Answers to Questions have been indicated in Red and a brief explanation of the answer is given.

1. Which of the following structures allow for communication between the cytoplasms of adjacent cells in multicellular eukaryotes?

    1. plasmodesmata
    2. anchoring junctions
    3. gap junctions
    4. tight junctions

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

Plasmodesmata are channels through plant cell walls to connect adjacent cells. Gap junctions are connections between adjacent animal cells.
Answer D = 0.5 marks

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2. When comparing a human skin cell and a photosynthetic plant leaf cell, both cell types are similar with the **exception** that only one has _____ .

A. a cell membrane
B. ribosomes
C. a cell wall
D. a Golgi apparatus
E. mitochondria

Plant and animal cells have all the *structures listed above with the exception that only plant cells have cell walls, animal cells do not.*

---

3. Which of the following does **not** contain functional ribosomes?

A. a plant mitochondrion
B. a chloroplast
C. a nucleolus
D. a prokaryotic cell
E. an animal mitochondrion

The nucleolus is where the subunits for ribosomes are made, but there are no functional ribosomes in the nucleus as no protein synthesis occurs there.

---

4. Who developed the first practical microscope?

A. Gregor Mendel.
B. Antony van Leeuwenhoek.
C. Robert Hooke.
D. Galileo Gallilei.
E. Thomas Morgan.

Refer to your notes.

---

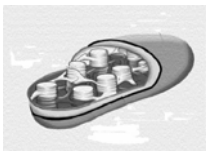
5. Which of the following structure – function pairs is **mismatched**?

A. microtubule – muscle contraction
B. nucleolus – ribosome production
C. Golgi apparatus – protein storage and modification
D. lysosome – intracellular digestion
E. ribosome – protein synthesis

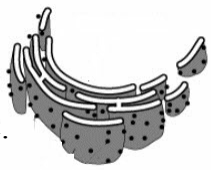
Microfilaments (actin fibrils) are involved in muscle contraction not microtubules.

---

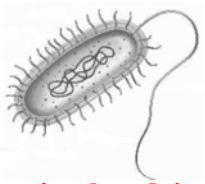
6. Which of the following electron micrographs is of a chloroplast?

A. 

B. 

C. 

D) 

E. 

B. is mitochondria, C is rough ER, D is a Golgi body, and E is a bacterium.

---

7. In animal cells, hydrolytic enzymes are packaged to prevent general destruction of cellular components.

   Which of the following organelles functions in this compartmentalization?

A. central vacuole
B. nucleolus
C. centriole
D. chloroplast
E. lysosome

BONUS QUESTION

8. The drug cytochalasin B blocks the function of actin in animal cells. Which of the following aspects of the cell cycle would be **most** disrupted by cytochalasin B?

A. cytokinesis.
B. synaptonemal formation.
C. microtubule attachment to the centromere.
D. spindle formation.
E. DNA synthesis.
Actin is involved with the contractile ring which aids in the separation of daughter cells via cytokinesis. Text book page 187.

---

9. During the cell cycle, the DNA content of a cell

A. decreases during metaphase.
B. decreases during the G_1 phase.
C. increases during the G_2 phase.
D. decreases during interphase.
E. increases during S phase.
Answer E is the only correct choice here. The DNA content of the cell remains the same in all the rest, it does not decrease.

---

10. All of the following occur during mitosis **except** the

A. disappearance of the nucleolus.
B. formation of a spindle.
C. synthesis of DNA.
D. uncoupling of chromatids at the centromere.
E. condensing of chromosomes.
DNA is not replicated during Mitosis.

---

11. A nucleus has 11 chromosomes. What is the only valid conclusion from this observation?

A. The cell is haploid.
B. The cell is in G_0.
C. The cell is able to undergo meiosis.
D. The cell is diploid.
E. Each chromosome has only one chromatid.

From this information the only valid conclusion that can be drawn is that the cell is haploid.

