

Exam #3



Here the Red Queen began again, "Can you answer useful questions?" she said. "How is bread made?"

I know that" Alice cried eagerly. "You take some flour__."

"Where do you pick the flower?" the White Queen asked. "In a flower garden or in the hedges?"

"Well, it isn't picked at all," Alice explained: "It's ground__."

"How many acres of ground?" said the White Queen. "You mustn't leave out so many things."

"Fan her head!" the Red Queen anxiously interrupted. "She'll be feverish after so much thinking."

Lewis Carroll

Directions: Quick, before you become too feverish, write your name on the first page of the exam and on the answer sheet. Answer the multiple choice questions on the computerized answer sheet; non-multiple choice questions should be answered directly in the test booklet. Please sign the Honor Pledge at the end of the exam - assuming of course, that you have complied with its terms. Notes: (1) unless otherwise indicated, questions are worth one point; (2) in some cases, you have a choice of questions to answer; (3) some questions require complete sentences; and (4) if you have questions, ask. **Good luck young Jedi Warriors - May the Force be with you!**

Multiple Choice Questions: *Darken the correct response on the answer sheet.*

1. Which of the following processes can occur in an oxygen-free (anaerobic) environment?
 - a. glycolysis
 - b. Kreb's cycle
 - c. mitochondrial electron transport
 - d. both a and c will occur in an anaerobic environment
2. Carbon dioxide is released during:
 - a. glycolysis
 - b. the Kreb's cycle
 - c. the mitochondrial electron transport chain
 - d. substrate level phosphorylation reactions
 - e. all of the reactions above produce carbon dioxide
3. The electron transport chain in the mitochondrion moves protons from the _____ to the _____.
 - a. intermembrane space; matrix
 - b. matrix; cytoplasm
 - c. matrix; intermembrane space
 - d. matrix; stroma

4. During the complete breakdown of glucose into carbon dioxide and water, approximately _____ ATP are produced via substrate level phosphorylation and approximately _____ ATP are produced via oxidative phosphorylation.
- a. 0, 30
 - b. 2, 30
 - c. 10, 30
 - d. 15, 15
 - e. 30, 2
5. Given the general equation for respiration, $\text{Glucose (C}_6\text{H}_{12}\text{O}_6) + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$, which of the following is TRUE?
- a. glucose is reduced to water
 - b. oxygen is reduced to carbon dioxide
 - c. glucose is oxidized to carbon dioxide
 - d. oxygen is oxidized to water
 - e. glucose and oxygen are both reduced to carbon dioxide
6. Which of the following statements about glycolysis is TRUE?
- a. no ATP are made during glycolysis
 - b. Glycolysis requires 30 ATP to get started
 - c. One redox reaction occurs during glycolysis
 - d. Glycolysis occurs only under anaerobic conditions
 - e. There are three oxidative phosphorylation reactions during glycolysis
7. Which of the following is NOT DIRECTLY produced during the anaerobic breakdown of pyruvic acid during fermentation in animals or plants?
- a. carbon dioxide
 - b. ethanol
 - c. lactic acid
 - d. NAD^+
 - e. ATP
8. The final (terminal) acceptor of electrons at the end of the mitochondrial electron transport chain is:
- a. ATP
 - b. carbon dioxide
 - c. NAD^+
 - d. oxygen
 - e. water
9. If a cell is treated with cyanide, the electron transport chain will soon stop because all of the carriers in the electron transport chain will be in the reduced form.
- a. False
 - b. True
10. The source of the electrons that flow through the electron transport chain in the mitochondrion is:
- a. ATP
 - b. carbon dioxide
 - c. oxygen
 - d. glucose
 - e. water
11. During the S-phase of the cell cycle:
- a. DNA is replicated
 - b. the cell prepares for DNA synthesis
 - c. the chromosomes migrate to the poles
 - d. cytokinesis divides the parent into daughter cells

12. Which of the following occurs during cell division in plants, but not animals?
- replication of DNA
 - division of centrioles
 - formation of a cell plate
 - pinching off of daughter cells

Mitosis & Meiosis Matching Question: For each of the following indicate if it is a feature of:

- a. mitosis b. meiosis c. both
- _____ anaphase occurs during this process
 - _____ characterized by two sets of divisions
 - _____ crossing over occurs during this process
 - _____ cytokinesis occurs during the process
 - _____ daughter cells are clones of the parent cells
 - _____ daughter cells have half the number of chromosomes as the parents
 - _____ formation of chiasma occurs
 - _____ four daughter cells are formed
 - _____ homologous chromosomes pair up during this process
 - _____ human gametes are produced by this process
 - _____ primary means of by which organisms increase cell number
 - _____ the genetic information of the daughter cells is identical to the parent
 - _____ used for repair and replacement of tissue

Phases of the Cell Cycle Matching Question: Match each of the following statements with the appropriate phase of the cell cycle

