GATE EY 2015

AI25BTECH11016-VARUN

Q.1 to Q.5 carry one mark each and Q.6 to Q.10 carry 2 marks each

1) Choose the most appropriate word from the options given below to complete the following sentence: The principal presented the chief guest with a _____,as token of appreciation.

a) momento b) memento c) momentum d) moment

(GATE EY 2015)

2) Choose the appropriate word/phrase, out of the four options given below, to complete the following sentence:

Frogs _____.

a) croak b) roar c) hiss d) patter

(GATE EY 2015)

3) Choose the word most similar in meaning to the given word:

Educe

a) Exert b) Educate c) Extract d) Extend

(GATE EY 2015)

4) Operators □,◇ and → are defined by: a◇b = a+b/a-b;a□b=a-b/a+b;a→b=ab. Find the value of (66□6)→(66◇6)

a) -2 b) -1 c) 1 d) 2

(GATE EY 2015)

5) If $log_x(5/7) = -1/3$, then the value of x is

a) 343/125 b) 125/343 c) -25/49 d) -49/25

(GATE EY 2015)

6) The following question presents a sentence, part of which is underlined. Beneath the sentence you find four ways of phrasing the underlined part. Following the requirements of standard written English, select the answer that produces the most effective sentence.

Tuberculosis, together with its effects, rank one of the leading causes of death in India.

a) ranks one of the leading causes of death

b) ranks as one of the leading causes of death

c) are the rank of one of the leading causes of death

d) are one of the leading causes of death

(GATE EY 2015)

7) Read the following paragraph and chose the correct statement.

Climate change has reduced human security and threatened human well being. An ignored reality of human progress is that human security largely depends upon environmental security. But on the contrary, human progress seems contradictory to environmental security. Ways to keep both the required in a given challenge is to address to one and all. One of the ways to curb the climate change may be via small scientific innovations, while the older may be the Gandhian perspective on small scale progress but with focus on sustainability.

a) Human progress and security are positively associated with environmental security.

b) Human progress is contradictory to environmental security

c) Human security is contradictory to environmental security.

d) Human progress depends upon environmental security.

(GATE EY 2015)

8) Fill in the missing value

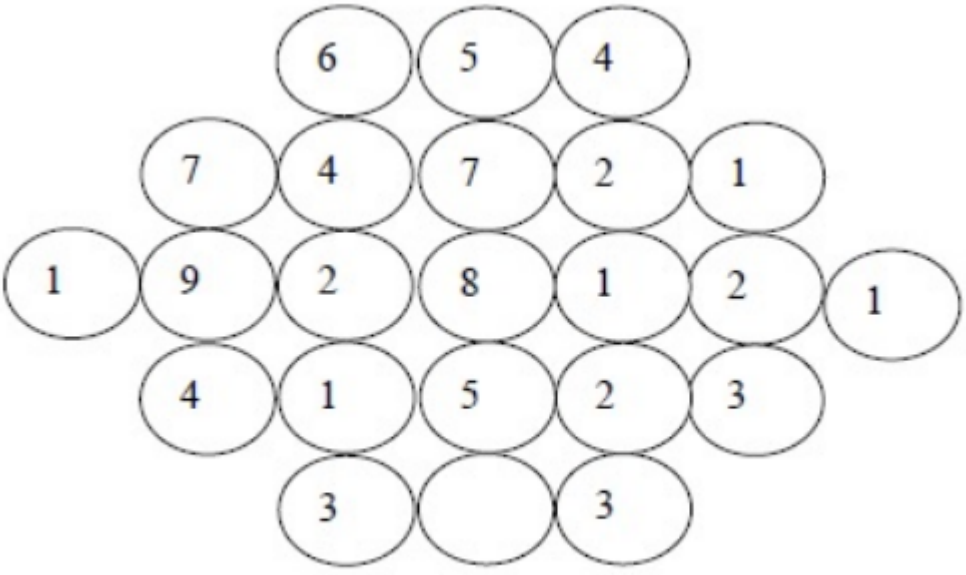

Fig. 1.

(GATE EY 2015)

9) A cube of side 3 units is formed using a set of smaller cubes of side 1 unit. Find the proportion of the number of faces of the smaller cubes visible to those which are NOT visible.

a) 1 : 4 b) 1 : 3 c) 1 : 2 d) 2 : 3

(GATE EY 2015)

10) Humpty Dumpty sits on a wall every day while having lunch. The wall sometimes breaks. A person sitting on the wall falls if the wall breaks.

Which one of the statements below is logically valid and can be inferred from the above sentences?

a) Humpty Dumpty always falls while having lunch

b) Humpty Dumpty does not fall sometimes while having lunch

c) Humpty Dumpty never falls during dinner

d) When Humpty Dumpty does not sit on the wall, the wall does not break

(GATE EY 2015) **Q.11 to Q.35 carry 1 mark each and Q.36 to Q.65 carry two marks each**

11) A genetic locus has only two alleles in a population. The frequency of heterozygotes at this population is 0.32. Assuming Hardy-Weinberg equilibrium, the frequency (in decimal notation, not in fractions or percentage) of the rarer allele is _____

(GATE EY 2015)

12) in a population of asexual organisms that remains at a constant size, an individual is expected to have an average of _____reproducing offspring.

(GATE EY 2015)

13) Which of the following processes captures the KEY DIFFERENCE between metapopulation versus single-population approaches to study population dynamics?

a) Births and Deaths

b) Life history variation

c) Immigration and Emigration

d) Environmental and demographic stochasticity

(GATE EY 2015)

14) A researcher used a t-test on two samples of data and obtained the following statistics: sample t-statistic = 5.2, critical t-statistic = 2.3 (for the appropriate degrees of freedom and alpha level of 0.05). Based on this information, the researcher should conclude that

a) $p < 0.05$, reject the statistical null hypothesis

b) $p < 0.05$, fail to reject the statistical null hypothesis

c) $p > 0.05$, reject the statistical null hypothesis

d) $p > 0.05$, fail to reject the statistical null hypothesis

(GATE EY 2015)

15) Among forests of the following states, tree diversity (e.g., species richness per unit area) is high in:

a) P and Q b) Q and S c) R and S d) P and R

(GATE EY 2015)

16) Many agriculturally important plants belong to which of the following families?

