

JGEEBILS (14th December, 2025) - Answer Key

1. An experiment fails 40% of times. If a student performs the experiment twice, what is the probability she will fail the experiment once and get success once?
 - a. 0.16
 - b. 0.24
 - c. 0.36
 - d. 0.48

2. If y is an integer greater than 2 and less than 7 and y is also an integer greater than 5 and less than 10, then we may correctly conclude that
 - a. y can be exactly determined
 - b. y may be either of two values
 - c. y may be any of three values
 - d. there is no value of y satisfying these conditions

3. The mean of a set of 7 observations is 10 and the mean of a set of 3 observations is 5. The mean of the combined set is given by
 - a. 7.5
 - b. 8.5
 - c. 10
 - d. 15

4. A is the father of C, and D is the son of B. E is the brother of A. If C is the sister of D. Then B is _____ of E.
 - a. Daughter
 - b. Husband
 - c. Sister – in – law
 - d. Brother – in law

5. A DNA molecule is 60% G + C. If one strand has 360 cytosine bases, what is the total number of base pairs?
 - a. 1500
 - b. 1200
 - c. 600
 - d. 3000

6. A mutation in a plant gene Z causes embryo lethality when homozygous recessive (zz). 100 plants were grown from seeds harvested from an heterozygous parent (Zz). How many of the them will be heterozygous (Zz)?
- 0
 - 34
 - 50
 - 66
7. Suppose you have a modern smartphone with a 48-MP camera sensor. Your phone typically offers the option to capture images at the full 48-MP resolution or at reduced resolutions such as 24 MP or 12 MP. How does the camera generate these lower-resolution images from the same sensor?
- The pixels are binned 2 or 4 times respectively to achieve the reduced resolution
 - The reduction in resolution is achieved by cropping the field of view by 2 or 4 times respectively
 - Only every alternate or the fourth pixel respectively collects photons to achieve the reduced resolution
 - The camera has different lenses in its rear with each lens allowing a specific output capacity
8. Complete the following sentence. When conducting a hypothesis test, we _____ and then evaluate the test results to determine if there is enough evidence to _____.
- Assume that the null hypothesis is false; accept the null hypothesis
 - Assume that the null hypothesis is true; reject the null hypothesis
 - Assume that the alternate hypothesis is true; reject the null hypothesis
 - Assume that the alternate hypothesis is false; reject the alternate hypothesis
9. A family has 2 children. Given that one of the children is a boy, what is the probability that the other child is also a boy?
- 1
 - 1/2
 - 1/3
 - 1/4

10. Straight hair is a recessive trait in humans. If 64% of the population has straight hair, what proportion of the population is heterozygous for the trait?

- a. 16%
- b. 32%
- c. 36%
- d. 48%

11. A bat population on an island was infected with a virus leading to 80% mortality. A second wave of infection immediately after led to a 90% cumulative mortality. What is the percentage mortality in the second wave?

- a. 20%
- b. 50%
- c. 85%
- d. 10%

12. The price of petrol increases by 25%. By what percentage must a customer reduce the consumption so that the earlier bill on the petrol does not alter?

- a. 20%
- b. 25%
- c. 30%
- d. 33.33%

13. A man walks 30 km towards the East, then, turning to the right, he walks 30 km. Then, turning to his right, he again walks 20 km. Again, turning to his left, he walks 30 km. How far is he from his starting point?

- a. 36.05 km
- b. 60.82 km
- c. 30 km
- d. 58.30 km

14. Use the table below to answer the question that follows.

Store No.	Discount from Manufacturer's Recommended Price
1	Rs. 4 off the price of each game
2	30% discount on each game
3	One-third off the price of two games
4	buy one game and get the second at half price

Suman wants to buy two computer games, each of which has a manufacturer's recommended price of Rs. 25. She checks four different stores and finds the prices of the games discounted as shown in the table above. At which store will Suman be able to buy the games for the least amount of money?

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

15. What digit does $(3)^{31}$ end in?

- a. 3
- b. 5
- c. 7
- d. 9

16. The mean velocity of particles in an ideal gas is 0 and the root-mean square velocity of the particles is v at some temperature T . If the temperature of the gas is increased to $2T$, what will be the mean and root-mean squared velocity of the gas respectively?