- _____ chromosomes migrate to the poles
 - _____ nuclei reform in each daughter cell
 - _____ DNA replication occurs during this phase
 - _____ cleavage furrow appears
 - _____ nuclear membrane disintegrates
 - _____ chromosomes align along the equator of the cell
 - _____ chromosomes become visible during this phase
 - _____ chromatids separate
- anaphase
 - interphase
 - metaphase
 - prophase
 - telophase
34. The uncoiled DNA dispersed in the nucleus during interphase is called the:
- centrosome
 - centromere
 - centrioles
 - chromatin
 - chromosome
35. The genotype, KKPpff, represents an individual with _____ different genes.
- 3
 - 5
 - 6
 - 12
 - impossible to determine
36. Assuming no linked genes, an individual with the genotype, KKPpff, will produce _____ different types of gamete(s):
- 1
 - 2
 - 3
 - 6
 - impossible to determine

37. I can detect the odor of S-methylthioester (odor of asparagus) in my urine after eating asparagus. The ability to detect this odor is due to a single gene with two alleles. The allele for odor detection (a) is recessive to the allele for non-detection (A). My wife Linda cannot smell asparagus in her urine but her mother can. The chance that our daughter, Amy, can detect this odor in her urine is:

- a. 0
- b. 25%
- c. 50%
- d. 75%
- e. 100%

38. My genotype for this trait is _____ and Linda's genotype is _____.

- a. Aa; aa
- b. Aa; Aa
- c. AA; aa
- d. aa; Aa
- e. aa; aa

39. Amy's genotype for the asparagus smelling trait is:

- a. Aa
- b. aa
- c. Aa or aa
- d. all of the above (AA, Aa, aa) are possible

40. A man and a woman, both with type AB blood, have a child. The probability that this child will be type AB is:

- a. 0%
- b. 25%
- c. 50%
- d. 75%
- e. 100%

41. In a paternity suit, a woman with type O blood claims that a man is the father of her child. The child has type O blood. If the suspected father has type A blood, you conclude that:

- a. the defendant is definitely not the father
- b. the defendant is almost certainly the father
- c. the defendant could be the father, but so could another type A male
- d. the child is a mutant

42. Blood typing is an example of:

- a. codominance
- b. incomplete dominance
- c. multiple alleles
- d. both a and c are correct
- e. all of the above (a, b, c) are correct

43. A 1:2:1 phenotypic ratio in the F₂ generation of a monohybrid cross is a sign of:

- a. codominance
- b. incomplete dominance
- c. multiple alleles
- d. pleiotropy
- e. polygenic inheritance

 "Fast Plants" are a variety of turnips that have a very short life cycle. Some Fast Plants have a mutation in which the flowers lack petals. This condition, called apetalous, is caused by a single gene with two alleles (A and A'). The normal condition is called "wild type".

44. Assume that an apetalous plant and a wild type plant are both true-breeding. The genotype of one of the plants is _____ and the genotype of the other is _____.

- a. AA; AA
- b. AA'; AA'
- c. A'A'; AA
- d. A'A'; A'A'
- e. impossible to determine from the information given

45. These plants are:
- both homozygous
 - both heterozygous
 - one is homozygous and the other heterozygous
 - it is impossible to determine from the information provided
46. When a true-breeding apetalous plant is crossed with a true-breeding wild type plant, all of the F1 offspring are wild types. Thus, the allele for the apetalous condition is:
- dominant
 - recessive
47. The F1 offspring from the question above will have the genotype(s):
- AA
 - A'A'
 - AA'
 - some offspring will be AA and some will be A'A'
 - some offspring will be AA, some A'A' and others AA'
48. If two of the F1 plants are crossed, the resulting offspring will be:
- all wild types
 - all apetalous
 - 50% wild type and 50% apetalous
 - 75% wild type and 25% apetalous
49. In another experiment, a cross between an apetalous plant and a wild type plant yielded 48 apetalous plants and 51 wild types. The genotype of the wild type parent must be:
- homozygous
 - heterozygous
 - impossible to determine
-
50. A normal male and normal female have a son who is afflicted with Royal hemophilia (sex-linked recessive trait, h). What are the genotypes of the parents?
- $X^H X^H$ and $X^H Y$
 - $X^h X^h$ and $X^h Y$
 - $X^h X^h$ and $X^H Y$
 - $X^H X^h$ and $X^h Y$
 - $X^H X^h$ and $X^H Y$
51. What is the probability that a daughter born to the parents above will be afflicted with hemophilia?
- 0%
 - 25%
 - 50%
 - 75%
 - 100%
52. Dimples in one or both cheeks are due to a dominant gene (D). What are the possible phenotypes of offspring from parents who both have dimples?
- all the offspring would be expected to have dimples
 - none of the offspring would be expected to have dimples
 - some offspring could have dimples and others no dimples.
53. If a woman with dimples and a man without dimples have 10 children (9 dimpled, 1 without dimples), what is the genotype of the dimpled woman?
- DD
 - Dd
 - dd
 - it could be DD or Dd, we can't be certain

