MULTIPLE CHOICE Circle the letter by the BEST answer. (5 points each)

201. Sister chromatids
a get "promoted" to become chromosomes when they replicate.
b are copies of homologous chromosomes.
c come together and pair up during mitosis.
d are identical copies of the same chromosome.
e are important in meiosis but not mitosis.

202. The primary structure a protein determines the _____ level of structure mostly due to its _____.
a quaternary; ion-binding capacity
b secondary; hydrophobicity
c tertiary; lack of charge
d secondary; sulfur atoms
e tertiary; side-chain chemistry

203. If an organism has a diploid number of 8, how many CHROMATIDS are present during prophase (beginning) of MITOSIS?
a 3

b 4
c 6
d 8
e 16

204. A woman with type B blood has a baby with type O blood. The father could be any of her three boyfriends; Jason, who has type A blood, Tom, who has type O blood, or Kevin, who has type AB blood. Based on blood types, who is definitely EXCLUDED as the father?
a Jason only
b Kevin only
c Tom only
d Jason and Kevin
e Kevin and Tom

205. You have discovered a new mutant lab mouse that is tailless. You breed your mouse to a normal, tailed mouse and half of the offspring are tailless. You then breed together a brother and sister from this litter, both of whom are tailless, and get about one-third tailled offspring and two thirds tailless offspring. What kind of mutant allele best explains these results?
a incompletely dominant
b codominant in embryos
c dominantly lethal in older adults
d recessively lethal in embryos
e most recessive allele in a series

206. Which of the following features of Mendel's original model does NOT have frequent exceptions in nature?
a There are only two forms (alleles) per trait (gene)
b One form is completely dominant over the other
c Offspring are the same regardless of which parent carries which alleles
d Each trait is controlled by a single gene
e True-breeding plant strains are homozygous for the traits tested

207. In the purple penguin, a series of alleles occurs at the P locus on an autosome. All alleles affect the color of feathers: P1= dark-purple, P2= medium-purple, P3 = light-purple, and P4 = very pale purple (almost white). The order of dominance is P1>P2>P3>P4. If a heterozygous light-purple female is crossed to a dark-purple male who is heterozygous for medium-purple, the ratio of phenotypes expected among the baby penguins would be
a 2 dark:1 medium:1 light
b 2 dark:1 light:1 very pale
c 1 dark:1 medium:1 light:1 very pale
d 1 dark:1 medium
e 1 medium:1 light

208. Which of the following is NOT a mechanism for sex determination in at least one species?
a the presence of a Y-chromosome
b the ratio of X-chromosomes to autosomes
c the lack of any X-chromosome
d the total number of chromosomes (haploid versus diploid)
e all of the above ARE real mechanisms

209. How many Barr bodies (inactivated X's) would be present in the cells of a male raccoon who is genetically XXY?
a 0

b 1
c 2
d 4
e can't tell for sure

210. There is a special problem with the replication of the telomeres of eukaryotic chromosomes because
a exonucleases cannot remove the last RNA primer.
b DNA polymerases cannot synthesize the ends of the lagging strands.
c the ends of lagging strands overhang the ends of leading strands.
d the terminus on the chromosome ends impedes synthesis.
e the DNA gyrase falls off the ends of the chromosomes.

211. Lyon's Hypothesis explained why all normal tortiseshell mice and cats should be female. It is because of
a Y-chromosome linkage
b sex linkage
c incomplete dominance of black versus red pigment alleles
d the cat version of Klinefelter's syndrome
e X-chromosome inactivation

212. Some parrots have a sex-linked disease, caused by a recessive allele, that makes their legs crooked. These bow-legged parrots are
a likely to be color blind also.
b more likely to be male than female.
c more likely to be female than male.
d equally likely to be male or female.
e likely to die as nestlings.

213. All of the following statements about meiosis are true, EXCEPT which one?
a Meiosis only occurs in eukaryotes.
b At the end of meiosis, each daughter cell is haploid.
c Meiosis II is essentially a mitotic division.
d The chromosomal material replicates twice during meiosis.
e The daughter cells produced during meiosis are not necessarily gametes.

214. Which of the following can affect or alter the expression of a phenotype?
a the environment
b epistasis
c dominance interactions between alleles
d modifying genes
e all of the above

215. Amino acids always have
a positively charged side groups.
b negatively charged side groups.
c hydrophobic (non-polar) side groups.
d carboxyl groups.
e side groups containing sulfur atoms.