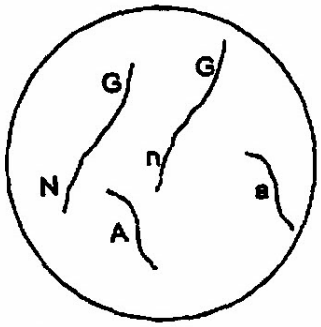
---

12. Which of the following is **not** a correct statement about the process of meiosis?

A. Segregation of unlinked alleles occurs during meiosis.
B. Kinetochores are responsible for holding sister chomatids together in meiosis I and II.
C. Meiosis occurs before cytokinesis.
D. Meiosis I separates chromosomes; meiosis II separates chromatids.
E. Synapsis and crossing-over occur during meiosis I.
Centromeres and not kinetochores hold sister chromatids together. Fig. 9.8

---

13. The figure below is of the nucleus of a cell taken from a diploid, sexually reproducing multicellular animal.



Which of the following gametes is possible from this cell?

A. AGN, AGn, aGN, aGn
B. AaGGNn.
C. GN, Gn, A, a
D. AGN, AgN, Agn, AGn, aGN agN, agn
E. AGN, AaG

This is a graphical way of writing the following. What possible gametes can be obtained from this individual:

Aa GG Nn

You could get:

AGN

AGn

aGN

aGn

Use this figure and description for Questions 14 and 15.

Lymphocytes (white blood cells) extracted from the kangaroo rat, *Potorous tridactylus*, were grown in culture for karyotype analysis.

The chromosomes depicted here are representative of the karyotype found in all of the cells of the culture.

14. Which of the following correctly describes the chromosome number in this karyotype?

A. The diploid chromosome number is 24.
B. The diploid chromosome number is 12.
C. There are 24 replicated chromosomes present.
D. The haploid number is 24.
E. The haploid number is 12.

If you count you get twelve chromosomes which are in duplicate. This means a diploid 2n = 12.

---

15. If this cell were to pass through meiosis how many chromosomes would be in the resultant cell(s)?

A. 12
B. 24
C. 48
D. 12 or 24 depending on whether this is destined to be a sperm or egg cell
E. 6

So meiosis would result in gametes each with 6 chromosomes, i.e. n=6.

---

16. Choose the most logical order for the descriptions below.

I. formation of four new nuclei, each with half the chromosomes present in the parental nucleus
II. alignment of tetrads at the metaphase plate
III. separation of sister chromatids
IV. separation of homologues; no uncoupling of the centromere
V. synapsis; chromosomes moving to the middle of the cell in pairs

A. V, II, IV, III, I
B. V, III, II, IV, I
C. IV, V, II, I, III
D. V, IV, II, I, III
E. I, II, III, IV, V

Refer to Figure 10.11

---

17. Once human nerve cells become mature, they normally exit the cell cycle and remain in

A. prophase
B. G_3
C. G_0
D. G_1
E. G_2

Refer to figure 9.4

---

18. Flower position, stem length, and seed shape were three characters that Mendel studied. Each is controlled by an independently assorting gene and has dominant and recessive expression as follows:

Character	Dominant	Recessive
Flower position	Axial (**A**)	Terminal (**a**)
Stem length	Tall (**T**)	Dwarf (**t**)
Seed shape	Round (**R**)	Wrinkled (**r**)

If a plant heterozygous for all three characters is allowed to self-fertilize, what proportion of the offspring would you expect to be *homozygous for Axial and Tall*, and *heterozygous for Seed shape*?

A. 1 / 32
B. 1 / 4
C. 1 / 64
D. 1 / 16
E. 1 / 8

So Aa Tt Rr x Aa Tt Rr

P(AA) ¼ x P(TT) ¼ x P(Rr) ½ = 1/32

---

19. From the cross,
Aa Bb cc Dd Ee ff x **AA Bb Cc Dd ee Ff**
what is the probability of obtaining the genotype **Aa bb Cc DD Ee ff** in the progeny?