- a. $0, v$
- b. $0, 2v$
- c. $0, \sqrt{2}v$
- d. $v, 2v$

17. The average time for a molecule to diffuse from the centre of a cell of radius R to its boundary is t . If the cell radius is doubled, but the diffusion constant of the molecule doesn't change, the average time now becomes:

- a. $2t$
- b. $4t$
- c. $0.5t$
- d. $0.25t$

18. Assume a spherical cell takes in nutrients at a rate proportional to its surface area, but to divide needs a total amount proportional to its volume. Let t be the time a cell of radius R takes to accumulate the nutrients it needs to divide. If R is doubled, what happens to t ?

- a. Doubles
- b. Is halved
- c. Stays the same

d. Quadruples

19. A plant cell placed in a sucrose solution exhibits an osmotic pressure of 0.2 MPa when the sucrose concentration is 0.1 mol/L and temperature is 300 K. If the concentration is doubled, what will be the new osmotic pressure (assuming ideal behavior)?

- a. 0.1 MPa
- b. 0.2 MPa
- c. 0.4 MPa
- d. 0.8 MPa

20. An enzyme-catalyzed reaction is operating at a substrate concentration that makes the reaction rate very close to the maximum V_{max} . If the substrate concentration is halved but remains well above the Michaelis constant K_m , what happens to the reaction rate?

- a. Halves
- b. Remains near V_{max}
- c. Doubles
- d. Drops close to zero

21. There is a latent heat associated with converting water at 273K to ice at 273K. This latent heat is needed

- a. to cool down the water molecules
- b. to change the entropy of the molecules
- c. to heat up the water molecules
- d. there is no latent heat associated with freezing.

22. What is the maximum volume V of a sphere that can be carved out of a cube of side a ?

a. $\frac{\pi a^3}{6}$

b. $\frac{4\pi a^3}{3}$

c. $\frac{\pi a^2}{4}$

d. $\frac{\pi a^3}{3}$

23. Let the equation of for energy be $E(x) = \frac{a}{x^{12}} - \frac{b}{x^6}$ where x has the dimension of the distance. What is the unit of b ?

- a. $\text{kg m}^8 \text{s}^{-2}$
- b. $\text{kg m}^6 \text{s}^{-2}$
- c. $\text{kg m}^{10} \text{s}^{-2}$
- d. $\text{kg m}^4 \text{s}^{-2}$

24. You are standing at the center of a circle of radius R . And an object of mass m is moving along the circumference of the circle with velocity v . What is the angular momentum of the object that you would measure?

- a. mvR
- b. mv/R
- c. mR^2v
- d. mv^2R

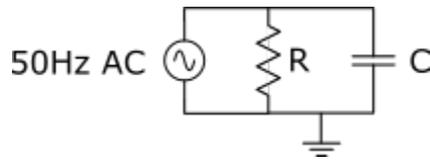
25. You have been given two blocks of copper:- Block-A having Weight = 2 kg and Block-B having weight = 5 kg. Both the blocks are kept at the same temperature. The specific heat of Block-A is _____

- a. the same as the specific heat of Block-B
- b. $\frac{5}{2}$ times the specific heat of Block-B
- c. $\frac{2}{5}$ times the specific heat of Block-B
- d. 5 times the specific heat of Block-B

26. Two objects P and Q are launched at the same time and place from ground on the Moon (no friction from air). Object P is launched with speed 25 m/s at an angle of θ from the horizon. Object Q is launched with speed 25 m/s at an angle of $\theta + 60^\circ$. What is the distance between P and Q after two seconds. At this moment neither P nor Q has hit the ground yet.

- a. $25\sqrt{5}$ m
- b. 30 m
- c. 50 m
- d. 125 m

27. In the RC circuit below, an AC voltage input of 50 Hz frequency results in a peak current of i_C through the capacitor. If the frequency of the input voltage is increased to 100 Hz keeping its amplitude unchanged, the peak current through the capacitor becomes i_C' . Which of the following is correct?



- a. $i_C' = 0.5 i_C$
- b. $i_C' = 0.25 i_C$
- c. $i_C' = i_C$
- d. $i_C' = 2 i_C$

28. You plot your data on a log-log graph (log to the base 10) which is well described by a straight line with slope $1/2$ and intercept -1 . What is the nature of the function that you are plotting?

