GATE 2014: General Instructions during Examination

1. Total duration of the GATE examination is **180** minutes.
2. The clock will be set at the server. The countdown timer at the top right corner of screen will display the remaining time available for you to complete the examination. When the timer reaches zero, the examination will end by itself. You need not terminate the examination or submit your paper.
3. Any useful data required for your paper can be viewed by clicking on the **Useful Common Data** button that appears on the screen.
4. Use the scribble pad provided to you for any rough work. Submit the scribble pad at the end of the examination.
5. You are allowed to use a non-programmable type calculator, however, sharing of calculators is not allowed.
6. The Question Palette displayed on the right side of screen will show the status of each question using one of the following symbols:

| 1 | You have not visited the question yet. |

| 3 | You have not answered the question. |

| 5 | You have answered the question. |

| 7 | You have NOT answered the question, but have marked the question for review. |

| 9 | You have answered the question, but marked it for review. |

The **Marked for Review** status for a question simply indicates that you would like to look at that question again. *If a question is answered, but marked for review, then the answer will be considered for evaluation unless the status is modified by the candidate.*

Navigating to a Question :

7. To answer a question, do the following:
   a. Click on the question number in the Question Palette to go to that question directly.
   b. Select an answer for a multiple choice type question by clicking on the bubble placed before the 4 choices, namely A, B, C and D. Use the virtual numeric keypad to enter a number as answer for a numerical type question.
   c. Click on **Save & Next** to save your answer for the current question and then go to the next question.
   d. Click on **Mark for Review & Next** to save your answer for the current question and also mark it for review, and then go to the next question.

Caution: Note that your answer for the current question will not be saved, if you navigate to another question directly by clicking on a question number without saving the answer to the previous question.

You can view all the questions by clicking on the **Question Paper** button. This feature is provided, so that if you want you can just see the entire question paper at a glance.

Answering a Question :

8. Procedure for answering a multiple choice (MCQ) type question:
   a. Choose one answer from the 4 options (A,B,C,D) given below the question, click on the bubble placed before the chosen option.
   b. To deselect your chosen answer, click on the bubble of the chosen option again or click on the **Clear Response** button.
   c. To change your chosen answer, click on the bubble of another option.
   d. To save your answer, you MUST click on the **Save & Next** button.

9. Procedure for answering a numerical answer type question:
   a. To enter a number as your answer, use the virtual numerical keypad.
   b. A fraction (e.g. -0.3 or -.3) can be entered as an answer with or without '0' before the decimal point. As many as four decimal points, e.g. 12.5435 or 0.003 or -932.6711 or 12.82 can be entered.
   c. To clear your answer, click on the **Clear Response** button.
   d. To save your answer, you MUST click on the **Save & Next** button

10. To mark a question for review, click on the **Mark for Review & Next** button. *If an answer is selected (for MCQ) or entered (for numerical answer type) for a question that is **Marked for Review**, that answer will be considered in the evaluation unless the status is modified by the candidate.*

11. To change your answer to a question that has already been answered, first select that question for answering and then follow the procedure for answering that type of question.
12. Note that ONLY Questions for which answers are *saved* or *marked for review after answering* will be considered for evaluation.

Choosing a Section :

13. Sections in this question paper are displayed on the top bar of the screen. Questions in a Section can be viewed by clicking on the name of that Section. The Section you are currently viewing will be highlighted.
14. A checkbox is displayed for every optional Section, if any, in the Question Paper. To select the optional Section for answering, click on the checkbox for that Section.
15. If the checkbox for an optional Section is not selected, the **Save & Next** button and the **Mark for Review & Next** button will NOT be enabled for that Section. You will

only be able to see questions in this Section, but you will not be able to answer questions in the Section.

16. After clicking the **Save & Next** button for the last question in a Section, you will automatically be taken to the first question of the next Section in sequence.

17. You can move the mouse cursor over the name of a Section to view the answering status for that Section.

Changing the Optional Section :

18. After answering the chosen optional Section, partially or completely, you can change the optional Section by selecting the checkbox for a new Section that you want to attempt. A warning message will appear along with a table showing the number of questions answered in each of the previously chosen optional Sections and a checkbox against each of these Sections. Click on a checkbox against a Section that you want to reset and then click on the **RESET** button. Note that RESETTING a Section will DELETE all the answers for questions in that Section. Hence, if you think that you may want to select this Section again later, you will have to note down your answers for questions in that Section. If you do not want to reset the Section and want to continue answering the previously chosen optional Section, then click on the **BACK** button.

19. If you deselect the checkbox for an optional Section in the top bar, the following warning message will appear: "Deselecting the checkbox will DELETE all the answers for questions in this Section. Do you want to deselect this Section?" If you want to deselect, click on the **RESET** button. If you do not want to deselect, click on the **BACK** button.

20. You can shuffle between different Sections or change the optional Sections any number of times.

GATE 2014 Examination

EY: Ecology & Evolution

Duration: **180 minutes**   *Maximum Marks*: **100**

Read the following instructions carefully.

1. To login, enter your Registration Number and password provided to you. Kindly go through the various symbols used in the test and understand their meaning before you start the examination.
2. Once you login and after the start of the examination, you can view all the questions in the question paper, by clicking on the **View All Questions** button in the screen.
3. This question paper consists of **2 sections**, General Aptitude (GA) for **15 marks** and the subject specific GATE paper for **85 marks**. Both these sections are compulsory.
   The GA section consists of **10** questions. Question numbers 1 to 5 are of 1-mark each, while question numbers 6 to 10 are of 2-mark each.
   The subject specific GATE paper section consists of **55** questions, out of which question numbers 1 to 25 are of 1-mark each, while question numbers 26 to 55 are of 2-mark each.
4. Depending upon the GATE paper, there may be useful common data that may be required for answering the questions. If the paper has such useful data, the same can be viewed by clicking on the **Useful Common Data** button that appears at the top, right hand side of the screen.

5. The computer allotted to you at the examination center runs specialized software that permits only one answer to be selected for multiple-choice questions using a mouse and to enter a suitable number for the numerical answer type questions using the virtual keyboard and mouse.
6. Your answers shall be updated and saved on a server periodically and also at the end of the examination. The examination will **stop automatically** at the end of **180 minutes**.
7. In each paper a candidate can answer a total of 65 questions carrying 100 marks.
8. The question paper may consist of questions of **multiple choice type** (MCQ) and **numerical answer type**.
9. Multiple choice type questions will have four choices against A, B, C, D, out of which only **ONE** is the correct answer. The candidate has to choose the correct answer by clicking on the bubble (◯) placed before the choice.
10. For numerical answer type questions, each question will have a numerical answer and there will not be any choices**. For these questions, the answer should be entered**by using the virtual keyboard that appears on the monitor and the mouse.
11. All questions that are not attempted will result in zero marks. However, wrong answers for multiple choice type questions (MCQ) will result in **NEGATIVE** marks. For all MCQ questions a wrong answer will result in deduction of⅓ marks for a 1-mark question and ⅔ marks for a 2-mark question.
12. There is **NO NEGATIVE MARKING** for questions of **NUMERICAL ANSWER TYPE**.

