

Multiple Choice Questions (worth 2 points each)

Questions 1-2 refer to the following scenario: A student counted the number of empty beer bottles in 11 bags of recycled glass. She observed the following numbers:
0, 0, 0, 0, 0, 0, 1, 6, 6, 6, 6

1. What are the **mean**, and **median** number of bottles?
A) Mean is 2.27 bottles/bag, median is 2.97 bottles/bag
B) Mean is 6, Standard deviation is 2.97
C) Mean is 1 bottle/bag, Standard deviation is 8.82
D) Mean is 2.27 bottles/bag, median is 0 bottles/bag.
E) Mean is 2.27, median is 0.
2. Bottles per bag is what type of character? The data above suggest what type of distribution?
A) Discontinuous measurable character, Normal distribution
B) Continuous measurable character, Bimodal distribution
C) Discontinuous measurable character, Bimodal distribution
D) Qualitative character, Bimodal distribution
E) Qualitative character, Normal distribution
3. The phenotype of an organism is
A) The observable properties of the organism
B) The combination of alleles possessed by the organism
C) A heritable property of the organism
D) The fundamental particle of heredity
E) A stretch of DNA that codes for a protein
4. How many different gametes can be formed by the following parental genotype?
Aa Bb cc DD
A) 2
B) 4
C) 6
D) 8
E) 1
5. Which of the following could cause a fly with the bithorax mutation to exhibit the bithorax phenotype?
A) Heat shock
B) Cold shock
C) Ether
D) Expression is automatic as long as the mutation is present
E) A, B and C

Questions 6-9: refer to the following genetics cross:

Albinism is a condition that results from the lack of normal pigmentation. In humans, individuals with two recessive alleles at the ALBINO (aa) locus are albino.

Attached earlobes result from two recessive alleles at the (ee) EARLOBE locus.

An albino man with attached earlobes marries a pigmented woman with non-attached earlobes. They have 20 children, (the F1) none of them twins. All of their children are pigmented with non-attached earlobes.

6. What is the most likely genotype of the **woman**?
 - A) AAee
 - B) aaEE
 - C) AaEe
 - D) AAEE
 - E) aaee

7. What set of alleles for earlobes and pigmentation do the **man's** gametes carry?
 - A) a e
 - B) a E
 - C) AA EE
 - D) A E
 - E) Aa Ee

8. What is the genotype of their children (the F1)?
 - A) aaee
 - B) aaEE
 - C) AaEe
 - D) AAEE
 - E) all of the above are possible

9. What proportion of the gametes **from their children** (the F1) would be expected to exhibit the dominant trait for pigmentation and the dominant trait for earlobes? (assuming no linkage)
 - A) 9/16
 - B) 3/4
 - C) 100%
 - D) 1/4
 - E) 1/16

10. What type of a variable is a person's political party?
 - A) An attribute
 - B) Discontinuous Measurable
 - C) A Rank
 - D) Continuous Measurable

11. About how many genes are there in the human genome?
 - A)1,000
 - B)10,000
 - C)45,000
 - D)500,000
 - E)ten million

Questions 12 – 16 refer to the following scenario. In *Drosophila melanogaster*, the recessive allele for the sepia locus causes flies to have very dark colored eyes. The recessive allele at the ebony locus causes the fly to have very dark body color.

A male from a true breeding line of sepia eyed-ebony bodied flies (line A) is crossed to a female from a true breeding line of red eyed, tan-bodied flies (the “wild type” line B) to create an F1:

Next, a female from the F1 is crossed to a male from the sepia-eyed, ebony bodied, line.