P) Dipterocarpaceae, Q) Poaceae, R) Solanaceae, S) Verbenaceae

a) P and Q b) Q and S c) P and S d) Q and R

(GATE EY 2015)

17) In India, *Partheniumhysterophorus*, *Lantanacamara*, and *Prosopisjuliflora* are examples of which of the following types of species? P) Endangered species, Q) Endemic species, R) Invasive species, S) Keystone species

a) P only b) P and Q c) R only d) S only

(GATE EY 2015)

18) Acid rain can be attributed to which of the following factors?

P) human alteration of global S cycle Q) human alteration of global N cycle R) increased average global temperature S) natural causes such as fluctuation in sunspots T) natural causes such as volcanism

a) P, Q, and R
b) P and R
c) S and T
d) P, Q, and T

(GATE EY 2015)

19) Periodic glaciation at a global scale is a feature of which geological age?

a) Cenozoic b) Paleozoic c) Jurassic d) Archaean

(GATE EY 2015)

20) Carbon-fixation reactions using RUBISCO and PEP occur in

a) C3 plants
b) C4 plants
c) CAM plants
d) C3, C4, and CAM plants

(GATE EY 2015)

21) Which of the following trees is phylogenetically MOST accurate?

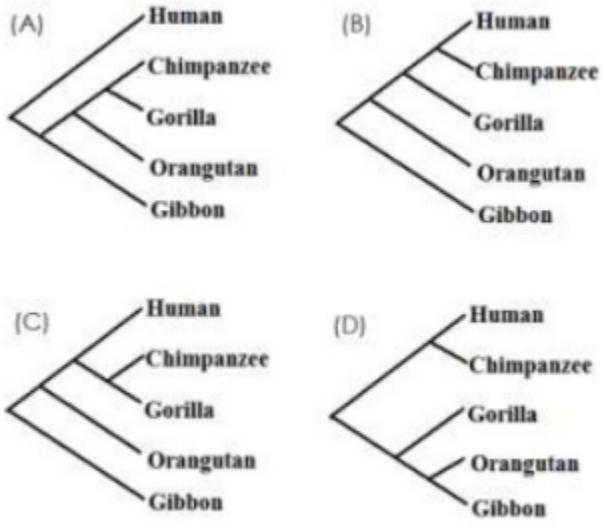

Fig. 2.

(GATE EY 2015)

22) Which of the following processes typically does NOT contribute to increase in genetic variation?

a) Mutation b) Migration c) Drift d) Recombination

(GATE EY 2015)

23) Maximum heterozygosity (in decimal notation, not in fractions or percentage) at a neutral locus with two alleles, given random mating, is _____

(GATE EY 2015)

24) A predator encounters a group of 10 prey and kills one of them to feed. The probability of getting killed is the same for all prey individuals. The probability that a given prey is killed by the predator is _____

(GATE EY 2015)

25) All else being equal, among isolated populations comprising of 10, 100, 500 and 1000 individuals, the impact of random genetic drift is LOWEST in the population with_____ individuals.

(GATE EY 2015)

26) If the mean of a sample is 4 units and its variance is 16 units, then its coefficient of variation (in decimal notation, not in fractions or percentage) is _____

(GATE EY 2015)

27) A scientist wants to prove that some birds line their nests with aromatic herbs to protect their chicks against insects that parasitize them. Which of the following experiments will NOT help to investigate this hypothesis?

a) Treating the nests containing aromatic herbs with insecticides

b) Comparing insect parasite load in nests with and without aromatic herbs

c) Comparing the effect of aromatic and non-aromatic herbs on the number of parasites

d) Examining the impact of aromatic herbs on insect parasites under laboratory conditions

(GATE EY 2015)

28) Many cranes are highly endangered and are often raised in captivity in zoos by having wild-collected eggs hatched in incubators. The hatchlings are then reared by the zoo keepers in the absence of adult cranes. In order to ensure successful reproduction of these zoo-reared cranes in the wild, which of the following should NOT occur?

a) Hatchlings must be fed their wild diet by the zoo keepers

b) Hatchlings must be exposed to predators by the zoo keepers

c) Hatchlings should imprint on the zoo keepers

d) Hatchlings should be trained to forage naturally in the wild by the zoo keepers

(GATE EY 2015)

29) Acoustic signals degrade most rapidly in which of the following environments?

a) In a rainforest

b) At a depth of 100 ft in the open ocean

c) In a desert

d) In a Eucalyptus plantation

(GATE EY 2015)

30) A plant species X is dioecious, another plant species Y is bisexual and cross-pollinated, while a third plant species Z is bisexual and self-pollinated. All else being equal, what might be the expected pollen:ovule ratio when arranged in descending order?

a) $Y > Z > X$

b) $X > Y = Z$

c) $X > Y > Z$

d) $X < Y = Z$

(GATE EY 2015)

31) The nodes of Ranvier are

a) Junctions in connective tissue

b) Myelinated junctions in nerve cells

c) Nodes in sarcolemmas

d) Non-myelinated gaps in nerve cells

(GATE EY 2015)

32) Many agriculturally important insect pests belong to which of the following groups?