13. Non-programmable type Calculator is allowed. Charts, graph sheets, and mathematical tables are **NOT** allowed in the Examination Hall. You must use the Scribble pad provided to you at the examination centre for all your rough work. The Scribble Pad has to be returned at the end of the examination.

Declaration by the candidate:

"I have read and understood all the above instructions. I have also read and understood clearly the instructions given on the admit card and shall follow the same. I also understand that in case I am found to violate any of these instructions, my candidature is liable to be cancelled. I also confirm that at the start of the examination all the computer hardware allotted to me are in proper working condition".

Q. 1 – Q. 5 carry one mark each.

Q.1   A student is required to demonstrate a high level of <u>comprehension</u> of the subject, especially in the social sciences.

The word closest in meaning to <u>comprehension</u> is

(A) understanding   (B) meaning   (C) concentration   (D) stability

Q.2   Choose the most appropriate word from the options given below to complete the following sentence.

One of his biggest _____ was his ability to forgive.

(A) vice   (B) virtues   (C) choices   (D) strength

Q.3   Rajan was not happy that Sajan decided to do the project on his own. On observing his unhappiness, Sajan explained to Rajan that he preferred to work independently.

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

(A) Rajan has decided to work only in a group.
(B) Rajan and Sajan were formed into a group against their wishes.
(C) Sajan had decided to give in to Rajan's request to work with him.
(D) Rajan had believed that Sajan and he would be working together.

Q.4   If $y = 5x^2 + 3$, then the tangent at $x = 0$, $y = 3$

(A) passes through $x = 0$, $y = 0$ (B) has a slope of $+1$
(C) is parallel to the x-axis   (D) has a slope of -1

Q.5   A foundry has a fixed daily cost of Rs 50,000 whenever it operates and a variable cost of Rs 800Q, where Q is the daily production in tonnes. What is the cost of production in Rs per tonne for a daily production of 100 tonnes?

Q. 6 – Q. 10 carry two marks each.

Q.6   Find the odd one in the following group: ALRVX, EPVZB, ITZDF, OYEIK

(A) ALRVX   (B) EPVZB   (C) ITZDF   (D) OYEIK

Q.7   Anuj, Bhola, Chandan, Dilip, Eswar and Faisal live on different floors in a six-storeyed building (the ground floor is numbered 1, the floor above it 2, and so on). Anuj lives on an even-numbered floor. Bhola does not live on an odd numbered floor. Chandan does not live on any of the floors below Faisal's floor. Dilip does not live on floor number 2. Eswar does not live on a floor immediately above or immediately below Bhola. Faisal lives three floors above Dilip. Which of the following floor-person combinations is correct?

	Anuj	Bhola	Chandan	Dilip	Eswar	Faisal
(A)	6	2	5	1	3	4
(B)	2	6	5	1	3	4
(C)	4	2	6	3	1	5
(D)	2	4	6	1	3	5

Q.8   The smallest angle of a triangle is equal to two thirds of the smallest angle of a quadrilateral. The ratio between the angles of the quadrilateral is 3:4:5:6. The largest angle of the triangle is twice its smallest angle. What is the sum, in degrees, of the second largest angle of the triangle and the largest angle of the quadrilateral?

Q.9   One percent of the people of country X are taller than 6 ft. Two percent of the people of country Y are taller than 6 ft. There are thrice as many people in country X as in country Y. Taking both countries together, what is the percentage of people taller than 6 ft?

(A) 3.0   (B) 2.5   (C) 1.5   (D) 1.25

Q.10   The monthly rainfall chart based on 50 years of rainfall in Agra is shown in the following figure. Which of the following are true? (k percentile is the value such that k percent of the data fall below that value)
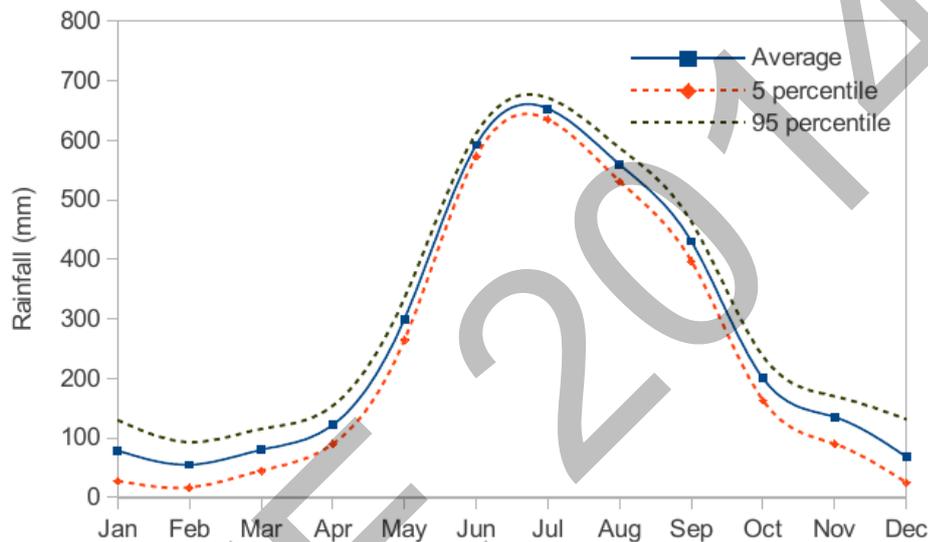

(i) On average, it rains more in July than in December
(ii) Every year, the amount of rainfall in August is more than that in January
(iii) July rainfall can be estimated with better confidence than February rainfall
(iv) In August, there is at least 500 mm of rainfall

(A) (i) and (ii)   (B) (i) and (iii)
(C) (ii) and (iii)   (D) (iii) and (iv)

END OF THE QUESTION PAPER

Q. 1 – Q. 30 carry one mark each.

Q.1   Darwin's ideas on evolution by natural selection were influenced by

(A) Lyell and Malthus
(B) Watson and Crick
(C) Meselson and Stahl
(D) Miller and Urey

Q.2   Which of the following statements about the evolution of humans is believed to be TRUE?