- a. $y = \frac{1}{10}\sqrt{x}$
- b. $y = \frac{1}{10}x - 1$
- c. $y = 10x^2$
- d. $y = 10\sqrt{x}$

29. You roll a dice 4 times. Which of these numbers is closest to the probability that you will roll a 6 at least once.

- a. 0.004
- b. 0.66
- c. 0.16
- d. 0.52

30. Find the angle between two vectors \vec{A} and \vec{B} , if the magnitude of their cross product is the same as that of their dot product.

- a. 0°
- b. 180°
- c. 90°
- d. 45°

31. fluorescent chemical probe is designed to selectively react with cysteine residues in proteins. Which of the following would be most appropriate for selective cysteine labeling?

- a. NHS ester
- b. Maleimide
- c. Azide
- d. Alkyne

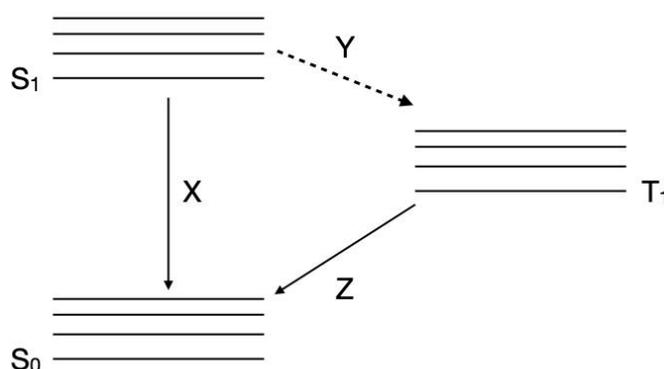
32. A mutation that replaces a serine residue with alanine in a protein is likely to:

- a. Increase the surface area of the protein
- b. Introduce a new hydrogen bond donor
- c. Prevent phosphorylation at that site
- d. Increase the protein's hydrophilicity

33. You want to label glycoproteins on the surface of live mammalian cells using click chemistry. You feed the cells an azide-modified sugar that gets incorporated into cell-surface glycans, then add a fluorescent alkyne probe. Which observation would *most strongly suggest* successful, specific labeling?

- a. Fluorescence signal is localized to the plasma membrane and is lost when azide sugar is omitted
- b. Fluorescence signal appears uniformly throughout the cytoplasm
- c. Fluorescence is only seen after fixing the cells with paraformaldehyde
- d. Fluorescence appears in mitochondria

34. In the Jablonski diagram shown below, solid arrows are radiative processes and a dashed arrow is a non-radiative process. Which option describes this figure correctly for an organic fluorophore?



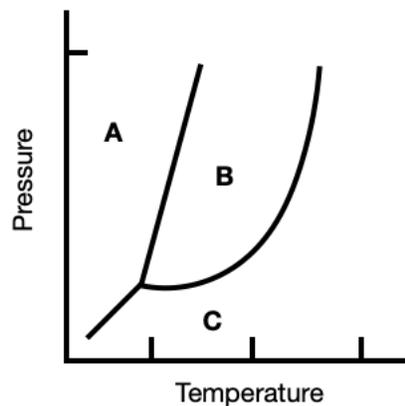
- a. X is fluorescence, Y is phosphorescence, Z is internal conversion, and Z is the fastest
- b. X is fluorescence, Y is internal conversion, Z is phosphorescence, and Z is the slowest

- c. X is fluorescence, Y is intersystem crossing, Z is phosphorescence, and Z is the fastest
- d. X is fluorescence, Y is intersystem crossing, Z is phosphorescence, and X is the fastest

35. One litre of a solution of pH 2 is mixed with two litre of another solution of pH 3. Which of the following values describes the pH of the mixture accurately? Hint: $\log_{10}2=0.3$

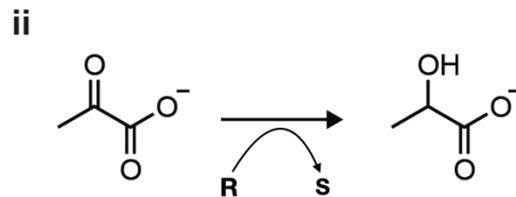
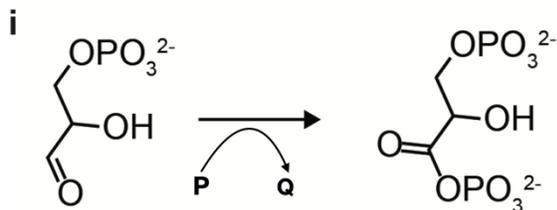
- a. 2.3
- b. 2.4
- c. 2.5
- d. 2.6

36. Under certain conditions CO₂ melts rather than sublimates (transition from solid to gas). To which transition in the phase diagram does this change correspond?