A. 1 / 64
B. 1 / 128
C. 1 / 512
D. 1 / 32
E. 1 / 256

So: P(Aa) ½ x P(bb) ¼ x P(Cc) ½ x P(DD) ¼ x p(Ee) ½ x P(ff) ½ = 1/256

---

20. Alleles

A. are alternate forms of a gene.
B. are the result of hybridization.
C. are present only in the F_1 generation.
D. don't affect the phenotypes until the F_2 generation.
E. occur in a 3:1 ratio.
Refer to your notes.

---

21. Which of the following statements about Mendelian genetics is **not** correct?

A. A locus is a gene's physical location on the chromosome.
B. Only two alleles can exist for a given gene.
C. Alleles can be dominant or recessive to each other.
D. Individuals with the same phenotype can have different genotypes.
E. Pairs of alleles segregate into gametes independently.
There are usually many different alleles in a population, even though any one diploid organism (such as us) can only have two.

---

22. Two plants are crossed, resulting in offspring with a 3:1 ratio for a particular trait. This indicates

A. that each offspring has the same alleles.
B. that the parents were both heterozygous.
C. incomplete dominance.
D. that the parents were true-breeding for contrasting traits.
E. that a blending of traits has occurred.

Aa x Aa

	A	**a**
A	**AA**	**Aa**
a	**Aa**	**aa**

---

23. A **9:3:3:1** phenotypic ratio is characteristic of

A. a trihybrid cross.
B. linked genes.
C. epistasis.
D. a monohybrid cross.
E. a dihybrid cross.
Figure 11.9

---

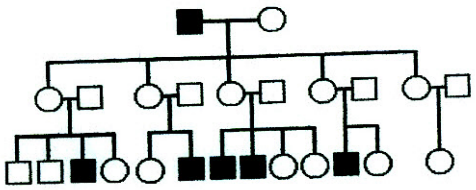
24. Gene **S** controls the sharpness of spines in a type of cactus. Cactuses with the dominant allele, **S**, have sharp spines, whereas homozygous recessive **ss** cactuses have dull spines. At the same time, a second gene, **N**, determines whether cactuses have spines. Homozygous recessive **nn** cactuses have no spines at all.

    The relationship between genes **S** and **N** is an example of

A. pleiotropy.
B. codominance.
C. epistasis.
D. incomplete dominance.
E. polygenic inheritance.
Refer to Figure 11.16

---

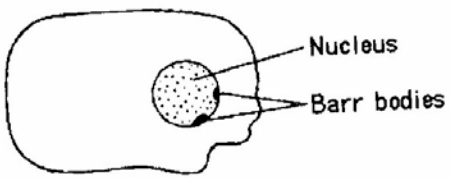
25. Determine the **most likely** mode of inheritance in the pedigree shown below.



A. Autosomal recessive
B. Autosomal dominant
C. Sex linked recessive
D. Mitochondrial inheritance
E. Sex linked dominant
The trait jumps generations and so is probably recessive. Since only males seem to inherit the trait if must be sex linked.

---

26. The diagram below represents the stained nucleus from a cheek epithelial cell of an individual whose genotype would probably be



A. XXY
B. XYY
C. XXX
D. XY
E. XX
In female mammals extra X chromosomes are inactivated for dosage compensation. An XXX female would thus have two Barr bodies evident.

---

27. A man who carries an X-linked allele will pass it on to

A. half of his daughters.
B. all of his sons.
C. all of his children.
D. all of his daughters.
E. half of his sons.
The man will pass his Y chromosome to his sons and his X to all his daughters.

---

28. Determine the sequence of genes along a chromosome based on the following recombination frequencies.

    A—B, 8 map units
    A—C, 28 map units
    A—D 25 map units
    B—C, 20 map units
    B—D, 33 map units

A. B-D-A-C
B. C-B-D-A
C. B-C-D-A
D. D-A-B-C
E. A-B-C-D

D A B C
----
25 8 20

---

29. What does the frequency of recombination of 50% indicate?

A. Independent assortment is hindered.
B. The two genes likely are located on different chromosomes.
C. Abnormal meiosis has occurred.
D. All of the offspring have combinations of traits that match one of the two parents.
E. The genes are located on sex chromosomes.