(A) Modern day humans evolved from Neanderthals
(B) Modern day humans and Neanderthals share a recent common ancestor
(C) Modern day humans and Neanderthals both evolved from chimpanzees
(D) Modern day humans evolved from chimpanzees

Q.3   On average, which ecosystem has the LOWEST net primary productivity per unit area?

(A) An open ocean   (B) A coral reef   (C) An estuary   (D) A fresh water lake

Q.4   A researcher measures the height of 100 trees of a species. The mean of these observations is 50 and the variance is 16. The standard error of the mean calculated from these observations is _____

Q.5   A researcher tested for the presence of parasitic infection in 100 male and 100 female deer. Forty males and 30 females were found to be infected. To test if males are significantly more susceptible to infection than females, which of the following is an appropriate statistical test?

(A)Student's t-test
(B)Mann-Whitney U test
(C) Chi-square test
(D)Correlation test

Q.6
The frequency of the dominantred allele (R) in a population of diploid organisms is equal to the frequency of the recessive white allele (r). The frequency of red individuals assuming Hardy-Weinberg equilibriumis(express the frequency using decimal notation, not as a fraction or a percentage) _____

Q.7   Two sympatric species of fruit flies congregate on the fruit of two closely related species of trees for mating. The cue most likely to be used by these fly species to locate their mates from a long distance would be

(A) shape of the fruit
(B) scent of the fruit
(C) colour of the male flies
(D) shape of the flower

Q.8   Human activities release about 7×10^{15} g of CO_2 into the atmosphere every year. Of this, about 3×10^{15} g accumulates in the atmosphere. Another 2×10^{15} g is absorbed by the oceans. The remaining 2×10^{15} g enters the "missing carbon sink." This sink is best explained by which of the following?

(A) CO_2 escapes into outer space from the upper regions of the atmosphere
(B) Plants increase their photosynthetic rate in a CO_2-enriched environment
(C) Cement production from limestone deposits
(D) Increased temperature due to the greenhouse effect

Q.9   The slope of a function is zero

(A) only at the maxima
(B) only at the minima
(C) at both maxima and minima
(D) exactly mid-way between maxima and minima

Q.10   According to foraging theory, if two food items are commonly available and equally abundant, an optimal forager should choose the item that

(A) contains greater energy
(B) takes less energy to process
(C) yields greater net energy
(D) is encountered first in the environment

Q.11   Phenotypic plasticity refers to

(A) change in phenotype over the course of generations with change in genotype
(B) the same genotype producing different phenotypes in different environments
(C) change in phenotype due to random genetic drift
(D) the phenotype being moulded by the environment through natural selection to an optimal state

Q.12   The coefficient of determination, R^2, represents how well a linear model fits the data. R^2 is the sum of squared deviations of observations from the regression line divided by the total sum of squared deviations from the mean value. For the figure below, R^2 is closest to
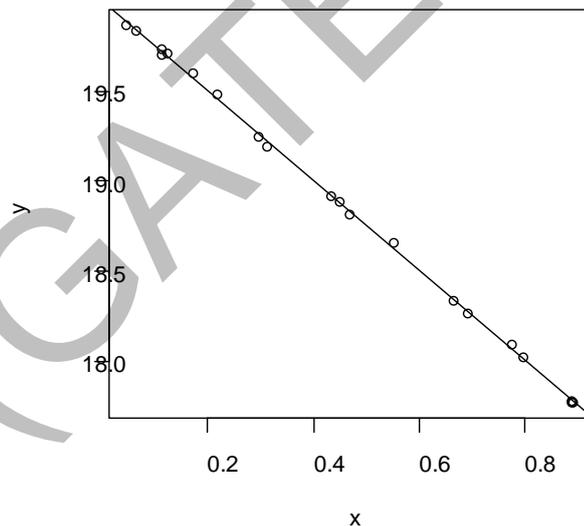

(A) -1   (B) 0   (C) 0.05   (D) 1

Q.13   Death feigning behaviour (i.e., pretending to be dead when attacked) is found in snakes and millipedes. This similarity in behaviour between snakes and millipedes is an example of

(A) convergent evolution
(B) phylogenetic constraint
(C) co-evolution
(D divergent evolution

Q.14   To evaluate the relationship between two variables (e.g., resource abundance and population density), a linear regression can be used. Here, the statistical null hypothesis which allows us to evaluate whether there is a relationship between these variables is

(A) intercept = 0
(B) slope = 0
(C) sample size = 0
(D) mean = 0

Q.15   Which of the following conditions is NOT necessary for evolution by natural selection?

(A) Variation in a trait
(B) Heritability of the trait
(C) Change in the environment
(D) Differential fitness related to the trait

Q.16 C_3, C_4 and CAM are the main photosynthetic pathways in plants. The relative abundance of C_3 plants _____ with increasing latitude.

(A) increases   (B) decreases   (C) stays the same   (D) shows no pattern

Q.17   The pyramidal structure of decreasing biomass with increasing trophic level in terrestrial ecosystems is a consequence of:

(A) the second law of thermodynamics
(B) bio-magnification
(C) conservation of energy
(D) increasing competition at higher trophic levels

Q.18   Typical green leaves from plants absorb light of the following colour/s:

(A) green   (B) red and green   (C) all colours   (D) red and blue

Q.19   Christian Bergmann, a 19th century biologist, observed that related taxa showed increasing body size with increasing latitude. One explanation for this pattern, also called 'Bergmann's Rule', is

(A) lower body mass in the tropics is a result of lower mass-specific metabolic rates
(B) species at higher latitudes have greater access to resources and, therefore, have larger sizes
(C) greater competition at higher latitudes results in larger organisms
(D) lower surface area to volume ratios in larger animals help conserve heat

Q.20   All else being equal, in a species with two sexes, which of the following is true with regard to mate choice?

(A) The sex with the higher number of chromosomes is more likely to be choosy
(B) The sex with the higher number of genes is more likely to be choosy
(C) The sex with the larger gamete is more likely to be choosy
(D) The sex with the smaller gamete is more likely to be choosy

Q.21   Temperate organisms have wider tolerance ranges for temperature than do tropical organisms. If temperatures increase across the globe by 2°C, which of the following is possible?

