Exam 1 PBG430/530 2017

1. According to the assigned website reading, the currently-grown crops resistant to the herbicide Roundup were created using which one of the following techniques?
   1. RNAi, in which the transcript of the herbicide susceptibility gene degraded.
   2. Non-sexual transfer of the herbicide resistance gene from one organism to another.
   3. CRISPR genome editing, in which the DNA sequence of the naturally occurring plant herbicide susceptibility gene was altered by substituting guanine for cytosine
2. The CRISPR gene editing system, according to the assigned TED talk by Jennifer Doudna, was discovered in which of the following organisms?
   1. The genetic model plant – Arabidopsis.
   2. The genetic model insect – Drosophila.
   3. The genetic model mammal – Mouse.
   4. Bacteria.
3. An inheritance pattern of 1 living:1 dead in the doubled haploid progeny of a plant heterozygous for resistance to Roundup herbicide is best described as
   1. Heterochromatic.
   2. Insoluble.
   3. Qualitative.
   4. Quantitative.
4. In a diploid species that is 2n = 18, the “F” gene is 2 kb long. Which of the following statements is most true?
   1. If you produce doubled haploids from an F1 (Ff) derived from the cross “FF x ff” the expected genotypic ratio for alleles at the F locus is 3:1.
   2. In a population of 1,000 plants of this species, only two alleles at the F locus are possible.
   3. Many alleles at the F locus are possible in a sample of 1,000 plants of this species, but only two alleles will occur at a locus in any single diploid plant.
   4. If there are different alleles at the F locus, there is no way to study their inheritance.
5. Assume you have two homozygous tomato plants. The plants differ from each other in having different alleles at approximately half the loci in the tomato genome. F1 plants will be heterozygous at approximately how many loci?
   1. 7,500 loci.
   2. 15,000 loci.
   3. 30,000 loci.
6. If you self an F1 hybrid plant that is completely heterozygous, what % reduction in heterozygosity in its progeny would you predict with each generation of selfing?
   1. 25%
   2. 50%
   3. 75%
   4. 100%
7. “Phenotype” refers to which of the following attributes of an individual?
   1. DNA sequence.
   2. Actual physical appearance.

Consider the following data from a diploid plant. Parent 1 is resistant to blight disease. Parent 2 is susceptible to blight disease. The parents are doubled haploids. You cross the two parents to produce and F1 and from the F1 you make 100 doubled haploids. You do not take note of the F1 blight phenotype.

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| Blight reaction | Number of doubled haploid plants |
| Resistant | 55 |
| Susceptible | 45 |

1. Based on the data provided, there is no way to know which trait is dominant: resistance or susceptibility.
   1. T
   2. F
2. You characterize the gene responsible for blight reaction and determine the sequence of the alleles responsible for resistance and susceptibility, respectively. The susceptible allele has a deletion of several nucleotides, leading to a premature stop codon, compared to the resistant allele. What was the most likely source of the susceptible allele?
   1. Equal sister chromatid exchange at mitosis.
   2. Crossing over at meiosis (outside the blight resistance gene).
   3. Mutation.
   4. Epigenetic silencing.
3. According to Komatsuda et al., the dominant allele at the *Vrs1* locus encodes a transcription factor. This means that
   1. The dominant *Vrs1* allele is not transcribed.
   2. The dominant *Vrs1*allele does not code for a protein.
   3. The dominant *Vrs1* allele encodes a protein that binds to another gene (or genes) and regulates the expression of that gene (or genes).
   4. The dominant *Vrs1* allele does not have a promoter.
4. In a chi square test, a very large difference between the observed and expected ratios (e.g. a calculated chi square value of 10.7 with 1 df) will cause you to
   1. Accept the null hypotheses.
   2. Reject the null hypotheses.
5. If you expect a 9:3:3:1 ratio, how may df will you use for your chi square test?
   1. 1
   2. 2
   3. 3
   4. 4
6. Segregation refers to alleles at a single locus and independent assortment to alleles at two or more loci.
   1. T
   2. F
7. Doubled haploid and F2 dihybrid ratios for loci showing independent assortment are expected to be
   1. 1:1:1:1 for both types of progeny.
