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**BIOL 101 – Foundations of Biology**  
**Exam 2 – Spring 2012-- Prof. Hardy**

Instructions:

1. Please do not turn this page over until Prof. Hardy has instructed you to do so.
2. Put your cell phone away.
3. Take out a scientific calculator. If you don't have one, use your pencil and paper for calculations when needed.
4. -Scantron answer bubbles should be completely filled in with a number 2 pencil.
5. -Start by filling in your complete last name and both first and middle name initials.
6. -Fill in your MU number in the Social Security number slot.
7. -Read ALL possible answers, then choose THE BEST answer.

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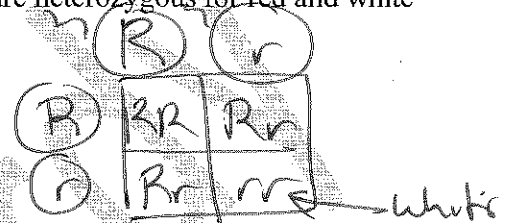
1. The fact that a parent from a lineage true-breeding for a dominant trait can have heterozygous offspring with a parent from a lineage true-breeding for a recessive trait is expressed by the ...

- A. The Law of Entropy
- B. The Law of Independent Assortment
- C. The Law of Homozygosity
- D. The Law of Segregation

2. What is the expected frequency of the red flowered phenotype in the immediate offspring generation following a cross between two parents that are heterozygous for red and white alleles in which the red is dominant to the white allele?

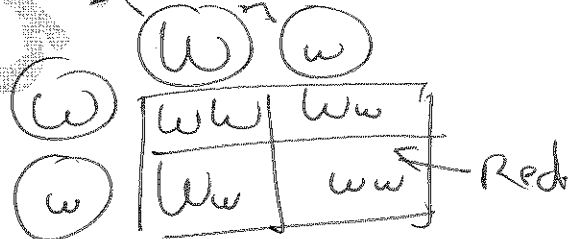
- A. 0.00
- B. 0.25
- C. 0.50
- D. 0.75
- E. 1.00

$Rr \times Rr$



3. What is the expected frequency of the red flowered phenotype in the immediate offspring generation following a cross between two parents that are heterozygous for red and white alleles where the white allele is dominant?

- A. 0.00
- B. 0.25
- C. 0.50
- D. 0.75
- E. 1.00



4. That any possible combination of two traits coded by two separate genes is possible in organisms is embodied best by...

- A. The Law of Entropy
- B. The Law of Independent Assortment
- C. The Law of Homozygosity
- D. The Law of Segregation

5. That, during gamete formation, the segregation of the alleles for one gene does not influence the segregation of the alleles for another gene is embodied best by...

- A. The Law of Entropy
- B. The Law of Independent Assortment
- C. The Law of Homozygosity
- D. The Law of Segregation

6. The mating between two pea plants that are heterozygous for the same gene is called a...

- A. Monohybrid cross
- B. Dihybrid cross

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7. Mendel crossed two lines of peas, each true-breeding for purple and white flower color, respectively. In the F1 generation, he only saw purple flowers. In the F2 generation he observed 550 offspring plants. How many of these 550 are expected to be white-flowered?

A. About 14  
B. About 140  
C. About 436  
D. About 410  
E. Zero

$$0.25 \times 550 = 137.5$$

8. Chromatin, the stuff chromosomes are made of, is made up of what?

A) lipids and DNA  
B) proteins and RNA  
C) ribosomes and DNA  
D) protein and DNA  
E) proteins and amino acids

9. The cellular products of mitosis are genetically \_\_\_\_\_ to the parent cell, whereas those of meiosis are \_\_\_\_\_.

A. spores, daughter cells  
B. haploid, diploid  
C. different, not  
D. female, male  
E. identical, not

10. Bacteria experience...

A. Mitotic Cell Division  
B. Meiotic Cell Division  
C. Binary fission

11. Bacterial chromosomes ....

A. ...are linear  
B. ...are circular  
C. ...number more than one.  
D. A and C  
E. B and C

12. Eukaryotic chromosomes typically ...

A. ...are linear  
B. ...are circular  
C. ...number more than one in diploid cells.  
D. A and C  
E. B and C

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13. Your gametes are...