(A) Temperate organisms will be more negatively affected than tropical organisms
(B) Tropical organisms will be more negatively affected than temperate organisms
(C) The effects on tropical and temperate organisms will be the same
(D) This will have no effect on temperate or tropical organisms

Q.22   The length of Henle's loop in the kidneys of rodents is longest in

(A) hot desert habitats
(B) cool temperate habitats
(C) tropical moist habitats
(D) wetland habitats

Q.23   A recent experiment with a fast growing variety of tomato studied the inheritance of two traits – dwarfism and flower colour. The experiment successfully demonstrated Mendel's law of segregation and for both traits the expected 3:1 ratio of dominant to recessive phenotype was observed. However, the experiment failed to demonstrate the law of independent assortment for the two traits. One possible reason for this is

(A) that the two loci are linked
(B) low penetrance of the traits
(C) that the two loci are on different chromosomes
(D) incomplete dominance

Q.24   Grazing by large herbivores can increaseplant diversity by which of the following mechanisms?
   (i)   Reducing abundance of dominant plants and favouringrare species
   (ii)   Accelerating rates of nutrient cyclingin the ecosystem
   (iii)   Promoting photo-respiration by increasing ambient CO_2 concentration
   (iv)   Decreasing stomatal conductance which promotes biomass production

(A) Both (i) and (ii)
(B) Both (iii) and (iv)
(C) Both (ii) and (iv)
(D) Both (i) and (iii)

Q.25   The doubling time for a bacterial population is 60 minutes. Given a density of 35 cells/ml in a population in its exponential growth phase and assuming unlimited resources, the number of hours that the population will take to grow to 560 cells/ml is _____

Q. 26 – Q. 55 carry two marks each.

Q.26   Birds that are brood parasites lay eggs in the nests of other birds. This is a successful strategy for the parasite only if

(A) the host bird and the brood parasite bird species are similar in size
(B) the parasite removes all the host eggs
(C) host birds cannot discriminate between their eggs and those of the parasite
(D) the parasite chicks are much smaller than those of the host bird species

Q.27   What should be the sound frequency ranges used for acoustic communication between two herds of elephants living far apart in isolated forests, domestic dogs in neighbouring streets, and insect feeding bats catching prey above the tree canopy?

(A) High frequency, low frequency and ultrasonic, respectively
(B) High frequency, human hearing range and ultrasonic, respectively
(C) Low frequency, human hearing range and ultrasonic, respectively
(D) Ultrasonic, high frequency and high frequency, respectively

Q.28   A student grows a bacterial culture in a container starting with a small population size and high resource levels. To estimate population growth, the student puts the container on a weighing machine after air-tight sealing of the container to avoid contamination. Which of the following graphs is the most likely result obtained in the experiment?

(A)

(B)

(C)

(D)
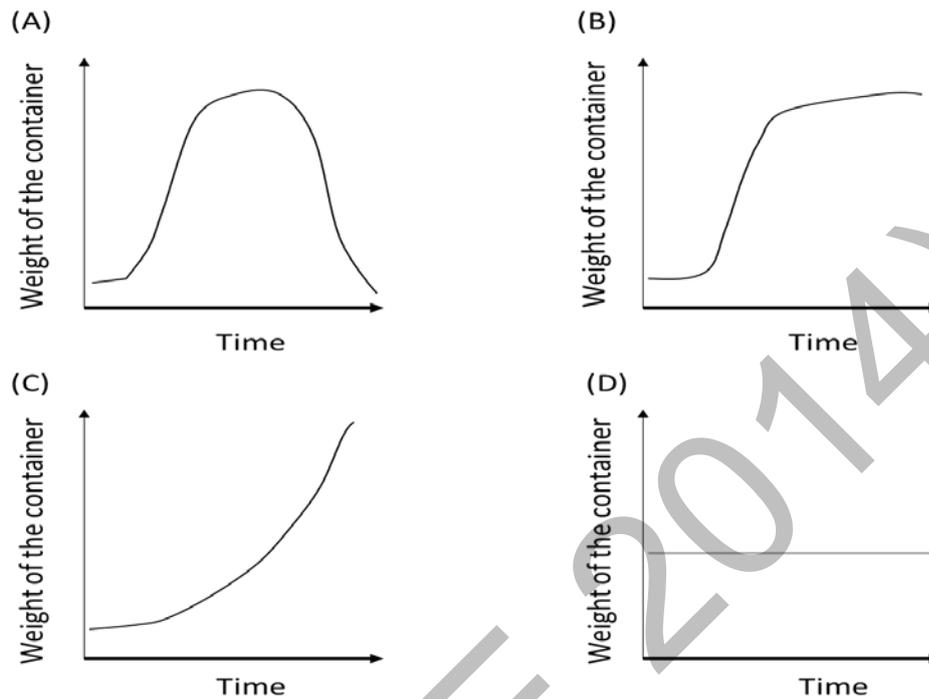
Q.29   Birds show much variation in sexual size dimorphism (body size differences between males and females), which is hypothesized to be associated with their mating system. Match the two groups below to reflect the expected pattern in mating system and sexual size dimorphism in birds.

Mating system	Size dimorphism
i. Monogamy (1 male and 1 female)	P. Males larger than females
ii. Polygyny (1 male and many females)	Q. Females larger than males
iii. Polyandry (1 female and many males)	R. Males and females similar in size

(A) i – Q; ii – P; iii – R   (B) i – R; ii – P; iii – Q
(C) i – P; ii – R; iii – Q   (D) i – R; ii – Q; iii – P

Q.30   Consider the following frequency distribution of an ecological variable:
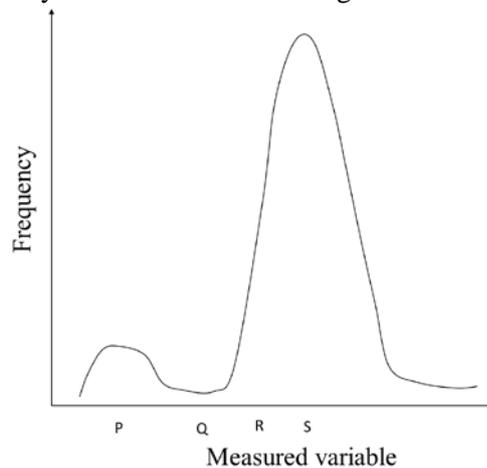
Such a distribution with two peaks is called a bi-modal distribution. Here, the peak with the higher frequency is called the major mode and the one with the lower frequency is called the minor mode. A student has marked four points on the x-axis, i.e., P, Q, R and S. Match the points with the most appropriate statistic: Mean, Median, Major mode, and Minor mode

(A) P-Major mode, Q-Mean, R-Median
(B) P-Major mode, Q-Median, S-Minor mode
(C) P-Minor mode, R-Mean, S-Major mode
(D) Q-Median, S-Major mode, S-Mean

Q.31   In blackbuck, it has been hypothesized that the reproductive fitness of an individual depends on the group size as given below.
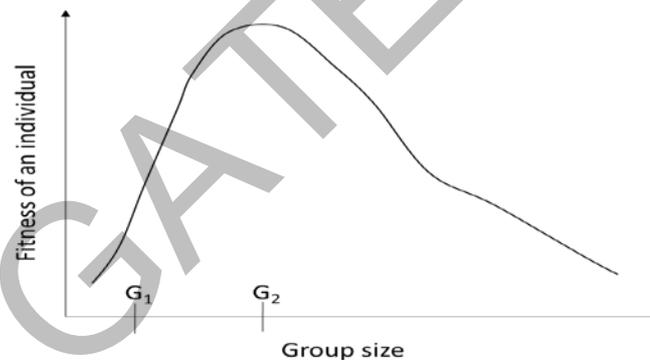

Two groups of unrelated individuals, labelled as G_1 and G_2, encounter each other. Note that G_2 is at the optimal group size. Individuals from each group can decide whether to stay in their group, or join the other group. Individuals cannot prevent others from leaving or joining any group. Under these circumstances, which of the following is most likely?