P) Coleoptera, Q) Odonata, R) Lepidoptera, S) Orthoptera, T) Chiroptera

a) P, Q and S

b) S, R and T

c) Q, S and T

d) P, R and S

(GATE EY 2015)

33) Plasmodesmata are found in

a) Cyanobacteria b) Plants c) Invertebrates d) Vertebrates

(GATE EY 2015)

34) In the schematic below, the circles and triangles represent climatic zones occupied by two different biomes along gradients of precipitation and temperature. Which of the following is an accurate description of these biomes?

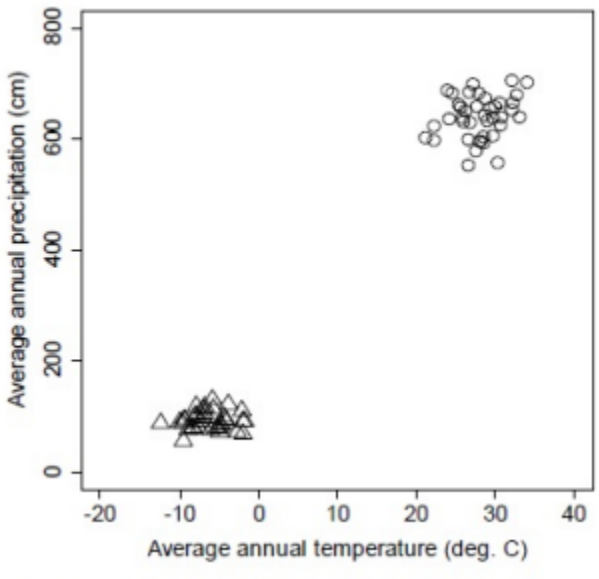

Fig. 3.

a) Circles = Tropical Rainforest; Triangles = Temperate Rainforest

b) Circles = Subtropical Desert; Triangles = Tropical grassland

c) Circles = Tropical Rainforest; Triangles = Tundra

d) Circles = Tundra; Triangles = Subtropical Desert

(GATE EY 2015)

35) Flower colour in a plant is governed by a gene with two alleles (A1 and A2). The genotypes A1A1, A2A2 and A1A2 produce red, white and pink flowers, respectively. The frequency of white flowers in a population is 0.16. In an experiment, if only the plants with pink flowers are selfed, then the resulting ratio of red:pink:white phenotypes in the next generation is expected to be

a) 3:2:1 b) 2:2:1 c) 1:2:1 d) 1:1:1

(GATE EY 2015)

36) A researcher studying the effect of urban environment on bird song finds that urban bird song is higher pitched than rural bird song. To test whether this difference has a genetic basis or is due to phenotypic plasticity, she creates four experimental treatments:

Treatment code	Eggs collected from	Eggs hatched and chicks raised in
RR	Rural	Rural
RU	Rural	Urban
UR	Urban	Rural
UU	Urban	Urban

She measures the average pitch of song of adult birds reared from these four treatments and concludes that genetic differences underlie the differences in pitch. Which of the following patterns in the variation in pitch provides evidence for this conclusion?

a) UR = UU = RR = RU
b) $UU > RU > UR = RR$
c) $RU > UR > UU = RR$
d) $UR = UU > RR = RU$

(GATE EY 2015)

37) In cooperatively breeding species, a single dominant female breeds while other subordinate adult females in the group rarely breed. Which of the following statements below are PROXIMATE explanations for this phenomenon? (P) When resources are limited, and competition for reproduction is strong, females evolve costly traits to monopolize reproduction

(Q) Intense aggression by the dominant female towards subordinates results in chronic stress, elevated stress hormone levels, and lowered rates of conception in subordinates

(R) When dispersal is costly, natural selection favours delayed dispersal of the young who instead help rear siblings, in return for continued residence on their natal territory

(S) Pregnant subordinate females are evicted from the group by the dominant female, and harsh conditions outside the group result in loss of body condition and increased risk of abortions

a) P and Q
b) P and R
c) Q and S
d) Q and R

(GATE EY 2015)

38) The figure panels below show population growth in two species (solid circles and open circles), when they are grown alone, and when they are grown together. The interaction between these species is an example of

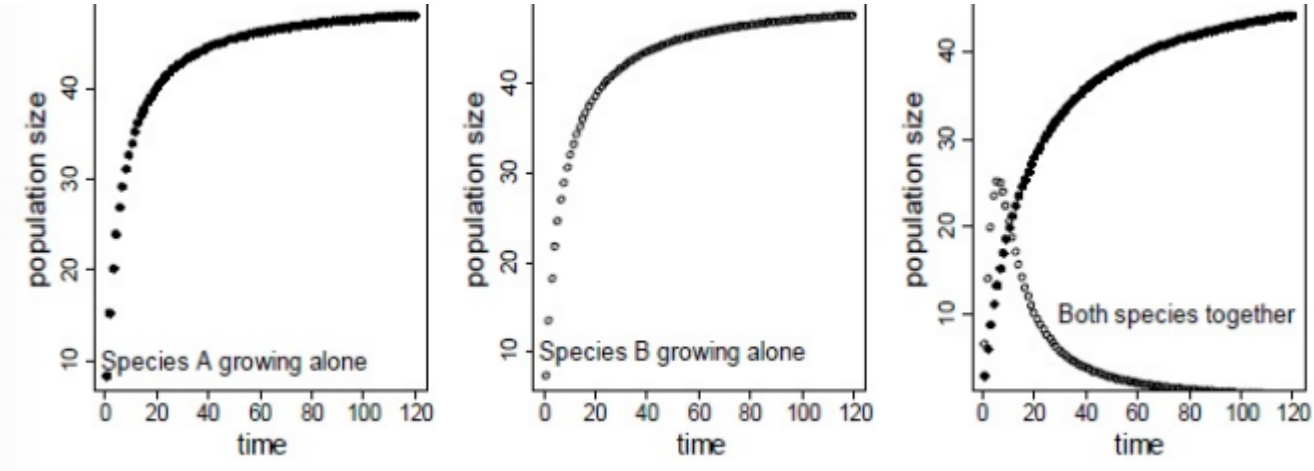

Fig. 4.