- a. A → B
- b. B → C
- c. C → A
- d. A → C

37. Consider the following two reactions.



Which one of the following combinations of coenzymes is correct?

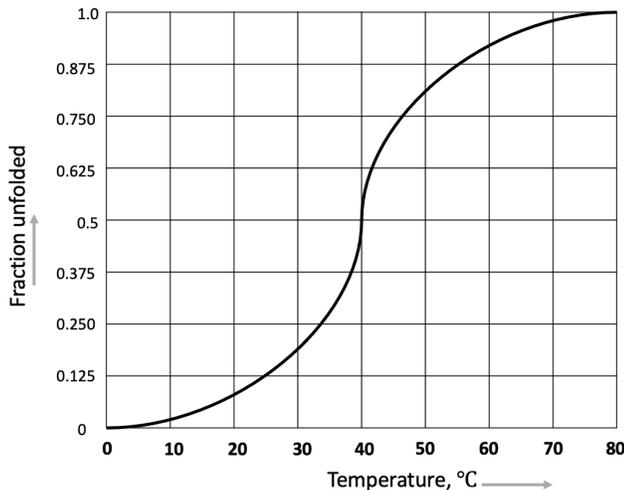
- a. P and S = NAD^+ ; Q and R = $\text{NADH} + \text{H}^+$
- b. P and R = $\text{NADH} + \text{H}^+$; Q and S = NAD^+
- c. P and R = NAD^+ ; Q and S = $\text{NADH} + \text{H}^+$
- d. P and S = $\text{NADH} + \text{H}^+$; Q and R = NAD^+

38. Given below are experimental measurements of thermodynamic parameters for interaction between a protein and 4 different ligands. Which one of the following ligands has the highest affinity for the protein, based on estimates of dissociation constant derived from the data below?

Ligand	ΔG (kcal/mol)	ΔH (kcal/mol)	ΔS (kcal/mol/K)
Lig1	- 8.5	- 2.5	+ 0.02
Lig2	- 3.5	+ 2.5	+ 0.02
Lig3	- 4.5	- 1.5	+ 0.01
Lig4	+ 4.5	- 1.5	- 0.02

- a. Lig1
- b. Lig2
- c. Lig3
- d. Lig4

39. Given below is the graph representing the unfolding of a protein.



Which one of the following options corresponds to the enthalpy change (in kcal/mol) accompanying unfolding of the protein, given that the entropy change is 2.5 kcal/mol/K?

- a. 0.008

- b. - 0.0625
- c. - 100
- d. 782.5

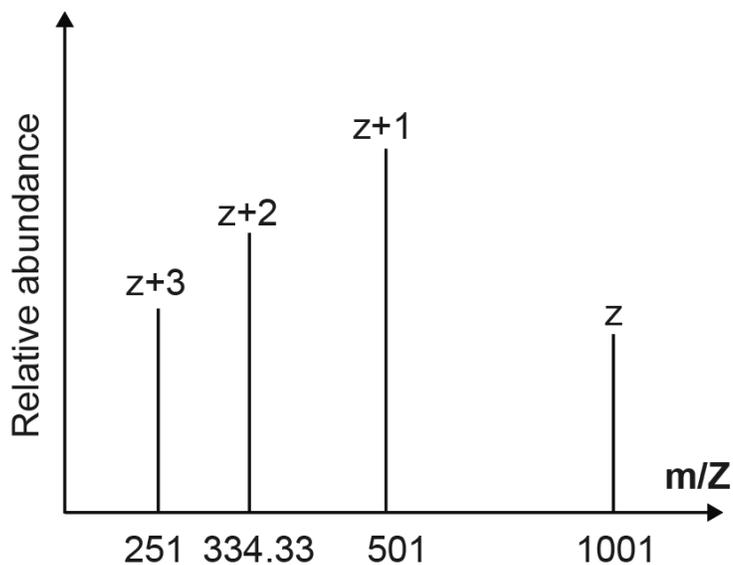
40. A mixture of the following amino acids is subjected to paper electrophoresis at pH = 3.9: Ala, Phe, Ser, Arg, His and Asp. The PI for Ala, Phe and Ser are near pH = 6, while that for Arg, His and Asp are 10.8, 7.6 and 3 respectively.