A recombination frequency of 50% means the genes are assorting independently of each other and so on different chromosomes.

---

30. One possible result of chromosomal breakage is for a fragment to join a nonhomologous chromosome. This is called

A. a translocation.
B. an inversion.
C. a duplication.
D. a disjunction.
E. a deletion.

See Figure 12.11

---

31. A cell that has (2n + 1) chromosomes is

A. polyploid.
B. tetraploid.
C. a Barr body.
D. monosomic.
E. aneuploid.

An individual with an extra or missing chromosome.

---

32. In cats, black colour is caused by an X-linked allele; the other allele at this locus causes orange colour. The heterozygote is tortoiseshell. What kinds of offspring would you expect from the cross of a black female and an orange male?

A. orange female; black male
B. orange female; orange male
C. tortoiseshell female; black male
D. black female; orange male
E. tortoiseshell female; tortoiseshell male

A tortoiseshell cat is a female who shows two coat colurs, orange and black due to X inactivation. So a black female is homozygous for black allele and an orange male is homozygous for orange allele. Male kitten inherits a black allele from its mother and a Y chromosome form its father. So it is black. Dominance does not matter here.

---

33. Consider the statement:
"Some people have brown eyes."

Which of the following **best** describes this statement based on logic alone?

A. Falsifiable, but not verifiable.
B. Verifiable, but not falsifiable.
C. Both falsifiable and verifiable.
D Neither falsifiable nor verifiable.

Remember that we are evaluating the feasibility of finding evidence to prove/disprove this statement.

To verify: you would need to find one (maybe two) individuals with brown eyes to verify this statement.

To falsify: you would need to show that NO individuals have brown eyes. In order to do this, you need to round up all people and demonstrate that none of them have brown eyes. This is not feasible.

34. Which of the following individuals is **incorrectly** matched with his contribution to the 'history' of evolutionary theory?

A. Aristotle – creating a scheme for naming species (i.e. nomenclature).
B. Gregor Mendel – providing a mechanism for inheritance that was consistent with evolution by natural selection.
C. Comte du Buffon – identifying and associating vestigial traits with species changing through time.
D. Georges Cuvier – linking extinctions in the fossil records to rapid change in the history of the earth.

Carle von Linne is the 'father' of taxonomy. Aristotle is associated with the Scala natura (i.e. ranking species in a hierarchy of perfection).

35. Which of the following historical ideas contributed to Darwin's formulation of the theory of evolution?

A. The earth created all living organisms, and then ceased to create new types of organisms.
B. Catastrophic events in the earth's history explain the appearance of different fossils.
C. Gradual changes in the structure of the earth must have occurred in the past in the same manner as they occur today.
D. Species vary in their complexity, and can be ranked on a scale from simple to most complex.

Recall that Darwin's theory of evolution by natural selection involved 'gradualism'. Darwin applied the geological concept of gradualism to biological organisms.

36. Which of the following statements **correctly** compares Darwinian evolution with Lamarckian evolution?

1. Darwin suggested that evolution resulted from variation among individuals in the number of offspring produced; Lamarck also suggested that evolution resulted from variation among individuals in the number of offspring produced.
2. Darwin suggested inheritance of favourable traits; Lamarck also suggested inheritance of favourable traits.
3. Darwin believed that species evolved; Lamarck did not believe species evolved.
4. Darwin suggested evolution occurred in response to the environment; Lamarck also suggested evolution occurred in response to the environment.

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

1. Lamarck's evolution was based on use/disuse and inheritance of acquired traits (i.e. transformational theory of evolution). The statement in part 1 is describing Darwin's variational theory of evolution; that is, it describes evolution by natural selection.
2. Both Darwin's and Lamarck's theories suggested inheritance of favourable traits. What they differed in was what kind of traits could be inherited (i.e. whether acquired traits could be inherited or not).
3. Lamarck's theory of evolution was, indeed, a theory of evolution. So he believed that species evolved.
4. Both Darwin and Lamarck saw evolution as occurring in response to the environment. The difference is in HOW the environment influenced/caused the evolution (in Darwin, through natural selection; in Lamarck, through use/disuse & inheritance of acquired traits).