a) mutualism

b) predator-prey interaction

c) competition

d) commensalism

(GATE EY 2015)

39) In male moths of a certain genus, size of antennae and sensitivity to female pheromone are under the influence of sexual selection. Species X and Species Y of moths within this genus occur together in the same geographical location. Species X naturally occurs in dense populations while Species Y naturally occurs in sparse populations. All else being equal, which of the following is most likely to be correct?

a) Males of Species X have larger antennae and are more sensitive to female pheromone

b) Males of Species Y have smaller antennae and are less sensitive to female pheromone

c) Males of Species X have smaller antennae and are less sensitive to female pheromone

d) Males of Species Y have larger antennae and are less sensitive to female pheromone

(GATE EY 2015)

40) Which of the following figures represents the equation

$$y = x^2 - c$$

,where c is a positive constant?

(GATE EY 2015)

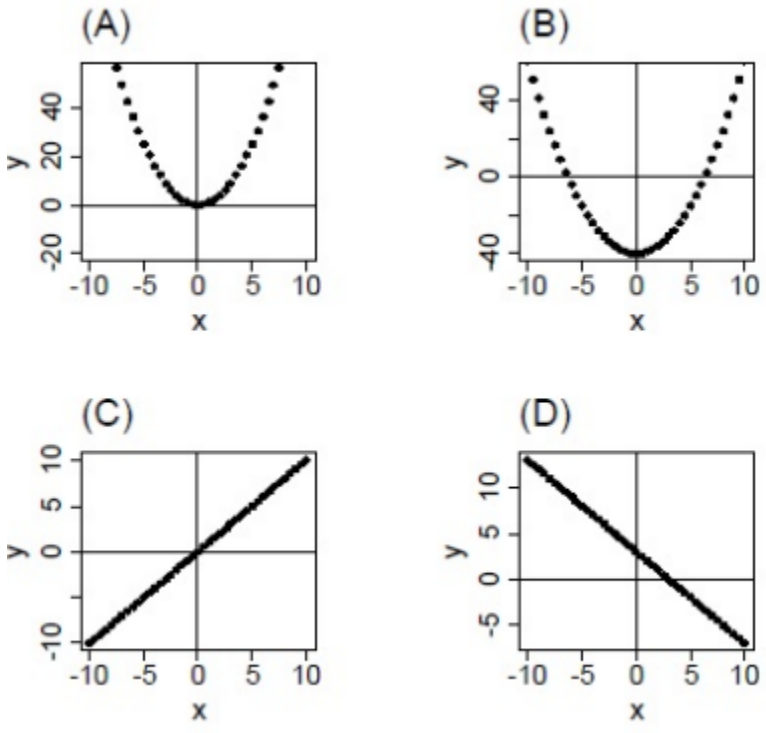

Fig. 5.

41) A researcher measures tail length of 1000 individuals in a bird species. In one population, mean tail length ($\pm SD$) was 15($\pm$8) while it was 10($\pm$2) in a second population, as depicted in the figure below. These values remain consistent across many generations. From these data, he can infer that

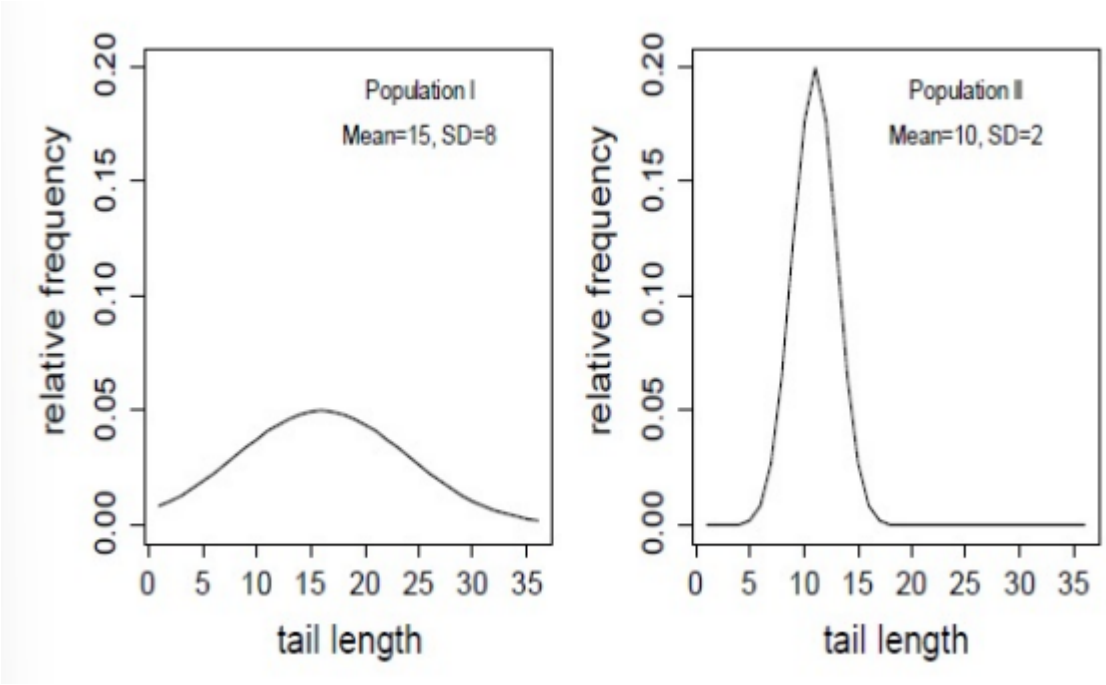

Fig. 6.

a) Population I is under stronger directional selection than population II
b) Population II is under stronger directional selection than population I
c) Population I is under stronger stabilizing selection than population II
d) Population II is under stronger stabilizing selection than population I

(GATE EY 2015)

42) The figure below shows how feeding rate varies with age (old/young) and with body size (small/large) in males of a deer species. Based on this figure, which of the statements below is FALSE?