FILL IN THE BLANK/MATCHING (5 points each blank)

216. List two mechanisms of sex determination that differ from the mammal/bird system in some important way.

_____

_____

217. Match the following items by placing a letter in each space.

1) heterogametic sex _____ 5) pseudoautosomal _____
2) codominance _____ 6) α-helix _____
3) pleiotropy _____ 7) epistasis _____
4) nondisjunction _____ 8) nonfunctional allele _____

A frequency with which individuals of a specific genotype manifest the corresponding phenotype
B associated with mixed or combination phenotypes in heterozygotes
C associated with intermediate phenotypes in heterozygotes
D associated with recessiveness
E the masking of the expression of one gene by another gene
F when several phenotypes are affected by one gene
G. when several genes are affected by one phenotype
H specialized region of a sex chromosome that is vital for meiotic pairing
I failure of chromosomes to separate during cell division
J specialized region of a chromosome that determines sex
K the sex that is heterozygous for many genes
L one of the subunits of a replicated chromosome before segregation
M common secondary structure in proteins
N common protein in hair and other tissues
O the sex that has a pair of heteromorphic chromosomes

PROBLEMS WRITE OUT YOUR CALCULATIONS FOR PARTIAL CREDIT!

218. (16 points) A true-breeding yellow female Labrador retriever (lab) is bred to a true-breeding chocolate male lab. The dog color pathway is:

E **B**
Colorless precursor----> Brown pigment ----->Black pigment

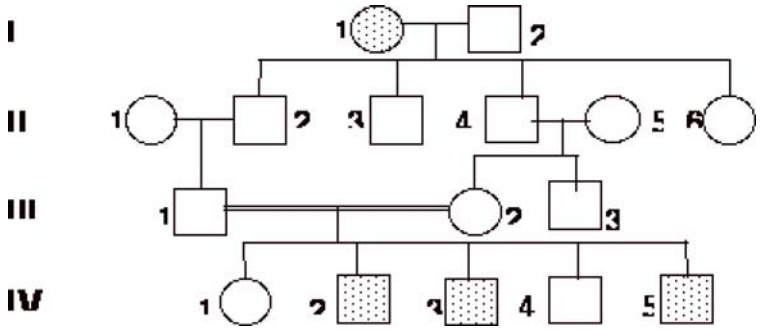
A) List all possible genotypes for the yellow mother lab.

B) Can any puppies from this cross be black? (Circle YES / NO)

C) If the same female is bred instead to an EEBB male, and then an F1 brother and sister are bred together, predict what the F2 offspring should be like.

F2 Genotypes F2 Phenotypes Ratios

219. (21 points) The human pedigree below shows the phenotypes for a rare form of bent thumb, attributed to the B gene.



A) Circle ALL modes of inheritance that are consistent with this pedigree.

Autosomal dominant Autosomal recessive

X-linked dominant X-linked recessive

B) For each person in generations III and IV, WRITE IN the presumed genotype for the B locus inside their genetic symbol. For individuals who may be either heterozygous or homozygous dominant, use a dash for the undetermined allele (B_).

C) If individual IV-1, a young woman, marries an unrelated man, what is the probability that their first child will have a bent thumb?

220. (18 points) A cross is made between a grey gerbil (genotype AaBbCc) and a black gerbil (genotype aaBbCc). The possible phenotypes for gerbil color are:

A_B_C_ grey
aaB_C_ black
A_bbC_ tan
aabbC_ chocolate
_ _ _ _cc albino

A) (6 points) What is the probability of an offspring from this mating being tan?

B) (6 points) What is the probability of an offspring from this mating being a grey male?

C) (6 points) What is the probability of an offspring from this mating being a TRUE-BREEDING chocolate gerbil?

221. (30 pts.) Another cross is made between a tan gerbil with genotype AAbbCc and a grey gerbil with an unknown genotype. They had 40 offspring in one year, whose color phenotypes are:

12	Grey	(A_B_C_)
16	Tan	(A_bbC_)
12	Albino	(_ _ _ _cc)
40	Total	

****** Use the workspace to figure the answers to A) and B), then enter your answers in the table provided. ******

A) (9 points) You hypothesize that the grey parent has genotype AaBbCc What then would be the EXPECTED ratio of phenotypes in the offspring? You can use ratios (e.g. 9:6:1) or fractions (e.g. 9/16, 7/16). WRITE YOUR ANSWER IN THE BLANKS OF THE TABLE (1ST COLUMN).

B) (9 points) What is the expected number of offspring in each class? WRITE YOUR ANSWER IN THE BLANKS OF THE TABLE (3RD COLUMN) and remember, the total # of offspring is 40.