   2. 1:1:1:1 and 9:3:3:1, respectively.
   3. 9:3:3:1 for both types of progeny.
8. The two alleles at a locus in a diploid plant
   1. May be identical in DNA sequence.
   2. May differ in DNA sequence for only one nucleotide.
   3. May differ in DNA sequence for multiple nucleotides.
   4. May differ in that the gene is present on one homolog and completely missing on the other homolog.
   5. All of the above.
9. Which of the following do you need to know before formulating a correct hypothesis regarding the inheritance of phenotypes in cross progeny?
   1. Degree of homozygosity of the parents.
   2. Generation in which the data were recorded.
   3. Genome size of the plant.
   4. A and B.
   5. A, B, and C.
10. The expected monohybrid genotypic ratio in the F2 is 1AA:2Aa:1aa. If you chose one of the F2 Aa individuals and selfed it, you would expect its F3 progeny to segregate in a genotypic ratio of 1AA:2Aa:1aa.
    1. T
    2. F
11. What type of mating biology does hazelnut have?
    1. Self-pollinated.
    2. Cross-pollinated.
    3. It has no mating biology: the nuts arise through sporophytic apomixis.
12. Doubled haploids produced from an F1 will always be genetically identical to the plants grown from apomictic seed produced by the same F1.
    1. T
    2. F
13. In the alternation of generations in angiosperms there is
    1. Only meiosis.
    2. Only mitosis.
    3. Meiosis and mitosis.
    4. A continuous state of epigenetic gene silencing.
14. Sexual reproduction is generally considered to be more advantageous than asexual reproduction. However, only dioecious plants enjoy this advantage.
    1. T
    2. F
15. The synergids in the embryo sac of a diploid plant
    1. Are each “3n”.
    2. Give rise to 3n endosperm.
    3. Have no known function.
    4. Attract the sperm to the egg.
16. You have two homozygous diploid plants with perfect flowers. They have contrasting alleles at the “Z locus”. You make two crosses: ZZ x zz and zz x ZZ (female genotype is shown first). In the F1 seed of each of the two crosses:
    1. Embryos will be Zz and endosperm ZZz.
    2. Embryos will be Zz in both crosses, but the endosperm will be ZZz in the F1 of ZZ x zz and zzZ in the F1 of zz x ZZ.
    3. There is no way to predict the genotype of the egg and endosperm given this information.
17. The ancestral condition of angiosperm flowers is thought to be
    1. Monoecious.
    2. Hermaphroditic.
    3. Dioecious.
    4. Self-incompatible.
18. If a plant has maternal inheritance of organelles, the genes in the mitochondrial genome are expected to
    1. Not segregate.
    2. Segregate 3:1.
    3. Segregate 1:2:1.
    4. Segregate 9:3:3:1.
19. In a monoecious plant, the male and female flowers form through
    1. The action of different genes.
    2. The selective abortion of floral organs during development.
    3. The separation of sister chromatids at mitosis.
20. Which of the following is the most important determinant of the degree of heterozygosity in a plant species?
    1. Genome size – e.g. species with genomes larger than 1000 Mb are most likely to be cross-pollinated.
    2. Numbers of chromosomes – e.g. species with 2n = 20 and higher are most likely to be highly homozygous.
    3. Mating biology – e.g. is the species dioecious, monoecious, or hermaphroditic.
21. In both megasporogenesis and microsporogenesis, each of the four products of meiosis survives to become sperm and eggs, respectively.
    1. T
    2. F
22. All nuclei within a single 8-nucleate embryo sac will be genetically identical, regardless of the genetic status of the megaspore mother cell.