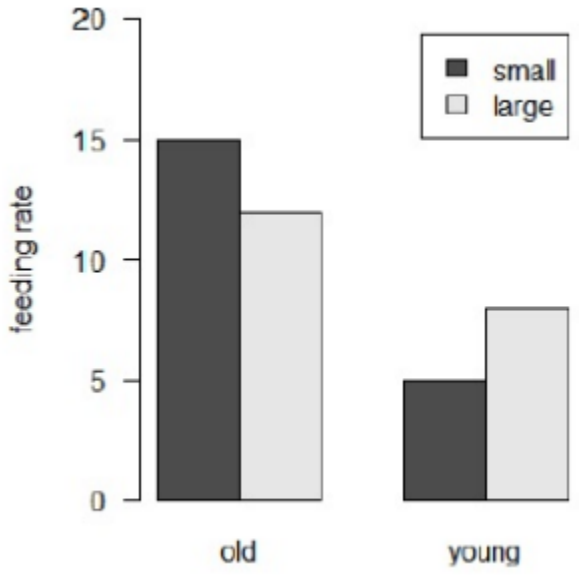

Fig. 7.

a) Large old males have higher feeding rates than large young males
b) Large young males have higher feeding rates than small young males
c) Regardless of size, feeding rate is higher in old males than in young males
d) Regardless of age, feeding rate is higher in small males than in large males

(GATE EY 2015)

43) Breeding males in a population show two alternative mating tactics: T1 and T2. These two tactics are hypothesized to be maintained by negative frequency-dependent effects on fitness. Which figure below represents negative frequency-dependence acting on the two tactics?

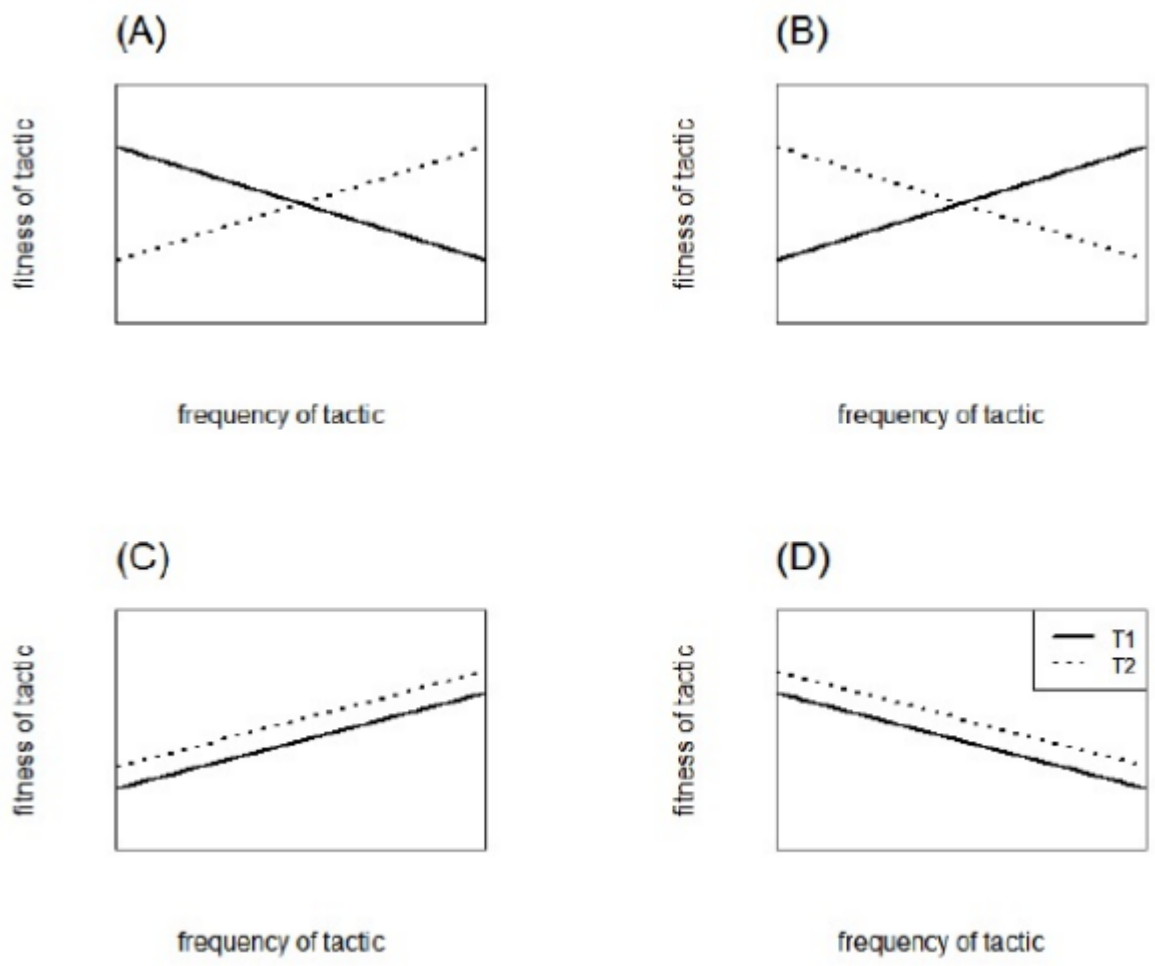

Fig. 8.

