MBG 2000

Midterm II Version 3 **Name:**_____

1. Commercial dessert bananas are sterile autotriploids with 3N=33. What could be observed in cells undergoing meiosis I?

a) 7 bivalents, 7 univalents and 4 trivalents
b) 15 bivalents and 1 trivalent
c) 11 bivalents, 3 trivalents and 2 univalents
d) 10 bivalents, 3 trivalents, and 4 univalents
e) more than one of the above

all numerically possible

this one seems better tho?

2. An animal has a genotype of *AabbCc*. Gene *A* is on chromosome 1, gene *B* on chromosome 2, and gene *C* on chromosome 3. What is the probability that this animal will produce *AbC* gametes?

A b C

$\frac{1}{2} \cdot \frac{1}{1} \cdot \frac{1}{2} = \frac{1}{4}$

a) 1/64
b) 1/16
c) 1/8
d) 1/4
e) none of the above

3. Plant species A (2N=24) was crossed to plant species B (2N=12) to produce a hybrid. This sterile hybrid eventually produced a fully fertile allotetraploid after many attempts at self pollination. How many chromosomes would you expect to find in the hybrid and the allotetraploid?

~~2N=36 → 4N=72~~

12 + 6 = 18 hybrid

4N=36 fertile

a) 24 and 48 respectively
b) 36 and 72 respectively
c) 18 and 36 respectively
d) 30 and 60 respectively
e) none of the above

4. A single nondisjunction event in meiosis II of human spermatogenesis can produce a gamete that has two Y chromosomes.

a) The above statement is true
b) The above statement is false

5. A student has a culture of tryptophan auxotrophs. These bacteria are able to survive in media that lacks tryptophan. trp⁻ need tryp

a) Above statement is true
b) Above statement is false

6. Individuals with Turner Syndrome are females without ovaries.

a) Turner
b) Down
c) Edward
d) Patau
e) Klinefelter XXY

XO
trisomies

7. Cytoplasmic sterility in maize (corn) is characterized by the suppression of egg production. [MS] males?

a) Above statement is true
b) Above statement is false

8. Which of the following statements best describes the genetic term *simple/complete dominance*?

a) An allele of one gene can completely mask the expression of another gene.
b) The level of chromosome compaction can affect gene expression.
c) A single gene can be responsible for a number of distinct and seemingly unrelated clinical symptoms.
d) An allele of one gene can completely mask the expression of another allele of the same gene.
e) none of the above

9. The diploid number of an organism is 2N=12. How many chromosomes would be expected in a triploid?

a) 13
b) 24
c) 36
d) 48
e) none of the above

N=6
3N = 18
6 6 6

10. A plant is 2N=78. How many chromosomes would be found in the leaves, endosperm and spores of this plant?

a) 156, 117 and 39 respectively
b) 78, 78 and 39 respectively
c) 78, 156, and 39 respectively
d) 78, 117 and 39 respectively
e) none of the above

117 39 N

78
2N

male WW female WZ

11. Silver-coloured feathers in chickens are due to a sex-linked dominant allele, *S*. The recessive allele, *s*, produces gold feathers when present in the hemizygous or homozygous condition. A gold-feathered male bird is crossed to a silver-feathered female. What proportion of F1 female offspring will have the gold-feathered phenotype?

a) 25%
b) 75%
c) 50%
d) 100%
e) 0%

S silver
s gold

W^sW^s male × W^sZ female

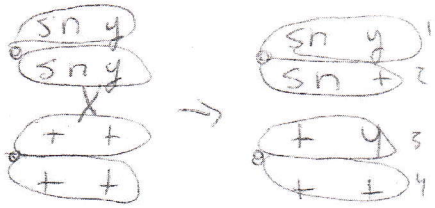
	W^s	W^s
W^s	S^sS^s	S^sS^s
Z	S^sZ	S^sZ

$W^sZ \times Z$ ⟹ of girls, all gold

Two X-linked recessive alleles in *Drosophila* are *sn* and *y*. Flies homozygous or hemizygous for the allele *y* have yellow bodies. Flies homozygous or hemizygous for *sn* have singed bristles (bristles curled and short). Wildtype flies have grey bodies and normal bristles. The *sn* locus is closer to the centromere than the *y* locus. (Map order: *centromere....sn.....y*) Use this information to answer the following question.