(A) Individuals of G_1 will choose not to merge with G_2 because the fitness of individuals of G_2 will decrease
(B) Individuals of G_1 will choose to merge with G_2 because it will increase their own fitness
(C) Individuals of G_2 will choose to merge with G_1 because it will increase their own fitness
(D) Individuals of G_2 will choose to merge with G_1 because the fitness of individuals of G_1 will increase

Q.32   In certain cases, a critical group size of organisms is required before a certain action, such as secretion of an enzyme, is taken by individuals of the group. This can be graphically represented as shown below.
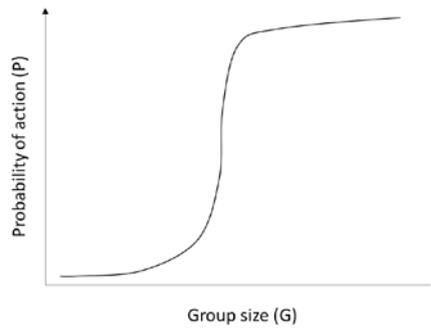

A student conducts experiments and collects data to study this behaviour in her favourite system. Instead of plotting P vs. G, the student plots G (on the y-axis) vs. P (on the x-axis). Assuming that her system did indeed exhibit the group behaviour of the type shown above, how will her modified plot look?
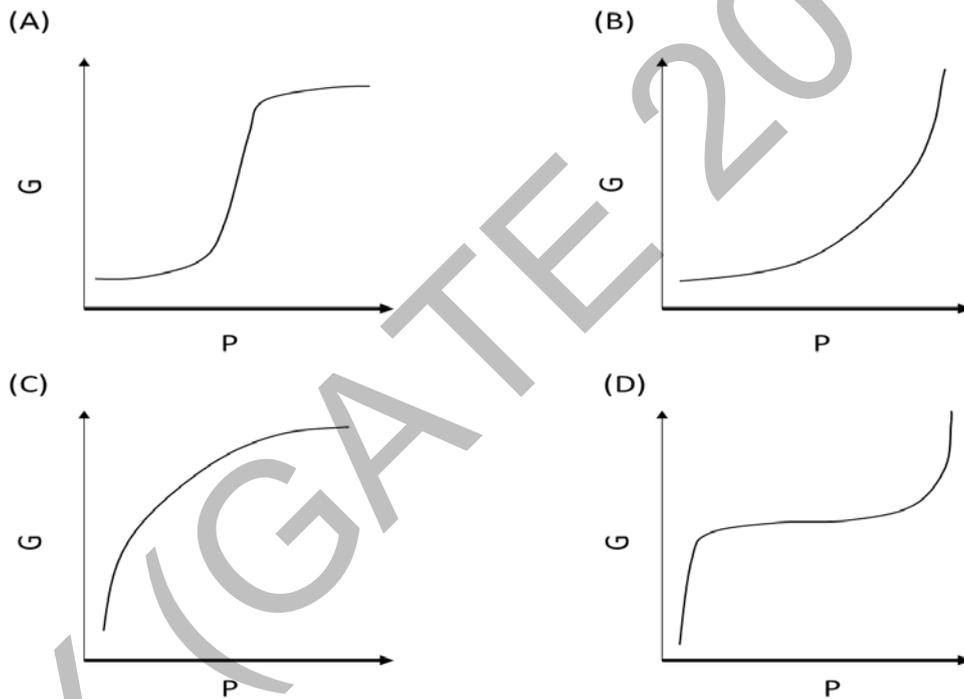
Q.33 All adults of a fish species have bright colour patterns in population P and all adults have dull colour patterns in population Q. Colour patterns in this species are determined early in development. Which of the following study designs is best suited to test whether this colour pattern difference has a genetic basis?

(A) For each population in its natural habitat, follow 100 eggs to the adult stage and measure the colour patterns of the adults

(B) Bring 100 adults of population P and 100 adults of population Q to the lab, allow them to acclimatize for one day under uniform conditions, and then measure colour patterns of the adults

(C) Bring 100 adults of population P to the habitat of population Q, allow to acclimatize for one day, and measure colour patterns of the adults; similarly move 100 adults of population Q to the habitat of population P and measure colour patterns

(D) Bring 100 eggs of population P and 100 eggs of population Q to the lab, maintain them at uniform conditions, follow them to the adult stage, and then measure colour patterns of the adults

Q.34 The figure below shows how competition among foragers in a resource patch reduces individual foraging rates. According to this figure, the expected foraging rate for a solitary individual is _____
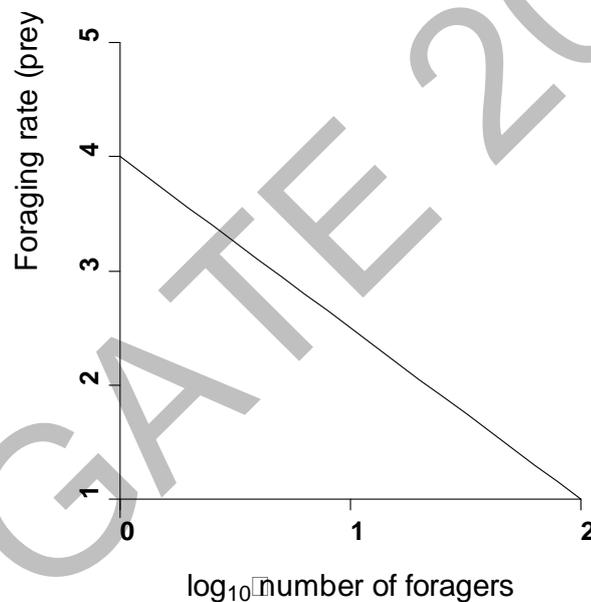
Q.35 Find the matching triplet

1. Invasive species	p. *Ficusbenghalensis*	i. wind-dispersed fruit
2. Keystone species	q. *Lantanacamara*	ii. bat-dispersed fruit
3. Endemic species	r. *Tectonagrandis*	iii. ant-dispersed fruit
4. Exotic species	s. *Partheniumhysterophorus*	iv. bird-dispersed fruit

(A) 2, r, i   (B) 1, q, iv

(C) 3, s, iii   (D) 4, p, ii

Q.36   In birds that pair during the breeding season, it is hypothesized that males need to aggressively guard their mates against mating with intruder males. To test this hypothesis, a scientist presents a male dummy bird to a male bird on his territory just before the female lays her eggs. The dummy is left on the territory. The male was aggressive towards the dummy before the eggs were laid and this aggression declined after egg-laying. Which additional experimentwillNOT provide further information totest this hypothesis?