(GATE EY 2015)

44) From an original population P of a butterfly species, two experimental populations X and Y were established. In X, males and females were maintained in standard conditions, and females were allowed to mate and lay eggs. Only eggs from females laying small clutches, i.e., 5 eggs or fewer, were allowed to hatch and the rest were not utilized. In Y, males and females were maintained in standard conditions and females were allowed to mate and lay eggs. From each female, 5 eggs were randomly selected and allowed to hatch, and the rest were not utilized. After 20 generations of these experimental conditions, relative to the original population P, and assuming that clutch size is under genetic control, we expect clutch size to be _____ in X and_____ in Y.

a) same; same
b) reduced; same
c) same; reduced
d) reduced; reduced

(GATE EY 2015)

45) Which of the following factors contribute to INCREASING beta diversity of tree species in a typical landscape?

(P) Habitat heterogeneity

(Q) Dispersal limitation

(R) Random mortality among trees

(S) Differences in physiological tolerance among specie

a) Only P b) P and R c) P, Q and S d) P, Q, R and S

(GATE EY 2015)

46) The area of a large forest is reduced by 10% due to fires. Assuming that the number of species (denoted by S) and area (denoted by A) are related by the equation

$$S = cA^z,$$

where c is a positive constant and z is a positive number less than one, the expected loss of species is

a) 10%

b) more than 10%

c) less than 10%

d) cannot be estimated without knowing the exact values of c and z

(GATE EY 2015)

47) The slope of the function

$$y = x - x^2$$

at x=1 is _____

(GATE EY 2015)

48) In which of the following four plots, showing reproductive fitness versus a trait, is the strength of selection MAXIMUM?

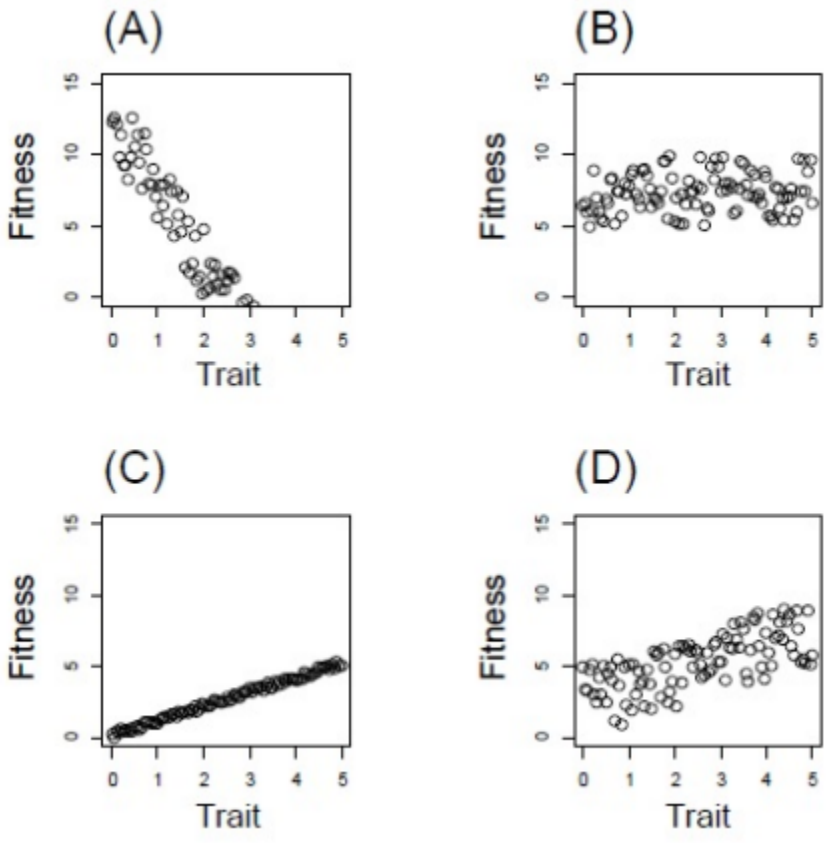

Fig. 9.

(GATE EY 2015)

49) Assuming that the chance of a male or female being born is equal, the probability (in decimal notation, not in fractions or percentage) that three out of four offspring born are female is _____

(GATE EY 2015)

50) An animal starts moving from point O as shown in the diagram below. At every junction marked by a thick circle, it has an equal probability of choosing any of the paths that takes it northwards.

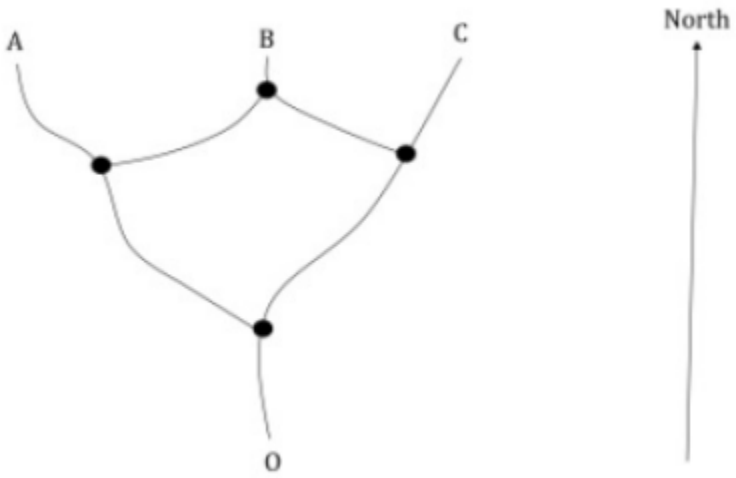

Fig. 10.

(GATE EY 2015)

The probability (in decimal notation, not as fraction or percentage) that the animal will reach point B is _____

(GATE EY 2015)

51) he Shannon index (H) for diversity is given by

$$H = -\sum_i p_i \log_e(p_i)$$

where p_i is the proportion of species i in the total population.

For the community of species given below, the Shannon index (H) is _____.