    1. T
    2. F
23. Parthenogenesis refers to:
    1. Development of a seedless fruit.
    2. Development of an egg without fertilization.
    3. Formation of a 6-nucleate embryo sac.
    4. Development of 2n pollen grains.
24. In gametophytic apomixis,
    1. An embryo sac forms from a 2n cell in the ovule with meiosis but no mitosis.
    2. Somatic 2n cells surrounding the ovule differentiate and become embryogenic.
    3. An embryo sac forms from a 2n cell in the ovule with mitosis but no meiosis.
25. In asparagus, supermale (YY) plants are produced by
    1. Self-pollinating male (XY) plants.
    2. Self-pollinating hermaphroditic plants.
    3. Deriving doubled haploids from female (XX) plants.
    4. Deriving doubled haploids from XY male plants.
26. In the production of doubled haploids, chromosome doubling can be spontaneous or induced by various chemicals. In both cases, the cause of doubling is:
    1. More than one spindle fiber attaching to each centromere.
    2. Failure of spindle fibers.
    3. Spindle fibers that move twice as fast.
    4. Functioning spindle fibers at Anaphase and Telophase.
27. Segregation of alleles at a locus (ignoring crossovers) occurs at what stage of meiosis?
    1. Zygonema.
    2. Pachynema.
    3. Anaphase I.
    4. Telophase.
28. The shortening of centromeres at mitosis is hypothesized to be related to aging.
    1. T
    2. F
29. The required reading on “Dark Matter” argued that non-coding (formerly known as junk) DNA is
    1. Useless.
    2. Involved in gene regulation.
    3. Actually coding for genes.
    4. Involved in aging.
30. Which of the following is most likely to **not** be heterochromatic?
    1. Relaxed DNA.
    2. Centromere.
    3. Telomere.
    4. Highly compact region.
31. An example of facultative heterochromatin is
    1. A centromere.
    2. A telomere.
    3. A Y chromosome.
    4. An X chromosome.
32. If a plant that is 2n = 2x = 20 undergoes meiosis, the result will be
    1. 2 daughter cells, each 2n = 20.
    2. 4 daughter cells, each n = 10.
33. Histone proteins are
    1. What spindle fibers are made of.
    2. Not translated from RNA.
    3. Involved in the nucleosome structure of chromatin.
    4. Not encoded by genes.
34. The centromere is
    1. a separate organelle added to the chromosome so that sister chromatids can separate at mitosis but not in meiosis.
    2. an excellent example of euchromatin.
    3. the molecular machine responsible for DNA replication.
    4. site of attachment of spindle fibers.
35. Crossing over between non-sister chromatids occurs at
    1. S phase.
    2. Pachynema.
    3. Metaphase I.
    4. Anaphase II.
36. A haploid plant will have intact floral structures but it will be sterile. This is due to:
    1. Mitosis does not function properly in haploids.
    2. Haploid plants do not have an S phase.
    3. Meiosis does not function properly because there is only one chromosome per homologous pair.
    4. Haploid mitochondrial genes always encode male sterility.
37. When homologous chromosome pair,
    1. The double helices are in direct DNA: DNA contact with each other for the full length of the bivalent.
    2. The synaptonemal complex separates the paired homologs.
    3. The only point of contact is the centromere.
    4. The only point of contact is the telomere.
38. Using the simple operative definition of a gene used in class, what percentage of a 3,000 Mb plant genome would you expect to consist of transcribed genes?
    1. 5%
    2. 80%
    3. 100%
39. Transposable elements are agents of genome expansion
    1. T
    2. F
40. Which of the following is most correct?
    1. Methylation leads to reduced gene expression and acetylation leads to increased gene expression.
    2. Methylation leads to increased gene expression and acetylation leads to reduced gene expression.
41. The C-value paradox refers to
    1. The fact that tall plants always have bigger genomes than short plants.
    2. In diploids, genome size in not related to chromosome number of the number of genes.
    3. The fact that “C” stands for cotton, a model species for genetic analysis.
42. Transgressive segregation refers to
    1. More than three alleles segregating at a single locus in a diploid individual.
    2. Four alleles segregating at a locus in a polyploid.
    3. Progeny with phenotypes lesser or greater than the parents.
    4. The situation in a GMO where the transgene shows complete dominance.
43. Pleiotropy occurs only with mitochondrial genes
    1. T
    2. F