(A)Present the dummyto a second set of males in the absence of females
(B) Present the dummy to a second set of males before the eggs are laid and remove the dummy from the territory
(C) Use a live male bird instead of the dummy
(D) Present the dummy to a second set of malesonly after the eggs are laid

Q.37   The figure panels below show population growth in two species, when they are grown alone, and also when they are grown together. From the nature of their growth curves, one can infer that the interaction between these species is an example of
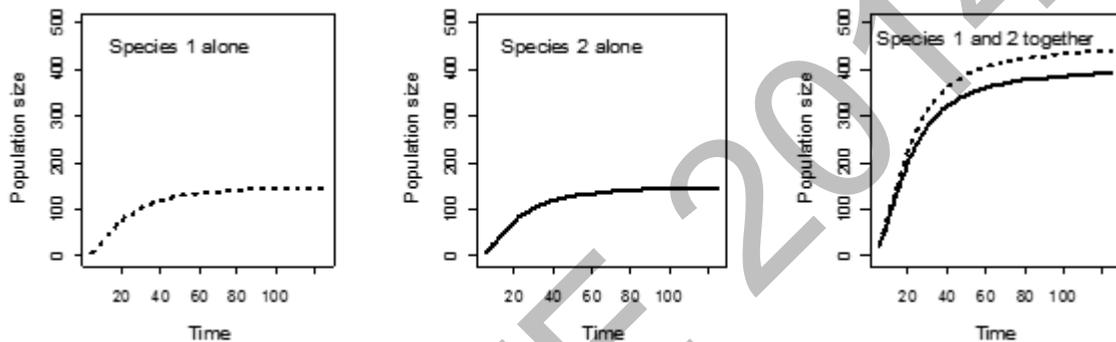
(A) mutualism   (B) commensalism
(C) predator-prey   (D) competition

Q.38   There are two coins in a bowl. Because of differences in the size of the two coins, the probability of picking the bigger coin is 0.6. The bigger coin is unbiased, whereas the smaller coin has a probability of 0.6 of yielding heads. A blind-folded student picks a coin from the bowl and tosses the coin. The probability (expressed using decimal notation, not as a fraction or percentage) that the coin yields a head is _____

Q.39   The accompanying figure shows logistic population growth for two species in the same habitat.

Which of the following conclusions hold true?
(i) Species 1 has higher intrinsic growth rate
(ii) Species 2 has higher intrinsic growth rate
(iii) Carrying capacity for Species 1 is higher
(iv) Carrying capacity for Species 2 is higher

(A) Both (i) and (iii)   (B) Both (i) and (iv)
(C) Both (i) and (ii)   (D) Both (ii) and (iv)

Q.40   Which of these is true with respect to Batesian mimicry?

(A) There is a mutalistic relationship between the model and mimic
(B) There is frequency independent selection on the model and the mimic
(C) A mimic exploitsthe signal of a model
(D) There is positive frequency dependent selection on the mimic

Q.41   In the phylogeny below, branch lengths are proportional to the percent sequence divergence. The scale below the phylogeny indicates branch length. Assume that the gene used to reconstruct the phylogeny of the species in a clock-like fashion. It is known that the divergence between Species 4 and Species 5 happened 2 million years ago. The time of divergence (in million years)between Species 3 and Species 1 is _____

Q.42   Humans have a preference for high calorie foods. Assume a study has shown that (i) the life expectancy of human beings has reduced from 85 to 74 years due to increased consumption of high calorie foods, and (ii) the maximum reproductive age is 70 years. Given these assumptions, which of the following is most likely to happen in the next 200 years?

(A) Humans will evolve a preference for low calorie foods
(B) Humans will evolve the genes to improve life expectancy when feeding on high calorie foods
(C) Humans will evolve enzymes to extract more energy from low calorie foods
(D) Humans will still have a preference for high calorie foods

Q.43   A recently discovered fossil contains 3.125% of ^{14}C found in present day organisms. If the half-life of ^{14}C is 5730 years, the age of the fossil in years is _____

Q.44   In the hypothetical scenario below, there are four small islands (P, Q, R and S) near a very large continent. The distances of the islands from the continent, as well as the sizes of the islands, vary as indicated in the diagram. Assume that dispersal happens only between the continent and the islands, but not among islands. The theory of island biogeography would predict that the number of species in each island will be best represented by which of the following?
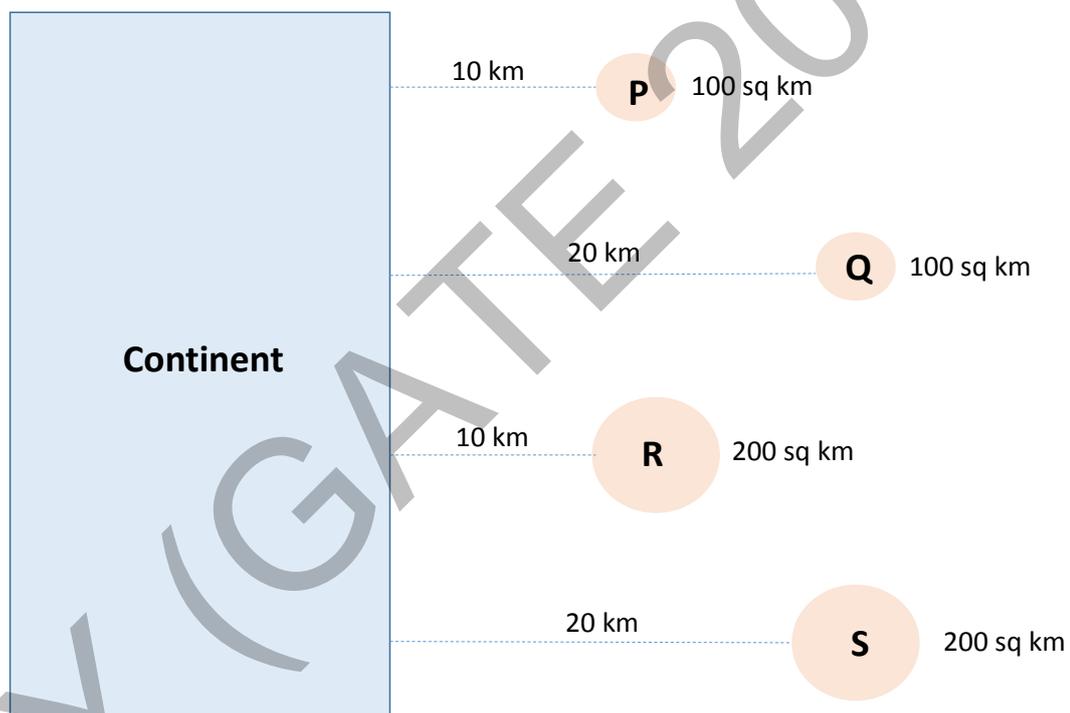

