PBG430 & PBG530 EXAM 1

Monday Feb 2nd 2015

1. Histone proteins are
    a. What spindle fibers are made of
    b. Formed in the nucleolus
    c. Involved in the nucleosome structure of chromatin
    d. Not encoded by genes

2. You would like to determine if your neighbor's Roundup Ready ™ crop has pollinated your certified organic crop (which is susceptible to Roundup). F1 plants grown from seed harvested from the organically-grown plants are all resistant to the herbicide. You allowed the Roundup resistant F1 plants to self-pollinate. You plant the selfed seed harvested from F1 plants to produce a population of 100 F2 plants. In the F2, 75 plants are resistant to Roundup and 25 are susceptible. Based on this information, Roundup resistance shows what kind of inheritance?
    a. Quantitative
    b. Qualitative

3. Which of the following is the physical basis of segregation?
    a. Pairing of homologous chromosomes
    b. Sister chromatid exchange
    c. Anaphase I
    d. Anaphase II

4. If a diploid plant is said to have 30,000 genes this would mean that the plant has 30,000 loci.
    a. T
    b. F

5. At which stage of mitosis would you see sister chromatids migrating to opposite poles?
    a. Prophase
    b. Metaphase
    c. Anaphase
    d. Telophase

6. Doubled haploid and testcross dihybrid ratios for loci showing independent assortment are expected to be
    a. 1:1
    b. 3:1
    c. 1:1:1:1
    d. 9:3:3:1

7. An allele can be best described as
    a. a homozygous genotype
    b. a heterozygous genotype
    c. one of several possible forms of a gene
    d. a phenotype of an organism

8. In a species with defined X and Y chromosomes, where males are XY and there is no recombination between the X and Y chromosomes, all genes on the Y chromosome will show complete linkage with each other.
    a. T
    b. F

9. If a plant has maternal inheritance of organelles, genes in the mitochondrial genome are expected to
    a. Not segregate
    b. Segregate 3:1
    c. Segregate 1:2:1
    d. Segregate 9:3:3:1

10. Segregation can be observed in both monohybrid and dihybrid crosses but independent assortment can only be observed in dihybrid crosses.
    a. T
    b. F

11. Segregation refers to alleles at a single locus and independent assortment to alleles at two or more loci.
    a. T
    b. F

12. Self-incompatibility (SI) is a mechanism of encouraging cross pollination in plants with perfect flowers. SI is based on which of the following
    a. Pollen sterility
    b. Apomixis
    c. Ability to self-pollinate but not cross pollinate
    d. A genetic system where there are multiple SI alleles per locus but any given plant has only two of these alleles

13. A The genome sizes of plants are directionally proportional to their physical sizes: e.g. small plants have small genomes and big plants have big genomes
    a. T
    b. F

14. The centromere is
    a. a separate organelle added to the chromosome so that sister chromatids can separate at mitosis but not in meiosis
    b. an excellent example of euchromatin
    c. the molecular machine responsible for DNA replication
    d. site of attachment of spindle fibers

15. Hermaphroditic flowers are very rare in angiosperms.
    a. T
    b. F

16. The ancestral condition of angiosperm flowers is thought to be
    a. Hermaphroditic
    b. Monoecious
    c. Dioecious
    d. Self-incompatible

17. 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%

18. In plants, the vegetative meristem undergoes a transition to a floral meristem. Subsequently, there is floral organ initiation in this meristem. Which of the following statements best describes sex determination in monoecious and dioecious plants?
    a. In all species with unisexual flowers, the floral organ initiation step is blocked.
    b. Floral development is blocked at different stages (e.g. floral organ initiation, pollen development, egg maturation) in different species.

19. In a diploid species that is 2n = 32, the "F" gene is 3 kb long. Which of the following statements is most true?
    a. If you produce doubled haploids from the cross of the F1 derived from FF x ff the expected genotypic ratio for alleles at the F locus is 3:1.
    b. In a population of 1,000 plants of this species, only two alleles at the F locus are possible.
    c. Many alleles at the F locus are possible in a sample of 1,000 plants of this species, but only two alleles will occur in any single plant.
    d. If there are different alleles at the F locus, there is no way to study their inheritance.

20. In genetics, polymorphisms can occur at
    a. The phenotype level
    b. The gene level
    c. The nucleotide level
    d. All of the above

21. The required reading on "dark matter" argued that non-coding (formerly known as junk) DNA is
    a. Useless
    b. Actually coding for genes
    c. Involved in aging
    d. Involved in gene regulation

22. 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.
    a. T
    b. F

23. Crossing over between non-sister chromatids in each bivalent occurs at which stage of meiosis?
    a. Zygonema
    b. Pachynema
    c. Metaphase I
    d. Metaphase II
    e. Telophase II

24. Genetic analysis is simpler in plant than in animals because plants have only one (the nuclear) genome.
    a. T
    b. F