12. A female fly has the genotype *sn y* //+ +. Mitotic recombination occurs between 2 chromatids by means of a cross-over between gene *sn* and gene *y*. The two cells produced by this event could genotypically be

a) + +//+ + and *sn y* // *sn y*
b) *sn* + // *sn* + and + *y* // + *y*
c) *sn* + //+ + and *sn y* // + *y*
d) *sn* + // *sn* + and + *y* // *sn y*
e) more than one of the above is possible



13. Of the following statements, how many are true?

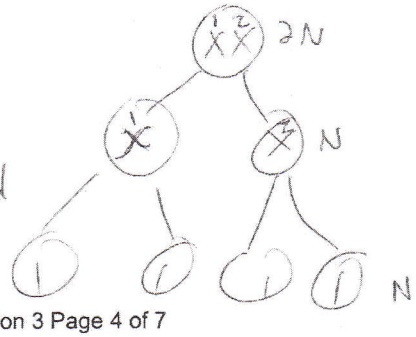
translation

i. The start codon (AUG) initiates transcription in the nucleus.
ii. Mitotic recombination is associated with a loss of heterozygosity.
iii. Females who are severely affected with an X-linked recessive trait typically have phenotypically normal fathers.
iv. In prophase II of meiosis in humans there are 23 chromosomes in the secondary spermatocytes.

$\frac{Sn\ y}{+\ y}$ $\frac{Sn\ +}{+\ +}$ or $\frac{Sn\ y}{+\ +}$ $\frac{Sn\ +}{+\ y}$

a) all four are true
b) three are true
c) two are true
d) one is true
e) none is true

dad $X^{Cb}Y$ ← mom
$X^{Cb}X^{Cb}$
∴ dad affected



14. Mice of the curly-tail breed have short, curled tails. This phenotype is due to a recessive allele, *ct*. Mice of the crooked-tail breed have short, kinked tails. This phenotype is due to a recessive allele, *cr*. If *cr* and *ct* are alleles of different genes, what would you expect to see in the F1 offspring when purebred curly-tailed mice are crossed to purebred crooked-tail mice? all normal

a) 1/2 would have curly or crooked tails and 1/2 would have normal tails.
b) 9/16 would have normal tails, 3/16 would have curly tails, 3/16 would have crooked tails and 1/16 would have no tails..
c) all would have either curly tails or crooked tails.
d) all would have phenotypically normal tails
e) none of the above

ctct RR × TTrr
+TRr

GH or Gh or gH or gh

15. A trihybrid plant, *GgHhWw*, is test crossed. If genes *G*, and *H* are very tightly linked (do not recombine) on chromosome 9 and *W* is on chromosome 2, how many phenotypic classes of progeny will there be?

a) 4
b) 8
c) 2
d) 6
e) 1

2·2 = 4
2·2 = 4
8

GgHhWw × ggwwww

GH Gh gH gh
GH/gh or Gh/gh or gH/gh or gh/gh
4

W w
w Ww ww
w Ww ww
2

16. In *Drosophila*, the allele for kidney-shaped eyes, *k*, is recessive to the allele *K*, for normal shaped eyes. The allele for ebony body colour, *e*, is recessive to the allele, *E*, which results in normal grey body colour. These genes are autosomal, and they are linked as shown in the linkage map below:

7 map units
------*K/k*----------*E/e*---------

True-breeding flies with ebony bodies and kidney shaped eyes are crossed to true-breeding flies that have grey bodies and normal eyes. The F1 progeny are tested crossed. What proportion of test-cross progeny will have grey bodies and kidney-shaped eyes?