Species	**Population size**
P	5
Q	10
R	20
S	25
T	40

(GATE EY 2015)

52) n a large forested landscape, where seed dispersal is the ONLY determinant of tree species distribution, two individual trees were randomly picked at a distance r units apart. If F(r) is the probability that the two individuals belong to the same species, which of the following figures shows how F(r) changes with r?

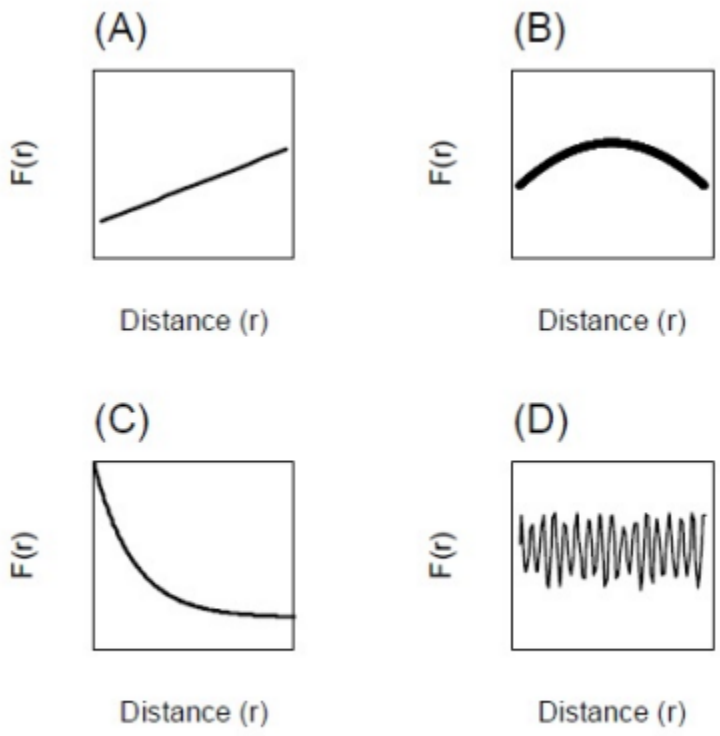

Fig. 11.

(GATE EY 2015)

53) Bacteria growing exponentially increase in number from 10^5 to 10^6in two hours. The ratio of per capita growth rate at the end of two hours to the per capita growth rate at the initial time is _____

(GATE EY 2015)

54) The figures below represent age-specific survivorship and fecundity for species X (denoted by open circles) and Y (closed circles). Based on these survivorship-fecundity relationships, which of the following can be inferred?

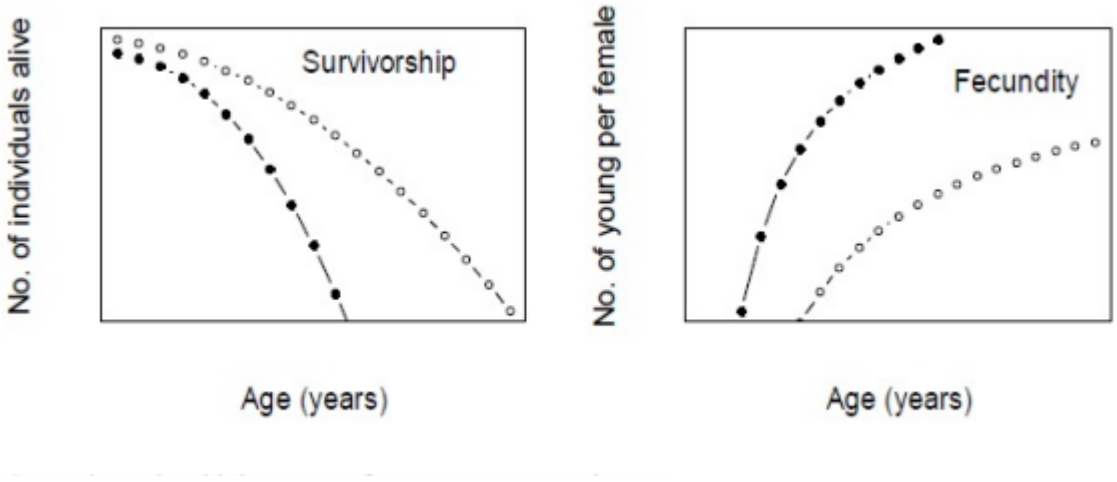

Fig. 12.

(P) Species Y has higher rates of turnover compared to X

(Q) Species Y has a longer life span and delayed reproduction compared to X

(R) Species X has steeper age-specific mortality compared to Y

(S) Species Y is more likely to colonize a site after disturbance compared to X

a) P and S b) Q and R c) P, R, and S d) R and S

(GATE EY 2015)

55) Tree densities are measured in 5 plots in a study area. An index (Variance in tree density / Mean tree density) estimates whether trees are randomly distributed, clumped, or spaced uniformly apart. Tree densities in these 5 sampled plots were 13, 14, 15, 16, and 17. The value of the above index for this data set is _____

(GATE EY 2015)

56) The ratio of Potential Evapotranspiration (PET) to Precipitation (PT) is expected to be more than 1, i.e., PET/PT > 1, in which of the following biomes?

a) Tropical rainforest b) Arid grassland c) Tundra d) Taiga

(GATE EY 2015)

57) Redox potential (Eh) indicates the capacity of atoms, ions, or molecules to donate or accept electrons (i.e., electric potential of energetic transformation during chemical reactions). For reactions involving the nitrogen cycle, Eh values are the following

A consequence of these differences is that:

Reaction	**Eh (volts)**
NO_3^- to N_2	+0.75
NO_3^- to NO_2^-	+0.42
NO_2^- to NH_4^+	+0.34
N_2 to NH_4^+	-0.28

a) N-fixation is energetically unfavourable

b) Denitrification is energetically unfavourable

c) Both N-fixation and denitrification are energetically favourable

d) Both N-fixation and denitrification are energetically unfavourable

(GATE EY 2015)