37. Imagine a population of common milkweed (a plant) in which individuals differ in the amount of latex (a chemical) in their seeds; some individuals have a lot of latex, some have a little, and some have none at all. When birds eat the seeds of a milkweed that contains latex, the birds become sick, and avoid eating more seeds from that plant.

Which of the requirements for evolution by natural selection does this scenario illustrate?

1. Individuals vary with respect to a trait.
2. Some individuals are more successful than others at surviving and/or reproducing.
3. Differences in fitness among individuals are related to variation in the trait.
4. Variation in the trait is at least partially heritable.

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

1. Individuals vary with respect to a trait. In the scenario, the trait is the amount of latex: individuals can have a lot, a little, or none.
2. Some individuals are more successful than others at surviving and/or reproducing. Because the birds stop eating the seeds of plants with latex, this means these plants (the ones with latex) are more likely to survive/reproduce.
3. Differences in fitness among individuals are related to variation in the trait. The birds don't stop eating seeds from plants with NO latex, but do stop if the plants have latex. It's the latex (the trait) that influences fitness.
4. Variation in the trait is at least partially heritable. There is NO indication in the scenario that latex content/amount is heritable.

---

38. The classic example of a species that experiences evolution by natural selection is Darwin's Finches.

What was the evidence that indicated that beak size had evolved in the population of Darwin's Finches on Isla Daphne Minor as a result of a drought in 1977?

A. The number of finches decreased as a result of the drought.
B. Finches with larger beaks were better able to obtain food during the drought.
C. The average beak size of the next generation (after the drought) of finches was larger.
D. Beak size varied among individuals of the finch.

The question asks for EVIDENCE of EVOLUTION.

While it is true that (A) the number of finches decreased as a result of the drought, this suggests that their was insufficient resources for all individuals to survive (i.e. struggle for existence).

While it is true that finches with larger beaks were better able to obtain food during the drought, this reflects NATURAL SELECTION. That is, some individuals were more likely to survive and/or reproduce. However, differential survival and reproduction does not necessarily result in evolution (i.e. change in allele frequencies/phenotype distribution of the population).

The fact that the average beak size of the next generation of finches was larger is evidence of evolution. Evolution, as we defined it, is the CHANGE IN ALLELE FREQUENCIES. As we saw in lecture, a change in allele frequencies is associated with a change in phenotype distribution of a population. Here, the change in average beak size is indicative of the change in allele frequencies.

It is true that beak size varied among individuals. However, this is simply a requirement for evolution by natural selection to occur. It is not evidence of evolution.

This question was ultimately testing whether you could distinguish between the requirements for evolution by natural selection, and an understanding of the definition of evolution versus the definition of natural selection.

39. A population of butterflies shows a high degree of variation in the number of spots on their wings. Some have many spots and some have few spots. Butterflies with many spots have offspring with many spots. Butterflies with few spots have offspring with few spots. These butterflies are preyed upon (i.e. eaten) by birds.

Which of the following statements suggests that the number of wing spots is experiencing natural selection in this population?

A. Butterfly offspring resemble their parents in number of spots.
B. Mutants with few spots appear in every generation, causing an increase in the frequency of butterflies with few spots in the population.
C. Butterflies with more spots are less likely to be seen by birds.
D. More than one of the above answers is correct.

Like question 38 (Darwin's finches), this question was assessing whether students understand the difference between natural selection and evolution. However, this also involves an application of the concepts to a novel situation/example.

A. This statement is a true statement, based on the scenario. However, it doesn't suggest natural selection. All it suggests is that number of spots could, in theory, evolve in a population (i.e. only traits that are heritable can evolve).

B. While this statement is theoretically possible, it is highly unlikely as mutants are rare and random. Yet, regardless of whether or not this statement is possible/likely, it is not suggesting natural selection. It suggests evolution (increase in frequency of butterflies with few spots).