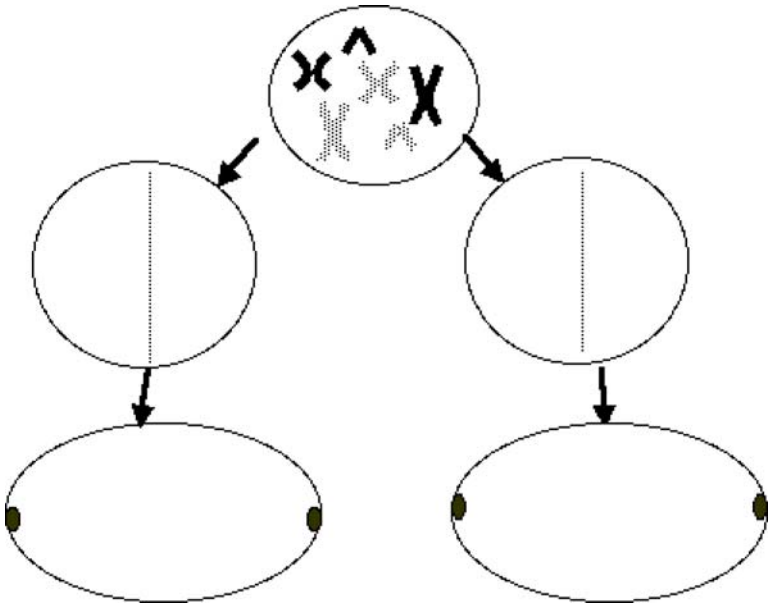
	Ratio	Observed Numbers	Expected Numbers	0 - E	$\frac{(O - E)^2}{E}$
Grey	_____	12	_____	_____	_____
Tan	_____	16	_____	_____	_____
Albino	_____	12	_____	_____	_____
Black	_____	0	_____	_____	_____

C) (8 points) Calculate the chi-squared statistic for these data, using the information in the table above. You can leave the answer as a fraction.

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

D) (4 points) If the critical chi-squared statistic for this test is 5.99, do the data reject the hypothesis that the grey parent is genotype AaBbCc?

222. (20 points) Below are the chromosomes in a cell that is about to divide. Draw the chromosomes 1) as they line up at the metaphase plate (dotted line) and 2) as they are being drawn to the poles (dark ovals) of the dividing cells. On the left side (A), draw the chromosomes as they would look during a mitiotic division, and on the right (B) as they would look during a first meiotic division.



A) Mitosis **B) Meiosis**

p>

SHORT ANSWER

223. (20 points) BRIEFLY answer ONE of the questions below (two to five sentences would be about right). I will take off points for wrong information or excessive length. Make it legible--if I can't read it, I don't grade it.

A) Explain the difference between epistasis and dominance.
B) Explain the difference between sex-linked and sex-influenced traits.

Key to Exam II **Bot/Zoo 342 B**

201. d 202. e 203. e 204. b
205. d 206. e 207. d 208. c
209. b 210. b 211. e 212. c
213. d 213. e 215. d

216. Haplodiploidy, x-autosome ratio, environmental cue, tissue-specific gene activation
217. 1) O 2) B 3) F 4) I 5) H 6) M 7) E 8) D
218. A) eeBB, eeBb, or eebb are possible genotypes--only eeBB and eebb are true-breeding B) Yes, if mother is eeBB
C) Assuming mother is eebb, then eebb X EEBB > EeBb in F1; EeBb X EeBb > 9/16 E_B_ black: 3/16 E_bb brown: 3/16 eeB_ + 1/16 eebb yellow
219. A) Autosomal recessive most consistent, X-linked recessive consistent if incomplete penetrance B) depends on which mode you used C) zero chance—father should be normal homozygote or hemizygote
220. A) AaBbCc X aaBbCc > P(A_bbC_) = 1/2 x 1/4 x 3/4 = 3/32

B) P(A_B_C_) male = 1/2 x 3/4 x 3/4 x 1/2 = 9/64
C) P(aabbCC) = 1/2 x 1/4 x 1/4 = 1/32
221.

Grey	3/8	12	15	3	9/15
Tan	3/8	16	15	1	1/15
Albino	2/8	12	15	4	4/10
Black	0	0			

X2 = 18/30 + 2/30 + 12/30 = 32/30 =16/15 = 1 1/15
Do not reject, since calculated X2 <<5.99
222. See book
223. A) Epistasis is when expression of 1 gene masks expression of another gene (2-gene interaction). Dominance is when one allele masks expression of another allele at the same gene.
B) Sex-linked traits are produced by genes on differentiated sex chromosomes. Sex-influenced traits are produced by genes on autosomes, but their expression is different in the two sexes due to hormonal influences.