54. The sketch at the right represents a cell in prophase I of meiosis. Which of the chromosomes are homologous?

- a. 1 and 2
- b. 2 and 5
- c. 4 and 5
- d. 2 and 3
- e. 3 and 6

55. Which of the following genes are linked?

- a. a, b and c
- b. b and d
- c. d and f
- d. a and d
- e. e and f

The pedigree below traces the inheritance of alkaptonuria, a biochemical disorder. Affected individuals, represented by the shaded symbols, are unable to break down a substance called alkapton, which colors the urine and stains body tissue. Recall that circles represent females, squares = males)

56. Alkaptonuria is likely a trait that is:

- a. dominant
- b. recessive
- c. X (sex)-linked recessive

57. What is the genotype of individual I.1?

- a. AA
- b. Aa
- c. aa
- d. either AA or Aa

58. What is the genotype of individual II.2?

- a. AA
- b. Aa
- c. aa
- d. either AA or Aa

59. What is the genotype of individual III.3

- a. AA
- b. Aa
- c. aa
- d. either AA or Aa

60. If a female calico cat mates with a black spotted male cat, then the offspring are predicted to be:

- a. all black-spotted
- b. all orange-spotted
- c. all calico
- d. a mix of black-spotted, orange-spotted and calico

61. A mating between a black-spotted female cat and an orange-spotted male cat is predicted to yield:

- a. 100% calico females
- b. 50% calico female, 50% black-spotted males
- c. 75% black-spotted females, 25% orange-spotted males
- d. 25% black-spotted males, 50% calico female, 25% orange-spotted males

62. Which of the crosses below best represents a test cross for genes A and B?

- a. AaBb x AaBb
- b. AaBb x aaBB
- c. AaBb x aabb
- d. aaBb x AaBB

63. The frequency of recombination between two gene loci is used to calculate:
- relative position of the loci along the chromosome
 - length of the chromosome
 - dominance relationships
 - distance between the centromere and one of the genes
64. Red coat color is incompletely dominant to white in horses. If a white mare has a "roan" colored (mix of red and white) foal, what is the color of the father?
- roan or red
 - roan
 - red
 - The father's color can't be determined without more information.
65. In Jimson weed, the allele that results in violet flowers (V) is dominant to one that results in white flowers (v) and the allele that makes prickly seed capsules (P) is dominant to one that results in smooth capsules (p). A plant with white flowers and prickly seed capsules is crossed with one that has violet flowers and smooth capsules. The F1 consisted of 47 plants with white flowers and prickly capsules; 45 plants with white flowers and smooth capsules, 50 plants with violet flowers and prickly capsules, and 46 plants with violet flowers and smooth capsules. The genotypes of the parents are:
- vvPP x VVpp
 - vvpp x VvPP
 - vvPp x Vvpp
 - VVPP x vvpp
 - VvPp x VvPp
66. The flower color gene and the capsule gene in the question above are:
- not linked
 - linked
 - not enough is provided
67. In peas, the allele for round seed shape (R) is dominant to one for wrinkled seeds (r) and the allele for yellow seeds (Y) is dominant to the one for green seeds (y). Assume that these genes are linked on the same pair of homologous chromosomes. Consider an individual with the genotype RrYy (see diagram below). Assuming crossing over does not occur, what are the possible genotypes of gametes that this individual can produce?
- Rr & Yy
 - Ry & rY
 - RY, Ry, rY, ry
 - RY & ry
68. Now, assume that a single crossover occurs. What types of gametes can this individual produce?
- Rr & Yy
 - Ry & rY
 - RY, Ry, rY, ry
 - RY & ry

answer the remaining questions directly on the test booklet.

A Non-Disjunction Question: *Aren't they all disjuncted?* (4 pts)

Assume that a non-disjunction of the sex chromosomes occurs during meiosis I in a male. Further assume that these sperm fertilize normally produced eggs. List the genotypes (*e.g.*, XY, XX, XXX), phenotypes (*e.g.*, normal or name of disorder), whether male or female, # chromosomes in the fertilized zygote, and the probability of the occurrence for all possible offspring. Note: not all rows in the table will necessarily be used.

Genotype	Phenotype	Sex	Chromosome #	Probability

Short Answer Questions:

1. Compare and contrast oxidative and substrate level phosphorylation.

2. Describe the process of binary fission.

Congratulations, You Made It!!!! You've Completed Your Third Intro Bio Exam!!

Pledge: I have neither given nor received help when taking this exam.

Signature _____ **Date** _____

Bonus Questions: *Earn one bonus point for each correct response. No points are deducted for incorrect responses.*

1. DNP was once used as a treatment to loose weight. Explain the theory of how it worked.
2. What does colchicine do?
3. Lactate dehydrogenase catalyzes the reduction of Pyruvate to lactate in an anaerobic environment. Why is the a relationship between this enzyme and a heart attack?
4. Write a question that you wished had been on the exam, but wasn't.