

Exam 1 PBG430/530 2013

1. In the case of the Round Ready sugar beet in the Willamette Valley, the principal concern relates to which of the following:
 - a. Possible health risks associated with excessive sugar consumption
 - b. Gene flow of transgenes in pollen
 - c. Gene flow of transgenes via spilled seed
 - d. Gene flow from organic production to Roundup Ready production
2. If a Roundup ready sugar beet crosses with an organic table beet, what is the expected ratio of Roundup resistance to Roundup susceptibility in the F₂ generation?
 - a. 1:1
 - b. 1:2:1
 - c. 3:1
 - d. 9:3:3:1
3. Gregor Mendel achieved fame for his discovery of the utility of Punnett Squares for understanding the genetic basis of traits showing quantitative inheritance
 - a. T
 - b. F
4. In genetics, polymorphisms can occur at
 - a. The phenotype level
 - b. The gene level
 - c. The nucleotide level
 - d. All of the above
5. If a farmer saves seed from an F₁ hybrid and self-pollinates plants in subsequent generations, the percentage of heterozygosity is expected to decrease by how much each generation?
 - a. 25%
 - b. 50%
 - c. 75%
 - d. 100%
6. The testcross is a specific type of backcross and the expected dihybrid ratio in the BC₁ generation is
 - a. 1:1
 - b. 3:1
 - c. 1:1:1:1
 - d. 9:3:3:1
7. According to Komatsuda et al., the gene determining two-row vs. six-row in barley
 - a. Determines the fertility of lateral florets
 - b. Regulates an unknown gene that determines fertility of lateral florets
8. A recessive trait can be due to
 - a. Complete deletion of a gene
 - b. Deletions or insertions of multiple nucleotides at key regions of a gene
 - c. Nucleotide substitutions at key regions of a gene
 - d. All of the above

9. Anther culture is a technique for producing doubled haploids based on the regeneration of plants from
- Male gametes
 - Female gametes
 - Chloroplasts
 - Mitochondria
10. Chi square tests can be used for phenotype data (e.g. 2-row vs. 6-row) but not for genotype data (e.g. specific nucleotides in the Vrs1 gene).
- T
 - F

You have 100 tomato plants in your garden. You observe that the plants vary for two traits: the color of the fruit (purple vs. red) and the height (tall vs. short) of the plants. You count 80 purple/tall and 20 red/short plants

11. Which of the following do you need to know before formulating a correct hypothesis regarding the inheritance of fruit color and plant height?
- The number of genes in the tomato genome
 - Degree of homozygosity of the parents
 - Generation in which the data were recorded
 - A and B
 - B and C
12. Assume you wish to test a 3:1 phenotypic ratio for the tomato color/height data, how many degrees of freedom would you use to determine if you will accept or reject your hypothesized ratio?
- 1
 - 2
 - 3
 - 4
13. Your calculated chi square is 1.3. Based on this result,
- You will accept the null hypothesis that the observed and expected ratios are the same
 - You will reject the null hypothesis that the observed and expected ratios are the same.
 - There is not enough information to test the hypothesis
14. Chloroplast and mitochondrial genomes usually show maternal inheritance, but in the case of anther culture, the functional chloroplasts and mitochondria are transmitted in the pollen.
- T
 - F
15. An asexually propagated plant, such as garlic, can be highly heterozygous but genetically identical from generation from generation.
- T
 - F