25. Assume there are 30,000 genes in the tomato genome. You create an F1 hybrid by crossing two completely inbred parents that have contrasting alleles at 10,000 of the 30,000 loci. You save seed harvested from the F1 plants and you plant it the next year. You expect that:
    a. The F2 plants will all look the same
    b. The F2 plants will all look different

26. From birth until death, both mitosis and meiosis are occurring in all cells of the organism, all the time.
    a. T
    b. F

27. Assume you get a job propagating a plant that is an obligate apomict. Your task is to identify heritable phenotypic variation in this species. You tell your boss that this is going to be a very challenging task because there are only two possible sources of heritable phenotypic variation in this obligate apomict. Which two sources of variation will you say are most likley?
    a. Segregation and independent assortment
    b. Mutation and epigenetics
    c. Monoecy and dioecy
    d. Centromere and telomere shortening

28. In a monoecious plant, the male and female flowers form through
    a. The action of different genes
    b. The selective abortion of floral organs during development
    c. The separation of sister chromatids at mitosis

29. The key difference between epigenetics and mutation is that differences in phenotype due to epigenetics are not inherited.
    a. T
    b. F

30. The genetic basis of apomixis is well-understood and most F1 hybrids sold in 2013 will be apomicts
    a. T
    b. F

31. Sexual reproduction is generally considered to be more advantageous than asexual reproduction in the long run. However, only dioecious plants enjoy this advantage.
    a. T
    b. F

32. Self-incompatibility, as in the hazelnut, is best defined as
    a. Male sterility due to non-functional pollen
    b. Failure to set seed when self-pollinated with viable pollen
    c. Female sterility due to a lack of stigmas
    d. Pollen failure due to a mutant gene in the cytoplasm

33. Apomixis is a system is which a heterozygous genotype can produce genetically identical offspring via seed.
    a. T
    b. F

34. A chromosome can usually synapse with any other chromosome at Zygotene.
    a. T
    b. F

35. Transposable elements are agents of genome expansion
    a. T
    b. F

36. A plant = 2n = 2x = 30. The total number of chromosomes in each of the four daughter cells produced by meiosis will be
    a. 15
    b. 30
    c. 45
    d. 60

37. There is an S phase, where DNA is replicated, in both mitosis and meiosis
    a. T
    b. F

38. Self-incompatibility can occur in both hermaphroditic and monoecious flowers.
    a. T
    b. F

39. In both megasporogenesis and microsporogenesis, each of the four products of meiosis survives to become sperm and eggs, respectively.
    a. T
    b. F

40. Considering the assigned reading of Komatsuda et al., the source of new Vrs1 alleles controlling row type in barley is:
    a. Mutation
    b. Colchicine
    c. Recombination
    d. Spontaneous generation

41. A key advantage of an "X,Y" sex chromosome system in which males are XY and females are XX is that it ensures there will always be more females than males.
    a. T
    b. F

42. Consider the following data from a diploid plant. The dominant parent has purple seeds. The recessive parent has white seeds. Your produce 100 doubled haploids from the F1 and found the segregation in the table following. Unfortunately, you forgot to check seed color at the F1 generation.

Seed color	Number of doubled haploid plants
Purple	45
White	55

How many loci do you hypothesize determine seed color?

a. 1
b. 2
c. 3
d. 4

43. Segregation of alleles at a locus (ignoring crossovers) occurs at what stage of meiosis?

a. Zygonema
b. Pachynema
c. Anaphase

44. In plants, the ancestral condition was dioecious. Monoecious and hermaphroditic plants evolved through the progressive elimination of sex chromosomes.

a. T
b. F

45. You calculate that the Chi-square for a predicted 1:1 ratio for purple: white is "1.0". How many degrees of freedom will you use to test the hypothesis that the observed and expected ratios are equal?

a. 1
b. 2
c. 3
d. 4

46. After referring to a chi square table (see last page of exam) will you accept or reject this ratio?

a. Accept
b. Reject
c. Neither accept nor reject: chi square tests are not appropriate for these sorts of quantitative data.

47. You cross a red flowered rose with a white flowered rose and the F1 is pink flowered. You self the pink flowered F1 plants and obtain a ratio of 1 red flowered: 2 pink flowered: 1 white flowered plants. Is this an example of:

a. Incomplete dominance
b. A quantitative trait
c. Complete dominance of the red allele
d. Complete dominance of the white allele

48. What key event in meiosis occurs that can lead two loci on the same chromosome to show independent assortment in a population of 100 individuals?

a. crossover
b. mutation
c. tetrad formation
d. segregation

49. 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 when resistance is dominant?
    a. 1:1
    b. 1:2:1
    c. 3:1
    d. 9:3:3:1

50. Which stage in the mitotic cell cycle lasts the longest?
    a. Prophase
    b. Metaphase
    c. Anaphase
    d. Telophase
    e. Interphase

51. Bonus (Extra Credit) Question. If a Scottish person said he/she was 'havering', would they be:
    a. Floating on air
    b. Trembling with anticipation
    c. Talking nonsense
    d. Eating haggis