58) A bird has the choice of four food resources with the following characteristics:

Resource	**Energy content (cal/g)**	**Energy expended in searching for and handling the resource (cal/g)**
P	20	30
Q	85	30
R	65	20
S	90	15

Assuming that all resources are equally abundant and that the bird forages for these resources in an optimal manner, it should exhibit the following sequence of preferences for the resources

a) $S > Q > R > P$

b) $Q > S > R > P$

c) $S > R > Q > P$

d) $S > R > Q = P$

(GATE EY 2015)

59) A scientist conducts an experiment to test the ability of the worm Caenorhabditis elegans to find a food source using only its odour. She places only food odour in the left arm of a Y-shaped tube; there is no food odour in the right arm. She tests 50 worms individually in separate tubes. She finds that they all move into the left arm. She concludes that individual worms can find food using odour alone. However, another scientist says that the experiment is flawed. Based on the information provided above, which of the following is a valid objection?

a) Worms could have used vision to find the food source

b) Worms should have also been tested with the odour placed in the right arm

c) Worms should all have been tested together in the same tube

d) Worms should have been tested individually using the same tube

(GATE EY 2015)

60) The DNA sequence -AAAAAAAAAAAA- undergoes substitutions at the rate of one change every day. Assuming that all base changes are equally probable, the MOST LIKELY composition of this 12 base pair sequence at the end of ten years will be

a) A=0.25 T=0.25 G=0.25 C=0.25

b) A=0.75 T=0.15 G=0.05 C=0.05

c) A=0.70 T=0.10 G=0.10 C=0.10

d) A=0.40 T=0.40 G=0.10 C=0.10

(GATE EY 2015)

61) There is a tightly-linked association between host and symbiont in obligate mutualisms; for example, between termites and their gut symbionts. The following is the phylogeny of the host species A, B, C, D and E, which harbour symbionts Sa, Sb, Sc, Sd and Se.

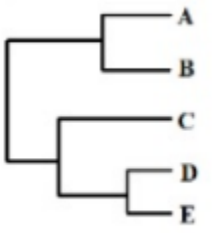

Fig. 13.

Assuming obligate mutualism between these hosts and symbionts, the phylogeny of the symbionts is best represented by which of the following trees?

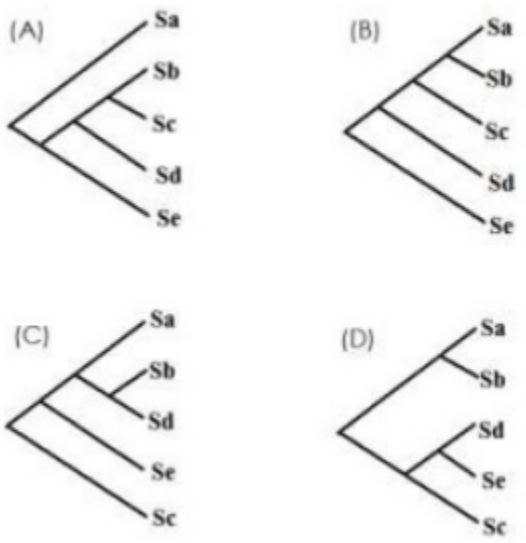

Fig. 14.

(GATE EY 2015)

62) Anita wants to study the effect of Compound X on leaf expansion rates in 100 individuals of a plant species S. Which of the following constitute suitable control(s) for this experiment?

P) Simultaneously measure leaf expansion rates in a second set of 100 plants of species S which has not been treated with Compound X. Q) Measure leaf expansion rates in a second set of 100 plants of species S which has been treated with Compound X for a longer duration. R) Measure leaf expansion rates in a set of 100 plants belonging to a different but closely related plant species treated with Compound X. S) Measure leaf expansion rates for a second set of 100 plants of species S treated with Compound X to test for repeatability of results.

a) P only b) Q and S c) R only d) P and S

(GATE EY 2015)

63) Three sanctuaries X, Y and Z have the same number of mammal species but different species compositions. The list of mammals reported from these sanctuaries is given below.

Sanctuary X : Langur, tiger, spotted deer, leopard, bison, wild dog, elephant Sanctuary Y : Lion, spotted deer, leopard, hyena, langur, blackbuck, wild boar Sanctuary Z : Gibbon, tiger, spotted deer, leopard, bison, rhinoceros, elephant

Which of the following options best describes the order-level diversity in these sanctuaries?

a) $X = Y = Z$ b) $X > Y = Z$ c) $X = Y > Z$ d) $X \neq Y \neq Z$

(GATE EY 2015)

64) The evolutionary relationship between five species of birds (A to E) is shown below.

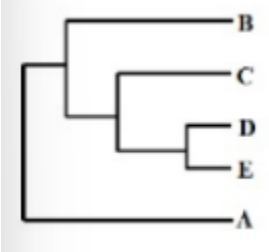

Fig. 15.

Species C, D, and E have a crest while the rest do not. Given this phylogeny and the principle of parsimony (i.e., involving the fewest number of evolutionary steps), which of the following statements reflects the evolution of the crest in this group?

a) Crests evolved multiple times in this group

b) The common ancestor of the five species did not have a crest

c) Species B and A lost their crests in the course of evolution

d) The presence of a crest in species C, D and E is due to convergence

(GATE EY 2015)

65) Parental care may be provided by only males, only females, or by both parents. Comparing parental care between mammals, birds and fishes, male-only care is most common in female-only care is most common in _____ and biparental care is most common in _____

a) birds; fishes; mammals

b) fishes; birds; mammals

c) birds; mammals; fishes

d) fishes; mammals; birds

(GATE EY 2015)