- A. haploid
- B. diploid
- C. triploid
- D. tetraploid
- E. pentaploid

14. Your somatic cells are...

- A. haploid
- B. diploid
- C. triploid
- D. tetraploid
- E. pentaploid

15. During meiosis in a normal female with no apparent disease, an egg is produced with two chromosome 21's. If that egg is fertilized by a normal sperm and develops into a baby, that baby is likely to have....

- A. Klinefelter's Syndrome
- B. Sickle Cell anemia
- C. Lactose intolerance
- D. No disease whatsoever
- E. Down Syndrome

16. How many chromosomes does that egg cell above have in it?

- A. 46
- B. 47
- C. 48
- D. 23
- E. 24

17. The two chromosome 21's above in that egg cell likely came from an error during ...

- A. Binary Fission
- B. Cytokinesis
- C. Cell plate formation
- D. Mitosis
- E. Meiosis

18. If humans have 23 chromosomes in their gametes and chimps have 24 in their gametes, what is the diploid number of chromosomes that a humanzee (hybrid) would have?

- A. 23
- B. 24
- C. 23.5
- D. 47
- E. 48

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19. Looking into your microscope, you spot an unusual cell. Instead of the typical rounded cell shape, the cell has a very narrow middle separating two bulging ends. It sort of looks like the number 8! Then you realize, this is a cell...
- A) undergoing cytokinesis.
  - B) in the S phase of interphase.
  - C) in the G1 phase of interphase.
  - D) in the G2 phase of interphase.
  - E) that is about to undergo mitosis.
20. During which phase of mitosis do the chromosomes line up at the cell's equator?
- A) interphase
  - B) prophase
  - C) metaphase
  - D) anaphase
  - E) telophase
21. Which of the following is a feature of plant cell division that distinguishes it from animal cell division?
- A) A cell plate forms.
  - B) A cleavage furrow forms.
  - C) Cytokinesis does not occur.
  - D) Four new cells (rather than two) are produced per mitotic division.
  - E) The nucleolus disappears and then reappears.
22. Crossing –over typically ....
- A) results in new combinations of alleles of the different genes along a chromosome.
  - B) contributes to genetic variation in populations.
  - C) results in two unequal-sized chromosomes
  - D) results in variation in chromosome size
  - E) A and B
23. Which one of the following does *not* occur during mitotic anaphase?
- A) Sister chromatids separate.
  - B) The chromatid DNA replicates.
  - C) All of the choices occur during mitotic anaphase.
  - D) None of the choices occur during mitotic anaphase.
24. How many sex chromosomes does a typical human gamete have?
- A. One
  - B. Two
  - C. Twenty-three
  - D. Forty-six
  - E. three

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25. How many sex chromosomes does a typical human brain cell have?
- A. One
  - B. Two
  - C. Twenty-three
  - D. Forty-six
  - E. three
26. How many sex chromosomes does a brain cell of a human with Klinefelter's Syndrome have?
- A. One
  - B. Two
  - C. Twenty-three
  - D. Forty-six
  - E. three
27. Order the three main sets of reactions in cellular respiration in the order in which energy from glucose is harnessed.
- A) Electron Transport, Glycolysis, Krebs Cycle
  - B) Glycolysis, Electron Transport, Krebs Cycle
  - C) Citric Acid Cycle, Electron Transport, Glycolysis
  - D) Glycolysis, Electron Transport, Citric Acid Cycle
  - E) Glycolysis, Krebs Cycle, Electron Transport
28. What is the difference between "mitochondria" and "mitochondrion"?
- A) the former is plural, the latter is singular
  - B) the former is singular, the latter is plural.
  - C) the former is involved in photosynthesis, the latter in respiration.
  - D) none of the above.
29. What is ATP?
- A) Adenosine Tri-Phosphate
  - B) The primary energy "currency" of the cell.
  - C) Active Transport Protein.
  - D) Both A and B
  - E) Both B and C.
30. Which of the reactions below best depicts aerobic cellular respiration?
- A)  $6\text{CO}_2 + 6\text{H}_2\text{O} \Rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
  - B)  $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \Rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$
  - C)  $\text{C}_6\text{H}_{12}\text{O}_6 \Rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$
  - D)  $6\text{CO}_2 + 6\text{O}_2 \Rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{H}_2\text{O}$
31. What atom is the final electron acceptor in the electron transport chain of respiration?
- A) carbon
  - B) nitrogen
  - C) phosphorus
  - D) hydrogen
  - E) oxygen

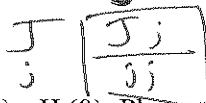
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32. What do NADH and FADH<sub>2</sub> do and where are they produced?
- A) they are forms of ATP produced during glycolysis that help to drive the electron transport chain.
  - B) they are forms of ATP produced during the Citric Acid Cycle that help to drive the electron transport chain.
  - C) they are molecules both produced during glycolysis that transport electrons to the electron transport chain.
  - D) they are molecules produced during the Krebs Cycle that transport electrons to the electron transport chain.
  - E) they are molecules produced during the electron transport chain that transport electrons to the Krebs Cycle.