- i. Ser, Phe and Ala will move towards cathode and would not separate.
- ii. Asp will also move towards the cathode.
- iii. His and Arg will move towards cathode and will separate out from the above 3 amino acids.
- iv. His and Ser will move towards the anode.

Based on this information, choose the statements from the below that are correct:

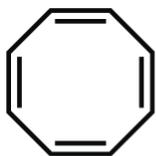
- a. (i), (ii) and (iii)
- b. (i) and (iii)
- c. (ii) and (iii)
- d. (iii) and (iv)

41. Calculate the mass of the analyte from the following mass spectra.

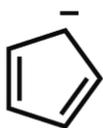


- a. 1000
- b. 1001
- c. 250
- d. 500

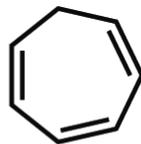
42. Which of the following is aromatic?



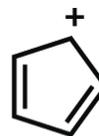
i



ii



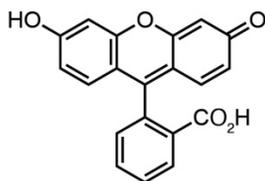
iii



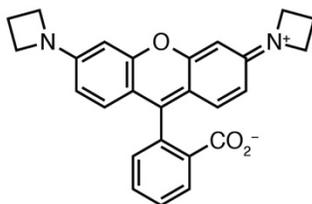
iv

- a. i
- b. ii**
- c. iii
- d. iv

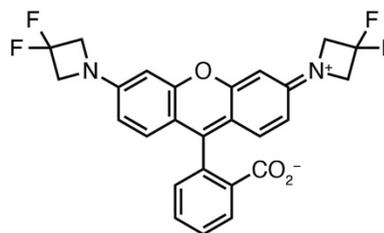
43. Two dyes differ primarily in the presence of a xanthene core with different substituents, which affects their absorption and emission maxima. Dye (1) absorbance maxima is ~488 nm. The absorbance of dye (2) is red shifted to ~549 nm. Based on this information and the structures shown here, what would be the absorbance maxima of dye (3)?



Dye 1
488 nm



Dye 2
549 nm



Dye 3
?

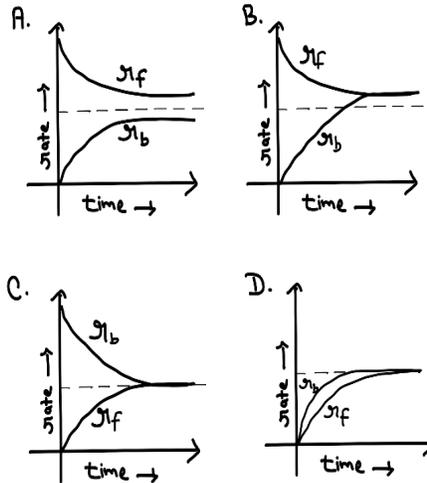
- a. More than 549 nm
- b. Less than 488 nm
- c. More than 488 nm but less than 549 nm**
- d. 549 nm

44. The rate constant of a second-order reaction $A + B \rightarrow C$ follows $\log_{10} k = 30 - \frac{6000}{T}$, where the temperature $T = 27^\circ C$. The value of the rate constant, k is

- a. 10^{-192}

- b. 10^2
- c. 10^{10}
- d. 7.78

45. Which of the following graphs correctly represents the equilibrium condition?



Note,
 r_f = rate of forward reaction
 r_b = rate of backward reaction

- a. A
- b. B
- c. C
- d. D

46. To increase the stability of RNA, replace the 2' OH with

- a. Amine (NH_2)
- b. Thiol (SH)
- c. Methoxy (OCH_3)
- d. Selenol (SeH)

47. A bacterial operon is negatively regulated by a repressor that is inactivated by lactose. Which of the following changes will result in *constitutive expression*?

- a. Mutation in the promoter sequence
- b. Mutation in the repressor binding site of the operator

- c. Mutation in the gene encoding beta-galactosidase
- d. Mutation that increases repressor affinity for operator

48. Two yeast mutants (A and B) both fail to synthesize leucine. When mated, the diploid regains the ability to grow without leucine. Which inference is correct?
- a. Mutations A and B are in the same gene
 - b. Mutations A and B are in different genes of the same pathway
 - c. The cross reverts one mutation
 - d. Both mutations affect a non-genetic process

49. You study a signaling pathway with three proteins: A, B and C. These are required for transcriptional activation of a gene X. Mutant A⁻ has no activation; mutant B⁻ also has no activation; mutant C⁻ has strong basal activation. When you overexpress C in A⁻ background, activation is restored. What is the best possible inference given the above data?

