocytic cells.
   e) B and T memory cells are made.

44. Tree shrews are solitary and highly territorial. Males will not tolerate the presence of another male in its cage and dominate males will not allow subordinate males to urinate in front of them.
   a) The Guide requires that these animals be group housed.
   b) Testosterone levels would be low in the subordinate shrew.
   c) The subordinate shrew would have high plasma levels of ACTH and glucocorticoids.
   d) The subordinate shrew would have high plasma levels of monocytes and neutrophils and low levels of lymphocytes.
   e) The subordinate shrew would likely die of kidney failure.
45. You are writing the adverse effects section of your protocol which involves the injection of tumor cells intradermally onto the backs of mice. Which of the following are appropriate humane endpoints (reason for euthanasia) according to IACUC policy?
   a) Inability to reach food or water for 24 hours.
   b) 10% decrease in normal body weight.
   c) Body condition score of 5 on a 5-point scale.
   d) A tumor that prevents normal mobility.
   e) A tumor that is abscessed or ulcerated.

46. You are experimenting with group housing rabbits in a large floor pen. Which of the following indicate that the rabbits in the floor pen are stressed?
   a) Movement into the center of the enclosure indicates escape or fear. Rabbits in the center are likely to be stressed.
   b) Rabbits that run around the walls of the enclosure are exhibiting thigmotaxis. These rabbits are likely to be stressed.
   c) You put a ball in the enclosure and all of the rabbits rub their chins on it. This is a stereopathy and indicates stress.
   d) Some rabbits have purple vulvas. This is a sign of stress.
   e) Glucocorticoid levels are higher at the hour before lights out than at noon. This is a sign of stress.
Essay Questions (40 points)

47. A mouse gets on an exercise wheel and begins to run. The SAMS system is activated. What is the goal of the SAMS system? (5 points)

48. The mouse continues to run all night and all day. It has a body condition score of 2. What has happened now? (5 points)
49. You are the manager of a barrier facility. A new investigator is bringing in a line of mice from a “dirty” facility. It has been decided that the mice need to be rederived by embryo transfer. The dirty line, Line D, is currently housed in quarantine. They will be transferred onto a clean recipient line already housed within the barrier, Line C.

The date for transfer has been set for 2/11. Mouse embryos will be removed on day 4 of gestation as blastocysts and transferred immediately into recipient females in day 4 of pseudopregnancy.

Answer the following questions—explain why: (10 points)

• For the donors, which hormones are used in superovulation, what breeding systems is used, on what date are they set up, are the males intact or vasectomized?
• For the recipients, what breeding systems is used, on what date are they set up, are the males intact or vasectomized? In what reproductive organ are the embryos surgically implanted?
50. You have a cage measuring 10” long x 6” wide x 5” high that is housing 5 adult males (30 g). One of the males has a large, moist lesion on his hindquarters, 3 males have small, dry scabs, and one male has no lesions. What is likely happening (I am looking for a pathology; not a hormonal explanation)? Give 2 options for resolution and the possible risks involved. Would you treat any of the lesions? (10 points)
51. Over the past 3 weeks, your once thriving hamster colony has begun to have health problems. Females show no cyclic discharge so you aren’t sure who to breed. The number of pups cannibalized has increased noticeably. Young hamsters are developing diarrhea, and even the stock animals are looking thin and lethargic. Several were euthanized this week with a body condition score of 1, although it was noted that generally, animals euthanized did not come from the same cage, but were spread randomly throughout different cages in the room. No changes in husbandry have occurred and you are at your wits end, when you discover during your monthly lighting check that the photoperiod clock has broken and the lights aren’t going out at night. What is going on in the hamster room? Discuss the major hormone responsible and the reasons behind the various signs mentioned above. (10 points)
## Recommended Space for Commonly Used Group-Housed Laboratory Rodents

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</tr>
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<td>≥15</td>
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<tr>
<td>Guinea pigs</td>
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<tr>
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<td>≥101</td>
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<table>
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<th>Animals</th>
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<th>Height, in</th>
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### Breeding Information

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<td>21 d</td>
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### Calendar

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12/4/2015
Answers to Final 2014

1. C  
2. E  
3. F  
4. G  
5. A  
6. E  
7. A  
8. C  
9. D  
10. F  
11. H  
12. F  
13. A  
14. G  
15. B  
16. B  
17. A  
18. C  
19. E  
20. D  
21. C  
22. H  
23. S  
24. D (Q ok)  
25. E  
26. P  
27. K  
28. M  
29. I  
30. O  
31. ac  
32. ace  
33. bde  
34. ae  
35. ac  
36. bd  
37. e  
38. ac  
39. abce  
40. d  
41. ae  
42. bde  
43. abcde  
44. bcde  
45. ade  
46. b

Bonus Question to try when you are done with the rest of the test (5 points extra credit).
Place one letter in each box. The numbers below the boxes refer to the answers on the Matching Questions. Find the appropriately numbered question in the test and fill in the box with the letter that you answered. Fill in the boxes over the question marks to complete the phrase that answers the clue. I will give partial credit.
Clue: What do you call a line of rabbits walking backwards?

```
A  R  E  C  E  D  I  N  G
5  ?  6  18  19  9  29  ?

H  A  R  E  L  I  N  E
22  7  ?  2  ?  29  ?
```
Essay Questions (40 points)

47. A mouse gets on an exercise wheel and begins to run. The SAMS system is activated. What is the goal of the SAMS system? (5 points)

The SAMS system provides energy for exercise as well as flight or fight. It does this by increasing tidal volume in the lungs so that the body takes in more O2. It increase blood glucose levels. And it increases transport of O2 and glucose by increasing cardiac output and by controlling vasodilatation and constriction so that the energy goes to the brain and muscles rather than non-essential organs like the gut.