a) 7%
b) 3.5%
c) 46.5%
d) 93%
e) none of the above

ke/ke × KE/KE
↓

17. Some members of a family have a very rare mtDNA disorder called Leigh Syndrome (LS). A woman from this family is very severely affected with LS. She marries a man who has no family history of LS and they consider having children. What is the probability that their first child will be affected with LS?

a) 0%
b) 50%
c) 25%
d) 0% if the child is a boy and 100% if the child is a girl
e) none of the above

18. Transduction is the process by which bacteria take up exogenous DNA fragments.

a) Above statement is true b) Above statement is false

19. Lysogens are bacteria with phage DNA integrated within the bacterial genome.

a) Above statement is true b) Above statement is false

In cavies (guinea pigs), the allele for the presence of extra toes, *E*, is dominant to the allele, *e*, for the normal number of toes. The allele for wire-haired coats, *W*, is dominant to the allele, *w*, for smooth coats. Both genes are autosomal. Dihybrid cavies were test-crossed. The following offspring were produced:

Phenotype	Numbers
Normal toes and wire coats	168
Extra toes and smooth coats	160
Normal toes and smooth coats	240
Extra toes and wire coats	232
	(Total progeny =800)

The next 3 questions refer to the above information.

20. What is/are the genotype/s of the above dihybrid parents?

a) $\frac{E\ W}{e\ W}$ b) $\frac{E\ W}{e\ w}$ c) $\frac{E\ W}{E\ w}$ d) $\frac{e\ W}{E\ w}$ e) more than one of the foregoing

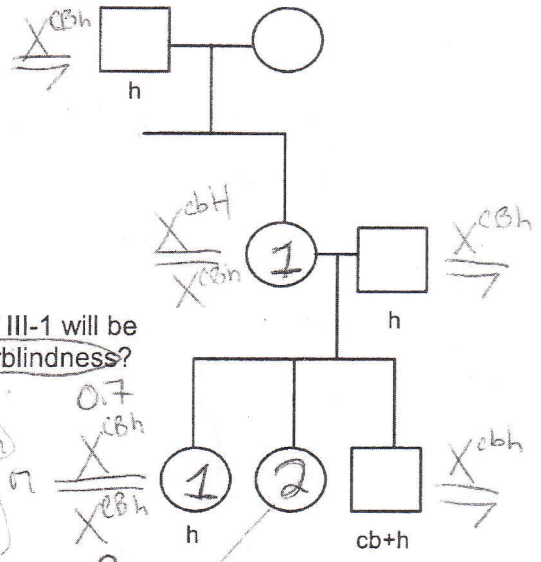
21. The distance between genes *W* and *E* would be

a) more than 45 map units
b) between 35 and 45 map units
c) between 25 and 35 map units
d) between 15 and 25 map units
e) less than 15 map units

22. What is/are the genotype/s of the wire-haired, extra-toed offspring?

a) $\frac{E\ W}{e\ w}$ ✓ b) $\frac{E\ w}{E\ W}$ c) $\frac{e\ W}{E\ w}$ d) $\frac{E\ W}{E\ W}$ e) more than one of the foregoing

The genes that control red-green colourblindness and haemophilia map to the X chromosome. Imagine that these two genes are **30 map units** apart on the X chromosome. Examine the pedigree below. (Note: individuals affected with colourblindness are indicated by cb and individuals affected with haemophilia are indicated by h). The next three questions refer to this information.



23. What is the genotype of II-1?

a) *h cb // H CB*
b) *H CB // H CB*
c) *H CB // h CB*
d) *H cb // h CB*
e) more than one of the above is possible

24. What is the probability that the first child of III-1 will be a male with haemophilia and red-green colourblindness?

a) 42.5%
b) 7.5%
c) 35%
d) 15%
e) none of the above

25. What is the probability that III-2 is *H CB // H CB*?

a) 30%
b) 15%
c) 35%
d) 70%
e) none of the above