C. This statement suggests natural selection. Recall that natural selection is differential survival and/or reproduction of individuals due to current environmental conditions. Here, the conditions are the presence of birds who eat the butterflies. The differential survival and/or reproduction comes in because birds are more likely to see (and subsequently eat) butterflies with MORE spots. So, butterflies with more spots have lower survival than those with less spots.

More than one of the above answers is correct CANNOT be correct. While all of A, B, and C are valid statements to some degree, they are NOT all statements suggesting natural selection.

Note: the confusion that arose in the question about the statement, "These butterflies are preyed upon (i.e. eaten) by birds" is not important. The question asks about the statements that follow (i.e. A, B, C, D). Technically, the question could have been answered without reading/understanding the scenario as it was described.

40. Which of the following descriptions illustrates the definition of microevolution?

A. A cricket with brown stripes has eight offspring while a cricket with no stripes has three offspring.
B. Many crickets with brown stripes die as a result of someone mowing the lawn where the crickets live.
C. A cricket with brown stripes is more likely to survive and reproduce than a cricket with no stripes.
D. The number of crickets with brown stripes in a population increases from one generation to the next.

Microevolution = change in allele frequencies overtime.
As with previous questions, a change in allele frequencies is associated with a change in the distribution (i.e. frequency) of phenotypes.

A is an illustration of differing FITNESS of crickets, with respect to their trait.

B could, in the long term, cause microevolution if the death of crickets with brown stripes causes a change in the allele frequencies in the next generation. However, there is no indication in the statement that this will occur or has occurred.

C is a description of NATURAL SELECTION. There is no indication that the consequence of this situation is a change in allele frequencies.

D is the only option that explicitly illustrates microevolution. There is a change in the phenotype frequency, which should be associated with a change in underlying allele frequencies.

41. Which of the following is the **best** definition of an 'adaptation'?

A. A phenotype that results in the highest survival of individuals with that phenotype, regardless of the environment.

B. A phenotype that results in individuals displaying it to be more successful than individuals without that phenotype in an environment.

C. A phenotype that develops in an individual in response to the environment, making them more successful in that environment.

D. A phenotype that arises in an individual because of changes in the environment.

In lecture, we discussed that adaptations evolve as a result of natural selection. So, adaptations confer relative success of the individual to the environment in which they evolved.

As a consequence, answer A is incorrect because it suggests that an adaptation is beneficial regardless of the environment.

Answer B very clearly describes an adaptation, drawing on the ideas of fitness ('more successful') and the link to the environment ('in an environment')

Answer C is incorrect because adaptations EVOLVE by natural selection. Remember that evolution occurs over time (i.e. over generations). In which case, the adaptation can't develop IN AN INDIVIDUAL in response to the environment. This would be use/disuse in the style of Lamarck.

Answer D is incorrect for the same reason as answer C, plus answer D makes no indication of the favourable nature of an adaptation.

42. In a population of parrots, blue individuals (**BB**) produce an average of **2** offspring over the course of their lifetimes. Green parrots (**Bb**) produce **8** offspring on average, and yellow parrots (**bb**) produce **6** offspring on average.

What is the relative fitness of genotype **Bb**?

A. 8
B. 1
C. 0.75
D. 0.125

To calculate relative fitness, we first need to identify which phenotype/genotype has the highest absolute fitness. Then we express all phenotypes as a proportion of that maximal absolute fitness.

In this scenario, then, the maximal absolute fitness is 8 offspring. This is the absolute fitness of the green parrots (Bb). Since we want the fitness of these green parrots (Bb), we either use the definition that the genotype/phenotype with the highest relative fitness has a relative fitness of 1.0, OR, we can actually use the calculation: relative fitness of Bb = absolute fitness of Bb / maximal absolute fitness
This would be: w = 8/8 = 1.0

43. What level of biological organization **evolves** by natural selection?

A. an allele
B. a gene
C. an individual
D. a population

Evolution is a change in allele frequencies overtime. Since allele frequencies are based on population characteristics, it is the population that evolves.