(A) R = S and P = Q
(B) R > Q and R>S
(C) R>Q and Q>P
(D) S>P and Q>S

Q.45   There are 19500 ants of a species on a small island of area 400 sq m. A student collects 1500 ants in 30 randomly placed pit-fall traps. She marks all of them with blue paint and releases them. Due to unusually low temperatures the following night, the ant population on the island experiences 10% mortality. The next day the student lays out another series of randomly placed pit-fall traps and collects 1183 ants. Assuming that (i) mortality is not affected by being painted, (ii) probability of falling into a trap is not affected by being painted, and (iii) probability of falling into a trap is not affected by the density of ants on the island, the expected number of ants with blue marks in the sample is _____

Q.46   A student wants to test the effect of latitude and longitude on seed size in a plant species. He has the resources to lay a maximum of 9 plots. Which plot design is most appropriate for this question?
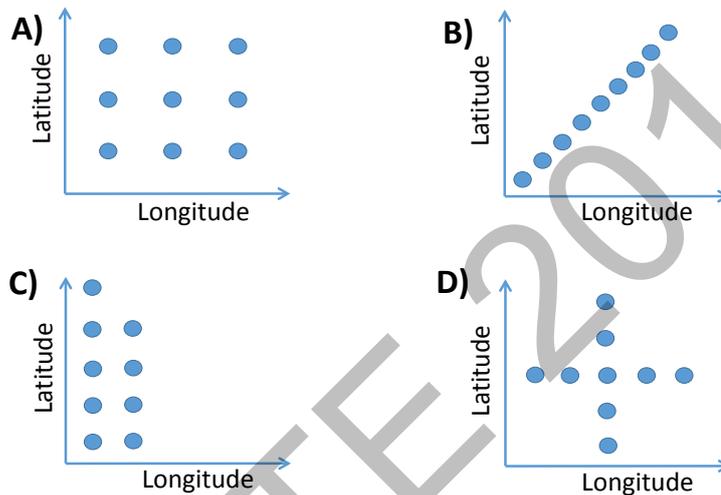

Q.47   In an experiment, cows were allowed to graze in closed pastures either with wild deer or without wild deer. This experiment was done in the rainy and dry seasons. The results for weight gain in the cows (mean and 95% confidence interval) are shown in the figure below. Based on these results which of the following statements is true?
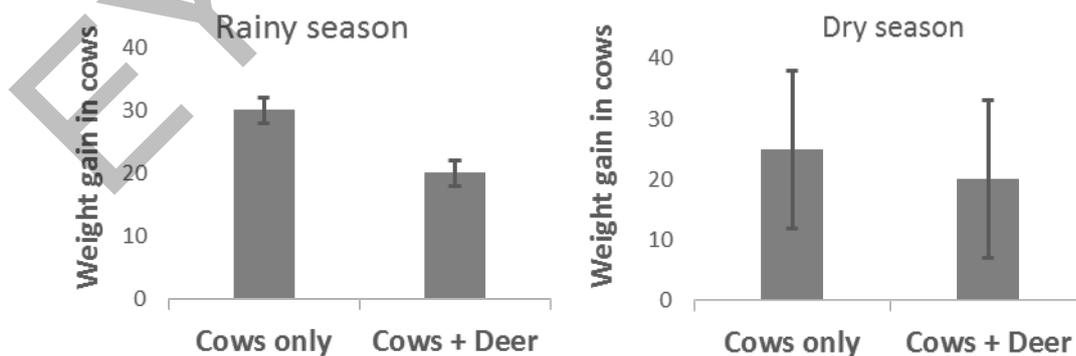
(A) The presence of wild deer does not affect weight gain in cows
(B) The effect of wild deer on weight gain in cows changes with season
(C) The presence of wild deer has an inhibitory effect on weight gain in cows in both seasons
(D) Cows and wild deer have a mutualistic relationship in the dry season

Q.48   The figure below shows how reproductive fitness varies with tail length in a bird species. Given this pattern, what kind of selection is most likely to act on tail length in this population?
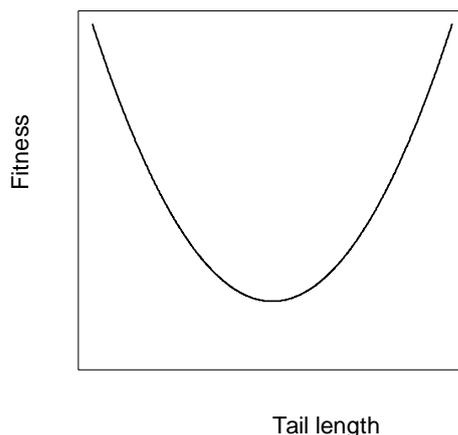
(A) Relaxed   (B) Directional   (C) Disruptive   (D) Stabilizing

Q.49   A study monitored insect abundance and drought stress in trees for a period of 10 years in a tropical dry deciduous forest. This study found a strong, statistically significant, negative relationship between insect abundance and drought stress in trees. Based on these results, what can be inferred about the causal relationship between insect abundance and drought stress in trees?

(A) Increased insect abundance causes increased drought stress in trees
(B) Increased drought stress in trees causes increase in insect abundance
(C) Decreased drought stress in trees causes increase in insect abundance
(D) No direct causal relationship can be inferred from these data

Q.50   Assume that a piece of bamboo is a hollow cylinder of negligible wall thickness. The numerical value (in cm) of the ratio of the volume to surface area of such a bamboo, measuring 6 cm in diameter, is _____

Q.51   Simpson's index of species diversity is given by

$$D = \frac{1}{\sum_{i=1}^{n} p_i^2}$$

where p_i is the proportion of species i in the total sample of individuals and n is the total number of species. For the species and their abundances given below, the numerical value of Simpson's index is _____

Species	Abundance
Q	50
R	30
S	20
T	40
U	50
V	10

Q.52   Primary succession refers to the sequence of changes in plant communities at a newly formed
        habitat. Species establishing first at the newly formed habitat (pioneer species) show characteristics
        that are different from those in species that establish later in the community. Which of the
        following represents the predicted characteristics of pioneer species?