48. The mouse continues to run all night and all day. It has a body condition score of 2. What has happened now? (5 points)

If the mouse becomes fixated on running and fails to eat or drink, then the HPA system is providing the necessary resources to continue the exercise. HPA provides blood glucose. At first it will do this by converting stored liver glycogen back into glucose, but as this source is depleted, it will begin gluconeogenesis, converting fat and protein into glucose. To do this it will break down body fat and muscle causing a drop in body condition.
You are the manager of a barrier facility. A new investigator is bringing in a line of mice from a “dirty” facility. It has been decided that the mice need to be rederived by embryo transfer. The dirty line, Line D, is currently housed in quarantine. They will be transferred onto a clean recipient line already housed within the barrier, Line C.

The date for transfer has been set for 2/11. Mouse embryos will be removed on day 4 of gestation as blastocysts and transferred immediately into recipient females in day 4 of pseudopregnancy.

Answer the following questions—explain why:

- For the donors, which hormones are used in superovulation, what breeding systems is used, on what date are they set up, are the males intact or vasectomized?
- For the recipients, what breeding systems is used, on what date are they set up, are the males intact or vasectomized? In what reproductive organ are the embryos surgically implanted?

- **Donors:**
  - Superovulate using PMPG, an FSH analog to stimulate follicular maturation and prevent atresia. This should be on 2/4.
  - On 2/6, inject hCG, an LH analog, to stimulate ovulation. Hand mate the females to intact males the night of the injection.
  - Check plugs on 2/7. This is day 0
  - On 2/11, mice will be euthanize and the blastocysts will be flushed from the uterus prior to implantation.

- **Recipients:**
  - Use vander Lee/Boot and Whitten effects to increase the number of females mating on the target date. (This isn’t necessary with the donors since they are being stimulated with exogenous hormones.) Group house the females by 1/21.
  - Hand mate females the same day as you inject the FSH in the donors. Place them into cages with the males on 2/4 (or with male pheromones/urine). They must be with the males by 2/6. Males for the recipients must be vasectomized. This will produce a pseudopregnancy.
  - Check for plugs on 2/7.
  - On 2/11, mice will be anesthetized and the blastocysts will be implanted into the uterus.
50. You have a cage measuring 10" long x 6" wide x 5" high that is housing 5 adult males (30 g). One of the males has a large, moist lesion on his hindquarters, 3 males have small, dry scabs, and one male has no lesions. What is likely happening (I am looking for a pathology; not a hormonal explanation)? Give 2 options for resolution and the possible risks involved. Would you treat any of the lesions? (10 points)

This looks like MOBs. First, we have 5 males, 4 with wounds and one without—the latter is most likely the dominant male. Second, we have a cage that is too small to hold this many 30 g mice. 6 x 10 = 60 sq inches. 60/15 = 4. So we should have 4 mice, not 5. Overcrowding increases aggression in male mice.

We need to remove at least one mouse to satisfy cage size requirements.

One option is to remove the dominant male mouse. Since all mice under him are wounded, this is probably the best option; however, we will have to monitor the other males since they will now have to reestablish a hierarchy which could lead to more fighting.

Another option is to remove only the badly injured male, but since all of the subdominant males have already been injured, one may drop into the subordinate position and be injured even more severely.

Regardless we could add enrichment. If we add enrichment, it should be a destructible enrichment device, paper tunnels or shelters rather than plastic.

The only lesion I would treat would be the large, moist lesion. The dry scabs are already healing and treating them may cause the mice to scratch at them. The moist lesion may become infected and should be treated with DNS and/or topical antibiotic ointment.
51. Over the past 3 weeks, your once thriving hamster colony has begun to have health problems. Females show no cyclic discharge so you aren’t sure who to breed. The number of pups cannibalized has increased noticeably. Young hamsters are developing diarrhea, and even the stock animals are looking thin and lethargic. Several were euthanized this week with a body condition score of 1, although it was noted that generally, animals euthanized did not come from the same cage, but were spread randomly throughout different cages in the room. No changes in husbandry have occurred and you are at your wits end, when you discover during your monthly lighting check that the photoperiod clock has broken and the lights aren’t going out at night. What is going on in the hamster room? Discuss the major hormone responsible and the reasons behind the various signs mentioned above. (10 points)

- Continuous lighting causes stress in most species and hamsters are particularly sensitive to photoperiod.
- Since you check the photoperiod clock monthly and the problems began 3 weeks ago, the clock probably failed shortly after your last check.
- The stress of continual light caused an increase in glucocorticoids, specifically cortisol in the hamster.
- Continuous lighting causes a decrease or absence of melatonin which is only secreted during the dark phase. Melatonin normally functions to inhibit the adrenal gland’s response to ACTH decreasing GC in the long nights of the winter months. Thus a lack of melatonin would allow for even higher levels of cortisol.
- Glucocorticoids are responsible for the breakdown of fat and muscle mass in those animals that are losing body confirmation. The fact that BC 1 animals were found in different cages around the room points to both individual variability and to the sensitization of a subordinate animal in a social hierarchy. Subordinate animals would have high GC levels to begin with and would be more likely to progress to breakpoint stress, while dominant and subdominant would be more likely to habituate.
- Reproductive hormones are also affected by elevated GC levels. GnRH, LH, and PRL are all suppressed by GC, so females will likely stop cycling. That is why we no longer see the vaginal discharge usually associated with estrus.
- Stress was one of the causes of cannibalism, so this behavior has increased.
- Wet tail is the pathology which causes diarrhea in young hamsters. It is caused by an opportunistic bacteria (Lawsonia intracellularis). GCs also depress the immune system leaving animals at greater risk of infection. In this case, the continual light couples with the stress of weaning to depress the immune system even more than normal.