44. Consider the following scenario:

You have a single prokaryotic cell that is susceptible to the antibiotic, "tetracycline". It would die if treated with tetracycline. You let the prokaryotic cell reproduce, creating a population of 100 prokaryotic cells.

Suppose you place the population of prokaryotic cells in a test tube and add tetracycline. Based on our understanding of evolution by natural selection, what would you expect to happen to this population?

A. Some of the cells would survive because a mutation would occur making some of the cells not susceptible to tetracycline.
B. Some of the cells would survive because they carry genes making them resistant to tetracycline, eventually causing resistance to increase in the population.
C. All of the cells would die because they are susceptible to tetracycline.
D. All of the cells would die because evolution requires at least one generation of bacteria to reproduce.

This was a challenging question because it required you to bring together a lot of different knowledge and thinking.

First, recognize that prokaryotes reproduce by binary fission, which creates IDENTICAL offspring/clones. So, if the single prokaryotic cell produced ALL of the individuals in the population of 100 (which it did), then this means that ALL of the 100 prokaryotes are identical.

Second, since the first prokaryotic cell was susceptible to tetracycline, that meant that ALL of the 100 prokaryotes were also susceptible.

Consequently, adding tetracycline to the test tube will kill all of the prokaryotic cells. C is the correct answer.

Answer A cannot be correct because it assumes that some of the cells will mutate in a favourable way (i.e. to be not susceptible to tetracycline). While this is theoretically possible, it is not a guarantee. The phrasing of the statement ("because a mutation would occur") indicates that this is clearly expected mutation. Ultimately, answer C is a far better answer than A because answer C does not require ANY assumptions.

Answer B is incorrect. Again, because the cells reproduce by binary fission, they will all be identical. Consequently, there is NO variation among the cells; none of the cells carry genes making them resistant to tetracycline. Much like answer A, it is theoretically possible that a mutation could have occurred during the reproduction of the cells, and it is possible that the mutation may confer resistance, but this is an assumption that is NOT made in answer C.

Answer D is, while similar in some ways to C, also incorrect. While it is true that to observe evolution, we need 'time' (i.e. we have to compare one generation to the previous), there also needs to be variation among the individuals in the first place for natural selection to act on. Again, since we are dealing with prokaryotes and binary fission, the cells are identical (no variation).

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45. The working distance is least when using the _____ objective lens

A. lower power (4x)
B. medium power (10x)
C. high power (40x)
D. None of A, B or C is correct
E. A, B and C are all correct

---

46. The chi-square statistic is best used to

A. prove the null hypothesis is wrong
B. prove the null hypothesis is right
C. compare the standards of two groups
D. check for significant differences between expected and observed results
E. check for significant differences between means

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47. Based on the information provided in the table of the various stages of mitosis, which stage takes the most time to complete?

Stage of Mitosis	# of cells	Percent of time in each stage = # of cells in stage / Total # of cell × 100
Prophase	22	44%
Metaphase	5	10%
Anaphase	7	14%
Telophase	16	32%
Total	50	

A. Prophase
B. Metaphase
C. Anaphase
D. Telophase
E. Neither A, B, C or D

You were expected to answer this question based on the information provided in the above table about the various stages of mitosis and not based on previous knowledge or your lab results.

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48. Richard samples five different populations of a single fish species and wants to use the chi-square to determine if there is a difference in predatory behaviour among the five populations.

Using a 5% rejection level, which critical chi-square value should he use?

Critical values of chi-square			
Degrees of freedom	p=0.50	p=0.05	p=0.01
1	0.46	3.84	6.64
2	1.39	5.99	9.21
3	2.37	7.82	11.35
4	3.37	9.49	13.28
5	4.35	11.07	15.09
6	5.35	12.59	16.81
7	6.35	14.07	18.48

A. 3.37
B. 9.49
C. 13.28
D. 5.99
E. 1.39

At the preselected 5% rejection level the correct p value is 0.05 and the degree of freedom is (n-1), where n is the number of fish species being sampled. So the correct degree of freedom here is 4.