16. Although asexually propagating plants can be very well-adapted to a specific set of environmental conditions, sexual reproduction is more likely to be an evolutionarily successful strategy.
- T
 - F
17. In a perfect flower, the site of pollen reception/ recognition/ and germination is the
- Stigma
 - Style
 - Ovary
 - Anther
 - Filament
18. In both megasporogenesis and microsporogenesis, each of the four products of meiosis survives to become sperm and eggs, respectively.
- T
 - F
19. All nuclei within the 8-nucleate embryo sac will be genetically identical
- T
 - F
20. Which of the following nuclei will be fertilized by 1 sperm to give rise to the 3n endosperm?
- Antipodals
 - Polar nuclei
 - Synergids
21. Apomixis is a system in which a heterozygous genotype can produce genetically identical offspring via seed.
- T
 - F
22. The genetic basis of apomixis is well-understood and most F1 hybrids sold in 2013 will be apomicts
- T
 - F
23. Dominant apomixis would be an excellent mechanism to prevent the unwanted migration of transgenes
- T
 - F
24. Self-incompatibility (SI) is a mechanism of encouraging cross pollination in plants with perfect flowers. SI is based on which of the following
- Pollen sterility
 - Apomixis
 - Ability to self-pollinate but not cross pollinate
 - A genetic system where there are multiple SI alleles per locus but any given plant has only two of these alleles

25. In all plants, the male and female flower structures are determined
- At the moment of double fertilization
 - By selective abortion of floral organs during plant development
 - By a genetic system where there are multiple alleles at the SI locus but any given plant has only two of these alleles
26. Self-incompatibility can occur in both hermaphroditic and monoecious flowers.
- T
 - F
27. Male sterility is an excellent system to control transgene flow in maize, if
- The maize is intended for seed production
 - The maize is intended for silage (e.g. not harvested for seed)
 - The weather is unfavorable for pollen movement
 - The maize is grown in Germany
28. In a plant with a defined X, Y sex chromosome system there will be approximately equal numbers of male and female plants
- T
 - F
29. In the case of “supermale” asparagus, the asparagus spears you eat will be
- XY (produced from the cross of XX x YY)
 - YY (produced as doubled haploids)
 - XX
 - All of the above
30. A chromosome during the G1 stage of the cell cycle consists of
- A single DNA molecule + proteins
 - Two DNA molecules + proteins, joined at the centromere
 - A single naked strand of DNA
 - Two naked strands of DNA
31. A key function of the centromere is that it
- caps the end of the chromosome
 - divides the chromosome in half
 - contains many genes in euchromatin
 - is the site of attachment of spindle fibers
32. According to the assigned reading on telomeres, there is now conclusive proof that every citizen should have her/his telomeres measured so that appropriate measure can be taken to prevent aging.
- T
 - F
33. Regions of the chromosome that are likely to have genes that are being highly expressed are most likely
- Constitutive heterochromatin
 - Facultative heterochromatin
 - Euchromatin
 - Chromatographs

34. At Metaphase of mitosis
- All the replicated chromosomes, each consisting of two sister chromatids align on the metaphase plate
 - All pairs of homologous chromosomes, where each bivalent consists of two pairs of chromatids, align on the metaphase plate
 - Spindle fibers fail to attach to the telomeres and the chromosome number is doubled
 - Each chromosome undergoes replication, giving two sister chromatids
35. At Anaphase of mitosis, the failure of spindle fibers to form and/or function accounts for the spontaneous chromosome doubling observed in anther culture.
- T
 - F
36. Non-sister crossing over in meiosis occurs
- During the pre-meiotic S phase
 - At Pachynema
 - At Anaphase I
 - At Metaphase II
37. If a diploid plant is said to have 30,000 genes this would mean that the plant has 30,000 loci.
- T
 - F
38. The C-value paradox refers to
- The number of genes is a direct function of genome size
 - The Kew Gardens database requires you supply your email address
 - The conversion of picograms to Megabases (Mb) of DNA
 - The observation that organisms of similar evolutionary complexity can differ vastly in genome size
39. The assigned reading on “Dark Matter” makes the case that
- Most genes encode dark pigments and therefore they matter
 - Most of the DNA in eukaryotes consists of genes
 - The DNA that is not coding for genes may be important in regulating gene expression
40. Epigenetics is a term meaning
- Changes in phenotype due to heritable changes in the genotype
 - Heritable changes in phenotype without change in the DNA
 - The study of telomere shortening in the epidermal layers of skin
41. Which of the following is most correct?
- Methylation leads to reduced gene expression and acetylation leads to increased gene expression
 - Methylation leads to increased gene expression and acetylation leads to reduced gene expression