- a. C acts upstream of A
- b. C acts downstream of A
- c. A negatively regulates C
- d. B activates C

50. You test two yeast mutants affecting mitochondrial morphology.

Genotype	Mitochondrial morphology
WT	Tubular
$\Delta fzo1$	Fragmented
$\Delta dnm1$	Hyperfused
$\Delta fzo1$ $\Delta dnm1$	Normal

Q: Which is the best possible explanation?

- a. fzo1 and dnm1 act in the same pathway.
- b. fzo1 promotes fission, dnm1 promotes fusion.

- c. dnm1 acts downstream of fzo1.
- d. fzo1 and dnm1 balances the system.

51. A mutation eliminates the signal peptide of a secretory protein. Where would the mature protein localize?

- a. Accumulate in the ER lumen
- b. Be degraded in lysosomes
- c. Remain in cytosol
- d. Be secreted normally

52. A biochemical pathway involves sequential enzymes E_1 , E_2 , and E_3 .

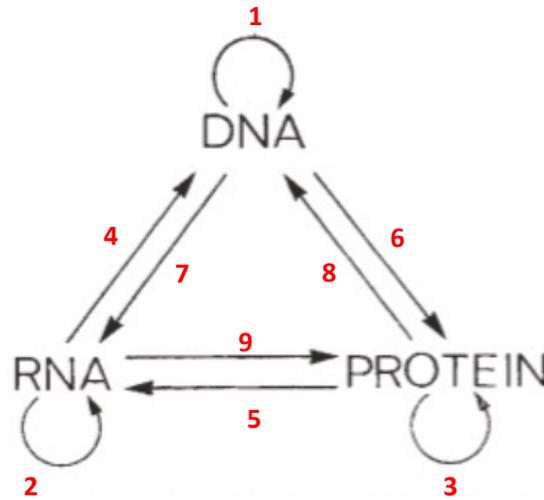
A mutation in E_2 leads to accumulation of compound X and deficiency of final product Y. Which experimental result would confirm feedback inhibition by Y on E_1 ?

- a. Addition of Y decreases the level of X
- b. Addition of Y increases the level of X
- c. Addition of Y has no effect on X
- d. Addition of X decreases the synthesis of Y

53. The Mars Rover returns to earth after 20 years and brings back soil samples from Mars. Examination of the soil samples results in the identification of fossils from which a compound resembling protein is isolated. You obtain a sample of Martian protein and analyze its composition. After much hard work you were able to identify 68 amino acids in this protein sample. Assuming that Martian DNA has four bases what is the minimum number of bases that need to be present in a codon to represent all 68 amino acids in the genome?

- a. A triplet code
- b. A doublet code
- c. A quadruplet code
- d. A quintuplet code

54. In the schematic that defines the flow of information in the Central Dogma of molecular Biology, which pathways (numbers) for the flow of information have not been discovered?



- a. 6
- b. 4
- c. 7
- d. 2

55. In sea urchin DNA, which is double-stranded, 17% of the bases were shown to be cytosine. The percentages of the other three bases expected to be present in this DNA are:

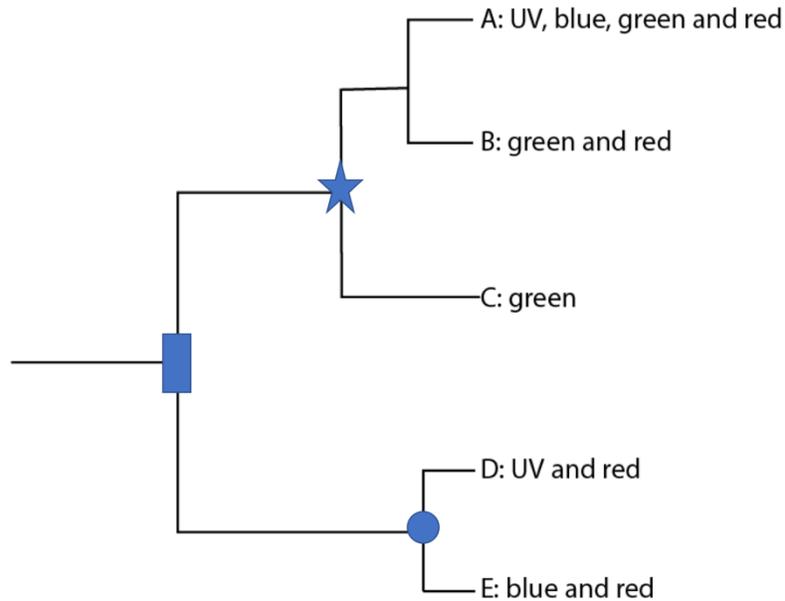
- a. G = 8.5%, A = 50%, T = 24.5%
- b. G = 34%, A = 24.5%, T = 24.5%
- c. G = 17%, A = 17%, T = 17%
- d. G = 17%, A = 33%, T = 33%