The phenotypes of 1000 progeny from this test cross were scored as follows:

Eyes	Body	Number Observed
Red	Normal	300
Sepia	Normal	200
Red	Ebony	200
Sepia	Ebony	300

12. What was the genotype of the F1?
- A) se se EB EB
 - B) se EB
 - C) se eb
 - D) SE se EB eb
 - E) Can't tell because of linkage
13. If the genes were not linked, what number of progeny from the test cross would be expected to be “wild type”? (Red Eyes, Tan Body)
- A) 200
 - B) 300
 - C) 250
 - D) 1000
 - E) 62.5, or 1/16 of the total
14. Do a Chi-Square test of Observed vs. Expected values, using independent assortment to generate your expected values. What is the value of χ^2 ?
- A) 40
 - B) 10
 - C) 7.4
 - D) 16
 - E) 1000
15. Crossing over (recombination) could occur in which of the following?
- A) The Male F1.
 - B) The Female F1
 - C) The homozygous recessive males
 - D) A and B
 - E) All of the above

		P		
		.50	.05	.001
Degrees of freedom	1	.45	3.84	6.63
	2	1.39	5.99	9.21
	3	2.37	7.81	11.34

16. Based on the table above (which is similar to the one in your lab manual on pp. 93), which of the following could reasonably be concluded from your Chi-square value from question 19?

- A) Independent assortment is supported, the loci are linked.
- B) Independent assortment is rejected because the Chi-square value is smaller than the critical value.
- C) Independent assortment is supported because the Chi-square value is small
- D) The Chi-square value is larger than the critical value, thus, independent assortment is falsified
- E) The Chi-square value is too large to show anything

17. In Ants, Bees and wasps, sex is determined by

- A) X and Y chromosomes
- B) The number of sets of chromosomes (haploid vs. diploid)
- C) Environment
- D) W and Z chromosomes
- E) a single gene on an autosome

18. The phenomenon of linkage is due to

- A) the process of cytokinesis
- B) the failure of Mendel's law of segregation
- C) The arrangement of genes on chromosomes
- D) The non-random fusion of gametes during fertilization
- E) The statistical association of genes and environment

19. Pleiotropy is:

- A) When a single locus affects many different traits.
- B) When the X chromosome is inactivated in some tissues, but not others
- C) When one gene locus affects the expression of others
- D) The inheritance pattern exhibited when a gene is carried on the sex chromosome
- E) None of the above.

20. In Alligators, sex is determined by

- A) X and Y chromosomes
- B) The number of sets of chromosomes (haploid vs. diploid)
- C) Environment (incubation temperature of eggs)
- D) W and Z chromosomes
- E) a single gene on an autosome

21. Which of the following are true about variation?

- A) It is ubiquitous-all species exhibit variation.
- B) It is important to the process of evolution.
- C) Much of it has a genetic basis.
- D) Much of it is a by-product of the environment
- E) All of the above.

Questions 22-23 refer to the following scenario:

A man with type B blood marries a woman with type A blood. Their first child has type O blood.

22. What is the genotype of the MAN?

- A) BB
- B) $I^B I^O$
- C) $I^O I^O$
- D) B
- E) $I^B I^B$

23. What is the probability that their **next** child will have type AB blood?

- A) .50
- B) .25
- C) 0
- D) .75
- E) 1.0

Questions 24-25 refer to the following scenario:

In garden peas, tall (T) is dominant to short (t), Purple Flowers are (P) dominant to white flowers (p), Axial flowers (A) are dominant to terminal flowers (a), and yellow seeds (G) are dominant to green seeds (g).

An individual from a true breeding line of tall, purple-flowered, axial-flowered, yellow-seeded pea plants is mated to an individual from a true breeding line of short, white-flowered, terminal-flowered, green-seeded plants.

The F1 are allowed to self-fertilize and produce an F2.

24. What proportion of the F2 are expected to exhibit all four recessive traits?

- A) 1/4
- B) 1/8
- C) 1/16
- D) 1/64
- E) 1/256

25. What proportion of the F2 are expected to exhibit purple flowers and yellow seeds?

- A) 1/4
- B) 3/4
- C) 81/244
- D) 9/16
- E) 1/244

26. The purposes of Meiosis include:

- A) The production of gametes in animals
- B) The reduction of 1 diploid cell to 4 haploid cells
- C) The joining of haploid cells to produce diploid cells
- D) The production of somatic cells for growth
- E) A and B.

27. Prokaryotes (generally):

- 1) have no gene exchange 2) have circular DNA
3) have smaller genomes than eukaryotes 4) have a nucleus

- A) 1 only
B) 1 and 2
C) 2 and 3
D) 2, 3 and 4
E) 1, 2, 3, and 4

Questions 28-30 refer to the following genetics cross:

Line A is a true-breeding line of **chocolate** labs (dogs). Line B is a true-breeding line of **yellow** labs. A male from line A is crossed to a female from line B. The resulting F1 are all **black** labs. The F1 mate with each other. The F2 have black, yellow, and chocolate lab puppies.