42. Transposable elements are agents of genome expansion
- T
 - F
43. Two classes of transposable elements are
- Transposons and retrotransposons
 - Prions and lincRNAs
 - mRNAs and RNA1
 - Chloroplasts and mitochondria
44. You observe that the % recombination between two loci is 20%.
- the % recombination value will be equal to the cM value
 - the % recombination value will be less than the cM value
 - the % recombination value will be higher than the cM value
 - To convert % recombination to cM you multiply by the number of Mb per chromosome
45. As more loci are added to a map (for example, in 2013 it is fairly straightforward and cost-effective to create a map based on thousands of loci), determining the correct order of loci becomes
- Trivial
 - More complicated
 - Density has no issue on the difficulty of determining order
46. You determine that the linkage maps of barley chromosome 1H and wheat chromosomes 1A, 1B, and 1D have many of the same marker loci in the same order. This is an example of
- Orthology
 - Homology
 - Homoeology
 - Cosmology
47. Independent assortment of alleles at two or more loci can be due to the
- Loci being on non-homologous chromosomes
 - Loci being far apart on the same chromosome
 - Loci being in the centromeric region of the same chromosome
 - A and B
 - A, B, and C
48. If an organism is $2n = 2x = 30$, and you have data from 2,000 markers providing complete genome coverage scored on a population of 100 doubled haploid plants, you should show how many linkage maps?
- 5
 - 10
 - 15
 - 30

Consider two loci. One locus controls flower color (alleles W and w determine white and red, respectively) and the other controls resistance to a foliar pathogen (alleles R and r determine resistance and susceptibility, respectively). One parent is WWRR and the other is wwrr. You score the two traits in 100 doubled haploid progeny and record the following data:

White and Resistant	White and Susceptible	Red and Resistant	Red and Susceptible
46	6	4	44

49. The non-parental classes are
- White/Resistant and Red/Susceptible
 - White/Susceptible and Red/Resistant
 - Not identifiable given these data
50. Because the two loci are reported to be on the same chromosome, you want to see if they are linked in your cross. To do so, you would divide
- The parental classes/100
 - The non-parental classes/100
 - The non-parental + parental classes/100

Table 2-2 Critical Values of the χ^2 Distribution

df	P									df
	0.995	0.975	0.9	0.5	0.1	0.05	0.025	0.01	0.005	
1	.000	.000	0.016	0.455	2.706	3.841	5.024	6.635	7.879	1
2	0.010	0.051	0.211	1.386	4.605	5.991	7.378	9.210	10.597	2
3	0.072	0.216	0.584	2.366	6.251	7.815	9.348	11.345	12.838	3
4	0.207	0.484	1.064	3.357	7.779	9.488	11.143	13.277	14.860	4
5	0.412	0.831	1.610	4.351	9.236	11.070	12.832	15.086	16.750	5
6	0.676	1.237	2.204	5.348	10.645	12.592	14.449	16.812	18.548	6
7	0.989	1.690	2.833	6.346	12.017	14.067	16.013	18.475	20.278	7
8	1.344	2.180	3.490	7.344	13.362	15.507	17.535	20.090	21.955	8
9	1.735	2.700	4.168	8.343	14.684	16.919	19.023	21.666	23.589	9
10	2.156	3.247	4.865	9.342	15.987	18.307	20.483	23.209	25.188	10
11	2.603	3.816	5.578	10.341	17.275	19.675	21.920	24.725	26.757	11
12	3.074	4.404	6.304	11.340	18.549	21.026	23.337	26.217	28.300	12
13	3.565	5.009	7.042	12.340	19.812	22.362	24.736	27.688	29.819	13
14	4.075	5.629	7.790	13.339	21.064	23.685	26.119	29.141	31.319	14
15	4.601	6.262	8.547	14.339	22.307	24.996	27.488	30.578	32.801	15