33. The expected genotypic and phenotypic ratios for the F1 generation, produced by the cross between the two parents shown below, are....

System: J = dominant allele for telling bad jokes      j = recessive allele for good jokes

P: Jj x jj



- A) Genotypic: jj (3) : Jj (1) : JJ (0); Phenotypic: good jokes (3) : bad jokes (1)
- B) Genotypic: jj (1) : Jj (2) : JJ (1); Phenotypic: good jokes (1) : bad jokes (3)
- C) Genotypic: jj (1) : Jj (1) : JJ (0); Phenotypic: good jokes (1) : bad jokes (1)
- D) Genotypic: jj (1) : Jj (1) : JJ (1); Phenotypic: good jokes (1) : bad jokes (2)

34. A cross is made between true-breeding red-seeded cucumber plants and true-breeding green-seeded plants of the same species. In the F1 generation, we observe only green-seeded plants. In the F2 generation following a monohybrid cross, we observed 60 red-seeded plants and 140 green-seeded plants. Is this significantly different from the expected outcome? Use the Table of Chi Square critical values given below to help you.

- A) Yes    B) No

Table 1. Critical chi-square values for various degrees of freedom.

df	X <sup>2</sup> Critical Value
1	3.84
2	5.99
3	7.81

	obs	exp
Green	140	150
Red	60	50
	200	200

$$\chi^2 = \frac{(140-150)^2}{150} + \frac{(60-50)^2}{50}$$

$$\chi^2_{calc} = 2.67, \text{ which is less than}$$

- 35) It is possible for an expressed phenotypic trait to skip a generation or two in your family.

- A) True  
B) False

than  
χ<sup>2</sup> of 3.84  
crit  
for df=1

- 36) Which one of the following is false?

- A) The genetic makeup of an organism constitutes its genotype.
- B) An organism with two different alleles for a single trait is said to be heterozygous.
- C) Alleles are alternate forms of a gene.
- D) An allele that is always fully expressed is referred to as recessive.
- E) The expressed physical traits of an organism are called its phenotype.

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37) Define a gene.

- A) A stretch of amino acids that form a particular protein.
- B) A stretch of RNA that codes for a particular protein.
- C) A stretch of DNA on a chromosome that codes for some type of product (typically a protein).

38) The constriction point of a chromosome and the point at which sister chromatids are attached is the....

- A) Central zone
- B) Centriole
- C) Centrosome
- D) Centromere
- E) Kinetichore

39) Recombinant chromosomes are produced via crossing over during which phase?

- A) Interphase
- B) Metaphase
- C) Anaphase
- D) Telophase
- E) Prophase

40) Chromosomes condense during which phase?

- A) Interphase
- B) Metaphase
- C) Anaphase
- D) Telophase
- E) Prophase

41) The nuclear envelope degenerates during which phase?

- A) Interphase
- B) Metaphase
- C) Anaphase
- D) Telophase
- E) Prophase

42) Sister Chromatids separate during which phase?

- A) Interphase
- B) Metaphase
- C) Prophase
- D) Telophase
- E) Anaphase



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43) Synapsis first occurs during which phase?

- A) Interphase
- B) Metaphase
- C) Anaphase
- D) Telophase
- E) Prophase

44) Yeast cells produce ethanol from sugars in which type of environments?

- A) Fe-rich
- B) Fe-poor
- C) Dry environments
- D) O<sub>2</sub>-rich
- E) O<sub>2</sub>-poor

45) What is the purpose of yeast cells producing ethanol from pyruvate/pyruvic acid during fermentation?

- A) To make oxygen
- B) To make CO<sub>2</sub>
- C) To make Glucose
- D) To make more ATP than in the electron transport chain.
- E) To regenerate NAD<sup>+</sup> from NADH in order to perform more glycolysis.

46) Lactic acid accumulation in your muscles occurs during

- A) Times when oxygen supply is greater than the oxygen demand by your muscles.
- B) Times when oxygen demand by muscles is greater than supply.
- C) Times when there is not sugar to digest.