28. What type of interaction between genes is this?

- A) incomplete dominance
B) sex-linkage
C) linkage
D) epistasis
E) pleiotropy

29. What proportion of the F2 would you expect to be **chocolate**?

- A) 9/16
B) 1/4
C) 100%
D) 0%
E) 3/16

30. If a dog from the F1 were allowed to breed with a dog from line B, what proportion of the resulting offspring would be expected to be **yellow**?

- A) 1/2
B) 3/4
C) 100%
D) 0%
E) 1/16

For questions 31-32, The postulates below refer to different evolutionary theories regarding sex.

- 1 Without recombination, mutation pressure alone can drive a species extinct
- 2 Without constant evolutionary change, species would go extinct.
- 3 Sexual reproduction provides the variation necessary for the continued survival of a species.
- 4 In a changing environment, variation among offspring ensures that at least a few have the potential to survive.

31. Which of the following is the cornerstone of Muller's Ratchet?

- A) 1
- B) 2
- C) 3
- D) 4
- E) None of the above

32. Which of the following apply to the "Red Queen Hypothesis".

- A) 1
- B) 2
- C) 3
- D) 2 and 3
- E) None of the above.

33. According to evolutionary biologists, why is the female expected to be choosier than a male when selecting a mate?

- A) Generally, female fitness is determined by the availability of resources and not the number of mates.
- B) Females contribute more of their genes to their offspring.
- C) Females generally invest more, in terms of parental care or reproductive effort.
- D) A and C
- E) None of the above

34. What type of mating system do giraffes possess?

- A) Polygyny: males arrive at a lek and "display" their long necks for the benefit of females.
- B) Monogamy: male and female giraffes mate for life.
- C) Polygyny: males fight for access to females as they come into oestrus, using their long necks.
- D) Polygyny: females fight for access to the dominant male.
- E) Monogamy: males mate with as many females as possible, but produce one gamete each time.

35. Which of the following groups contains the **smallest** proportion of undiscovered and/or undescribed species?

- A) Birds
- B) Bacteria
- C) Diatoms
- D) Beetles
- E) Can't tell, not enough data.

36. Which of the following reasons might cause a sexual species to have an evolutionary advantage relative to an asexual species?
- A) Mullers ratchet-eventually all the members of an asexual species will have deleterious mutations that impair their fitness.
 - B) The Red Queen hypothesis-the variation produced by sexual reproduction facilitates the continual evolution necessary for species to survive in the long term.
 - C) Bet-hedging-by producing variable offspring, females can ensure that at least a few of their offspring will survive.
 - D) Without sex, no species can reproduce, and eventually all the members will die.
 - E) A and B.
37. Which of the following would you expect in a polygynous mating system where males arrive at a lek and display for the benefit of females?
- A) Sexual selection due to female choice
 - B) High variability in the number of mates per male
 - C) Males would provide no parental care
 - D) Males would provide extensive parental care
 - E) A, B and C
38. Which of the following statements about *Paramecium caudatum* are true? (List all that apply)
- A) It is an animal
 - B) It is a prokaryote
 - C) It is a eukaryote
 - D) It reproduces sexually
 - E) It reproduces asexually
39. Which of the following best describes the sexual life history of the blue wrasse?
- A) Monogamous species, mates for life, sex determined by X and Y chromosomes.
 - B) Polygynous species, sex determined by X and Y chromosomes.
 - C) Polygynous species, sequential hermaphrodite, males keep a harem of females.
 - D) Polyandrous species, females keep a harem of males, sex determined by water temperature.
 - E) B and C are both correct.
40. Which of the following genetic mechanisms is responsible for the color of bell peppers?
- A) 1 locus system, green color is dominant to red and red is dominant to yellow.
 - B) 2 locus system with epistasis. The interaction between alleles at two loci determines color.
 - C) 1 locus system with incomplete dominance. Yellow color is caused by the heterozygous condition.
 - D) Color is environmentally determined.
 - E) None of the above.