56. You design a GFP reporter driven by a promoter of gene Y, which is repressed by protein Z. You knock out Z gene and GFP levels shoot up but gradually return to baseline after 24 hrs. RT-qPCR shows Y mRNA also decreases back to baseline.

Q: What could explain this transient activation?

- a. Z is redundant with another repressor.
- b. Y indirectly activates a feedback that re-expresses Z.
- c. GFP destabilizes Y promoter.
- d. Knockout of Z caused increased translation.

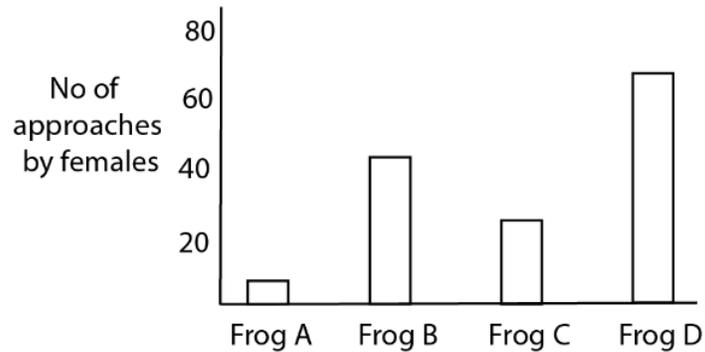
57. Mantis shrimps express dozens of opsins genes. Each opsin has a slightly different peak sensitivity to different wavelengths of light and hence confers a different color sensitivity to the shrimp. A researcher sequenced the opsin genes of 5 different species in the Indian and Pacific Ocean and mapped their opsin expression onto their phylogenetic relationships. See the following to answer the question below:



Q: Based on the phylogenetic relationship shown above, the opsin gene with red sensitivity evolved at which node?

- Node marked with a star
- Node marked with a rectangle
- Node marked with the circle
- Node marked with a triangle

58. Male frogs attract females with their mating calls. These calls include both visual and acoustic signals: females prefer males with louder calls (auditory) and large inflating vocal sacs (visual). To understand the relative contribution of the two sensory signals, researchers placed 4 dummy frogs at equal distances and released a female frog in the middle. Dummy frog A did not make any sound or vocal sac movements, dummy frog B made only sound calls, dummy frog C made only vocal sac movements, but no sound and dummy frog D produced both sounds and vocal sac movement. The researchers quantified the number of approaches towards each dummy frog as an indicator of female preference. Based on the data below, which of the following is true?



- (A) Female frogs have a stronger preference for visual signal (vocal sac inflation) as compared to the auditory signal
- (B) Female frogs have a stronger preference for auditory signal as compared to the visual signal
- (C) Female frogs show strongest preference for males that display both visual and auditory signals together
- Both b and c

59. Hepatocytes harbor the cellular organelles called peroxisomes, while both hepatocytes and peroxisomes can be assumed as spherical. If hepatocytes have diameter in the range of 20-30 μm , and peroxisomes in the range of 0.1-1 μm , what is the closest estimated number of peroxisomes inside a hepatocyte with 20% of the peroxisomal volume, considering average diameters for both?

- ~3000
- ~25 $\times 10^3$
- ~11 $\times 10^8$
- ~500

60. You are being given a restriction map of a plasmid. How many fragments will you get if you cut the plasmid with the restriction enzyme EcoRI and BamHI?

BamHI sites: 5, 5325, 7838
 EcoRI sites: 455, 2968, 8835

- a. 4
- b. 5
- c. 6
- d. 3