        (A) Large dispersal distance, high fecundity, low competitive ability, short lifespan
        (B) Short dispersal distance, high fecundity, high competitive ability, short lifespan
        (C) Large dispersal distance, high fecundity, high competitive ability, long lifespan
        (D) Short dispersal distance, low fecundity, high competitive ability, long lifespan

Q.53   Consider the two phylogenies. Which of the following statements is true?
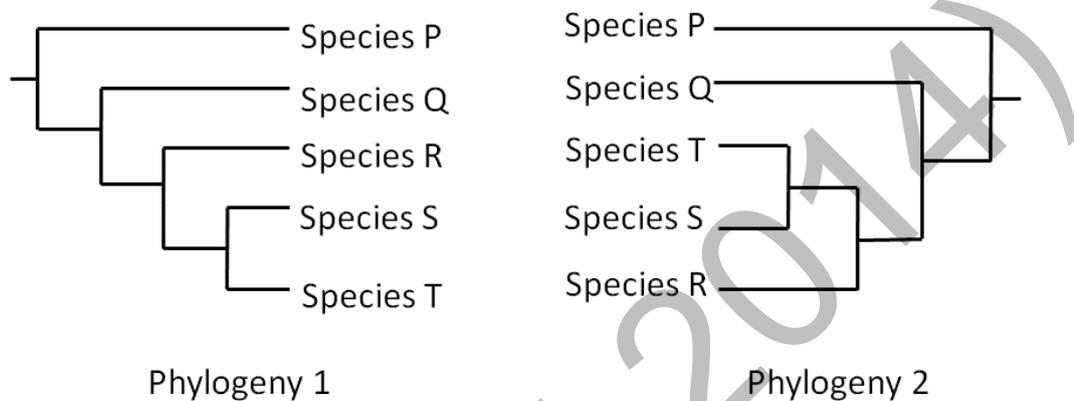
        (A) The two phylogenies are the same
        (B) The relationship between P and Q is the same in both phylogenies, whereas the relationships
        among R, S and Tdiffer between the two phylogenies
        (C) Q and Rare more closely related to each other in phylogeny 1 than in phylogeny 2
        (D) R diverged from S and T earlier in phylogeny 1 than in phylogeny 2

Q.54   Species P and Species Q are respectively self-pollinated and cross-pollinated plants that are closely
        related. Their flowers are visited by bees. Correctly identify which sets of traits are characteristic of
        Species P relative to the traits of Species Q

        (A) larger flowers, scented flowers, and fewer pollen grains per flower
        (B) larger flowers, unscented flowers, and more pollen grains per flower
        (C) smaller flowers, unscented flowers, and fewer pollen grains per flower
        (D) smaller flowers, scented flowers, and more pollen grains per flowers

Q.55   The Venn Diagram below shows numbers of species in three forest types. Which of the following statements is true?

Moist deciduous forest
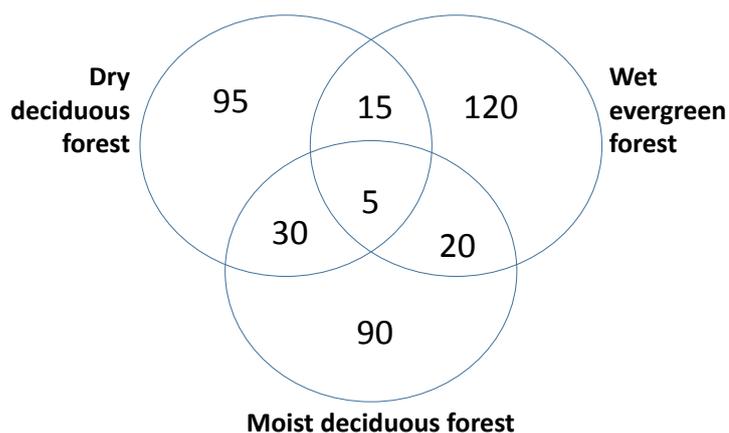
(A) Overlap of species between dry deciduous and moist deciduous > overlap between moist deciduous and wet evergreen

(B) Overlap of species between wet evergreen and dry deciduous > overlap between wet evergreen and moist deciduous

(C) Total species in dry deciduous > moist deciduous

(D) Total species in moist deciduous > wet evergreen

END OF THE QUESTION PAPER

Space for Rough Work

Space for Rough Work

Space for Rough Work

Space for Rough Work

GATE 2014
Answer Keys for EY - Ecology and Evolution

Section	Q. No.	Key / Range	Marks	Section	Q. No.	Key / Range	Marks
GA	1	A	1	EY	24	A	1
GA	2	B	1	EY	25	3.9 to 4.1	1
GA	3	D	1	EY	26	C	2
GA	4	C	1	EY	27	C	2
GA	5	1300 to 1300	1	EY	28	D	2
GA	6	D	2	EY	29	B	2
GA	7	B	2	EY	30	C	2
GA	8	180 to 180	2	EY	31	B	2
GA	9	D	2	EY	32	D	2
GA	10	B	2	EY	33	D	2
EY	1	A	1	EY	34	3.8 to 4.2	2
EY	2	B	1	EY	35	B	2
EY	3	A	1	EY	36	B	2
EY	4	0.35 to 0.45	1	EY	37	A	2
EY	5	C	1	EY	38	0.535 to 0.545	2
EY	6	0.74 to 0.76	1	EY	39	B	2
EY	7	B	1	EY	40	C	2
EY	8	B	1	EY	41	7.9 to 8.1	2
EY	9	C	1	EY	42	D	2
EY	10	C	1	EY	43	28000 to 29000	2
EY	11	B	1	EY	44	B	2
EY	12	D	1	EY	45	90 to 93	2
EY	13	A	1	EY	46	A	2
EY	14	B	1	EY	47	B	2
EY	15	C	1	EY	48	C	2
EY	16	A	1	EY	49	D	2
EY	17	A	1	EY	50	1.4 to 1.6	2
EY	18	D	1	EY	51	4.9 to 5.1	2
EY	19	D	1	EY	52	A	2
EY	20	C	1	EY	53	A	2
EY	21	B	1	EY	54	C	2
EY	22	A	1	EY	55	A	2
EY	23	A	1				