47) Which generates the most ATP?

- A) Light reactions
- B) Dark reactions
- C) glycolysis
- D) Kreb's Cycle
- E) Chemiosmosis

48) Who was the "Father of Genetics" in the sense that his work with peas demonstrated the fundamental mechanisms of inheritance?

- A) Einstein
- B) Roosevelt
- C) Hoefnagels
- D) Watson
- E) Mendel

49) Oliver is a humanzee.

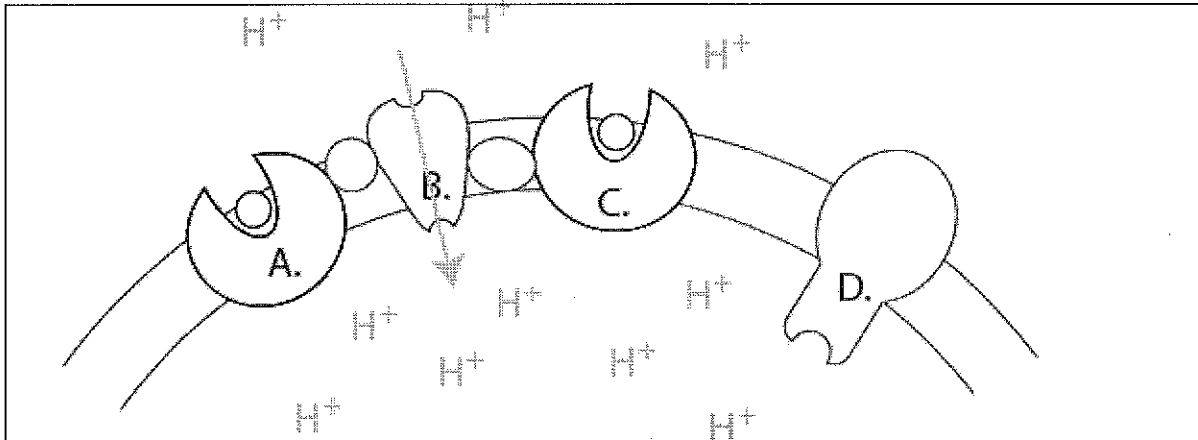
- A) True
- B) False

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50. The majority of the carbon atoms in our bodies can be traced ultimately to
- A) the CO<sub>2</sub> molecules taken in by a plant and into the Krebs cycle.
  - B) the CO<sub>2</sub> molecules taken in by a plant and into the light reactions.
  - C) the CO<sub>2</sub> molecules taken in by a plant and into the dark reactions.
  - D) the hydrolysis of ATP during photosynthesis.
  - E) the dehydration of ATP during photosynthesis.
51. The production of free oxygen during photosynthesis is most closely associated with which?
- A) ATP synthase
  - B) RuBisCO
  - C) Photosystem I
  - D) Photosystem II
  - E) Proton pumps
52. Light Reactions ...
- A) Fix carbon
  - B) Make ATP
  - C) Make NADPH
  - D) Both A and B
  - E) Both B and C
53. What pigment makes photosynthesis possible?
- A) Eumelanin
  - B) Pheomelanin
  - C) chlorophyll
54. Photosynthesis is a process that naturally takes which of the following greenhouse gasses out of our atmosphere?
- A) N<sub>2</sub>
  - B) CO
  - C) CH<sub>4</sub>
  - D) CO<sub>2</sub>
  - E) O<sub>2</sub>

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Questions 55-58, refer to diagram below.



55. Protons are being pumped against their concentration gradient by the protein labeled "B". This is a form of \_\_\_\_\_ and \_\_\_\_\_.
- A) passive transport; no energy is required
  - B) passive transport; ATP provides the energy required
  - C) passive transport; electrons provide the energy required
  - D) active transport; ATP provides the energy required
  - E) active transport; electrons provide the energy required
56. Structure "C" is which?
- A) Photosystem I.
  - B) Photosystem II.
  - C) ATP Synthase.
  - D) Reaction Center.
  - E) Both Photosystem I and II.
57. O<sub>2</sub> is formed closest to which structure above?
- A) structure A.
  - B) structure B.
  - C) structure C.
  - D) structure D.
58. ATP is formed closest to which structure above?
- A) structure A.
  - B) structure B.
  - C) structure C.
  - D) structure D.